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The Neuropsychology of Sex Offenders: A Meta-Analysis

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Abstract

Typically, neuropsychological studies of sex offenders have grouped together different types of individuals and different types of measures. This is why results have tended to be nonspecific and divergent across studies. Against this background, the authors undertook a review of the literature regarding the neuropsychology of sex offenders, taking into account subgroups based on criminological theories. They also conducted a meta-analysis of the data to demonstrate the cognitive heterogeneity of sex offenders statistically. Their main objective was to test the hypothesis to the effect that the neuropsychological deficits of sex offenders are not broad and generalized compared with specific subgroups of participants based on specific measures. In all, 23 neuropsychological studies reporting data on 1,756 participants were taken into consideration. As expected, a highly significant, broad, and heterogeneous overall effect size was found. Taking subgroups of participants and specific cognitive measures into account significantly improved homogeneity. Sex offenders against children tended to obtain lower scores than did sex offenders against adults on higher order executive functions, whereas sex offenders against adults tended to obtain results similar to those of non-sex offenders, with lower scores in verbal fluency and inhibition. However, it is concluded that neuropsychological data on sex offenders are still too scarce to confirm these trends or to test more precise hypotheses. For greater clinical relevance, future neuropsychological studies should consider specific subgroups of participants and measures to verify the presence of different cognitive profiles.

Keywords

neuropsychology, cognition, sexual deviance, sex offenders, pedophiles

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The etiological and risk factors in pedophilia and sexual deviance are notoriously complex, with intricate biopsychosocial roots (e.g., Seto, 2008a, 2008b). From a biological perspective, neurodevelopmental abnormalities are commonly suspected to be involved in pedophilia although the evidence for this is indirect and causality is unclear (e.g., left-handedness, different fraternal birth order, second-to-fourth-finger-length ratio, childhood traumatic brain injuries; Blanchard et al., 2003; Cantor, Klassen, et al., 2005; Quinsey, 2003; Rahman & Symeonides, 2008). Neuropsychological studies have generally found sex offenders to present significant cognitive impairments. However, the research has typically focused on heterogeneous groups of participants and batteries of different measures, which might explain the nonspecific and divergent results obtained (for reviews, see Blanchard, Cantor, & Robichaud, 2006, and Joyal, Black, & Dassylva, 2007). Consequently, a fundamental question remains unanswered concerning cognitive impairments in sex offenders: Are they specific or generalized? As pointed out by Blanchard et al. (2006), older neuropsychological studies as a whole have strongly suggested the presence of general cognitive impairments in sex offenders detected by virtually all measures. However, more specific deficits might be identified if subtypes of sex offenders and subtypes of cognitive measures were considered (Joyal et al., 2007). This type of results would illustrate the usefulness of neuropsychological evaluation with sexual offenders, which is still underused in the field. Against this background and in light of the recent interest in the cognitive evaluation of sex offenders (Cohen, Nesci, Steinfeld, Haeri, & Galynker, 2010; Eastvold, Suchy, & Strassberg, 2011; Kruger & Schiffer, 2011; Schiffer & Vonlaufen, 2011; Suchy, Whittaker, Strassberg, & Eastvold, 2009), we conducted a comprehensive review of the relevant literature. Second, we performed a meta-analysis of the data to demonstrate the cognitive heterogeneity of sex offenders statistically and the ineffectiveness of grouping these offenders together for neuropsychological evaluation. A meta-analysis would also help estimating the relative effects reported in previous studies and identifying potentially important moderators. Third, we sought to determine whether subgroups of sex offenders would present more specific cognitive profiles when distinct measures were used.

Neuropsychological research has recently begun distinguishing subgroups of offenders and different cognitive profiles have tended to emerge, for instance, between pedophilic and nonpedophilic child molesters (Eastvold et al., 2011; Schiffer & Vonlaufen, 2011; Suchy et al., 2009). The use of measures that target more specific dimensions, such as impulsivity versus reasoning, instead of broad cognitive categories such as "executive functions" seems fruitful. If subtypes of sex offenders can be associated with particular cognitive profiles, then neuropsychological evaluation could further our understanding and improve prevention of sexual offending. Inversely, if all sex offenders present similar profiles of broad, generalized cognitive impairments, neuropsychological examination would have limited utility.

The Neuropsychology of Sex Offenders

Sex offenders are clearly seen as a heterogeneous group in criminology and psychology. Several typologies have been proposed to distinguish subgroups (e.g., Marshall, Laws, & Barbaree, 1990; Prentky, Knight, Rosenberg, & Lee, 1989). Surprisingly, neuropsychological studies have tended to ignore these typologies and to group subtypes of sex offenders and/or subtypes of cognitive measures (merging together pedophilic child molesters and rapists of adults, for instance, or using composite scores of neuropsychological batteries; e.g., Flor-Henry, 1987; Langevin & Curnoe, 2008a; Langevin, Wortzman, Wright, & Handy, 1988; Spinella, White, Frank, & Schiraldi, 2006; Young, Justice, & Edberg, 2010). This approach has yielded the classic neurobiological hypothesis of sexual deviance, which attributes a prominent role to fronto-temporal anomalies, especially in the left hemisphere (e.g., Flor-Henry, 1987; Gillespie & McKenzie, 2000; Lang, 1993; O'Carroll, 1989). These fronto-temporal anomalies and their neuropsychological manifestations, however, are neither specific nor characteristic of sex offenders, as they are associated with a wide array of conditions from conduct disorders (e.g., Moffitt & Silva, 1988) to schizophrenia (Heinrichs & Zakzanis, 1998). More recently, the so-called executive functions have been the main focus of neuropsychological studies of sex offenders (Cohen et al., 2010; Eastvold et al., 2011; Schiffer & Vonlaufen, 2011; Stone & Thompson, 2001). However, the term "executive functions" refers to a broad range of capacities, which might explain in part the lack of convergence and specificity across studies. This is why both specific subgroups of participants and more targeted measures of cognition should be considered in the aim of determining the existence of particular neuropsychological profiles among sex offenders. Based on criminological and psychological theories (e.g., Knight & Prentky, 1990; Marshall et al., 1990; for a review of the theories see Ward, Polaschek, & Beech, 2006; for a review of the discriminative factors see Seto & Lalumière, 2010) and existing neuropsychological studies of sex offenders, at least three fundamental moderating factors can be used to distinguish subgroups of participants and measures: (a) age of victim (prepubescent vs. adult/peer); (b) type of neuropsychological assessment; and (c) type of comparison group.

