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NEUROPSYCHOLOGICAL PROFILING OF OFFENDERS

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Offenders, Neuropsychological profiling, Executive functions, Working memory, Inhibition.

Abstract

Current neuropsychological hypothesis of offenders posit that deviant behavior is associated with executive dysfunction. Though many studies have been done on this domain in western countries, limited knowledge is available on offenders in India. Hence the present study attempted to look into this area. The aim of the study is to find the neuropsychological profile of offenders. The research design used was Cross sectional design. Sample size: Thirty adults with criminal back ground were selected from the prison. Purposive sampling was used for selecting the sample. To assess functions such as intelligence, memory and executive functions such as fluency, working memory, planning, set shifting, inhibition, social cognition and behavior following tools were used: Bhatia's battery of intelligence, PGI Memory scale, Tower of London, Trail making and Wisconsin card sorting test. Finding suggests that the offenders were found to have low intellectual functioning and deficit in various executive functioning like attention, verbal memory, set shifting, concept formation and inhibition.

I. Introduction & Review

Many authors have defined crime as an anti-social, immoral or sinful behavior. According to the legal definition, crime is any form of conduct which is declared to be socially harmful in a State and as such forbidden by law under pain of some punishment. The Oxford dictionary defines crime as an action or omission which constitutes an offence and is punishable by law. Thus crime is an unlawful act which is an offence against the public and the perpetrator of that act is liable to legal punishment. Going further into understanding what crime is, one realizes that though the act of committing a crime is fulfilled in a matter of seconds, the journey has begun long before. The problem needs to be highlighted because it not only affects the victim, but also the community at large. Various factors explain as to why such an act is committed in the first place. One such factor among many is neuropsychological factors.

Neuropsychological functioning as a cause of criminal behavior plays an important role as it focuses on the working of the brain and how the individual behaves in various situations especially those which demand self control. An act of aggression is consistently reported as a complex behavior in which individual, cultural, social, developmental and environmental factors play their causal roles to a lesser or greater extent, dependent on the individual (Hollin & Bloxsom, 2007). Neuropsychological functioning plays an important role in the etiology of aggression and violent behavior (Giancola, 1995; Bergvall, 2001; Brower & Price, 2001; Seguin, 2007). Researches emphasize that neuropsychological deficits have been found to be associated with characteristics that increase the likelihood of violent impulsive aggression. Structural damages or dysfunction of neurotransmission (serotoninergic and dopaminergic transmission balance) in the striato-thalamo-frontal loop may also result in the malfunction of the inhibition processes, presence of intrusive thoughts and actions and other impulse control disorders such as kleptomania, trichotillomania and Tourette's syndrome (Jenike 1996, Pujol 2004, Szesko 2005, Schiffer, 2007). Violent aggression has been found to be influenced by abnormal neurotransmitter levels, especially reduced serotonin levels (Krakowski, 2003; Volavka, 2002), hormones, particularly increased testosterone levels (Dabbs, Frady, Carr, & Besch, 1987), focal brain lesions of orbitofrontal and ventromedial frontal regions (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Grafman, 1996), temporolimbic abnormalities (Gatzke-Kopp, Raine,

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Buchsbaum, & LaCasse, 2001; Tonkonogy, 1991), and other structural brain abnormalities (Raine, Lencz, Bihrle, LaCasse, & Colletti, 2000) that may not result in significant neurocognitive dysfunction.

