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Neuropsychological Features of Indigent Murder Defendants and Death Row Inmates in Relation to Homicidal Aspects of Their Crimes

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Abstract

Neuropsychological features of 77 indigent murder defendants and death row inmates were examined in relation to criminal variables underlying their homicidal acts. Clinically, the sample was characterized by elevated rates of developmental disorders (49%), personality disorders (54%), Axis I psychiatric disorders (45%), substance abuse (86%), and history of violence (43%). By statute, killing more than one person is an aggravating factor in many jurisdictions that renders a murder defendant eligible for the death penalty. Individuals who committed a single murder were characterized by executive dysfunction, lower intelligence, slower speed of information processing, and a higher frequency of developmental disorders (58%), relative to those charged and/or convicted of killing two or more people, who were characterized by a significantly higher rate of personality disorders (79%) and a lower rate of developmental disorders (34%). Additionally, using the FBI criminal classification system for categorizing homicide by motive, a significant difference in the frequency of psychosis was found among subgroups associated with the following motives: Criminal enterprise; personal cause; and sex. The collective neuropsychological profile of the sample revealed that executive functions were significantly decreased, relative to memory functions, with over half of the sample (55%) demonstrating executive dysfunction.

Keywords: Homicide; Forensic evaluation; Neuropsychology; Criminal behavior; Violence; Prisoners; Capital punishment; Murder

Neuropsychologists are frequently asked to evaluate the neurocognitive and intellectual status of murder defendants with respect to issues of fitness, sanity, capacity for a knowing and intelligent waiver of Miranda rights, and mitigation regarding eligibility for the death penalty (Denney, 2005a; Marcopulos, Morgan, & Denney, 2008; Yates & Denney, 2008). Criminal defense attorneys, prosecutors, and the courts rely on the objective results of neuropsychological evaluations to determine the presence of neurocognitive deficits related to various neurological and psychiatric disorders, intellectual impairments associated with developmental disorders, and malingering of cognitive and psychiatric symptoms (Barr, 2005; Denney, 2005b; Hanlon & Mayfield, 2005; Denney & Wynkoop, 2000; Martell, 1992).

Despite the demand for neuropsychological assessment of murder defendants, relatively few studies have investigated the neurocognitive characteristics of murderers, specifically. Previous research with murder defendants, death row inmates, and nonhomicidal violent offenders has documented neurocognitive impairments in a number of domains, including executive functions, attention, and language.

Relative to nonviolent offenders, murder defendants and other nonhomicidal violent offenders tend to manifest a higher frequency of neuropsychological impairment, involving attentional disturbance (Langevin, Ben-Aron, Wortzman, Dickey, & Handy,1987), language dysfunction and intellectual impairment (Bryant, Scott, Golden, & Tori, 1984), and executive

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dysfunction (Brower & Price, 2001; Lewis, Yeager, Blake, Bard, & Strenziok, 2004). Several studies have documented significant differences between violent and nonviolent juvenile offenders with respect to neuropsychological status, particularly involving language, memory, and psychomotor speed (Brickman, McManus, Grapentine, & Alessi, 1984; Golden, Jackson, Peterson-Rhone, & Gontkovsky, 1996; Spellacy, 1977). In general, this body of research has documented that violent offenders, including adults and juveniles, tend to manifest greater neuropsychological impairment, relative to their nonviolent counterparts.

Neuropsychological deficits have been found to be associated with characteristics that increase the likelihood of violent impulsive aggression. Executive dysfunction has been associated with aggression and impulse control problems, both prospectively and retrospectively (e.g., Foster, Hillbrand, & Silverstein, 1993; Morgan & Lilienfeld, 2000; Stanford, Greve, & Gerstle, 1997). The prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD) is also remarkably high among violent offenders, with rates of 45% (Rosler et al., 2004) and 41% (Vitelli, 1996) reported among prison inmates in Germany and Canada, respectively. Furthermore, several studies of adult psychopaths have documented neuropsychological deficits, particularly executive dysfunction, among psychopaths when compared with nonpsychopathic criminal offenders (e.g., Hare, 1993; Lapierre, Braun, & Hodgins, 1995; Mitchell, Colledge, Leonard, & Blair, 2002; Pham, Vanderstukken, Philippot, & Vanderlinden, 2003; Smith, Arnett, & Newman, 1992).

Elevated rates of neurological disorders have been well documented among murder defendants and death row inmates. In a sample of 31 murderers, 20 (64.5%) were diagnosed with at least one neurological disorder, including epilepsy, traumatic brain injury (TBI), fetal alcohol syndrome, and dementia, among others (Blake, Pincus, & Buckner, 1995). Of the 20 subjects who underwent EEG, 8 revealed electrophysiological abnormalities. Of the 19 subjects who underwent CT or MRI scans of the brain, 9 showed structural abnormalities. Of the 27 murderers who underwent neuropsychological evaluation, all reportedly revealed cognitive abnormalities. In a small sample ($N = 15$) of adult death row inmates, 80% revealed some evidence of neurological abnormality, whereas 33% manifested major neurological impairment (Lewis, Pincus, Feldman, Jackson, & Bard, 1986). Similarly, 9 of 14 juveniles condemned to death manifested major neurological impairment and half of the sample revealed significant neuropsychological abnormalities (Lewis et al., 1988).