Moderator 1: Age of Victim (Prepubescent vs. Adult/Peer)

Neuropsychological studies have commonly grouped child molesters with prepubescent victims together with rapists (adult/peer victims) in their analyses. Despite the little direct evidence presently available to this effect, these two subgroups should present distinct cognitive profiles. First, a narrative review of older studies underlined that child molesters seemed to exhibit more diverse and more severe cognitive dysfunctions than did sex offenders against adults/peers (Joyal et al., 2007; see also Langevin & Curnoe, 2008a). Second, as a group, child molesters have a lower mean IQ than do rapists of adults (Cantor, Blanchard, Robichaud, & Christensen, 2005a), and a significant correlation exists between mean IQ of child molesters and age cutoff for child victims (Cantor, Blanchard, Christensen, Dickey, & Klassen, 2004). Although IQ levels are not necessarily associated with status of cognitive functioning, we might hypothesize that sex offenders against children on average show more neuropsychological deficits than do sex offenders against adults/peers.

Another important aspect to consider in the neuropsychology of sex offenders is the distinction between sexual deviance (i.e., atypical sexual interests) and antisociality (e.g., impulsivity, substance abuse, antisocial environment). These are two fundamental factors in classic models of sexual offending (e.g., Hall & Hirschman, 1991; Knight & Prentky, 1990). The two explain significant and distinct, albeit overlapping, proportions of variance in sexual offending and reoffending (McCann & Lussier, 2008). Each factor might also be related to distinct neuropsychological profiles. Sexual deviance such as sexual attraction to children is traditionally linked with asocial traits, including isolation, poor interpersonal and courtship skills, low self-esteem, feelings of inadequacy, lack of assertiveness, fear of rejection, and lack of sexual knowledge (e.g., Davis & Leitenberg, 1987; for reviews, see Seto, 2008a, 2008b). In psychiatry, asociality is clearly predictive of more severe cognitive impairments affecting in particular the higher order executive functions (e.g., reasoning, deduction, cognitive flexibility, working memory; Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002; Green, Olivier, Crawley, Penn, and Silverstein, 2005; Schonfeld, Paley, Frankel, & O'Connor, 2006). The presence of antisocial behaviors is associated with less cognitive impairment among persons with a severe mental illness (Joyal, Hallé, Lapierre, & Hodgins, 2003).

Given that a previous meta-analysis confirmed that child molesters as a group present weaker social skills for interacting with the opposite sex than do sex offenders against adults (Dreznick, 2003), we might hypothesize that they present more cognitive impairments overall than do sex offenders against adults because cognitive impairment and social skill deficits are related. In this regard, unpublished data suggest that among sex offenders, those who victimize prepubescent children are more socially reclusive, less likely to have lived independently and to have been married, less intelligent, and more likely to present cognitive deficits and psychopathology (King, 2010).

Moderator 2: Type of Comparison Group

Given the high prevalence of psychological comorbid conditions and criminological histories reported among sex offenders, it comes as no surprise that they obtain significantly poorer neuropsychological results compared with the general population (Blanchard et al., 2006). However, other comparison groups, such as antisocial non-sex offenders, should also be considered given the key role of antisociality in sexual offending (Seto & Lalumière, 2010). Sex offenders of the antisocial type are opportunistic and self-centered, act without premeditation, often present an associated substance abuse problem, and are at lower risk of recidivism for sexual offending than for non-sexual offending (McCann & Lussier, 2008). Consequently, this type of offender might simply present a neuropsychological profile similar to that of general offenders. This profile is clearly associated with impulsivity (e.g., lack of inhibition, high risk-taking tendencies, low consideration for consequences, weak sustained attention, poor operant conditioning) and verbal processing impairments (e.g., Moffitt & Henry, 1989; Moffitt & Silva, 1988; White et al., 1994; for a meta-analysis see Ogilvie, Stewart, Chan, & Shum, 2011). Working-memory deficits and other higher order executive dysfunctions have also been reported although these have been observed more specifically in chronically violent persons (e.g., Séguin, Nagin, Assaad, & Tremblay, 2004). In this regard, antisocial and psychopathic juvenile delinquents demonstrate good higher order executive functions when they cooperate, especially respecting capacities assessed with the Wisconsin Card Sorting Task (WCST; Moffitt & Henry, 1989; Moffitt & Silva, 1988; Roussy & Toupin, 2000).

Moderator 3: Type of Neuropsychological Assessment

Pioneer neuropsychological studies of sex offenders tended to report global composite scores from neuropsychological test batteries (e.g., Graber, Hartmann, Coffman, Huey, & Golden, 1982; Hucker et al., 1986; Langevin, Ben-Aron, Wright, Marcheses, & Handy, 1988; Langevin, Curnoe, & Bain, 2000; Langevin, Glancy, Curnoe, & Bain, 1999; Langevin, Lang, Wortzman, Frenzel, & Wright, 1989; Langevin, Wortzman, Dickey, Wright, & Handy, 1988; Langevin, Wortzman, Wright, & Handy, 1989; Plante, Manuel, and Bryant, 1996; Scott, Cole, McKay, Golden, & Liggett, 1984). These generated nonspecific and divergent results (Blanchard et al., 2006). To evaluate specific neuropsychological hypotheses concerning subgroups of sex offenders, individual validated and specialized measures should be used (for a compendium of neuropsychological assessments, see Lezak, Howieson, Bigler, & Tranel, 2012).

Measures of executive functions are of particular interest in that an association has been suggested between sexual deviance and dysexecutive symptoms (Eastvold et al., 2011; Schiffer & Vonlaufen, 2011). However, the distinction between lower order executive functions (e.g., behavioral inhibition, control of interference, selective attention) and higher order ones (e.g., reasoning, deduction, planning, cognitive flexibility) has rarely been made. Such a distinction would help refine hypotheses. For instance, classic tests of executive functions such as the Stroop task (Stroop, 1935) and the Trail-Making B task (Army Individual Test Battery, 1944) are more sensitive to impulsivity and poor control of interference than other measures of executive functions. Other classic tests of executive functions such as the Category Test (Reitan, 1955), the Wisconsin Card Sorting Task (WCST; Berg, 1948), and Raven's Matrices (Raven, 1982) measure higher order executive functions. Although these traditional tests are not as specific as more recent measures, they should at least be considered separately. In addition, measures of cognitive functions not considered to be "executive" should also be used, including verbal-learning and memory tasks such as the Logical Memory Test (Weschler, 1987) and verbal-fluency tasks, such as the Controlled Oral Word Association Test (Benton & Hamsher, 1989). In short, to test specific hypotheses, individual measures must be used.

