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LONG TERM MENTAL HEALTH IMPLICATIONS OF SEXUALLY ABUSED CHILDREN

The Cognitive Impact of Sexual Abuse and PTSD in Children: A Neuropsychological Study

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Sexual abuse is known to have an impact on both child and adult mental health, but the neuropsychological basis of this effect is still largely unknown. This study compared neuropsychological test results from a group of 76 children, 13 of them sexual abuse victims with symptoms of post-traumatic stress disorder, 26 victims of sexual abuse who showed no symptoms post-traumatic stress disorder, and 37 controls. The groups were matched by age, sex, socioeconomic status, and educational level. Child sexual abuse was associated with reduced ability to inhibit automatic responses measured by the Stroop test regardless of post-traumatic stress disorder status. These findings indicate possible attentional inhibition difficulties in child victims of sexual abuse, which may help explain psychopathology associated with the experience.

KEYWORDS post-traumatic stress disorder, attention, inhibition, neuropsychology

There is now increasing evidence for the impact of child sexual abuse on the likelihood of developing later psychopathology, but the neuropsychological

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basis of this increased risk is still largely unknown. Previous studies have linked the experience of child sexual abuse to the development of a range of psychiatric difficulties, including depression (Maniglio, 2010), self-harm (Klonsky & Moyer, 2008), anxiety disorders (Levitan, Rector, Sheldon, & Goering, 2003), and post-traumatic stress disorder (PTSD; Paolucci, Genuis, & Violato, 2001). However, it is now clear that abusive sexual experiences during childhood are but one risk factor for later psychological problems where the final outcome is likely to be mediated by numerous other biological, psychological, and social events and characteristics (Maniglio, 2009).

Neuropsychological functioning is recognized as one of the most important mediating factors in psychopathology in general (e.g., Wood, Allen, & Pantelis, 2009), although its association with childhood sexual abuse is still not widely studied. Choi, Reddy, Liu, and Spaulding (2009) conducted what is perhaps the only study to date on how the cognitive impact of child sexual abuse could mediate later psychopathology. They found that better memory performance was associated with lower levels of psychopathology, even among those who had suffered severe sexual abuse.

This lack of research is surprising, as trauma and PTSD have a known neuropsychological impact and PTSD has been clearly related to the experience of childhood sexual abuse (Paolucci et al., 2001). With regard to child PTSD in general, only a few studies have attempted to assess the neuropsychological effects of trauma (Berliner, Hyman, Thomas, & Fitzgerald, 2003). Beers and De Bellis (2002) used the Stroop Test (a measure of attentional inhibition) and Navalta, Polcari, Webster, Boghossian, and Teicher's (2006) used the Go No-Go Association Task (a measure of behavioral inhibition) to study child victims of abuse. This study indicated that there are clear difficulties in executive function, which likely include abilities such as inhibition of automatic responses, self-regulation and monitoring, and cognitive flexibility. This suggests a potentially similar neuropsychological basis for PTSD symptoms in children as that found in adults (Aupperle, Melrose, Stein, & Paulus, 2012). In line with this, De Bellis, Hooper, Woolley, and Shenk (2010) reported that child victims of maltreatment with PTSD showed reduced visual memory performance, which has also been found in adult PTSD patients (Brewin, Kleiner, Vasterling, & Field, 2007).

The neuropsychological impact of child sexual abuse has largely been studied in adults, with few studies examining children specifically. Those that have studied children, however, typically show that child sexual abuse is associated with reduced cognitive function. For instance, Jones, Trudinger, and Crawford (2004) reported that Australian children referred for sexual abuse investigations generally showed reduced academic achievement and general cognitive function when compared to norm referenced values. Similarly, children with a history of sexual abuse had significantly reduced IQ

scores when compared to physically abused and nonabused children (Sadeh, Hayden, McGuire, Sachs, & Civita, 1994). A more recent study by Porter, Lawson, and Bigler (2005) reported reduced attention and concentration performance in a sample of sexually abused children when compared to matched controls.