In a sample of 41 murderers comprised of defendants who were pleading not guilty by reason of insanity (NGRI) or considered mentally unfit to stand trial, diagnoses included schizophrenia, TBI, and epilepsy, among others (Raine, Buchsbaum, & LaCasse, 1997). Positron emission tomography using a continuous performance task revealed significant group differences between the murderers and normal controls. Specifically, the murderers revealed decreased glucose metabolism in the lateral and medial prefrontal cortex, as well as hemispheric laterality effects involving increased glucose metabolism in subcortical structures of the right hemisphere, including amygdala, hippocampus, and thalamus, relative to normal controls.

In a follow-up study of the same sample of murderers, Raine and colleagues (1998) classified subjects as predominantly affective or predatory, with regard to their homicidal acts. Results indicated that affective murderers, those who murdered impulsively, had reduced prefrontal activity relative to both controls and predatory murderers, as well as increased metabolism in right hemisphere subcortical structures, including the amygdala, hippocampus, and thalamus. In contrast, predatory murderers, those who murdered in a planned and controlled manner, had increased metabolism in the same right hemisphere subcortical structures as the affective murders, but the prefrontal activity levels of predatory murderers were similar to normal controls.

Finally, a history of head trauma and TBI has been linked to violent aggression and criminal behavior, and the prevalence of TBI among violent offenders has consistently been documented as higher than that of the general population. In a sample of 279 veterans who had sustained penetrating brain injuries during military service in Vietnam, Grafman and colleagues (1996) found that veterans with ventromedial frontal lobe lesions had an increased risk of aggressive and violent behavior, relative to veterans with nonfrontal brain lesions and normal controls. However, research on the prevalence of closed head trauma among criminals is often based on the self-report of inmates in correctional facilities (e.g., Schofield et al., 2006). Such studies have documented extremely high rates of self-reported incidents of closed head trauma, including 86% of prison inmates in New Zealand (Barnfield & Leathem, 1998) and 87% of county jail inmates in Washington (Slaughter, Fann, & Ehde, 2003). In a sample of 15 convicted murderers sentenced to death, Lewis and colleagues (1986) found that 100% of this death row sample had a history of severe head injury.

However, in addition to the association between neuropsychological abnormalities and violence, the literature on violent aggression describes a multitude of other factors that have been implicated in aggression and criminal behavior. A genetic predisposition for antisocial and criminal behavior has consistently been demonstrated by twin studies (e.g., Coccaro, Bergeman, Kavoussi, & Seroczynski, 1997; Grove et al., 1990) and adoption studies (e.g., Ishikawa & Raine, 2002; Mednick, Gabriellli, & Hutchings, 1984); however, this link has only been consistently demonstrated for property crime rather than violent crime.

Other factors shown to influence violent aggression include abnormal neurotransmitter levels, particularly decreased serotonin levels (e.g., Krakowski, 2003; Volavka, 2002), hormones, particularly increased testosterone levels (e.g., Dabbs, Frady, Carr, & Besch, 1987), focal brain lesions, specifically orbitofrontal and ventromedial frontal lesions (e.g., Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Grafman et al., 1996), temporolimbic abnormalities (e.g., Gatzke-Kopp, Raine, Buchsbaum, & LaCasse, 2001; Tonkonogy, 1991), and other structural brain abnormalities (e.g., Raine, Lencz, Bihrle, LaCasse, & Colletti, 2000) that may not result in significant neurocognitive dysfunction. Additionally, the association between various developmental factors and violent aggression, such as abuse (e.g., Goodman, New, & Siever, 2004; Shields & Cicchetti, 1998), lower socioeconomic status and poverty (Dahlberg, 1998; Gartner & Whitaker-Azmitia, 1996), and parenting style (e.g., Brook, Zheng, Whiteman, & Brook, 2001; Raine, Brennan, Mednick, & Mednick, 1996), is well documented.

The objectives of the current study were threefold. First, we sought to examine the cognitive and intellectual characteristics of a relatively large sample of indigent murder defendants and convicted murderers, and generate a neuropsychological profile of a criminally homogeneous sample of violent offenders. Based on the scientific literature regarding the neurobehavioral aspects of violent aggression (e.g., Brower & Price, 2001; Filley et al., 2001; Morgan & Lilienfeld, 2000), combined with our experience with this population, we hypothesized that many indigent murderers manifest significant neurocognitive dysfunction, particularly executive dysfunction. Second, we examined cognitive and psychopathological differences between two subgroups of murderers, based on a statutory factor (i.e., killing one person vs. killing two or more people) that may determine whether a murder defendant is eligible to receive a death sentence. We hypothesized that multiple murderers tend to manifest more personality pathology and less neurocognitive dysfunction than individuals who commit a single murder. Third, we hypothesized that murderers motivated by emotional issues associated with their relationship to known victims tend to manifest more extensive neuropsychological dysfunction and psychopathology, relative to those motivated by other issues. As a result, we explored diagnostic and neuropsychological characteristics in relation to a forensic classification system developed by criminal profilers of the FBI (Douglas, Burgess, Burgess, & Ressler, 2006), to determine if the motive to kill (i.e., personal cause, criminal enterprise, or sex) is associated with specific psychiatric or neuropsychological abnormalities.

Materials and Methods

Subjects

The current sample was comprised of 77 indigent men and women charged with and/or convicted of first-degree murder in Illinois and Missouri. Collectively, these individuals were charged with or convicted of the murders of 137 people. Sixty-seven were charged with first-degree murder or convicted of murder and awaiting sentencing. Ten were convicted murderers on death row.