In light of the above, we could expect a double dissociation to emerge between measures of lower and higher order executive functions, on one hand, and asocial and antisocial sex offenders, on the other. Given that antisociality is more closely related to the sexual victimization of peers/adults than to that of children (McCann & Lussier, 2008; Seto & Lalumière, 2010) and that the opposite is true for asociality, it is reasonable to posit that the two groups differ in terms of their cognitive profiles.

In sum, to be clinically relevant in the field of sexual deviance, neuropsychological studies should consider more homogeneous subgroups of participants and individual cognitive measures. Demonstrating that subgroups of sex offenders present different cognitive deficits would help improve our understanding of sex offenders and their treatment, as well as the prevention of sex offending. It could in time contribute also to individual neuropsychological profiling and recidivism risk assessment.

The main goal of this study, then, was to perform a meta-analysis of existing neuropsychological studies of sex offenders and to test the capacity of three fundamental moderators to generate more cognitively homogeneous subgroups. The purpose of the meta-analysis was to calculate and compare effect sizes of different subgroups of offenders with different types of cognitive measures. More specifically, the following hypotheses were tested:

Hypotheses 1: The overall effect size of neuropsychological differences (all types) between sex offenders (all types) and the general population would be significantly heterogeneous.

Hypotheses 2: Each moderating factor (age of victim; type of cognitive domain; and type of comparison group) would significantly improve the homogeneity of the data.

Hypotheses 3: Sex offenders against children would be more cognitively impaired than sex offenders against adults.

Hypotheses 4: Sex offenders against adults would score lower than sex offenders against children on tasks that are sensitive to antisociality.

Hypotheses 5: Sex offenders against adults and non-sex offenders would present comparable neuropsychological profiles.

Method

Data Search

An extensive literature search was performed in various computerized databases (Scopus, Web of Science, Google scholar, Dissertations and Theses, Medline, and PsycInfo) on combinations of the following keywords: pedophilia, pedophiles, sex offenders, sexual deviance, child molesters, rapists, paraphilia, cognition, neuropsychology, neurocognition, and executive functions. Both published and unpublished data sets were considered (e.g., dissertations, theses, proceedings, and personal communications). The reference lists of all pertinent papers were inspected as well, as were all studies that referred to these papers and all related papers identified by the search engines. All studies published prior to June 2011 were taken into account. To be included in the meta-analysis, studies had to meet three conditions: (a) contain at least one individual neuropsychological measure (as opposed to general indexes from neuropsychological batteries; reports limited to IQ were excluded as an excellent meta-analysis focused exclusively on the IQ of sex offenders already existed, i.e., Cantor et al., 2005a); (b) provide minimal statistical information to calculate effect sizes (e.g., *N*, mean, and standard deviation for direct calculations or other type of information such as exact probability levels or frequency distributions for estimations using formulas proposed by Lipsey & Wilson, 2001); and (c) include a comparison group (either a control group, another experimental group, or both).

Statistical Analyses

Variable coding was carried out following the guidelines and forms proposed by Lipsey and Wilson (2001). The effect sizes of the mean differences between sex offenders and controls were calculated for each neuropsychological measure using the Comprehensive Meta-Analysis Software, version 2 (Biostat Inc., Englewood, NJ, USA). Cohen's *d* (standardized mean difference using pooled standard deviations) was used to generate an overall (average) effect size across all studies along with 95% confidence intervals. To increase stability, a measure had to have been used in at least four studies to be included in the meta-analysis. The overall (mean) effect size was based on all types of sex offenders and all neuropsychological variables, and effect sizes of .20, .50, and .80 were used as thresholds to define small, medium, and large effects, respectively (Cohen, 1988). Each study could contribute only one effect size per variable category, and all effect sizes were independent within a category. Effect sizes obtained in larger studies were not given more weight than those obtained in smaller studies (e.g., with the inverse-variance method; Hedges & Olkin, 1985; Higgins & Green, 2008; Lipsey & Wilson, 2001) as the latter were pioneer reports with more methodological limitations (e.g., participant overlap, file-based collection of clinical data, reporting of composite scores from neuropsychological batteries, unmatched comparison groups; e.g., Hucker et al., 1986; Hucker, Langevin, Dickey, et al., 1988; Langevin, Ben-Aron, et al., 1988; Langevin et al., 1985; Langevin, Lang, et al., 1989; Langevin, Wortzman, et al., 1988, 1989; for critical reviews see Blanchard et al., 2006; Joyal et al., 2007). Therefore, results were entered in straightforward fashion.

The meta-analysis was based on random effects, which constitutes a more conservative model, as several factors that could not be controlled owing to the small number of available studies were expected to intervene within the effect sizes. It is assumed under this model that effect sizes can differ because characteristics vary from one study to another, whereas in a fixed-effects model, it is assumed that all studies are derived from a common population and that the only source of variation across studies is random error, which was not the case here (Lipsey & Wilson, 2001; Thompson & Higgins, 2002). Possible intervening factors include validity of diagnosis, presence of matched or unmatched control group, nature of comparison group (e.g., violent nonsexual vs. nonviolent property offenders; general population), distinction between preferential and situational type of sex offender against children (e.g., exclusive pedophilia), criminal history (e.g., various types of crimes vs. specialized, only sex crimes), validity of neuropsychological tasks, distinction between measures of cognitive functions (e.g., verbal memory) and executive functions (e.g., working memory), and distinction between lower order (e.g., impulsivity) and higher order (e.g., reasoning) executive functions. Because the number of meta-analysis moderators should be determined a priori, based on theoretical grounds and having a sufficient number of studies (Higgins & Green, 2008; Lipsey & Wilson, 2001), we considered the following three moderators: (a) age of victim (sex offenders against children vs. sex offenders against adults), (b) type of cognitive domain and neuropsychological measure involved and (c) type of comparison group (general population vs. non-sex offenders).