Murder defendants and other non-homicidal 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 dysfunction (Brower &Price, 2001; Lewis, Yeager, Blake, Bard & Strenziok, 2004). Executive functioning, which is a collection of various abilities involving regulatory control over thought and behavior in the accomplishment of goal-directed or intentional action, problem solving and flexible shifting of actions to meet task demands, (Lesaca, 2001) has also been found to be associated with aggression and impulse control problems (Foster, Hillbrand & Silverstein, 1993; Morgan & Lilienfeld, 2000; Stanford, Greve & Gerstle, 1997). Several studies of adult psychopaths have also demonstrated neuropsychological deficits, particularly in executive dysfunction, among psychopaths when compared with nonpsychopathic criminal offenders (Hare, 1993; Lapierre, Braun, & Hodgins, 1995; Mitchell, Colledge, Leonard, & Blair, 2002; Pham, Vanderstukken, Philippot, & Vanderlinden, 2003; Smith, Arnett, & Newman, 1992). Structural and functional brain anomalies are thought to play an important role in sexual offenders as brain mechanisms are responsible for stimulation, direction and control of the sex drive. Anomalous sexual interests can stem from cerebral trauma that both disrupts normal psychosexual development and lowers intellectual functioning test results (Blanchard, 2006). Neuropsychological functioning plays a key role in both the development and persistence of anti-social behavior patterns and thus evaluations of offenders becomes an important method to determine the presence of neurocognitive deficits due to which the crime has been committed.

Though many studies have been done on this domain in western countries, limited knowledge is available on offenders in India, especially regarding the neuropsychological functions. Hence the present study attempted to look into this area.

II. Methodology

Aim

The aim of the study was to find the neuropsychological profile of offenders.

Objectives

The objectives of the study as follows:

a. To assess the level of intellectual functioning among prisoners.
b. To assess memory functioning among the prisoners.
c. To assess level of executive functioning among the prisoners.

Research Design

As the study aims to describe the neuropsychological profile of particular category prisoners, the research design used was cross sectional research design.

Sample

Thirty adults with criminal back ground were selected from the prison. Purposive sampling was used for selecting the sample. The sample consisted of 30 offenders among which 15 were females and 15 were males.

Inclusion Criteria

- The offenders who could read and write.
- The offenders who were within the age of 20 years to 60 years.

Exclusion Criteria

- The offenders who could not read and write.

Tools

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To assess the neuropsychological components like intelligence, memory, and executive functions such as attention, planning, response inhibition, set shifting and concept formation, the following tests were done by the researcher:

Bhatia Performance Tests of Intelligence

The test was developed by C.M. Bhatia in 1955. It is a battery is a compilation of performance tests. It incorporates five sub-tests namely Koh's Block Design test, Alexander's Pass-a-long test, Pattern drawing test, immediate memory test and Picture construction test. It provides two scores: performance quotient and verbal quotient which when averaged together provides the intelligence quotient. Individual administration takes less than an hour. The main objective of the test is to measure the intelligence of children, less educated individuals or illiterate. Standardized sample for the illiterate group consisted of 512 subjects within the geographical distribution of 11 rural districts of West, North, Central and Eastern Uttar Pradesh. The occupations of these subjects ranged from shopkeepers, artisans, hired laborers to domestic servants. Literate group consisted of 642 subjects from 3 schools in Allahabad and 4 schools from other urban areas. The occupations of this sample were professionals, lawyers, doctors, engineers, university teachers and high government officials, middle class clerks, lower class manual services, business class and agriculturists.

The PGI Memory Scale

The test was developed by Pershad and Verma in 1977. It was designed to assess memory functions and its impairments. The tool consists of 10 subtests: remote memory, recent memory, mental balance, attention and concentration, delayed recall, immediate recall, verbal retention for similar pairs, verbal retention for dissimilar pairs, visual retention and recognition for common objects. Quintile norms were developed for the subjects in the age range of 20-45 years for both urban and rural samples and consisted of three educational levels (0-5, 6-9 and 10+ years of schooling) seperately for the ten sub-tests. The scale was found to have a correlation of .71 with Boston Memory scale and .85 with Weschler Memory scale. Test-retest reliability ranged between .70 and .84 for organic-psychotic groups, .48 and .84 for neurotic-normal group. Split-half reliability was found to be .91 and .83 respectively.

Wisconsin Card Sorting Test

The test was published in 1948 by Grant and Berg. The test examines concept formation, abstract reasoning and the ability to shift cognitive strategies in response to changing environments. It is applicable for ages 6.5 years to 89 years and takes around 20-30 minutes for administration. It is an individually administered test in which the client must adjust to the changing sorting criteria. The findings reveal raw scores, percentiles, T scores and standard scores. The norms of the test were developed on a sample of 899 normal subjects aggregated from six distinct samples. A high relationship between years of education and age was found for subjects aged 6.5 years to 19 years (r=.99).