The public health implications of these effects may be substantial in terms of their impact on everyday functioning, education, and schooling in childhood as well as in terms of their being possible risk factors for behavioral problems. For example, performance on inhibitory control tasks has been found to predict behavioral problems and social competency in school children without psychiatric or neurological disorders (e.g., Nigg, Quamma, Greenberg, & Kusche, 1999; Riggs, Blair, & Greenberg, 2003). Similarly, an increased risk of behavioral difficulties, psychopathology, and neurobiological changes in children who have experienced sexual abuse is well established (De Bellis, Spratt, & Hooper, 2011; Wilson, Hansen, & Li, 2011). It is still not clear, however, to what extent sexual abuse and PTSD have distinct neuropsychological effects. While sexual abuse is a risk factor for the disorder, not all children who are abused sexually go on to develop the symptoms of PTSD. In light of this, this study compares neuropsychological performance in children who have experienced abuse with and without PTSD diagnoses and with children who have not experienced abuse. Owing to the impact of both child PTSD and sexual abuse, it was hypothesized that abused children with PTSD would show poorer neuropsychological performance than both abused children without PTSD and unaffected children, particularly on tests of executive function, which have been most associated with the diagnosis.

METHOD

Participants

Children who had experienced sexual abuse were recruited from a nongovernmental organization specializing in assisting children affected by sexual abuse who were involved in legal action to prosecute their alleged abusers. Each child was initially evaluated by a psychologist involved in the study using the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998) and the Posttraumatic Stress Symptoms Checklist (Pineda, Guerrero, Pinilla, and Estupiñan, 2002) to diagnose cases of PTSD. Controls who did not report experiences of sexual abuse were recruited from a local school. They were selected to control for demographic characteristics and also evaluated using the MINI to exclude participants who presented with psychopathology or experienced traumatic events. All participants were Spanish speaking as their native language.

TABLE 1 Demographic Information for the Participants in the Study

		Age		Years of Schooling		Sex		SES			Family situation		
	n	Mean	SD	Mean	SD	M	F	Lo	Med	Hi	BP	1P	NoP
Controls	37	10.11	2.17	4.19	2.05	9	28	21	14	2	15	18	4
Cases	39	10.23	2.07	4.21	2.04	29	10	28	9	2	11	22	6
PTSD +	13	10.92	2.63	4.69	2.46	5	8	8	4	1	4	7	2
PTSD–	26	9.88	1.68	3.96	1.8	5	21	20	5	1	7	15	4

Note. PTSD+ = post-traumatic stress disorder present; PTSD– = post-traumatic stress disorder absent; SD = standard deviation; M = male; F = female; SES = socioeconomic status; BP = both parents present; 1P = one parent present; NoP = no parents present.

As a result, the final sample consisted of 76 children in three subgroups: (a) a group of 13 children who had experienced sexual abuse and who had a diagnosis of PTSD, (b) 26 children who had experienced sexual abuse but who did not fulfill the criteria for a PTSD diagnosis, and (c) 37 control children who did not report any experience of abuse and did not fulfill the PTSD criteria (for full demographics of the sample, see Table 1).

Measures

To assess the possible presence of PTSD and related psychiatric symptoms, and to evaluate cognitive performance, the following instruments were used.

Posttraumatic Stress Symptoms Checklist

The Posttraumatic Stress Symptoms Checklist, developed by Pineda and colleagues (2002), is a diagnostic scale delivered as a structured interview. It was developed and validated in Colombia to diagnose PTSD based on the *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) criteria.

Mini International Neuropsychiatric Interview (MINI)

The MINI (Sheehan et al., 1998**)** is a structured diagnostic interview that allows the reliable diagnosis and exclusion of DSM-IV-TR psychiatric disorders. The interview was used in its validated Spanish translation (Bobes, 1998; Bobes et al., 1997).