Regarding the first hypothesis, a Q-test of heterogeneity was conducted to determine whether the observed effect sizes across existing studies (all groups of sex offenders and different types of cognitive measures) resulted from sampling the same population of effect sizes. A significant Q-value indicates that variance in effect sizes across studies is due to factors other than sampling error, suggesting that systematic differences across the studies might be causing meaningful differences in the effects (Hedges & Olkin, 1985; Hunter & Schmidt, 2004; Lipsey & Wilson, 2001). For the purposes of our study, variability in the distribution of the effect sizes used to compute the overall effect size was expected to exceed that of sampling error alone, and the overall effect size was *not* expected to meet the requirement of the homogeneity test. When statistically significant, the Q-test of heterogeneity justifies the quest for moderating factors. Consequently, additional Q-tests of homogeneity were performed to determine whether moderating factors accounted for a significant portion of the overall heterogeneity. Between-group differences were assessed with an ANOVA analog based on the Q-test, which groups effect sizes into mutually exclusive categories on the basis of an independent variable and represents a measure of the magnitude of the effect size difference between groups (Lipsey & Wilson, 2001). When the number of effect sizes was insufficient to conduct an ANOVA analog (i.e., fewer than 10 studies; Higgins & Green, 2008), we evaluated the statistical significance of the difference between groups by excluding zero in the confidence intervals (Seto & Lalumiere, 2010).

Results

The bibliographical search generated 141 references, including 113 different published or unpublished neuropsychological studies involving sex offenders as participants (see references with an asterisk in the reference list). However, approximately half of the neuropsychological studies ($N = 63$) focused exclusively on IQ and were therefore excluded (see Cantor et al., 2005a, for a meta-analysis of IQ reports regarding sex offenders). Among the studies that reported cognitive evaluations other than IQ measures, some were clinical reports or small research projects involving few participants and no comparison group (Bowden, 1989; Burns & Swerdlow, 2003; Cassens, Ford, Lothstein, & Gallenstein, 1988; Graber et al., 1982; Mendez, Chow, Ringman, Twitchell, & Hinkin, 2000; Pflugradt & Allen, 2010; Tost et al., 2004; Walhberg et al., 2003). Other studies reported only global indexes of neurological integrity from neuropsychological batteries (e.g., with the Reitan or Luria-Nebraska batteries; Hucker et al., 1986; Hucker, Langevin, & Bain, 1988; Hucker, Langevin, Dickey, et al., 1988;

Plante et al., 1996; Scott et al., 1984; Yeudall, 1977), scaled or standardized scores (e.g., *T*-scores or *z* scores; Flor-Henry, 1987; Knox-Jones, 1995; Martin, 1999; Young et al., 2010), or composite scores (Kelly, Richardson, Hunter, & Knapp, 2002; Langevin & Curnoe, 2008a; Simpson Tate, Ferry, Hodgkinson, & Blaszczynski, 2001). In these cases, attempts were made to contact the principal author to obtain additional information, which we managed to do for three data sets (our thanks to Lisa Cohen, Angela Eastvold, and Yana Suchy for their kind replies). Two German studies had to be excluded (Schiffer, Krueger, et al., 2008; Schiffer, Paul, et al., 2008) because participants overlapped with a third report that we did include (Kruger & Schiffer, 2011; our thanks to Boris Schiffer and Tillman Kruger for confirming the information). In a few rare cases, different reports used the same control group. These were included but with one common control group (e.g., Langevin, Lang, et al., 1989; Langevin, Wortzman, et al., 1988, 1989). Finally, as certain neuropsychological tasks were used in fewer than four studies, they could not be compared (Cantor et al., 2004; Fazel, O'Donnell, Hope, Gulati, & Jacoby, 2007; Hambridge, 1994; Spinella et al. 2006; Valliant Gauthier, Pottier, & Kosmyna, 2000).

In the end, 23 neuropsychological studies reporting data on 1,756 different participants were included in the meta-analysis (see Table 1 and references with three asterisks in the reference list). Of these participants, 1,063 were sex offenders (of whom 530 victimized children), 375 were non-sex offenders (of whom 78 were violent), and 318 were recruited in the general population (no criminal record). Ten neuropsychological variables were reported (raw data) with sufficient consistency (in at least four studies) to be coded for the meta-analysis: The Stroop interference condition (time; cognitive inhibition), the trail-making B task (time; speed processing and switching), the Wisconsin Card Sorting Task (categories, perseveration, and correct responses; reasoning and cognitive flexibility), the Halsteid-Reitan Category Task (number of correct responses; reasoning), Raven's Standard Progressive Matrices (total score; reasoning and fluid intelligence), the Control Oral Word Association Test (COWAT; number of correct responses; verbal fluency), the logical memory subtest (delayed recall; memory), and the visual reproduction subtest (delayed recall; memory) of the Weschler Memory Scale (see Table 1). A total of 147 effect sizes were calculated, of which all but eight were based on means and standard deviations.

Overall cognitive performance of sex offenders versus general population. Fourteen comparisons were available between sex offenders and members of the general population with all cognitive measures combined (Table 2). A highly significant overall effect size was noted between the groups when all neuropsychological tasks were combined ($d = 0.592$, $SD = 0.024$, 95% confidence interval: [0.292, 0.893], z score = 3.86; $p < .0001$). As expected, however, these effect sizes were not homogeneous across studies ($Q = 43.58$, $df = 13$; $p < .0001$), confirming the need to include moderators. The first moderator entered in the analysis was age of victim. When sex offenders against children (12 years old or younger) were considered separately from sex offenders against adults, the level of heterogeneity diminished considerably though it did remain significant ($Q_{within} = 22.8$, $df = 12$, $p = .03$). This result suggested that homogeneity increased

Table 1. Studies and Overall Effect Sizes Included in the Meta-Analysis (Statistical Significance in Bold; Positive Values Indicate Better Performance From the Comparison Group).

