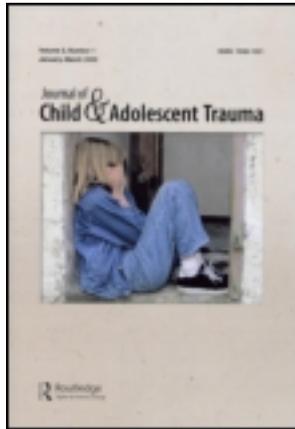


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Characteristics of Neglected and Maltreated Children

Attentional and Executive Functions in Neglected Children

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This study examined attentional and executive functions of 30 neglected children ages 8 to 12, who were compared with a control group of 30 children. Neuropsychological tests measured aspects of simple and complex attention. The results have shown that neglected children were not different from control children with simple tests of attention. However, neglected children were shown difficulties in executive functions, in particular in tasks requiring mental flexibility. Thus, results supported the presence of difficulties regarding executive functions in neglected children, and supported that this form of maltreatment had consequences on high-level mental functions.

Keywords child neglect, neuropsychology, attention, executive functions, anxiety

Over the past few decades, the links between abuse and social, emotional, behavioral, cognitive, and psychopathological problems have been well documented (Cicchetti & Toth, 1995; Glaser, 2000). The Canadian Incidence Study of Reported Child Abuse and Neglect carried out by Trocmé et al. (2003), identified four categories of abuse: (a) physical abuse, (b) sexual abuse, (c) emotional abuse, and (d) neglect. This study deals specifically with neglect, because, first of all, this is the most common type of abuse in terms of incidence, and secondly, because it is the least studied (De Bellis, 2005). When experiencing neglect, the child's security and development is jeopardized through lack of attention or protection by the caregiver (Trocmé et al., 2003). Parents show the inability to provide the necessary care or basic needs linked to health, hygiene, protection, education, and affective environment (Éthier, Lacharité, & Gagnier, 1994).

For children, neglect is a traumatizing experience that results in anxiety and distress. Schore (2001) saw neglect as a relational trauma that disturbs the attachment relationship and neurobiological development. This leads to the activation of the stress response systems and a change in brain development (De Bellis, 2005), which can hinder the development of brain structures, neuronal circuits, and neurotransmission mechanisms involved in emotional regulation (De Bellis, 2005; Lee & Hoaken, 2007). Indeed, certain regions of

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the brain are vulnerable to anxiogenic events experienced at a young age, especially in the prefrontal cortex (Teicher et al., 1997).

The prefrontal cortex is essential to the proper functioning of executive functions (Stuss & Benson, 1984). Executive functions encompass all cognitive abilities including attention, anticipation, initiation, planning, organization, problem-solving, inhibition, flexibility, use of feedback and working memory (Anderson, Jacobs, & Anderson, 2008). They consist of a set of interrelated functions that are essential for the self-regulation of the cognitive, affective, and behavioral functions (Gioia, Isquith, Guy, & Kenworthy, 2000). Given the importance of these processes in adaptation and social participation, and that the cerebral regions that underlie their proper function are vulnerable to stress, it would appear essential to have better knowledge of what happens with neglected children. Moreover, a few studies reported that executive functions were affected in neglected children (De Bellis, Hooper, Spratt, & Woolley, 2009; Nolin & Éthier, 2007).

More specifically, the study conducted by Nolin and Éthier (2007) showed that neglected children who have not suffered physical abuse tend to have more problems with auditory attention and visuo-motor integration; whereas troubles with problem solving, abstraction, and planning problems were specifically higher in neglected children with physical abuse. The research of De Bellis and colleagues (2009) demonstrated that neglected children did not do as well on tests measuring complex visual attention, planning, problem solving, speeded naming, verbal and nonverbal memory, academic achievement, and intellectual functioning. These authors also showed that neglected children who had posttraumatic stress disorder (PTSD) along with neglect performed significantly lower on tests involving a visuo-spatial processing and attentional/executive functions, when compared with children who were neglected only. In short, although deficits in the executive function level for neglected children were reported in earlier studies, it appears difficult to know which of these deficits are attributable to comorbid factors associated with neglect such the presence of physical abuse or a PTSD. For this reason, this study will therefore target only children who have been neglected.