Trail Making Test (TMT)

The TMT (Stanczak, Lynch, & Brown, 1998) consists of two parts that require participants to connect a sequence of ascending numbers using an unbroken

line as quickly as possible and then connect a sequence of ascending numbers and letters in alternate order (e.g., 1, A, 2, B, etc.) as quickly as possible. The test provides a measure of attention, sequencing, mental flexibility, visual motor skill, and visual search and is appropriate for the developing motor skills of children (Bialystok, 2010).

California Verbal Learning Test (CVLT)

The CVLT (Delis, Kramer, Kaplan, & Ober, 1987) was developed as a verbal memory test that includes both immediate and delayed recall conditions. The test involves the presentation of a list of 16 words followed by five recall trials of the list. A second 16-word list is then presented followed by a recall of the original list again. After 20 minutes of nonverbal tasks, memory for the original list is tested again. Although a children's version of the CVLT is available, a similar version is not available in Spanish, so the study used the validated adult Spanish version of the test (Fortuny, Romo, Heaton, & Pardee, 2001).

The Rey-Osterrieth Complex Figure Test

The Rey-Osterrieth Complex Figure Test (Lezak, Howieson & Loring, 2004) is a test to assess visual memory and constructional abilities as well as perceptual and motor skills. The task requires participants to copy a nonfamiliar two-dimensional figure and then reproduce it from memory. The test has been widely used and validated with children (e.g., Schouten, Hendriksen, & Aldenkamp, 2009; Waber & Holmes, 1986).

Stroop Color-Word Interference Test

The Stroop Test (Lezak et al., 2004) consists of three parts and is administered to measure cognitive flexibility and response inhibition. The first part involves reading color names printed in black ink, while the second requires one to name the ink color of rows of Xs. Both of these tasks are designed to ensure that the participant is capable of the major test components and understands the task. The third and final part involves naming the ink color of words that describe the names of specific colors, each of which is printed in an ink color that does not match the named color. For example, when the word "blue" printed is in red ink, the participant is asked to respond "red." The participant is asked to complete this test as quickly as possible, making the fewest possible errors and is scored both on completion time and total error score. The Spanish version of the Stroop Test was used in this study, which has been validated in children (Armengol, 2002).

Wisconsin Card Sorting Test (WCST)

The WCST (Heaton, Chelune, Talley, Kay, & Curtis, 2001) was designed in order to assess abstract reasoning and cognitive flexibility (Axelrod, 2002). This study used the procedure outlined by Heaton and colleagues (2001) and norms published by Greve (2001). The participant is presented with four category cards and 128 response cards with pictures that vary according to three dimensions (color, form, and number). The examiner selects a dimension and participants are required to find which dimension has been selected by selecting response cards to match category. Participants then receive feedback about whether they have correctly matched the selected dimension. After 10 consecutive correct matches, the examiner changes the dimension without warning. Participants were scored on how many times they persisted with responding with a discarded dimension (perseverative errors). The test has been used widely and validated with child participants (e.g., Chelune & Baer, 1986; Rzezak et al., 2009).

Procedure

Information about both the research project and experimental procedure were given to both the child and his or her guardian with an opportunity to ask questions or request more information before the consent form was signed. Sessions typically lasted approximately one and one-half hours and included both the psychometric evaluations and neuropsychological assessments completed by a qualified, registered psychologist. During the postconsent evaluation, any decision not to discuss the experiences was fully respected, and in these cases, demographic details were drawn from the case histories. At the conclusion of the evaluation, the child and the researcher met with the child's regular clinician (each is assigned a counselor as part of the assistance provided by the nongovernmental organization) to evaluate whether the child had been adversely affected by the procedure. Also the researcher was available to answer any subsequent questions or queries that had not been addressed before or during the evaluation. Neither the children nor the independent clinicians reported any subsequent distress related to their participation.