Study	Comparison (*N*)	Measure	EF	*Z*	*Q*
Abracen (1991)	SOC (12) vs. Ctrl (13)	All	**0.92***	**2.2**	0.05
		Raven	**0.98***	**2,3**	
		Trail-B	**0.85***	**2.0**	
Cohen et al. (2002)	SOC (22) vs. Ctrl (24)	All	0.02	0.07	2.59
		Trail B	–0.21	–0.7	
		WCST-Cat	0.0	0.0	
		WCST-Cor	0.28	1.0	
		WCST-Per	–0.2	–0.6	
		COWAT	0.01	0.9	
		Stroop	0.25	0.8	
Cohen et al. (2010)	SOC (22-50) vs. Ctrl (20-87)	All	0.15	0.6	**10.97***
		Trail B	–0.21	–0.7	
		WCST-Cat	0.0	0.0	
		WCST-Cor	0.28	1.0	
		WCST-Per	–0.2	–0.6	
		COWAT	0.01	0.9	
		Stroop	0.25	0.8	
Dolan et al. (2002)	SO (20) vs. HO (27)	All	0.31	1.0	5.02
		Trail B	–0.17	–0.57	
		WCST Per	**0.54***	**1.80**	
		COWAT	0.13	0.49	
		Logical memory	0.38	1.26	
		Visual memory	**0.67***	**2.20**	
Eastvold et al. (2011)	Pedo (30) & CM (30) vs. NSO (29)	All	0.20	1.1	**14.43****
	SOC vs. NSO	Trail B	–0.34	–1.31	
		COWAT	0.17	0.6	5
		Stroop	**0.56***	**2.1**	
	Pedo vs. NSO	Trail B	–0.21	–0.79	
		COWAT	0.25	0.95	
		Stroop	**0.86****	**3.2**	
Gillepsie and McKenzie (2000)	SO (8) vs. NSO (8)	All	0.32	0.6	2.70
		Trail B	–0.26	–0.45	
		COWAT	**0.89***	**1.7**	

(continued)

Table 1. (continued)

Study	Comparison (*N*)	Measure	EF	*Z*	*Q*
		Stroop	0.11	0.22	
		Raven	0.5	1.02	
Joyal et al. (2007)	SOC (12) & SO (8) vs. Ctrl (13-118) SOC vs. Ctrl	All	**0.64****	**2.3**	**49.39*****
		Trail B	0.09	0.23	
		WCST Cat	0.05	0.17	
		WCST Per	–0.29	–0.89	
		COWAT	**1.98*****	**4.8**	
		Stroop		**1.67*****	**5.2**
		SO vs. Ctrl	Trail B	–0.07	–0.15
		WCST Cat	0.11	0.28	
		WCST Per	0.03	0.07	
		COWAT	**2.02*****	**4.39**	
		Stroop		**0.68***	**1.85**
Kruger and Schiffer (2011)	Pedo (20) vs. Ctrl (28)	All	0.42	1.4	0.17
		WCST Cor	**0.51***	**1.72**	
		WCST Per	0.34	1.14	
Langevin et al. (1985)	Pedo (32) vs. Ctrl (54)	Raven	0.58**	I.D	
Langevin et al. (1988)	Incest (88) vs. NSO (14)	Trail B	0.76**	I.D	
Langevin et al. (1989a)	Pedo (114) vs. NSO (31)	Trail B	0.48	I.D	
Langevin et al. (1989b)	Exhibitionists (13) vs.NSO (14)	Trail B	0.50	I.D	
Miller (1998)	SO (50) vs. NSO (50)	All	0.28	1.4	2.34
		WCST Cat	0.25	1.25	
		WCST Cor	0.075	0.38	
		WCST Per	**0.51****	**2.5**	
O'Carroll (1989)	SO (11) vs. Ctrl (11)	All	0.45	1.0	0.06
		Trail B	0.37	0.86	
		Raven	0.52	1.21	
Quinsey et al. (1980)	SOC (25) & SO (25) vs. NSO (25)	Raven	0.24	0.90	0.00
		SOC vs. NSO	Raven	0.24	0.85

(continued)

Table 1. (continued)

Study	Comparison (*N*)	Measure	EF	*Z*	*Q*
Rimmer (1998)	SO (20) vs. NSO (20)	All	0.21	0.6	9.45**
		Trail B	–0.49	–1.5	
		COWAT	0.18	0.56	
		Raven	0.93***	2.79	
Rubenstein (1992)	Pedo (25) vs. Ctrl (25)	All	0.24	0.9	0.64
		WCST Cat	0.21	0.74	
		WCST Per	0.24	0.86	
		COWAT	0.35	1.21	
		Logical Memory	0.07	0.24	
		Visual Memory	0.34	1.19	
Schiffer and Vonlaufen (2011)	Pedo (15), SOC (15) vs.Ctrl (17)	All	0.92***	3.4	13.11*
	SOC vs. Ctrl	Trail B	0.68*	1.88	
		WCST Cat	0.63*	1.74	
		WCST Cor	0.69*	1.88	
		WCST Per	0.75*	2.04	
	Pedo vs. Ctrl	Trail B	0.18	0.50	
		WCST Cat	1.76***	4.22	
		WCST Cor	1.52***	3.78	
		WCST Per	1.28***	3.30	
Stone and Thompson (2001)	SO (63) Ctrl (60)	All	1.74***	7.9	84.6***
		Trail B	0.73***	3.9	
		WCST Cat	0.77***	4.12	
		WCST Per	1.6***	7.84	
		COWAT	2.89***	11.16	
		Stroop		2.71***	10.86
Suchy et al. (2009)	Pedo (20), SOC (20) vs. Ctrl (20)	All-	0.43*	1.9	7.1
		SOC vs. Ctrl	Stroop	0.26	0.82
		Logical memory	0.54	1.67	
		Visual memory	0.20	0.64	
	Pedo vs. Ctrl	Stroop	1.19***	3.48	
		Logical memory	0.29	0.93	
		Visual memory	0.09	0.30	

(continued)

Table 1. (continued)

Study	Comparison (*N*)	Measure	EF	*Z*	*Q*
Tarter et al. (1983)	SO (14) vs. NSO (28)	Trail B	–0.34	–1.0	0.00
Veneziano et al. (2004)	SO (60) vs. NSO (60)	All	–0.18	–1.0	3.36
		Trail B	–0.29	–1.56	
		WCST Cat	–0.12	–0.68	
		WCST Cor	**–0.35***	**–1.92**	
		WCST Per	0.07	0.42	
		COWAT	–0.23	–1.26	
Westergren (2002)	SOC (41) vs. SO (11)	All	0.11	0.3	0.00
		WCST Cat	0.12	0.35	
		WCST Per	0.10	0.29	
Overall			**0.37***	**3.18**	

