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Psychological Adjustment of Domestic Adult Adoptees

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Abstract
We examined the psychological adjustment of 318 adults adopted at birth and 131 adults not adopted at birth, in the domains of personality, aggression, delinquency, symptoms of psychological disorders, and cognitive abilities (while controlling for age, sibship size, and recruitment method). Adoptees and non-adoptees differed in all domains studied, but the differences were small overall, and most adoptees had non-problematic adjustment. Age at the time of participation did not moderate the relationships between adoption and adjustment. Later age at adoption was associated with more negative outcomes, especially in the area of cognitive abilities, and especially in men. There were few differences between adoptees who had attempted to discover their biological family and those who had not.

Keywords Adoption · Development · Adjustment · Personality · Cognitive abilities · Aggression

Introduction

In the US, between one and three percent of children have been adopted (Kreider 2003; Kreider and Fields 2005), which corresponds to between two and three million individuals. In Canada, the latest estimates show that during the period 1981–1990 about 41,000 children born in Canada have been adopted within the country (Sobol and Daly 1994). About two thousand children per year are adopted in Canada from abroad (Milan 2011). Many studies have examined the psychological adjustment and behavioral outcomes of adoptees. These studies can be classified into three groups, on the basis of the research methods used. Epidemiological studies have examined the percentage of adoptees in clinical samples and special schools compared to the percentage of adoptees in the general population. Clinical studies have compared the development of adoptees and non-adoptees recruited from clinics and special schools. Non-clinical studies have examined the development of adoptees and non-adoptees in samples recruited from the general population. Most of these studies, regardless of research design, have been conducted with children or adolescents. In the study presented in this article, a non-clinical design was used with a domestic adult sample. We first provide a brief review of the literature on the development and psychological adjustment of domestic adopted individuals.

Psychological Adjustment of Child and Adolescent Adoptees

Epidemiological studies of children and adolescents have found that adoptees are over-represented in samples recruited from inpatient clinics (4–21%; Borgatta and Fanshel 1965; Dickson et al. 1990; Kim et al. 1988; Piersma 1987; Rogeness et al. 1988; Senior and Himadi 1985; Work and Anderson 1971; Zucker and Bradley 1998), outpatient clinics (2–8%; Brinich and Brinich 1982; Goodman et al. 1963; Kotsopoulos et al. 1988; Simon and Senturia 1966), and special schools (5–7%; Brodzinsky and Steiger 2001; Grotevant and McRoy 1990). Three meta-analyses have confirmed these findings (Juffer and van Ijzendoorn 2005; van Ijzendoorn et al. 2005; Wierzbicki 1993).

Results from clinical studies of children and adolescents suggest that adoptees are at higher risk of externalizing and academic problems—e.g., aggression, running away, substance abuse, some personality disorders, learning disabilities, attention deficits, hyperactivity—than

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non-adoptees (Brodzinsky et al. 1998; Cadoret 1990; Cohen et al. 1993; Deutsch et al. 1982; Moore and Fombonne 1999; Rosenberg 1992; Simon and Senturia 1966; Silver 1989; Wierzbicki 1993). Adoptees are not, however, at higher risk of internalizing problems (e.g., mood disorders) or of psychotic disorders (Dickson et al. 1990; Kotsopoulos et al. 1988; Piersma 1987; Weiss 1985; Wierzbicki 1993).

Non-clinical studies have produced less consistent findings. Some studies have found that adopted children and adolescents are at higher risk of externalizing, internalizing, or academic problems than non-adopted children and adolescents (Brodzinsky et al. 1987; Lipman et al. 1992; Miller et al. 2000; Sharma et al. 1996; van Ijzendoorn et al. 2005; Wierzbicki 1993), while others have found few or no group-differences (Burrow et al. 2004; Carey et al. 1974; Elonen and Schwartz 1969; Singer et al. 1985). A few studies have even found better outcomes for adoptees with regard to confidence and prosocial behavior (Marquis and Detweiler 1985; Sharma et al. 1996). Furthermore, Wierzbicki's (1993) meta-analysis showed that the group differences are typically more prominent for adolescents than for children or young adults, and other studies using longitudinal designs have generally observed that group differences tend to diminish with age and often completely disappear by young adulthood (Bohman 1970; Bohman and Sigvardsson 1978, 1979, 1980, 1990; Maughan and Pickles 1990).