RESULTS

As can be seen from Table 1, the sample consisted of a statistically balanced sample of children across groups. When controls and cases were compared with chi-square tests, distributions were not significantly different from chance for sex χ^2 (1, $n = 76$) = .018, $p = .895$, socioeconomic status χ^2 (2, $n = 76$) = 2.036, $p = .361$, and family situation χ^2 (2, $n = 76$) = 1.364,

$p = .506$. The same comparison between three groups (controls, cases with PTSD, and cases without PTSD) also showed that the distributions were not significantly different from chance for sex χ^2 (2, $n = 76$) = .018, $p = .895$, socioeconomic status χ^2 (4, $n = 76$) = 2.979, $p = .561$, and family situation χ^2 (4, $n = 76$) = 1.426, $p = .840$. Furthermore, when compared using a two-tailed independent samples t-test there was no significant difference between cases and controls for age $t(74) = .252$, $p = .802$, or years of schooling $t_(74) = .034$, $p = .973$. In addition, a comparison between three groups (controls, cases with PTSD, and cases without PTSD) using a one-way independent samples ANOVA also showed no difference for age $F(2,73) = 1.088$, $p = .342$ or years of schooling $F(2,73) = .554$, $p = .577$ with no significant post hoc differences.

Analysis of the results of the neuropsychological battery across the three groups using an independent samples one way ANOVA, as illustrated in Table 2, indicated a significant effect only for Stroop errors ($p = 0.025$), with perseverations on the WCST showing a trend to significance ($p = 0.097$). Post hoc differences between groups were tested using Sheffe tests. No additional significant differences were found, although on Stroop errors there was a trend to significance in the comparison of controls and cases with PTSD ($p = 0.09$) and controls and cases without PTSD ($p = 0.077$). The difference between cases with and without PTSD was nonsignificant ($p = 0.93$).

Owing to the lack of difference between children who had experienced sexual abuse with and without PTSD, all were collapsed into a single group for further analysis. As can be seen in Table 3, when all cases of sexual abuse were compared as a single group with controls using independent samples two-tailed t-tests, both Stroop time and Stroop errors show significant differences between groups. Specifically, the sexual abuse group completed the task more slowly and with greater errors. However, if corrected for multiple comparisons, only the difference in Stroop errors remains significant. Furthermore, the number of WCST perseverative responses shows a trend to significance ($p = 0.094$) with cases making more errors than controls.

TABLE 2 Results of Neuropsychological Assessment for Controls, Cases of Sexual Abuse with PTSD, and Cases of Sexual Abuse without PTSD

	Controls		Cases PTSD+		Cases PTSD–		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F	p
Rey Delay Copy	13.66	8.24	12.42	6.57	13.29	6.49	0.135	0.874
Trails B Errors	1.27	1.81	2.54	3.31	1.19	1.74	0.135	0.874
WCST Perseveration	25.70	16.52	27.15	13.80	35.69	22.07	2.406	0.097
Stroop Time	99.41	42.49	118.08	54.39	120.73	42.77	1.995	0.143
Stroop Errors	4.86	2.72	7.85	5.71	7.31	4.88	3.875	0.025
CVLT Total	33.57	10.06	30.38	15.09	33.04	9.11	0.428	0.654
CVLT Intrusions	6.30	8.85	8.54	7.51	5.65	4.66	0.669	0.515

Note. SD = standard deviation; WCST = Wisconsin Card Sorting Test; CVLT = California Verbal Learning Test; PTSD+ = post-traumatic stress disorder present; PTSD– = post-traumatic stress disorder absent.

TABLE 3 Results of Neuropsychological Assessment for Controls Versus All Cases of Sexual Abuse

	Controls		All Cases		t-test		95% CI	
	Mean	SD	Mean	SD	t	P	Lower	Upper
Rey Delayed copy	13.66	8.24	13.00	6.44	0.39	0.697	−4.03	2.71
Trails B Errors	1.27	1.81	1.64	2.42	0.75	0.454	−0.61	1.35
WCST Perseveration	25.70	16.52	32.85	19.93	1.70	0.094	−1.25	15.53
Stroop Time	99.41	42.49	119.85	46.25	2.00	0.049	0.11	40.77
Stroop Errors	4.86	2.72	7.49	5.10	2.77	0.007	0.74	4.51
CVLT Total	33.57	10.06	32.15	11.32	.57	0.567	−6.32	3.49
CVLT Intrusions	6.30	8.85	6.62	5.83	1.05	0.295	−0.22	0.72

Note. SD = standard deviation; CI = confidence intervals; WCST = Wisconsin Card Sorting Test; CVLT = California Verbal Learning Test; PTSD+ = post-traumatic stress disorder present; PTSD− = post-traumatic stress disorder absent.