Note. EF: Effect size; *z*: *z* score; *Q*: *Q* score; SOC: Sex Offenders of Children; Pedo: Pedophiles; SO: Sex Offenders; NSO: Non-sex Offenders; HO: Homicide Offenders; Ctrl: controls (nonoffenders); WCST: Wisconsin Card Sorting Task (Cat: Categories achieved; Per: Perseverative errors; Cor: Correct responses); COWAT: Controlled Oral Association Test; I.D.: Insufficient data to calculate z and Q scores.
$^{*}p \leq .05$. $^{**}p \leq .01$. $^{***}p \leq .001$.

for neuropsychological results when sex offenders were dichotomized as a function of age of victim although the two groups could still be refined further (e.g., with vs. without physical contact; pedophilic vs. nonpedophilic child molesters; intra vs. extrafamilial victims). The number of available neuropsychological data with more precise subgroups of sexual offenders is still too low to perform such analyses. Comparisons with non-sex offenders were considered next.

Overall cognitive performance of sex offenders versus non-sex offenders. Seventeen independent effect sizes were available between sex offenders and non-sex offenders (violent or nonviolent). As a group, sex offenders again performed significantly lower than non-sex offenders when all neuropsychological tasks were considered together (d = 0.257, SD = 0.004, 95% CI: [0.128, 0.387], z = 3.89, p < .001). This time, the distribution of the effect sizes was statistically homogeneous (Q = 7.95, df = 16, p > .05), indicating similarities between populations. Still, homogeneity with non-sex offenders seemed to concern more specifically sex offenders against adults (Q = 0.64, p = .98; d = 0.2, SD = 0.011, [–0.007, 0.410] 95% CI, z = 1.89, p >.05) than sex offenders against children (d = 0.29, SD = 0.084, [0.127, 0.458] 95% CI, z = 3.46, p = .001). For this reason, it was decided to further explore the data with individual measures, first compared with the general population, then compared with non-sex offenders.

Table 2. Effect Sizes, Significance (*Z*), and Heterogeneity (*Q*) of Neuropsychological Assessments in Sexual Offenders.

E.S.	*SD*	95% CI	z	Q
Overall				
Sex offenders vs. general population on all neuropsychological measures (*k* = 14)				
0.59	0.024	[0.29, 0.89]	3.86***	43.58***
Subgroups of sexual offenders				
Child molesters vs. general population on all neuropsychological measures (*k* = 9)				
0.42	0.01	[0.22, 0.62]	4.41***	11.9
Sex offenders of adults vs. general population on all neuropsychological measures (*k* = 5)				
0.98	0.23	[0.05, 1.9]	2.06*	10.98**
Trail making-B task (*k* = 9)				
Sex offenders vs. general population				
0.60	0.007	[0.44, 0.76]	7.32***	8.53
Child molesters vs. general population				
0.28	0.12	[0.04, 0.52]	2.82*	3.93
Sex offenders of adults vs. general population				
0.57	0.18	[0.23, 0.92]	3.23***	2.18
WCST (categories) (*k* = 9)				
Sex offenders vs. general population				
0.48	0.20	[0.08, 0.88]	4.07**	15.3***
Child molesters vs. general population				
0.48	0.03	[0.14, 0.82]	2.76**	14.3***
Sex offenders of adults vs. general population				
0.53	0.10	[–0.09, 1.15]	1.65	2.35
Stroop (*k* = 7)				
Sex offenders vs. general population				
0.86	0.006	[0.38, 1.13]	3.49***	65.33***
Child molesters vs. general population				
0.80	0.25	[0.31, 1.30]	3.12***	15.19***
Sex offenders of adults vs. general population				
1.71	1.0	[–0.28, 3.71]	1.69	20.9***
COWAT (*k* = 6)				
Sex offenders vs. general population				
1.36	0.10	[0.73, 1.17]	5.23***	97.42***
Child molesters vs. general population				
0.39	0.02	[–0.08, 0.64]	1.74	17.36**
Sex offenders of adults vs. general population				
2.54	0.41	[1.73, 3.34]	6.16***	2.50
Comparisons with non-sexual offenders				
Sex offenders vs. non-sexual offenders on all neuropsychological measures (*k* = 17)				
0.26	0.004	[0.13, 0.39]	3.89***	7.95
Child molesters vs. non-sexual offenders on all neuropsychological measures (*k* = 11)				
0.29	0.08	[0.13, 0.46]	3.46***	6.86

(continued)

Table 2. (continued)

E.S.	*SD*	95% CI	z	Q
Sex offenders of adults vs. non-sexual offenders on all neuropsychological measures (*k* = 6)				
0.2	0.01	[–0.007, 0.41]	1.89	0.64
Trail making-B task (*k* = 16)				
Sex offenders vs. non-sexual offenders				
0.02	0.009	[–0.16, 0.21]	0.24	25.9*
Child molesters vs. non-sexual offenders				
0.13	0.11	[–0.11, 0.35]	1.10	18.1*
Sex offenders of adults vs. non-sexual offenders				
–0.23	0.02	[–0.47, 0.02]	–1.83	2.2
WCST (*k* = 7)				
Sex offenders vs. non-sexual offenders				
0.20	0.01	[–0.02, 0.43]	1.79	1.89
Child molesters vs. non-sexual offenders				
0.28	0.05	[–0.16, 0.72]	1.24	1.52
Sex offenders of adults vs. non-sexual offenders				
0.18	0.01	[–0.08, 0.45]	1.34	0.22
Stroop (*k* = 5)				
Sex offenders vs. non-sexual offenders				
0.43	0.03	[0.13, 0.79]	2.71*	5.9
Child molesters vs. non-sex offenders				
0.50	0.04	[0.13, 0.88]	2.62***	5.5
Sex offenders of adults vs. non-sex offenders				
0.11	0.25	[–0.87, 1.09]	0.22	0.22
COWAT (*k* = 7)				
Sex offenders vs. non-sexual offenders				
0.24	0.01	[0.03, 0.45]	2.26*	1.49
Child molesters vs. non-sexual offenders				
0.25	0.01	[–0.09, 0.58]	1.44	0.36
Sex offenders of adults vs. non-sexual offenders				
0.24	0.02	[–0.03, 0.50]	1.74*	1.12