Psychological Adjustment of Adult Adoptees

Epidemiological studies suggest that adult adoptees are not over-represented in clinical populations (Brinich and Brinich 1982; Simon and Senturia 1966). Similarly, a clinical study has shown no difference between adopted and non-adopted adults (Brinich and Brinich 1982). Non-clinical studies have produced, again, inconsistent results. Some studies have shown that adult adoptees are at higher risk of depression (Borders et al. 2000; Cubito and Brandon 2000), low self-esteem (Borders et al. 2000; Levy-Shiff 2001), substance abuse (Bohman and von Knorring 1979), personality disorders (Bohman and von Knorring 1979), alienation (Lieberman and Morris 2004), psychological distress (Levy-Shiff 2001; Smyer et al. 1998), low educational achievement, and low IQ (Teasdale and Owen 1986). Other studies have found no difference in substance abuse or criminality (Bohman and Sigvardsson 1990; Borders et al. 2000), life satisfaction (Borders et al. 2000), or general psychological adjustment (Collishaw et al. 1998; Feigelman 1997), or have found a better adjustment in adoptees for educational achievement, alcohol consumption, and affiliation, to give a few examples (Lieberman and Morris 2004; Smyer et al. 1998).

Methodological Issues

As mentioned by several researchers (e.g., Borders et al. 2000; Zamostny et al. 2003), most studies have been conducted with children and adolescents, even though most agree that adoption and its developmental consequences are a lifelong process and that studying older samples is important to better understand the long-term adjustment of adoptees (e.g., Borders et al. 2000; Brodzinsky et al. 1998). In addition, many studies suffer from methodological problems. For instance, few studies consider age at adoption—later age at adoption is related to worse emotional, academic, and behavioral outcomes (e.g., van Ijzendoorn et al. 2005; Sharma et al. 1996). Most of the studies also fail to consider the number of placements prior to final adoption—a higher number of placements are related to a higher risk of maladjustment (e.g., Barth et al. 1988; Lewis et al. 2007). Furthermore, until recently, few studies have considered the ethnic background of participant and whether the adoption was domestic or international–national adoptees tend to experience worse adjustment than international adoptees (e.g., Juffer and van Ijzendoorn 2005). Lastly, studies tend to ignore the search status of adoptees—adoptees who have not attempted to discover their biological family tend to be better adjusted than adoptees who have (e.g., Aumend and Barrett 1984; Cubito and Brandon 2000; Sobol and Cardiff 1983).

Theoretical Rationale

The majority of authors agree that adoption can provide care, support, and a permanent and nurturing environment for children whose parents cannot take care of them (e.g., Rutter 1990). However, and despite this positive change, adopted children may remain at increased risk for psychological maladjustment. Developmental models, such as the Model of Developmental Adaptation (Martin and Martin 2002), suggest that early events can have direct and indirect long-term impact on developmental outcomes. Both genetic and environmental explanations have been proposed. For example, the increased risk may come from the biological parents: the genetic vulnerability for psychological difficulties in the biological parents of adoptees might interfere with their abilities to keep and raise their child, which could lead to adoption (Westermeyer et al. 2015; Wierzbicki 1993). In addition, many pre-adoption events during the perinatal or early childhood of adoptees (e.g., intrauterine exposure to substances, birth complications, loss of birth parents, abuse, lack of stimulation, malnutrition) could compromise the growth and the

development of adoptees (e.g., Grotevant and McDermott 2014; Smith and Howard 1994). Early life stressors affect biological functioning (e.g., stress regulation system) and are associated with psychological difficulties, aggressive and oppositional behaviors, personality dysfunctions, and cognitive problems or delays (e.g., Bowlby 1988; Hanson et al. 2015; Pechtel and Pizzagalli 2011). Lastly, the experience of rejection, separation, or loss associated with adoption (e.g., loss of biological parents, loss of genealogical continuity, becoming different; Brodzinsky et al. 1987) can increase risk for psychological disorders by making adoptees feel incomplete, abandoned, or neglected (Levy-Shiff 2001).

The Current Study

We investigated a large and homogenous group of adult, Caucasian, domestic adoptees recruited from the Province of Québec, and a similar group of non-adoptees. We hypothesized that if there are differences between adoptees and non-adoptees, the differences will be small and will suggest more problematic adjustment among adoptees. We examined several variable domains: personality, aggression, delinquency, psychological health, and cognitive abilities. We selected these variable domains for two reasons. First, most variables included in studies of adoption relate to these domains. Second, several explanations that have been proposed to elucidate why the psychological adjustment of adoptees should differ also relate to these domains. We examined the psychological adjustment of adoptees in these domains in adults while addressing the methodological issues mentioned earlier. We used multiple measures for each domain, while statistically controlling for participants' age, size of their adoptive family, and recruitment method. We also examined whether age at the time of participation in the study, age at adoption, and search status were associated with outcomes. This study is part of a larger study examining the effect of birth and rearing order on adult adjustment.