Trail Making test

It was developed by Elia, Satz, Uchiyama and White in 1996 as a part of a multicenter study on HIV infection. It has two parts: part 1 requires sustained attention, perceptual tracking and simple sequecing while part 2 requires mental flexibility in addition to the requirments of part 1. It is a measure of focused attention as the subject needs to ignore the irrelevant numbers while scanning for the correct sequence. It can be used only for literates as one needs to have knowledge to identify the given numbers. The inter-rater reliability for part A is 0.94 and for part B is 0.90.

Tower of London

Developed by Shallice in 1982, the test measures the executive function of planning. It evaluates the subject's ability to plan and anticipate the results of their actions to achieve a predetermined goal.

Procedure

The representational sample i.e. prisoners for the study were taken from a jail located in Gujarat. A total of 30 adult prisoners were selected for the research purpose. After getting consent from higher authorities of the jail, data was collected using the demographic sheet, consent form and required tools. The prisoners were explained the nature of the study and participants who were willing to participate in the study were approached. The administration of the tests was conducted for each prisoner in two to three sessions. After obtaining the required sample, the jail authorities were thanked for their support and co-operation.

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Statistics
Percentage, Mean and Standard deviation were obtained using a statistical tool.

III. Results and Discussion

The neuropsychological profiling of the offenders in the present study was based on the following categories: Intellectual functioning, Working Memory, Attention, Response inhibition, Planning, Set Shifting, and Concept Formation.

Socio-demographic details

Table 1 showing the socio-demographic details of the male participants of the sample

Variables	Groups	Frequency	Percentage
Age	26-60 years	15	100.0
Education	College educated	10	66.0
	School educated	5	33.0
Marital status	Married	12	80.0
	Single	3	20.0
Number of years in the prison	5 – 10 years	11	73.0
	11 – 15 years	2	13.0
	16 – 20 years	2	13.0
Crime committed	Murder	13	86.0
	Rape	2	14.0

Table 2 showing socio-demographic details of the female participants of the sample

Variables	Groups	Frequency	Percentage
Age	22 – 62 years	15	100.0
Education	College educated	1	6.0
	School educated	11	73.0
	Illiterate	3	26.0
Marital status	Married	13	86.0
	Single	2	13.0
Number of years in the prison	1 – 5 years	9	60.0
	6 – 10 years	2	14.0
	11 – 15 years	3	20.0
	16 – 20 years	1	6.0
Crime committed	Murder	13	86.0
	Theft	2	13.0

30 adults participants with a criminal background was selected from the prison. The sample was divided equally into two halves: 50% males (15) and 50% females (15). Male offenders' age ranged between 26 years to 60 years with 66% being college educated and 33% school educated. There were no illiterates in the male offenders group. In terms of their marital status, 80% of the males were married. Out of the 15 adult male offenders, 73% were in the prison since 5-10 years and 13% each were since 11-15 years and 16-20 years respectively. The crimes for which they were punished included murder (86%) and rape (14%).

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The female offenders' age ranged between 22 years to 62 years with only one being college educated, 73% school educated and 26% illiterates. 86% of them were married. 60% of the female offenders were in the prison since 1-5 years, 14% since 6-10 years, 20% since 11-15 years, 6% since 16-20 years. With respect to the crimes they committed, 13% were punished for reason of theft and 86% were in the prison for reason of murder.

Most of the researches which have focused on the importance of neuropsychological factors have mentioned the manner of how brain functions while an act of crime is committed. Such similar findings have been derived from the present study.