Moreover, no study published using this clientele has examined attentional tasks by dividing these processes into simple and complex aspects. Yet, a study involving mild traumatic brain injury in children (Nolin & Mathieu, 2001) pointed out the relevance of considering hierarchical treatment based on the Norman and Shallice model (1986). This model stipulates that, during routine or relatively routine situations, the subject uses an automatic plan repertoire that requires minimal attentional control. However, when the person becomes unable to deal with the intensity of the information to process, especially in new situations, the supervisory attentional system (SAS), managed by the prefrontal cerebral regions, is activated. As a result, the person uses his attention to increase his ability to process complex information.

Based on the fact that neglect is a relational trauma that disturbs neurological development in children (De Bellis et al., 2009), it has been proposed that neglected children will have more pronounced problems with complex attention tests. Those tests require the use of the SAS and the prefrontal cerebral regions, which are themselves recognized to be affected by stress.

Method

Participants

Clinical characteristics relevant to both groups are presented in Table 1. This research included a total of 60 children ages 8 to 12. This age range was chosen given the

Table 1
Clinical characteristics for the neglected children and nonmaltreated children

Variables	Neglect	Controls	<i>T or F</i>	Pearson χ^2
<i>N</i>	30	30		
Age, mean (<i>SD</i>)	10.67 (1.55)	10.22 (1.06)	1.30	
% Male	60%	63%		0.07
% Right Handed	83%	97%		2.96
% Caucasian	100%	100%		
Child IQ, mean (<i>SD</i>)	95.33 (13.09)	105.17 (16.54)	2.55**	
DSM-IV Anxiety problems (parents)	59.27 (7.12)	54.37 (5.53)	10.96**	
DSM-IV Anxiety problems (teacher)	53.93 (4.01)	54.27 (5.73)	0.24	
DSM-IV Posttraumatic problems (parent)	59.17 (7.07)	57.03 (6.74)	2.41	
DSM-IV Posttraumatic problems (teacher)	57.93 (5.03)	55.10 (4.27)	4.32*	
Hollingshead SES Score, mean (<i>SD</i>)	69.93 (4.25)	60.32 (8.53)	5.53***	

* $p < .05$. ** $p < .01$. *** $p < .001$.

availability of standardized neuropsychological measurements (use of tests and standards) and strong development of the cognitive functions during this period (significant changes in gray and white matter in the brain). Indeed, considerable gains have been documented during this period regarding vigilance, sustained attention, working memory, inhibition, mental flexibility, and context organization/planning for problem-solving (Anderson et al., 2008).

Group 1 (neglected children) was made up of 30 children identified as being exposed to neglect only. The average age was 10.67 years ($SD = 1.55$) and included 18 boys and 12 girls. Participants were appointed to the group of neglected children based on consultation of files from the Mauricie and Centre-du-Québec Child Protection Agencies. Group 2 (control group children) included 30 children: 19 boys, and 11 girls. The average age was 10.22 years ($SD = 1.06$). They were recruited in cooperation with five elementary schools of the Chemin du Roy School Board in Mauricie (Quebec, Canada).

Average education for both groups was equivalent to Grade 4 of elementary school. All children were Caucasian and spoke French. Children were equivalent according to sex, gender, handedness, and age but were not similar on IQ and SES. The mean IQ was 95.33 ($SD = 13.09$) in neglect children and 105.17 ($SD = 16.54$) in the control group. Socioeconomic status (SES) was calculated using the Hollingshead Index of Socioeconomic Status. Given that these variables showed significant differences between these two groups, they were taken into account as covariables in the group comparison analyses. None of the children reported being sexually abused or were diagnosed with mental retardation, brain injury, neurological disorder, autism, or pervasive developmental disorder.

Control Tests

Anxiety and posttraumatic stress problems. The Achenbach System of Empirically Based Assessment: School-Age Forms and Profiles (ASEBA, Child Behavior Checklist for Ages 6–18 [CBCL] and Teacher’s Report form [TRF]; Achenbach & Rescorla, 1991) is frequently used, both for research and clinically, to investigate psychopathologies in children. This instrument has good metrological properties (Achenbach & Rescorla, 2006). The CBCL and TRF comprise 113 items and were completed by two distinct respondents: a parent and a teacher of the child. Only scales for anxiety problems and posttraumatic stress problems were used for this study. The answers were recorded and scored using the computerized system, Assistant Data Manager (ADM; Achenbach, 2007). A *T-score* between 65 and 70 is borderline and a *T-score* greater than 70 indicates that the child has attained the clinical cut-off threshold (Achenbach & Rescorla, 2006).