With regard to location, 70% of individuals in this sample were evaluated while in custody at the Cook County Jail in Chicago, IL, and 17% were evaluated in other county jails in Illinois and Missouri. The death row inmates were evaluated in maximum security prisons of the Illinois Department of Corrections and the Missouri Department of Corrections. All defendants were referred for a neuropsychological evaluation by attorneys in relation to one of the following concerns: Fitness to stand trial or criminal responsibility such as sanity during the guilt-innocence phase; mental retardation or neuropsychological abnormalities that represent potentially mitigating factors during the sentencing phase; or neuropsychological abnormalities that represent potentially mitigating factors during post-conviction appeals.

Demographics, clinical classifications, and criminal characteristics of the sample are provided in Tables 1 and 2. Demographic characteristics of this sample were compared with national data provided by the Federal Bureau of Investigations Uniform Crime Reports (www.fbi.gov/ucr/cius2007), which summarizes information related to all murders reported by law enforcement agencies in the U.S. in 2007. This sample includes 11,209 subjects for whom age was known, 12,181 subjects for whom gender was known by data analysts, and 11,986 for whom race was reported. Comparison of these two samples is summarized in Fig. 1, which illustrates the overall demographic similarities. The gender split in the current sample is consistent with the national trend. Some notable exceptions were found. The current sample has a higher proportion of offenders who are neither Caucasian nor African American. Ten percent of this sample, compared with only 2% in the national sample, consisted of individuals of “other” races; 9 of the 10 offenders in the “other” race category in this study were Hispanic. In addition, this study includes a smaller proportion of offenders who are in their 30s and a relatively higher proportion of offenders who are under the age of 20.

Table 1. Demographics and clinical characteristics of the sample ($N = 77$)

Characteristics	*n* (%)
Mean age (*SD*)	31.92 (11.5)
Mean years of education (*SD*)	10.52 (2.2)
Sex (male)	69 (89.6)
Race	
African-American	52 (67.5)
Caucasian	15 (19.5)
Hispanic	9 (11.7)
Asian	1 (1.3)
Psychiatric history of an Axis I disorder	35 (45.5)
Mood disorder	20 (26)
Psychosis	11 (14.3)
Personality disorder	42 (54.5)
Developmental disorder (MR, learning disorder)	38 (49.4)
ADHD or disruptive behavior disorder	28 (36.4)
Previous psychiatric treatment	34 (44.2)
Substance use history	66 (85.7)
History of alcohol use	59 (76.6)
History of drug use	61 (79.2)
Marijuana	55 (71.4)
Cocaine and/or heroin	26 (33.8)
Hallucinogen (LSD and/or PCP)	22 (28.6)
Self-reported history of head trauma	67 (87)
Abuse (sexual, physical, or both)	27 (35.1)

Note: ADHD = attention-deficit/hyperactivity disorder; LSD = d-lysergic acid diethylamide; PCP = phencyclidine.

Table 2. Criminal characteristics of the sample ($N = 77$)

Characteristics	*n* (%)
Criminal history	43 (55.8)
History of violence	33 (42.9)
History of juvenile crime	29 (37.7)
Criminal classification	
Criminal enterprise	32 (41.6)
Personal cause	37 (48.1)
Sexual homicide	8 (10.4)
Number of victims per offender	
Single murder	48 (62.3)
Double murder	13 (16.9)
Triple murder	6 (7.8)
Spree murder	2 (2.6)
Classic mass murder	5 (6.5)
Family mass murder	1 (1.3)
Serial murder	2 (2.6)

Note: Spree murder = single event with two or more victims at two or more locations; Classic mass murder = single event with four or more victims at one location; Family mass murder = single event with four or more victims (family members) at one location; Serial murder = three or more separate events at three or more locations (see Douglas et al., 2006). For subsequent analyses, number of victims per offender was combined into one victim ($n = 48$, 62.3% of sample) and more than one victim ($n = 29$, 37.7%).

Procedures

All defendants were referred for forensic neuropsychological assessment. Information regarding education, medical history, psychiatric history, and criminal history were obtained from school, medical, psychiatric, and law enforcement/correctional records, respectively. All defendants underwent a clinical interview and were administered a battery of standardized neuropsychological tests. Data from the following neuropsychological measures were included in the current analysis: Wechsler Adult Intelligence Scale-III (WAIS-III); subtests of the Wechsler Memory Scale-III (WMS-III), including Logical Memory and Face Recognition; Wisconsin Card Sorting Test (WCST), Trail Making Test, Controlled Oral Word Association Test (COWAT), and the Stroop Color-Word Test.