Table 3 showing the Mean Scores of Bhatia's Performance tests of Intelligence, PGI Memory Scale and Tower of London

Sr. no	Category	Scores (Males)	Scores (Females)	Overall
1.	IQ	93	75	84
2.	REMOTE MEMORY	6	6	6
3.	RECENT MEMORY	5	5	5
4.	DELAYED RECALL	9	8	8.5
5.	IMMEDIATE RECALL	11	9	10
6.	VERBAL RETENTION	16	15	15.5
7.	VISUAL RETENTION	10	8	9
8.	RECOGNITION	9	8	8.5
9.	ATTENTION	49 secs	99 secs	74 secs
10.	MENTAL FLEXIBILITY	108 secs	157 secs	132.5 secs
11.	PLANNING	10 moves	8 moves	9 moves

Intellectual functioning

From table 3 we can see that the mean IQ of the sample was 84 which indicate dull normal intellectual functioning (score range: 80-89). The intellectual functioning of males was in the average range (score range: 90-109) with IQ score of 93, which was higher than the intellectual functioning of the female offenders which falls in the borderline range (score range: 70-79) with the score of 75.

A number of researches have stated that criminal activities usually erupt from a low intellectual functioning. This link between low level of intellectual functioning and crime is been found regularly in previous studies as well (Diaz, Belena, & Baguena, 1994; Jolliffe & Farrington, 2004). In fact, a meta-analysis of research examining the influence of cognitive and affective empathy to offending behavior found that the relationship between low empathy and offending disappeared after controlling for intelligence and social economic status (Jolliffe & Farrington, 2004). This shows that a lack in understanding the emotions and situations of others can be the source of crime (Jolliffe & Farrington, 2004). More broadly, research that has aimed to examine the origins of offending behaviour (particularly juvenile delinquency) continues to identify low IQ as a predictor of criminal behaviour (Diaz et al., 1994). As mentioned before, in this study also, the intellectual functioning of males was in the average range (93) which is higher than the intellectual functioning of the female offenders which falls in the borderline range (75).

Executive functioning

Memory

The results (Table 3) of the present study indicate that remote and recent memory, mental balance, attention and concentration, delayed recall, visual retention and recognition range in the scores of below 16 for both the groups which indicates no dysfunction. The dimensions of immediate recall (11) and verbal retention (16) show mild dysfunction for males whereas the same dimensions indicate no dysfunction for females. Baddeley and Hitch's (1974) model of working memory says that when one is engaged in a verbal working memory task the phonological loop and central executive work together to temporarily store and process the information, but when one is engaged in a visuospatial task the visuospatial sketchpad and central executive work together to temporarily store the information (Lobley, Gathercole, & Baddeley, 2005; Jarvis & Gathercole, 2003; Shah & Miyake, 1996). In the present study, verbal retention in males is found to be dysfunctional. In a similar study by Brito et.al, 2013 it was

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stated that verbal working memory shows impairments and visuo-spatial retention is found to be intact. Further research is still required to establish a direct link between dysfunction in working memory and crime.

Inhibition

Another executive function that was found impaired is inhibition. Inhibition for both the groups of male and female offenders was found to be proceeding towards a dysfunction. These findings indicate that the sample is found to be less attentive and displays impulsive behavior. Inhibition comprises deliberately suppressing ones dominant responses or impulses (Miyake et al., 2000), e.g., in order to think before acting aggressively (Brower and Price, 2001). Prisoners may have difficulties suppressing harmful impulses, such as aggressive impulses. The finding in this study in line with the findings of the study done by Barbosa and Monteiro (2008), which suggests that impaired inhibition in both violent and non-violent offenders, with the exception of those prisoners characterized by a history of premeditated, non-impulsive violent crimes. (Maijers & larte, 2015).

Table 4 showing the Mean scores for Wisconsin Card Sorting Test

Sr. no	Category	Scores (Males)	Scores (Females)	Overall
1.	NO. OF CATEGORIES COMPLETED	3.33	4	3.63
2.	TOTAL NO. OF TRIALS ADMINSTERED	128	128	128
3.	CORRECT RESPONSE	74.20	80.86	77.37
4.	ERRORS	52.20	47.71	50.10
5.	PERCENT ERRORS	40.72	37.21	39.09
6.	PERSEREVATIVE RESPONSES	39.67	36.43	38.63
7.	PERCENT PERSERATIVE RESPONSE	30.93	28.29	30.03
8.	PERSEVERATIVE ERRORS	32.40	30.71	31.93
9.	NON PERSEVARATIVE ERRORS	25.25	23.93	24.89
10.	PERCENT NON PERSERAVATIVE RESPONSE	21.13	16.43	18.57
11.	PERCENT	16.35	14.14	15.04
12.	TRIALS TO COMPLETE FIRST CATEGORY	33.87	18.50	25.97
13.	FAILURE TO MAINTAIN SET	3.07	2.36	2.70
14.	CONCEPTUAL LEVEL RESPONSE	46.53	63.00	54.76