Method

Participants

This study is part of the "Étude sur le développement et la personnalité des personnes qui ont été adoptées à la naissance et des personnes que n'ont pas été adoptées" (EDPPAN). Eligible participants were men and women over age 18 who were either (1) adopted and had found their biological family, (2) adopted and actively searching for their biological family, (3) adopted and had never attempted to find their biological family, (4) had never been adopted. Seven hundred and forty individuals expressed interest in the study. Of those, 713 participated in at least one of the three parts of the study (see below). More than half of our participants were recruited from the 12,000 members of the Mouvement Retrouvailles in the Province of Québec, a support organizationfor adoptees and their family. Recruitment of adopted and not adopted participants occurred mainly at formal and informal meetings of organization members, and also via a dedicated website and letters send to all members. Other adopted and non-adopted participants were recruited at Youth Centres in the Province of Québec, booths at malls and festivals, newspaper, television, and radio ads, and various websites, social clubs, and community centres.

Participants were selected for analyses if they had completed at least the first two parts of the study—a phone interview, and a home questionnaire—leaving 375 adoptees and 161 non-adoptees; if they reported being Caucasian (leaving 360 adoptees and 156 non-adoptees); if they had only one family of adoption (leaving 336 adoptees); if they knew the age at which they had been adopted (leaving 333 adoptees); if they provided their sibship size (leaving 320 adoptees and 152 non-adoptees) and if they were at least 24 years old at the time of the interview (leaving 318 adoptees and 131 non-adoptees)—the last criterion was used to equate the two groups with regard to age and point of entry (recruitment method)—most individuals under age 24 were non-adoptees recruited from schools. The mean age of the 318 adoptees was 42.6 years old (SD = 9.3), and for the 131 non-adoptees, 40.9 years old (SD = 13.3).

Data Collection and Questionnaires

We obtained information from a phone interview, from self-report questionnaires, and from in-person testing.

Biographic Information

A phone interview and a self-report questionnaire were designed for the purpose of this study to obtain information about gender, age, sibship size (total number of brothers and sisters with whom the participants were raised; biological, adoptive, half-sibling, step-sibling), ethnicity, number of children, level of education, and marital status, along with other biographic variables not included in this report.

Personality

The Revised NEO Personality Inventory (NEO-PI-R; Costa and McCrae 1992) is a self-report questionnaire to measure personality based on the Five-Factor Model of personality. The NEO-PI-R consists of 240 items with a five-point answer scale (from *strongly disagree* = 0 to *strongly agree* = 4). It measures five basic domains of personality (48

items per domains, with multiple facets for each domain): neuroticism (e.g., "I often worry about things that might go wrong"), extraversion (e.g., "I really enjoy talking to people"), openness to experience (e.g., "I believe that laws and social policies should change to reflect the needs of a changing world"), agreeableness (e.g., "I believe that most people are basically well-intentioned"), and conscientiousness (e.g., "I pay my debts promptly and in full"). The five domains and facets scales show good reliability and validity (Costa and McCrae 1992; Costa et al. 2000). The French version of the questionnaire (Rolland et al. 1998; Rolland and Petot 1994) was used for the current study and its psychometric properties are also good (Rolland et al. 1998; Rolland and Petot 1994). In the current study, a total score for each domain was calculated, with Cronbach's αs varying from .86 [95% CI .84, .88] (agreeableness) to .93 [.92, .94] (neuroticism).

Aggression and Delinquency

The Buss–Perry Aggression Questionnaire (1992) consists of 29 items answered on a five-point scale (ranging from *extremely uncharacteristic of me* = 1 to *extremely characteristic of me* = 5) to measure four domains of aggression: physical aggression (9 items, e.g., "I have become so mad that I have broken things"), verbal aggression (5 items, "I can't help getting into arguments when people disagree with me"), hostility (8 items, "I am sometimes eaten up with jealousy"), and anger (7 items, "When frustrated, I let my irritation show"). Psychometric properties of the questionnaire suggest good reliability and validity (Buss and Perry 1992; Gallo and Smith 1998). A French translation of the questionnaire was used for this study (Côté and Lalumière 1999a) and has shown good validity (Bouchard 2007). In the current sample, the Cronbach's α values were $\alpha = .89$ [.87, .90] for the overall aggression score, $\alpha = .79$ [CI .76, .82] for physical aggression, $\alpha = .68$ [CI .63, .73] for verbal aggression, $\alpha = .79$ [CI .76, .82] for hostility, and $\alpha = .80$ [CI .77, .83] for anger. The αs for the individual scales were similar to those obtained by Buss and Perry in the original English version.