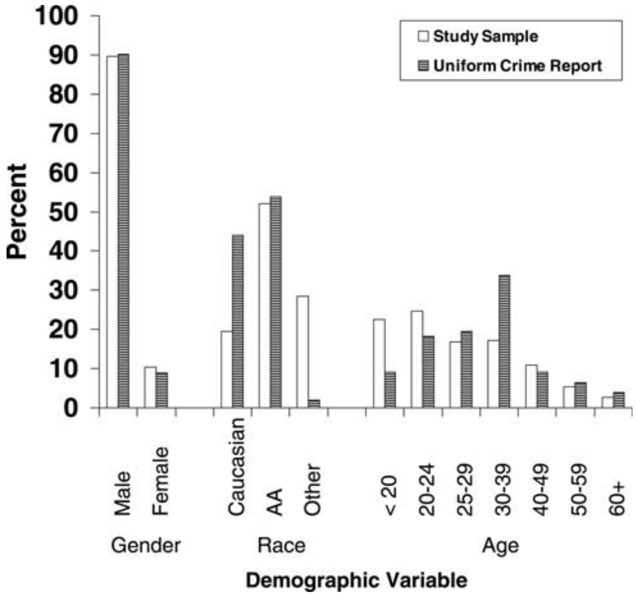

Fig. 1. Comparison of demographic characteristics of study sample to to national data provided by the Federal Bureau of Investigations Uniform Crime Reports. AA = African American.

Given the elevated rates of symptom exaggeration and malingering associated with the criminal population (Ardolf, Denney, & Houston, 2007; Denney, 2007, 2008; Rogers, 1997), inclusion in the current study required valid performance on at least three separate symptom validity tests, including the Word Memory Test (Green, Iverson & Allen, 1999; Green, 2005), the Test of Memory Malingering (Tombaugh, 1996), and the Rey15-Item Memory Test (Rey, 1958) or the Victoria Symptom Validity Test (Slick, Hopp, Strauss, & Thompson, 1997). Additionally, if psychotic symptoms were reported or if a history of psychosis was documented in pertinent records, the Structured Interview of Reported Symptoms (SIRS) (Rogers, Bagby, & Dickens, 1992) was completed to assess for psychiatric malingering. Successful completion of at least three symptom validity tests provided objective support for concluding that the neuropsychological data were accurate and valid, at the time of the assessment.

Specifically, inclusion in the current study required that examinees score at or above the established cutoff scores on the following symptom validity measures: Trial 2 and the Retention Trial of the Test of Memory Malingering (i.e., 45 of 50 or 90% accuracy); Immediate Recall (IR), Delayed Recall (DR) and Consistency (CNS) scores of the Word Memory Test (i.e., 36 of 40 or 90%); and accurate recall of at least nine of 15 items on the Rey 15-Item Memory Test; or a “Valid” performance on all three scores of the Victoria Symptom Validity Test (i.e., Easy Items, Difficult Items, Total Items). During the period of time that the current 77 murder defendants and death row inmates were evaluated, an additional 19 murder defendants (20%) failed one or more of the same symptom validity tests, and as such were not included in the current analyses. No death row inmates examined during this period failed to perform above the established cutoffs on the same symptom validity tests.

Two retrospective classification procedures were completed, based on criminal characteristics. By statute, many jurisdictions deem the murder of more than one person an aggravating factor that may render the defendant eligible for the death penalty. In Illinois, for example (720 ILCS 5/9-1; see Thomson/West, 2009), an individual found guilty of first-degree murder may be sentenced to death if “the defendant has been convicted of murdering two or more individuals . . . . regardless of whether the deaths occurred as the result of the same act or of several related or unrelated acts so long as the deaths were the result of either an intent to kill more than one person or of separate acts which the defendant knew would cause death or create a strong probability of death or great bodily harm to the murdered individual or another.” As such, we divided the sample into two groups: Those who were convicted of or charged with the murder of one person ($n = 48$) versus those who were convicted of or charged with the murder of two or more people ($n = 29$). The latter group consisted of individuals charged with or convicted of double or triple murders, spree murders, serial murders, or mass murders (*see* Douglas et al., 2006).

Second, employing the FBI’s motivational model of homicide classification, as outlined in the Crime Classification Manual (Douglas et al., 2006), the murders committed by the individuals in the current sample were classified into one of the following categories: Criminal enterprise (murder committed for material gain); personal cause (murder committed as the result of an emotional conflict); or sexual homicide (murder committed as part of a sexual act). This classification was established by two independent raters blind to each other's ratings. Given the classification guidelines provided by Douglas and colleagues (2006) combined with detailed crime scene descriptions in police reports, known relationships between the victim and the offender, and in many cases statements of confession by offenders, interrater reliability (r) was .89 ($p < .001$). Inconsistencies between raters were resolved through consensus.

Statistical Analyses

Data were analyzed using SPSS 15 for Windows. IQ scores (i.e., full-scale IQ [FSIQ], verbal IQ [VIQ], performance IQ [PIQ]) and scores on each of the four indexes (Verbal Comprehension Index, Perceptual Organization Index, Working Memory Index, Processing Speed Index) were considered. The other neuropsychological tests were grouped into two domains: Memory and executive functions. The memory domain was comprised of the following tests: Logical Memory and Face Recognition subtests of the WMS-III. The executive function domain was comprised of the following tests: Trail Making Test (A and B), COWAT, WCST, and the Stroop Color-Word Test. The Revised Comprehensive Norms for an Expanded Haltead–Reitan Battery (Heaton, Miller, Taylor, & Grant, 2008) were used to interpret performance on the Trail Making Test. For the COWAT, the norms published by Ruff, Light, and Parker (1996) were used. With regard to the WCST, the norms of the WCST: Computer Version-Research Edition (Heaton & PAR Staff, 2003) were used. The norms published by Golden & Freshwater (2002) were used to interpret performance on the Stroop Color-Word Test. Descriptive statistics were utilized to characterize the demographics, clinical, and criminal characteristics, as well as the neuropsychological profile of the total sample. Prior to conducting statistical analyses, the distributions of each outcome were examined to ensure normality and equality of variances and to check for statistical outliers (i.e., values more than 3 *SD* above or below the mean).