Note. E.S.: Effect Size; *SD*.: Standard Deviation; CI: Confidence Intervals; *z:* z score; *Q*: Q score; *k*: number of studies; COWAT: Controlled Oral Association Task; WCST: Wisconsin Card Sorting Task.
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

Cognitive performance of sex offenders versus general population on individual tests. Only four neuropsychological tasks were included in at least four studies comparing sex offenders to the general population: the trail-making B task (time; speed processing and switching; $k = 9$), the WCST (cognitive reasoning and deduction; $k = 9$), the Stroop condition (cognitive inhibition and control of interference; $k = 7$) and the COWAT (vocabulary and verbal fluency; $k = 6$). The validity (more than specificity) of these four tasks is well documented (e.g., Lezak et al., 2012). The distributions of effect sizes for all measures except the trail-making B task (completion time) were heterogeneous (trail-making B: $Q = 8.53$, $df = 8$, $p > .05$; COWAT: $Q = 97.42$, $df = 5$, $p < .001$; WCST: $Q = 15.3$, $df = 8$, $p = .05$; Stroop: $Q = 65.33$, $df = 6$, $p < .001$). As expected, sex offenders obtained significantly poorer results than controls did on all tasks (Table 2).

Cognitive performances of sex offenders versus non-sex offenders on individual tests. The same four neuropsychological tasks were found in at least four studies that included non-sex offenders as a comparison group (the trail-making B, $k = 16$; the WCST, $k = 7$; the Stroop, $k = 5$; and the COWAT, $k = 7$). This time, the distribution of effect sizes was only heterogeneous for the trail making B, so further analyses were performed only for that measure. As expected, the overall performance of sex offenders did not significantly differ from that of non-sex offenders ($d = 0.0$, $SD = 0.009$, [–0.164, 0.209] 95% CI, $z = 0.238$, $p > .05$; $Q_{\text{within}} = 20.2$, $df = 13$, $p > .05$). However, the $Q_{between}$ was significant ($Q_{between} = 5.66$, $df = 2$, $p = .05$), with the between-group difference significant for sex offenders against children (more impairment; $z = 3.46$; $p < .01$) but not for sex offenders against adults ($Z = -1.83$; $p > .05$; Table 2). The last moderator, subgroups of sex offenders, was entered in comparisons with the general population.

Cognitive performance of sex offenders against children and sex offenders against adults versus general population on individual tests. The ANOVA confirmed that, in studies with control groups recruited among the general population, effect sizes for the trail-making B task were similarly distributed across sex offenders against children and sex offenders against adults ($Q_{between} = 2.41$, $df = 1$, $p > .05$; $Q_{within} = 6.10$, $df = 7$, $p > .05$) although the effect might be stronger (higher d and higher z scores compared with the general population, which might indicate greater impairment) for sex offenders against adults ($d = 0.573$, $SD = 0.02$, CI = [0.226, 0.921], $z = 3.23$, $p = .001$) than for sex offenders against children ($d = 0.282$, $SD = 0.03$, CI = [0.04, 0.524], $z = 2.28$, $p < .05$; sex offenders against adults). On the COWAT, the variance was important (Table 2), the effect size distribution was clearly heterogeneous ($Q = 97.42$, $df = 5$, $p < .001$), and the effect appeared to be stronger for sex offenders against adults ($d = 2.54$, $SD = 0.41$, CI = [1.73, 3.34], $z = 6.16$, $p < .001$) than sex offenders against children ($d = 0.39$, $SD = 0.016$, CI = [0.142, 0.643], $z = 1.74$, $p > .05$). On the WCST (category achieved, sex offenders against adults: $d = 0.527$, $SD = 0.10$, CI = [–0.09, 1.15], $z = 1.65$, $p > .05$; sex offenders against children: $d = 0.478$, $SD = 0.03$, CI = [0.139, 0.817], $z = 2.76$, $p < .01$), and the Stroop (sexual offenders against adult: $d = 1.71$; $SD = 1.0$; CI = [–0.278, 3.71], $z = 1.69$, $p > .05$; offenders against children: $d = 0.80$, $SD = 0.25$; CI = [.0309, 1.295], $z = 3.12$, $p = .001$), z scores were significant only for offenders against children (compared with the general population) although that might simply reflect differences in the N because effect sizes seem comparable in each subgroup. Again, the variance was still high and distributions of effect sizes were heterogeneous for both measures (WCST category achieved: $Q = 15.3$, $df = 8$, $p = .05$; Stroop: $Q = 65.33$, $df = 6$, $p < .001$). Next, sex offenders against children were compared to sex offenders against adults.

Between group comparisons. In this meta-analysis, it was not possible to directly and statistically compare the performance of sex offenders against adults to that of sex offenders against children from the same studies because they generally included one group or the other, but not both. In an attempt to compare these subgroups, we randomly assigned each sample of sex offenders against adults to a sample of sex offenders against children with the same task from different studies. According to these exploratory comparisons, sex offenders against adults tended to be better than sex offenders against children on the WSCT ($d = 0.232$, $SD = 0.16$, CI = [0.053, 0.661], $z = 1.70$, $p = .08$), and sex offenders against children were better than sex offenders against adults on the COWAT ($d = 0.521$, $SD = 0.13$, CI = [0.271, 0.771], $z = 4.08$, $p < .001$) and the Stroop ($d = 0.393$, $SD = 0.18$, CI = [3.55, 4.29], $z = 20.7$, $p < .001$). Both groups obtained similar scores on the trail making B ($d = 0.138$, $SD = 0.10$, CI = [–0.33, 0.058], $z = 1.37$, $p > .05$).

Discussion

The first objective of this study was to conduct a comprehensive review of the literature regarding the neuropsychology of sex offenders. Though the number of studies found was impressive ($k = 113$, references with one asterisk in the reference list), nearly half focused exclusively on IQ and only 23 presented results on individual neuropsychological tests and used a comparison group. It could be concluded that the number of neuropsychological studies based on validated tasks and experimental designs (with subgroups) is still very low in the field of sexual deviance.