Intelligence. IQ was estimated using four subtests of the Canadian Wechsler Intelligence Scale for Children, 3rd edition, with the method developed by Kaufman, Kaufman, Balgopal, and McLean (1996) and whose psychometric value has been demonstrated. This shortened version is made up of two verbal subtests (Similarities and Vocabulary) and two nonverbal subtests (Picture completion and Block design). The average IQ is 100 with a standard deviation of 15 (Wechsler, 1991). Given that this variable shows significant differences between these two groups, it will be taken as a covariable in the group comparison analyses.

Instruments Measuring Attentional Functions

Simple attention tests. The French-Canadian version of the Visual Attention subtest from the Developmental Neuropsychological Assessment (NEPSY; Korkman, Kirk, & Kemp, 1998) assesses attention, speed, and the accuracy with which a child can visually scan a set of elements and locate a targeted element. The child observed the images and crossed out the targets as quickly and accurately as possible. Raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This subtest has good psychometric properties for its validity and reliability (Korkman, Kirk, & Kemp, 2003).

Part A of the French-Canadian version of the Auditory Attention and Response Set subtest from the NEPSY (Korkman et al., 1998) assesses the children’s capacity for selective auditory attention. The children must place different colored foam squares into a box by following audiotaped instructions. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (Korkman et al., 2003).

The Color-Word Interference Test, Condition 1: Color Naming Delis-Kaplan Executive Function System (Delis, Kramer, Kaplan, & Holdnack, 2004) was used to measure the simple selective visual attention. The child had to say which color squares were (50 in total, in red, blue, and green) as quickly as possible. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (Delis et al., 2004).

The Color-Word Interference Test, Condition 2: Word Reading (Delis et al., 2004) was used to evaluate simple selective visual attention. The child had to read 50 words (red–blue–green) as quickly as possible. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (Delis et al., 2004).

Complex attention tests. Part B of the French-Canadian version of the Auditory Attention and Response Set subtest from the NEPSY (Korkman et al., 1998) assesses the children's capacity for selective auditory attention and the ability to change and maintain a new answer plan involving matching and differentiating answers. The children must place different colored foam squares into a box by following audiotaped instructions. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (see Korkman et al., 2003).

The Color-Word Interference Test, Condition 3: Inhibition is used to evaluate the inhibition skills for an automated response. The red, green, and blue words are printed in a different color (for example, the word "red" is printed in blue) and the child has to name the color of the ink used to print the word. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (see Delis et al., 2004).

The Color-Word Interference Test, Condition 4: Inhibition/Switching measures mental flexibility and control of interference. The child must carry out the task described for the Color-Word Interference Test, Condition 3: Inhibition, except for words that were in text boxes where the child must read the word instead of giving the color of the ink. The raw scores were converted to age-corrected standard scores ($M = 10$, $SD = 3$). This test has good psychometric properties for its validity and reliability (see Delis et al., 2004).

Procedures

The research project was approved by the Ethics Committee of the University of Québec in Trois-Rivières. Parents signed an informed consent form before the children were assigned to a research professional. Children 10 years or older also signed a form before the evaluation, and those younger than 10 gave their verbal consent. Then, a research professional met with the children at their school to carry out an evaluation that took approximately two hours.

Statistical Analysis

Age, Hollingshead Index of Socioeconomic Status and IQ were examined using analysis of variance (ANOVA). Sex and handedness were examined using a chi square. DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.; American Psychiatric Association, 1994) Anxiety problems (parents), DSM-IV Anxiety problems (teacher), DSM-IV Posttraumatic stress problems (parent), and DSM-IV Posttraumatic stress problems (teacher) were analyzed using an analysis of variance using the Hollingshead Index of Socioeconomic Status and IQ as covariables (ANCOVA). Two multivariate analyses with the Hollingshead Index of Socioeconomic Status and IQ score as covariables (MANCOVA) were carried out, first with the simple attention tests followed by the complete attention tests. Partial Eta Square (η_p^2) was reported to describe effect sizes for significant differences (Small < 0.06; Medium = 0.12; Large > 0.16).