Two sets of analyses were conducted to examine differences in cognition and intelligence between subjects who killed one individual versus more than one individual. First, a series of independent t-tests were conducted to examine group differences in unadjusted scores. Second, hierarchical regressions were conducted when warranted by the t-tests to assess the extent to which killing one or more individuals accounted for performance on intelligence and/or cognition after other relevant demographics, clinical, and criminal characteristics on which the groups differed were included in the model. In Step 1 of the hierarchical regressions, all covariates on which the groups differed were entered into the model. In Step 2, the grouping variable distinguishing subjects who killed one individual versus more than one individual was entered.

Next, two sets of analyses were conducted to examine differences between the criminal classification categories (i.e., criminal enterprise, personal cause, sexual homicide) on intelligence and cognition. First, a series of between-subjects analysis of variance (ANOVA) were conducted to examine group differences in unadjusted scores. Second, hierarchical regressions were conducted when warranted by the ANOVAs to assess the extent to which the criminal classification categories accounted for performance on intelligence and/or cognition when other relevant demographics, clinical, and criminal characteristics on which the groups differed were included in the model. In Step 1 of the hierarchical regressions, all covariates on which the groups differed were entered into the model. In Step 2, criminal classification categories (two dummy coded variables) were entered.

Results

Table 1 summarizes the demographic and clinical characteristics of the sample. The sample was predominately men (90%) and African-American (68%). Over half of the sample had a documented history of special education ($n = 40$; 52%). Based on school records, nearly half of the sample had a documented history of a learning disorder ($n = 38$; 49.4%), whereas a smaller subgroup ($n = 12$; 15.6%) had a documented history of ADHD. Fourteen defendants (18%) met diagnostic criteria for mental retardation.

Eighty-seven percent of the sample reported a history of closed head trauma; however, only 10% had a documented history of TBI, based on medical and radiological records. Additionally, 10% had a documented history of witnessed seizures and ongoing treatment with antiseizure medications. Table 2 provides the criminal characteristics of the sample.

Not all participants (<1%) completed all subtests of the WAIS-III. However, all participants completed a sufficient number of subtests to enable computation of the four indices (VCI, POI, WMI, and PSI), VIQ and PIQ, and an FSIQ. Table 3 provides the means, standard deviations, range, and 95% confidence intervals (CIs) of the mean for each of the WAIS-III indices and IQ scores for the entire sample. Mean IQ scores and index scores were consistently in the low average range. Examination of the 95% CIs suggest that participants' performance was primarily in the low average range for FSIQ, VIQ, PIQ, and PSI and in the low average to average range for VCI, WMI, and POI. However,

Table 3. Neuropsychological test performance

Outcome	*N*	*M* (*SD*)	Range	95% CI
WAIS-III				
Full scale IQ	77	84.69 (14.57)	53–130	81.38–88.00
Verbal IQ	77	85.64 (13.94)	55–122	82.47–88.80
Performance IQ	77	86.13 (14.93)	63–134	82.74–89.52
Verbal comprehension index	77	87.40 (13.80)	55–120	84.23–90.54
Working memory index	77	87.32 (13.39)	63–136	84.29–90.36
Perceptual organization index	77	89.45 (15.26)	63–142	85.99–92.92
Processing speed index	77	83.34 (13.64)	50–122	80.24–86.43
Memory				
Logical memory (SS)				
Immediate	68	7.76 (2.34)	3–12	7.20–8.33
Delayed	68	7.91 (2.27)	2–13	7.36–8.46
Face recognition (SS)				
Immediate	68	8.68 (2.37)	4–15	8.10–9.25
Delayed	68	9.46 (2.44)	4–16	8.87–10.05
Executive functioning (*T*-scores)				
Trail making test				
Trails A	73	43.24 (9.92)	10–61	40.89–45.59
Trails B	73	39.66 (11.94)	10–68	36.87–42.44
COWAT	70	42.57 (8.70)	27–57	40.50–44.65
WCST				
Total errors	68	42.87 (11.93)	24–68	39.98–45.76
Total perseverative responses	68	46.41 (13.75)	24–73	43.08–49.74
Total nonperseverative errors	67	43.79 (10.61)	24–66	41.20–46.38
Stroop				
Words	60	40.80 (7.68)	20–56	38.82–42.78
Color	60	40.20 (7.09)	26–55	38.37–42.03
Color words	60	37.10 (7.58)	21–56	35.14–39.06

Note: Logical memory and face recognition are scaled scores. All executive function measures are *T*-scores.

a detailed examination of the distribution of scores indicated that there was a great variability within each measure, with scores ranging from 50 to 142 across the seven measures.

A subset of participants completed the WMS-III Logical Memory and Face Recognition subtests ($n = 68$). Table 3 illustrates the participants' performance (*M*, *SD*, range, 95% CI) on the memory measures. Mean scaled scores for narrative verbal recall (immediate and delayed) were in the low average range. Mean scores for recognition of facial features (immediate and delayed) were in the average range. Examination of the 95% CIs suggest that participants' performance was in the low average to average range for paragraph recall and in the average range for face recognition. However, there was a great variability within each measure with scaled scores ranging from 2 (severely impaired) to 16 (very superior) across the four memory measures.