A two-predictor logistic regression model was also fitted to the data to examine whether performance on any of the neuropsychological tests would predict the likelihood of the participants having experienced sexual abuse. The model contained seven independent variables, each pertaining to results on the neuropsychological tests. The full model containing all predictors was statistically significant χ^2 (7, $n = 76$) = 15.346, $p = 0.032$, indicating that the model was able to distinguish between participants who had and had not been sexually abused. The model as a whole explained between 18.3% (Cox and Snell R^2) and 24.4% (Nagelkerke R^2) of the variance in sexual abuse status and correctly classified 68.4% of cases. As shown in Table 4, only one variable made a significant contribution to the model (Stroop errors, $p = 0.022$), with Stroop time showing borderline significance at $p = 0.052$. The confidence intervals of the nonsignificant variables lie close to zero, suggesting a high level of confidence in accepting these null results.

TABLE 4 Logistic Regression Predicting Likelihood of Sexual Abuse Status by Neuropsychological Results

							OR 95% CI	
	B	SE	Wald	df	p	OR	Lower	Upper
Rey Delayed copy	−0.018	0.039	0.212	1	0.646	0.982	0.909	1.061
Trails B Errors	−0.053	0.127	0.172	1	0.678	0.949	0.740	1.216
WCST Perseveration	−0.025	0.019	1.796	1	0.180	0.975	0.940	1.012
Stroop Time	−0.012	0.006	3.788	1	0.052	0.988	0.976	1.000
Stroop Errors	−0.188	0.082	5.268	1	0.022	0.829	0.706	0.973
CVLT Total	0.003	0.026	0.017	1	0.896	1.003	0.953	1.057
CVLT Intrusions	0.037	0.051	0.539	1	0.463	1.038	0.939	1.147

Note. SE = standard error; Wald = Wald statistic; df = degrees of freedom; OR = odds ratio; CI = confidence interval; WCST = Wisconsin Card Sorting Test; CVLT = California Verbal Learning Test.

DISCUSSION

This study compared neuropsychological performance in two groups of children who had experienced sexual abuse. These groups consisted of one with and one without a diagnosis of PTSD. In addition, a group of control children who had no reported abuse and were without a diagnosis of PTSD was compared with the other groups. A reduced ability to inhibit automatic responses was most associated with a history of sexual abuse, regardless of PTSD status. Although these results suggest that there may be a difference with regard to the inhibition of automatic responses associated with sexual abuse, it is notable that the majority of neuropsychological tests do not show a clear difference, indicating that the experience of sexual abuse may have a selective impact on attentional inhibition.

The study shows a clear and significant difference with regard to Stroop error scores, suggesting that there may be an association between the experience of sexual abuse and cognitive inhibition. Although there is a clear connection between PTSD and difficulties with cognitive inhibition linked to prefrontal cortex function (Aupperle et al., 2012) it is notable that no difference was found between groups of sexually abused children with and without PTSD. Research on whether problems with executive inhibition are associated with child PTSD is still lacking, and some doubts remain whether this ability is developed enough to be considered subject to impairment in preadolescent children (Salmon & Bryant, 2002).

While sexual abuse has been most associated with a general reduction in cognitive function (Jones et al., 2004; Sadeh et al., 1994), a specific link with reduced attention and concentration was reported by Porter and colleauges (2005), potentially suggesting a link to inhibitory skills. However, it is not clear in these cases whether sexual abuse has an impact on cognition or whether children with lower cognitive abilities are more likely to be targeted by abusers.