Results

Problems of Anxiety and Posttraumatic Problems

According to the perceptions of parents, neglected children had more anxiety problems (DSM-IV Oriented Scales; Achenbach, 2007; $F(1,57) = 10.96$, $p < 0.01$) than control children whereas, according to the perception of teachers, neglected children did not differ

Table 2
Neuropsychological findings for the neglected children and nonmaltreated children

Cognitive Domain	Neglect mean (<i>SD</i>)	Controls mean (<i>SD</i>)	Statistic	Partial Eta ²
<i>Simple tasks of attention</i>				
<i>IQ</i>			$F(4, 53) = 1.03$	.07
<i>SES</i>			$F(4, 53) = 1.96$	.13
Group effect			$F(4, 53) = 1.26$	.09
Visual attention (NEPSY)	8.50 (2.68)	10.37 (2.27)	$F(1, 56) = 1.02$	.02
Auditory attention (Part A, NEPSY)	8.87 (1.43)	8.80 (1.54)	$F(1, 56) = 0.75$	.01
Color Naming (Condition 1, D-KEFS)	8.87 (3.72)	10.97 (2.39)	$F(1, 56) = 2.87$	.05
Word Naming (Condition 2, D-KEFS)	9.60 (3.15)	11.37 (2.06)	$F(1, 56) = 2.87$	.05
<i>Complex tasks of attention</i>				
<i>IQ</i>			$F(4, 54) = 2.63$	.13
<i>SES</i>			$F(4, 54) = 0.02$	.00
Group Effect			$F(3, 54) = 2.98^*$	.14
Auditory attention (Part B, NEPSY)	7.57 (1.76)	7.70 (1.54)	$F(1, 56) = 0.00$	.00
Inhibition (Condition 3, D-KEFS)	9.63 (3.05)	10.97 (2.19)	$F(1, 56) = 0.69$	.01
Inhibition/Switching (Condition 4, D-KEFS)	8.73 (2.83)	11.27 (1.84)	$F(1, 56) = 8.33^*$	.13

* $p < 0.05$.

on this scale ($F(1,57) = 0.24$, ns), after controlling the SES and IQ (see Table 1). According to the perception of teachers, neglected children had more posttraumatic stress problems (DSM-IV Oriented Scales, Achenbach, 2007; $F(1,57) = 4.32$, $p < 0.05$) than control children whereas, according to the parents perception, neglected children were not different on this scale ($F(1,57) = 2.41$, ns) (see Table 1). These results were important for meeting the objectives of the study because they demonstrated that neglected children had life contexts that were more stressful than that of the children in the control group, without their condition reaching critical PTSD thresholds.

Simple Attention Tests

The multivariate covariance analysis (MANCOVA) showed no effect of the socioeconomic level ($F(4,53) = 1.95$, ns) or IQ ($F(4,53) = 1.03$, ns) covariables and no group effect ($F(4,53) = 1.26$, ns). The neglected children did not differ from the control group children regarding simple attention tests (Table 2).

Complex Attention Tests

The MANCOVA showed no effect on the socioeconomic ($F(3,54) = 0.02$, ns) or IQ ($F(3,54) = 2.64$, ns) covariables. However, a group effect was observed ($F(3,54) = 2.98$,

$p < 0.05$). Neglected children had more problems in terms of complex attention tests versus children in the control group. Follow-up univariate analyses showed the groups differ on cognitive flexibility (Color-Word Interference Test, Condition 4: Inhibition/Switching) with medium effect sizes (see Table 2). Neglected children had lower results on this test. These results confirm the prior hypothesis that neglected children would have more problems with complex attention tests than children in the control group.

Discussion

The purpose of this study was to look at the sensitivity of certain neuropsychological tests that measure simple and complex attentional functions in neglected children versus the children in a control group. Overall, the results indicated that neuropsychological tests helped identify weaknesses in neglected children. These results showed the importance of expanding the study of maltreatment to neurosciences, as De Bellis (2005), De Bellis et al. (2009), and Glaser (2002) have proposed.