A subset of the 77 subjects completed the measures of executive function (number of subjects range from 60–71). All executive function measures are presented in T-scores. Table 3 illustrates performance (*M*, *SD*, range, 95% CI) on the executive function measures. On the Trail Making Test, means and 95% CIs were in the low average range for Trails A and B. T-scores ranged from 10 (severely impaired) to 61 (high average) on Trails A and from 10 to 68 (superior) on Trails B. On the COWAT, the mean and 95% CI were in the low average range with T-scores ranging from 27 (severely impaired) to 57 (high average). On the WCST, the mean scores and 95% CIs for total errors, perseverative responses, and nonperseverative errors were in the low average to average range. T-scores ranged from 24 (severely impaired) to 73 (very superior) across the three measures. On the Stroop Color-Word Test, mean T-scores and 95% CIs on Trials 1 through 3 were in the low average range with scores ranging from 20 (severely impaired) to 56 (average) across the three measures.

Neuropsychological Profile

To directly compare performance across neuropsychological measures, all scores were transformed to *z*-scores. To compare the memory and executive function domains, two composite *z*-scores were computed. The memory composite was comprised of four tasks: Logical Memory (immediate and delayed) and Face Recognition (immediate and delayed). The executive

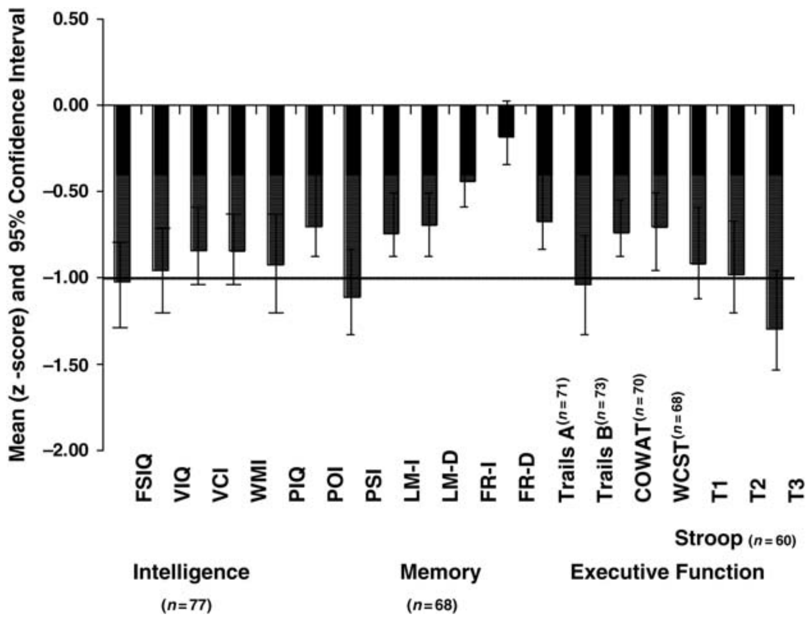

Fig. 2. Neuropsychological profile of 77 murderers. FSIQ = Full Scale IQ; VIQ = Verbal IQ; PIQ = Performance IQ; VCI = Verbal Comprehension Index; WMI = Working Memory Index; POI = Perceptual Organization Index; PSI = Processing Speed Index; LM-I = Logical Memory Immediate; LM-D = Logical Memory Delay; FR-I = Face Recognition Immediate; FR-D = Face Recognition Delay; COWAT = Controlled Oral Word Association Test; WCST = Wisconsin Card Sorting Test; T1 = Words; T2 = Color; T3 = Color-words.

function composite was comprised of seven measures: Trail Making Test (A and B), COWAT, WCST (total errors), and Stroop (Trials 1–3). Fig. 2 presents the neuropsychological profile (intelligence, memory, executive functions) for the sample. Considering all measures, cognitive and intellectual status was generally subaverage and selectively deficient. Of the 54 individuals completing all memory and executive function tasks, executive function ($M = -0.84$, $SD = 0.58$) was significantly decreased relative to memory ($M = -0.47$, $SD = 0.61$), $F(1, 53) = 23.25$, $p < .001$.

Number of Murder Victims

There were significant psychiatric and neuropsychological differences between offenders who killed one person versus offenders who killed two or more people. The two groups differed with regard to personality disorders and developmental disorders (mental retardation and/or learning disorder), χ^2 (1, $n = 77$) = 11.51, $p = .001$, and χ^2 (1, $n = 77$) = 4.11, $p = .04$. Specifically, individuals who killed more than one victim were more likely to have a personality disorder (79.3%) and less likely to have a developmental disorder (34.5%). Conversely, individuals who killed one person were more likely to have a developmental disorder (58.3%) and less likely to have a personality disorder (39.6%). There was also a trend for offenders who killed two or more victims (69%) to have a criminal history, compared with individuals killing one victim (47.9%), χ^2 (1, $n = 77$) = 3.25, $p = .098$.