Although a direct link between sexual abuse and cognitive performance has yet to be adequately studied, it is notable that a growing literature has linked the experience of childhood sexual abuse with adult hallucinations (Hammersley et al., 2003; Read, Agar, Argyle, & Aderhold, 2003; Shevlin, Dorahy, & Adamson, 2007). This suggests that it may have an impact on the ability to discriminate between internally and externally generated cognitive events and may present a specific cognitive bias toward the misattribution of internal cognitive events to external sources (Aleman & Larøi, 2008). Clearly, this is something very relevant to cognitive inhibition.

Nevertheless, the fact that reductions in cognitive inhibition were most associated with the experience of abuse, and not the diagnosis of PTSD, raises the interesting question of whether abuse itself rather than the subsequent development or susceptibility to PTSD is most important with regard to impact on cognitive function. It is worth bearing in mind that PTSD is

only one of the possible outcomes following sexual abuse. Moreover, the cognitive inhibition differences seen in this study may reflect a general risk factor that increases the chances of a range of problems during early and later life. Even if the higher risk of psychopathology is present, however, it is important to highlight that not all sexual abuse survivors develop mental health problems. However, it remains possible that cognitive risk factors, such as reduced inhibition performance suggested by this study, may still be present. This suggests that the experience of abuse, rather than PTSD per se, may be more associated with specific cognitive changes.

However, it is clear that this is still an area that lacks systematic research despite the fact that sexual abuse of children is still widespread. As the effects of such abuse can affect both child and adult psychopathology and can have a significant lifelong impact, we hope that further research on the cognitive effects of child sexual abuse can be further studied to help us understand—and ultimately intervene in—the pathways that increase the risk for emotional and psychological impairment.

In the interpretation of the results, it is worth bearing in mind some limitations of the study. The children affected by sexual abuse were recruited from an organization that supports children and their families as they go through the process of prosecuting their alleged abusers. As by definition, these cases are those that have been reported to the authorities. It is possible that the sample may not be representative of all cases of sexual abuse and perhaps have a larger representation of cases involving violence, nonfamily, or other factors that may increase the chance of involving the authorities. Furthermore, each child from this sample was assigned a counselor by the organization. Interventions could range from formal psychotherapy to simple mentoring, potentially mitigating the impact of sexual abuse in the affected children. It is also the case that the sample of control children who recruited as not having experiences of sexual abuse were not given a specific structured interview focused on sexual abuse history. It is, therefore, possible that there were some who had experienced sexual abuse even if it was not labeled as such by their families or themselves. It is also possible that the use of the adult CVLT in a pediatric population, owing to the nonavailability of the child version in Spanish, may have made finer differences in verbal memory more difficult to detect.

One important issue is how well these results generalize to non-Colombian or non-Spanish-speaking children. It is clear that not all cultures share an identical definition of child abuse as "childrearing practices that may be viewed as acceptable by one group but as unacceptable or even abusive and neglectful by another" (Korbin, 1980, p. 3). It is worth noting, however, that Colombia shares a view of sexual abuse in line with international standards, both socially and governmentally (Ministerio de la Protección Social, 2011), and this study included children who were involved in prosecuting their attackers according to these definitions. With regard to language,

it is important to note that all measures have been validated in Spanish and were specifically chosen to be relevant to the population being investigated. Furthermore, as neuropsychological performance is perhaps one of the less value-laden outcomes in psychology, we would expect that neurocognitive impact is likely to be similar across countries, although we hope to investigate this hypothesis further in future studies.

In conclusion, the study results suggest that there may be difficulties in the use of attentional inhibition in sexually abused children, regardless of their PTSD status, and we suggest that this may be a general risk factor for behavior problems and psychopathology during development. With the increasing focus on cognitive remediation as an intervention that aims to directly address core cognitive deficits in psychological disorders (Wykes & Spaulding, 2001), the discovery of executive inhibition deficits may be key for targeting treatment. Furthermore, understanding the cognitive basis of symptoms may be important for formulating psychotherapeutic interventions on the individual level. However, we hope these results will be replicated and extended in order to further understand the neuropsychological impact of abuse on children with the aim of informing treatments and interventions.

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