Attention and Set shifting

Area of attention was found proceeding towards dysfunction. This can be due to inability in inhibiting response as the overall scores were found to be 24.89. In a study assessed attention in offenders (Kavanagh et al., 2010) supports the findings of the present study, by suggesting that the offenders, a random general sample of offenders, performed significantly worse than controls on the attention task, as the authors report a semipartial correlation of 0.38.

Set-shifting comprises the ability to change perspectives (Diamond, 2013), for example to think of new solutions for persisting problems, or switch from dysfunctional behavior to more functional behavior. The participants in this study not only completed lesser number of categories but also made more errors, took more trials and were also perseverative. Total number of trials administered were 128 both for males and females. Overall errors found were 50.10. Number of errors was more amongst male 52.20 than females which were 47.71. The overall percentage for errors was found to be 39.09. In the perseverative responses it was found that the responses were higher in males 39.67 than in females 36.43 the overall percentage for perseverative response was found to be 30.03 and the overall percentage for perseverative errors was found to be 31.93. The scores indicate that the participants show low level of conceptual level scores and problems in maintaining consistent problem solving strategies. Conceptual level scores for males were found to be 46.53 and for females it was found to be 63.53 and the overall percentage was found to be 54.76. The impaired set-shifting found in prisoners therefore suggests that they may experience increased difficulties to desist from old dysfunctional behavior and to think of other, more effective solutions to their problems. This finding is supported by a study which suggests that violent offenders in this group performed significantly worse than controls while the non-violent offenders did not differ significantly (Baker and Ireland, 2007).

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Planning

The last executive function which was assessed was planning. The scores in planning were found to be in average level in the participants in present study for males it was found to be 74.20 and for females it was found to be 80.86. Some studies found worse performance in planning among violent offenders, although this difference with controls was also not statistically significant. (Kavanagh, 2010).

In view of the millions of prisoners worldwide, and the high impact of this population on society, it is striking that only few studies were found that examined the executive functions of the general prison population. Furthermore, most studies assessed only some specific executive functions instead of a wide range, and sample sizes were small. Consequently, the results of these studies should be considered with caution. Nevertheless, the findings suggest the existence of various executive function deficits in regular prisoners. One of these functions which were found to be mildly impaired was working memory. Working memory provides the ability to actively hold information in mind, and work with that information, for example to keep a certain goal in mind and integrate new relevant information, while discerning irrelevant information (Diamond, 2013).

IV. Conclusion

The aim of the study was to find the neuropsychological profile of offenders includes intellectual functions, memory functions and executive functions. The following are the major findings from the study:

- The mean IQ of the sample was 84 which is indicative of dull normal intellectual functioning.
- The intellectual functioning of males was in the average range with IQ score of 93, which was higher than the intellectual functioning of the female offenders which falls in the borderline range with the score of 75.
- No significant dysfunction in memory functioning was observed. Only males show mild dysfunction in verbal retention and immediate recall.
- Inhibition for both the groups of male and female offenders was found to be proceeding towards dysfunction indicating that the participants were found to be less attentive and displayed impulsive behavior.
- The participants show low level of conception (males 46.53, females 63.53) and face difficulty in maintaining consistent problem solving strategies. They were also assessed to have poor set-shifting abilities.
- Participants were found to be having average functioning in the executive function of planning (males 74.20, females 80.86).

V. Limitations and Suggestions

Since the study was conducted on a small group of prisoners (N=30), inferring generalizations is difficult. The present study could not use a comparison sample group which would have given a broader perspective of differences in the neuropsychological profiling of prisoners from general population. In future, studies can be replicated with a larger sample size and with a comparison group. Prisoners from various criminal backgrounds could also be assessed in order to look for any significant differences in their functioning if any.

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