Table 4 provides results (only for tests showing significant differences or trends) from the t-tests that were performed to examine group differences on intelligence, memory, and executive function. With respect to intelligence, individuals who killed two or more victims had significantly higher PIQ scores compared with individuals who killed one victim, $t(75) = -2.06$, $p = .04$. This difference was primarily driven by differences between the two groups on the PSI index, $t(75) = -3.43$, $p = .001$. There were no significant differences between the two groups on the memory measures (ps > .09). On the executive function measures, the two groups differed significantly on the WCST (total perseverative responses) and Stroop Trials 1 and 2, whereby individuals who killed two or more victims outperformed individuals who killed one victim, $t(66) = -2.07$, $p = .04$, $t(58) = -2.13$, $p = .04$, and $t(58) = -2.15$, $p = .04$, respectively. A series of hierarchical regression analyses were conducted to see if the differences between the groups remained on PIQ, PSI, WCST (total perseverative responses), and Stroop Trials 1 and 2 after first controlling for personality and developmental disorders and criminal history on which the two groups differed. In the adjusted analyses, the group difference in favor of individuals who killed more than one victim only remained on the PSI index, $t(72) = 2.36$, $p = .02$. After controlling for the covariates ($R^2 = .12$), the group difference explained an additional 6% of the variance on the PSI.

Table 4. Performance on intelligence and other cognitive tests by individuals killing one or more than one victims: Results from unadjusted group comparisons

Outcome measures	1, *M* (*SD*)	>1, *M* (*SD*)
WAIS-III ($n = 77$)		
Full scale IQ†	82.31 (13.83)	88.62 (15.16)
Performance IQ*	83.46 (13.78)	90.55 (15.94)
Processing speed index***	79.46 (12.86)	89.76 (12.62)
Memory ($n = 68$)		
Face recognition-immediate (SS)†	8.32 (2.19)	9.33 (2.58)
Executive functioning (*T*-scores)		
Trail making test ($n = 73$)		
Trails B†	37.74 (12.10)	43.12 (11.02)
Wisconsin Card Sorting Test ($n = 68$)		
Total errors†	40.80 (11.05)	46.00 (12.73)
Total perseverative responses*	43.68 (13.12)	50.56 (13.89)
Stroop ($n = 60$)		
Words*	39.35 (7.73)	43.70 (6.90)
Color*	38.85 (7.61)	42.90 (5.08)

Note: *$p < .05$, *** $p < .001$, †$p > .05$, and $p < .10$.

Table 5. Performance on memory and executive functioning by criminal classification category: Results from unadjusted group comparisons

Outcome measures	Criminal enterprise ($n = 32$, *M* [*SD*])	Personal cause homicide ($n = 37$, *M* [*SD*])	Sexual homicide ($n = 8$, *M* [*SD*])
Memory ($n = 68$)			
Face recognition delay (SS)†	9.96 (2.17)[a]	8.78 (2.70)[a]	10.38 (1.60)[a]
Executive functioning (*T*-scores)			
Stroop ($n = 60$)			
Words†	40.08 (7.72)[a]	40.10 (7.50)[a]	48.60 (4.78)[b]
Color*	41.04 (5.65)[a]	38.42 (6.73)[a]	48.80 (5.54)[b]

Note: Means in the same row that do not share superscripts differ at $p < .05$.
*$p < .05$, †$p > .05$, and $p < .10$.

Criminal Classification Categories

The only significant clinical difference among the three criminal classification categories was a history of psychosis, χ^2 (1, $n = 77$) = 9.13, $p = .01$. Specifically, the percentage of individuals with a documented psychotic disorder was roughly equivalent for those committing personal cause murders (24%) and sexual homicides (25%). However, there were no individuals with psychosis among the criminal enterprise-motivated murderers. There were also trends for individuals classified into each of the three categories to differ on education, substance abuse history, and previous psychiatric treatment, $F(2, 74) = 3.04$, $p = .054$, χ^2 (1, $n = 77$) = 5.40, $p = 0.067$, χ^2 (1, $n = 77$) = 5.83, $p = .054$. Individuals in the sexual homicide subgroup ($M = 12.13$, $SD = 1.64$) tended to be the most educated, followed by personal cause murderers ($M = 10.59$, $SD = 2.10$), and criminal enterprise murderers ($M = 10.03$, $SD = 2.34$). Those motivated by personal cause (95%) had the highest rates of substance abuse, followed by sexual homicide (88%) and criminal enterprise (75%). Additionally, those motivated by personal cause (57%) had the highest rate of previous psychiatric treatment followed by sexual homicide (50%) and criminal enterprise (28%).

Table 5 provides the results (only for tests showing significant differences or trends) from the ANOVAs that were performed to examine group differences on intelligence, memory, and executive function. Individuals classified into each of the three groups did not differ on intelligence (ps > .47) or memory (ps > .09). With respect to executive functions, the groups significantly differed on Trial 2 of the Stroop, $F(2, 57) = 5.99$, $p = .004$, whereby the sexual homicide group outperformed the criminal enterprise, and personal cause groups, $F(1, 57) = 5.79$, $p = .02$, and $F(1, 57) = 11.30$, $p < 0.001$, respectively. A hierarchical regression was conducted to determine if the differences between the groups remained on Stroop Trial 2 after controlling for psychosis, education, substance abuse history, and previous psychiatric treatment. After controlling for the covariates ($R^2 = .13$), the sexual homicide group ($\beta = 0.37$; $\Delta R^2 = .12$) continued to outperform the criminal enterprise and personal cause groups, $t(53) = 2.91$, $p = .01$.