Our second objective was to demonstrate empirically that sex offenders represent a heterogeneous group from a neurocognitive point of view. As expected, the Q-tests of heterogeneity of effect sizes were highly significant for sex offenders. This suggests that it is preferable to avoid regrouping different types of sexual offenders and/or measures in neuropsychological studies (e.g., Langevin & Curnoe, 2008a; Spinella et al., 2006; Young, Justice & Edberg, 2010). In this study, homogeneity improved when subgroups were considered separately. On one hand, homogeneity might have improved simply as a result of repeatedly fragmenting the sample into smaller groups (although randomly fragmenting the sample would result in similar heterogeneity in the smaller subsamples if heterogeneity was relatively evenly distributed across data sets). On the other hand, other key moderating factors still present might have influenced the heterogeneity of results. These include preferential versus situational types of sex offenders against children and exclusive versus nonexclusive types of pedophiles (Holmes & Holmes, 2009). As the available data were too few for these moderators to be included in the study, future neuropsychological assessments focusing on more refined subgroups of sex offenders should help resolve this question.

Our main goal was to determine whether different subgroups of sex offenders showed different cognitive profiles when individual neuropsychological tasks are used. Unfortunately, only two broad subgroups of sex offenders and a few traditional neuropsychological tests could be included in the meta-analysis. It is clear from the analyses that sex offenders as a group present significant and wide-ranging cognitive impairments compared with the general population. Interestingly, however, somewhat different cognitive performances were observed when sex offenders against children, sex offenders against adults, and non-sex offenders were considered separately. First, sex offenders against children tended to score lower than sex offenders against adults on the WCST (deduction and cognitive flexibility) although they were significantly better on the COWAT (verbal fluency) and the Stroop test (control of internal interference). These results suggest that different subgroups of sex offenders might present different neuropsychological profiles. Surprisingly, both subgroups obtained comparable results on the trail-making B task although only the time variable (motor speed), not the number of errors (switching capacities) was available. But again, distribution of effect sizes was particularly wide for sex offenders against children. The distinction between nonpedophilic child molesters and exclusive pedophile child molesters, for instance, could be crucial in neuropsychology because the latter seem to be less cognitively impaired (Eastvold et al., 2011; Schiffer & Vonlaufen, 2011; Suchy et al., 2009). Pedophilic child molesters might perform as well as controls (and better than nonpedophilic child molesters) on a wide variety of neuropsychological measures when mean IQ and other socioeconomic factors are similar (Schiffer & Vonlaufen, 2011). In fact, some pedophiles have higher IQ levels and more years of education compared with the general population (Langevin et al., 2000; Lothstein, 1999; Plante & Aldridge, 2005). Other potentially important distinctions such as preferential vs. situational or intrafamilial vs. extrafamilial sexual child abuse should be considered in neuropsychology as well. Given the growing number of neuropsychological studies that distinguish subgroups of sex offenders, it will soon be possible to test hypotheses of the sort (e.g., Cohen et al., 2010; Eastvold et al., 2011; Kruger & Schiffer, 2011; Schiffer & Vonlaufen, 2011; Suchy et al., 2009).

Another interesting result was the confirmation that sex offenders against adults, as a group, tended to score similarly to non-sex offenders (inhibition and verbal deficits). Future neuropsychological studies with more specific measures and participants might find difference between antisocial and deviant sex offenders against adults (e.g. generalized vs. specialized criminality).

If confirmed, results of this study suggest that more specific neuropsychological assessments might also help identify different risk factors associated with sexual offending, such as general delinquency (antisociality, impulsivity, and risk taking) or low social competence (asociality and poor higher order executive functioning). The opposite might also be true, as neuropsychological profiles of high impulsivity scores, low verbal capacities, and poor lower order executive functioning might predict higher risks for general but not sexual recidivism (McCann & Lussier, 2008). To this end, neuropsychological assessments should be based on more specific measures. Traditional tasks such as the WCST, the Stroop, and the trail-making were not developed to assess precise cognitive functions and they are sensitive to various types of cognitive dysfunctions. Higher versus lower order executive functioning could be assessed, for example, using subtests of more specialized batteries (e.g., the Behavioral Assessment of the Dysexecutive Syndrome, or BADS, by Chamberlain, 2003) and specific measures of motor impulsivity (e.g., the CPT-II), behavioral inhibition (e.g., the Stop-Signal task), and risk taking (e.g., the IOWA gambling task, the delay aversion task, or the balloon analog task; see www.millisecond.com for computerized versions of these tests). Specific measures of verbal learning and memory (e.g., California Verbal Learning Task or CVLT-II by Delis, Kramer, Kaplan, & Ober, 2000) could help discriminate between subgroups of sexual offenders as well, given that these faculties are more closely linked with antisociality than with asociality.

Overall, this first meta-analysis of existing neuropsychological results regarding sex offenders yielded some interesting findings although available data were too few to test or confirm all of the hypotheses. The main goal was to define specific subgroups of sex offenders based on criminological typologies and to demonstrate that they present distinct cognitive profiles. Unfortunately, it was not possible for us to achieve this goal. Consequently, it is currently impossible to say whether sex offenders present broad, nonspecific cognitive impairments or, instead, specific neuropsychological profiles. Besides limitations associated with meta-analyses in general (e.g., the file-drawer problem, publication bias, unequal methodological qualities across studies, subjective coding of variables; for a review see Lipsey & Wilson, 2001), the present study is based on few studies with numerous limits. Among these limits are file-based data collection, neuropsychological assessments for clinical purposes with different examiners, participants recruited exclusively in institutional settings, high rates of refusals, different testing procedures, inclusion of unmatched comparison groups (age, gender, education, cultural background, etc.), and inclusion of highly different individuals in a single group (sadistic persons vs. gang members; serial rapists vs. exhibitionists, asocials vs. antisocials, etc.). Future neuropsychological investigations should consider these limits and include subgroups of offenders based on criminological and psychological typologies as well as validated and specific cognitive measures (for a good example, see Schiffer & Vonlaufen, 2011). In time, neuropsychological evaluation could help specify diagnoses, determine specific risk factors, and estimate recidivism risk for individual sex offenders.

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Note: *References marked with an asterisk indicate studies found in the literature search. References marked with three asterisks indicate studies included in the meta-analysis.*

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