However, the results of the analyses showed that not all functions seem to be affected by neglect. Indeed, this is what has been observed in the area of simple attentional functions in which there is no significant difference between the groups. These results can be explained by the few cognitive requirements used in the tests taken. Indeed, simple attentional tests require a child to select information and ignore nonrelevant information and distractions (Baddeley, 2002), but they do not use more complex functions, particularly executive functions (e.g., inhibition of a dominant response, working memory, etc.). Using more sensitive and diversified tests (sustained visual and auditory attention, shared attention, processing time, and reaction time) may in the future confirm that it is truly all the simple attentional dimensions that are maintained in neglected children.

In contrast, in the area of complex attention or executive functions in which tasks require greater cognitive resources, neglected children show significant weakness versus children in the control group. These results are in line with previous studies (De Bellis et al., 2009; Nolin & Éthier, 2007). Low performance in the executive functions is suggestive of gaps in the neurological functioning in the areas of the brain used in the presence of stress, in particular the dorsolateral and medial prefrontal cortex (De Bellis et al., 2009), and would be related to the supervisor attentional system (Shallice, 1995). More specifically, the deficits observed in this study are primarily related to control of interference and mental flexibility which ensure effective regulation of the cognitive processes as well as good resistance to distractions during conflictual situations (Barkley, 1997).

Indeed, mental flexibility includes the ability to alternate between sets of responses, learn from one's errors, come up with alternative strategies, divide one's attention and handle several sources of information simultaneously (Anderson, 2002; Baddeley, 2002). The deficits seen for executive functions could contribute to clinically observed rigidity in the day-to-day activities of neglected children including problems alternating between two tasks, and problems changing their behavior and initiating a new response. Indeed, inflexible individuals are generally considered rigid and ritualistic; they react strongly to changing situations and do not manage to adapt to new requests. They generally strive to mentally manipulate information or remember information presented beforehand. Deficits in this area are also associated with persevering behaviors (e.g., repeats the same mistakes or breaks the same rules). Thus, although a child may be able to describe the adequate process, he or she cannot carry out the appropriate action.

The results of this study also support the idea put forth by Cicchetti (2004) that neglect adversely affects the development of the child beyond the simple fact of living in a poor socioeconomic setting. In fact, the results of the covariance analyses showed that the two groups differed in complex attentional measurements even after having controlled the socioeconomic effect. Those problems affecting executive functions were than associated with neglect rather than poverty.

Limits and Future Research

Certain limits need to be taken into account in this study, in particular (a) the limited number of participants in the groups; and (b) the purity of the neglected group versus other types of maltreatment. Indeed, it is impossible to be 100% certain that neglected children have never been exposed to other types of abuse or violence. The cooperation of caseworkers and the administrative and legal structure that governs the identification of types of maltreatment have definitely been a great help in targeting neglected children in this case. However, this study's results cannot be generalized to all children who have been followed by youth protection centers. Furthermore, other factors, especially social desirability in parents, could have influenced the results without the specific reasons being known.

Future studies are necessary to clarify the nature and scope of the difficulties seen in neglected children based on the type of maltreatment to which they are exposed to better understand their cognitive function and organize interventions accordingly. Neuropsychology is an interesting discipline because it allows one to make a link between the neurobiological aspects and the behaviors observed in the day-to-day life of the child. Moreover, given the deficits seen in the neglected children in this study, it is important to develop intervention programs that take into consideration the child's age given the developmental trajectory of attentional and executive functions that will develop until adulthood (Anderson et al., 2008).

Cognitive remediation looks promising given the plasticity of the brain and allows lacking cognitive functions to be recovered. Training executive and attentional functions could reduce behavioral and school problems (e.g., opposition), and thus promote better adaptation in children. Currently, certain cognitive remediation software programs are available to implement personal intervention strategies with these children (e.g., Attentional: Laporte, Pépin, & Loranger, 2002; RÉÉDUC software: Pépin & Loranger, 2007; Lancelot et les peuples du Savoir: Leblanc & Daigneault, 2003). Furthermore, it is important to intervene early on in the development of the child by also instilling cognitive-behavioral psychotherapy groups as well as family therapy, in particular, given the internalized problems identified in neglected children (e.g., anxiety); problems that could be related to executive function deficits. These kinds of therapies could promote the development of a sense of control in the child and reduce the intensity and frequency of maladaptive behavior. Lastly, because the executive functions are essential to the realization of activities of daily living, it is essential that those responsible for children in centers of youth protection solicit neuropsychological assessments to develop intervention plans that will help in preventing adjustment problems at home and at school.

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