Discussion

The incorporation of criminal variables in studies of the neuropsychological characteristics of murderers and other violent criminals is important to increasing our conceptual understanding of the psychology of violent aggression and homicide (Barr, 2008; Meloy, 2006; Raine, 1993; Raine et al., 1998). Decreased intellectual functioning among violent criminals, in general (e.g., Raine, 1993; Volavka, 2002), and murderers, specifically (e.g., Lewis et al., 1986, 1988), has been previously documented. Similarly, neuropsychological impairments, involving executive dysfunction (e.g., Lewis et al., 2004; Morgan & Lilienfeld, 2000), attentional disturbance (e.g., Langevin et al. 1987), and language-based limitations (e.g., Brickman et al. 1984; Golden et al., 1996), have been well documented. However, the integration of variables regarding specific aspects of homicidal acts in the analysis of neuropsychological data is relatively uncommon (e.g., Raine et al., 1998).

Consistent with previous studies of the neuropsychiatric and neuropsychological characteristics of murderers (e.g., Blake et al. 1995; Lewis et al., 1986, 2004), the current sample of 77 murderers was characterized by elevated rates of developmental disorders, psychopathology, TBI, seizure disorders, and neuropsychological dysfunction. Nearly half of the sample (49.4%) had a documented history of learning disorder and/or mental retardation and over one-third of the sample (36.4%) had a documented history of ADHD and/or behavior disorder. Additionally, nearly half of the sample (45.5%) had a documented history of an Axis I psychiatric disorder other than substance abuse and over half (54.4%) had a documented history of a personality disorder.

Despite the criminal homogeneity of the offenders in this sample (i.e., all subjects were charged with or convicted of first degree murder), they revealed considerable variability with respect to cognitive and intellectual functions. Although the mean FSIQ was in the low average range (84.7), intellectual status ranged from the moderate mental retardation range (53) to the very superior range (130). However, over one-third of the sample (37%) had a FSIQ in the borderline or intellectually defective range, consistent with the high rate of developmental disorders. Similarly, the mean PSI of the sample was in the low average range (83.3); however, 41% demonstrated deficient visuomotor processing speed, based on PSI scores in the borderline or defective range.

Similar degrees of variability characterized the sample with regard to memory and executive functions. Multiple measures of executive functioning were included in the current analysis (i.e., WCST, Trail Making Test, Stroop Color-Word Test, COWAT), given the multi-faceted nature of executive functions. Consistent with the elevated rates of developmental disorders, specifically, and psychopathology, in general, over half of the current sample (55%) revealed evidence of executive dysfunction on one or more tests of executive function. With regard to verbal memory for narrative information, based on Logical Memory II, the mean scaled score for the sample was in the low average range (7.9), however, 36% of individuals in the sample scored in the defective range. Conversely, only 15% demonstrated deficient visual memory for facial features, based Facial Recognition II, with a mean scaled score for the entire sample in the average range (9.5).

We hypothesized that there would be clinical and neuropsychological differences between offenders who committed single murders versus those who committed multiple murders. Consistent with our expectation, multiple murderers (i.e., more than one victim) were twice as likely to have a personality disorder (79%) compared with offenders who committed a single murder (39%). In contrast, over half of the offenders who committed a single murder had a history of developmental disorder (58%), whereas about one-third of multiple murderers had a developmental disorder (34%). Consistent with the difference between these two groups regarding developmental disorders, single murderers tended to be less intelligent and manifested decreased cognitive functions relative to multiple murderers. Specifically, the primary cognitive difference between these two groups involved speed of information processing.

In contrast to expectation, the only diagnostic difference between subgroups of murderers, based on motive (i.e., personal cause, criminal enterprise, sex), was history of a psychotic disorder, because none of the individuals in the criminal enterprise subgroup had a history of psychosis. In general, murderers motivated by personal cause (i.e., driven by emotional conflict with the victim) were characterized by higher rates of substance abuse (95%) and Axis I psychiatric disorders other than substance abuse (57%), relative to murderers motivated by material gain (i.e., criminal enterprise) or sex.

Inferences drawn from this study are clearly limited by the selective nature of the sample. All defendants and inmates in the sample were referred for neuropsychological evaluation by attorneys, primarily because they had a documented or suspected history of developmental disorder, psychiatric illness, or neurological abnormality. As such, generalizations regarding the neuropsychological status of individuals who commit murder are limited, based on the current findings. However, with respect to basic demographic variables, including gender, race, and age, the current sample is roughly consistent with known national trends (Federal Bureau of Investigation, 2008; see Fig. 1). And, despite the selectivity of the sample, the offenders that comprise this sample are typical of murder defendants and convicted murderers referred for forensic neuropsychological evaluations. As such, this group of 77 murder defendants and death row inmates may be considered to constitute a standard sampling of the types of homicide cases referred to neuropsychologists within the context of the criminal justice system.

In summary, the implications of the current study are as follows: (a) many indigent murderers, despite extreme variability regarding cognitive and intellectual functions, manifest neurocognitive impairment, particularly executive dysfunction, combined with relatively decreased intellectual status and an abnormally slow rate of information processing; (b) indigent murderers, as a group, are characterized by high rates of developmental disorders, substance abuse, and psychopathology; (c) indigent murderers who kill more than one victim manifest extremely high rates of personality disorders, whereas those who kill one victim manifest extremely high rates of developmental disorders; (d) with the notable exception of a history of psychosis, motive for killing is not a particularly discriminating variable with respect to the neuropsychological status of indigent murderers.

Conflict of Interest

None declared.

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