The Childhood and Adolescence Psychopathy Scale (CAPS; Seto et al. 1997) consists of eight self-report items measuring various components of antisocial and aggressive behaviors before the age of 16. Four items are answered as yes–no items (e.g., "Were you ever arrested before age 16?"), three items are answered on a seven-point scale ranging from *never or no problem at all* = 1 to *very often or serious problem* = 7 (e.g., "Did you get in a lot of physical fights, excluding siblings, before you were 16 years old?"), and the remaining item is coded as the sum of yes answers to 11 delinquent and antisocial behaviors engaged in before 15 years (e.g., "Often initiate physical fight"). The CAPS shows good validity (Lalumière and Quinsey 1996). A French translation was used in this study (Côté and Lalumière 1999b). Two items were excluded because they are related to the adoption status of the participants ("Did you live with both your natural parents until age 16?" and "Do you feel that one or both of your biological parents had a drinking problem while you were growing up?"), and one of the 11 delinquent behavior ("Forcing sexual activity") was excluded because some participants had misinterpreted it. In our sample, the total score (omitting the above mentioned items) had a Cronbach's α reliability value of $\alpha = .73$ [CI .69, .77].

Psychological Health

The Holden Psychological Screening Inventory (HPSI, 1996) consists of 36 items answered on a five-point scale ranging from *never* = 0 to *always* = 4. The instrument measures three major domains or categories of psychopathology. Psychiatric symptomatology assesses generalized psychopathology, including anxiety, somatic preoccupations, and psychotic processes (12 items, e.g., "Harmless things can disturb me"). Social symptomatology assesses inadequate or deviant socialization and impulse control (12 items, "I mind taking orders"). Depression assesses loss of confidence in abilities, self-depreciation, pessimism, and social introversion (12 items, "I feel contented"). Psychometric properties of the scale suggest good reliability and validity (Book et al. 2001; Holden 1996; Holden and Grigoriadis 1995). The French version of the questionnaire (Holden 1998) was used for the current study. In the current sample, the Cronbach's α reliability values were $\alpha = .77$ [CI .74, .80] for the overall total score, $\alpha = .74$ [.70, .78] for psychiatric symptomatology, $\alpha = .70$ [.66, .74] for social symptomatology, and $\alpha = .71$ [.66, .75] for depression.

Cognitive Abilities

The Épreuve Individuelle d'Habileté Mentale (EIHM; Chevrier 1993a) is a Weschler type of intellectual ability test that has been designed and validated on the French population in the Province of Québec. It consists of 11 subscales to measure global, verbal (i.e., Information, Comprehension, Digit Span, Similarities, Arithmetic, Vocabulary), and non-verbal (i.e., Pictures Arrangement, Substitution, Object Assembly, Picture Completion, Block Design) intellectual abilities. The test has good reliability and validity (Chevrier 1993a). Raw scores were converted into scaled scores, taking into account the participant age (Chevrier 1993b, c, d).

The Water Level Test (WLT; Piaget and Inhelder 1956) measures spatial visualization and perception. Participants hadto draw the water line (approximately half full) for eight empty bottles inclined at various angles (e.g., 300°, 30°, 220°) and place an « X » where the water should be. An example with the French instructions elaborated by

Robert et al. (1998) was shown to participants. Psychometric properties of the test suggest good reliability and validity (Robert et al. 1998; Wittig and Allen 1984). Scoring was made with a protractor. Deviations of 5° or less from the horizontal was accepted as good answers (Piaget and Inhelder 1956; Robert et al. 1998; Wittig and Allen 1984). The number of good answers constituted the total score.

The Mental Rotation Test (MRT; Vandenberg and Kuse 1978) measures spatial visualization and internal representation. It consists of 20 items each with four objects. A bidimensional representation of a tridimensional object (the criteria figure) is shown in different axe rotations and participants have to identify the two items that represent the criteria figure in a rotated position (correct alternatives). The two other objects are distractors. The psychometric properties of the test are very good (e.g., Vandenberg and Kuse 1978). Participants were given 6 min to complete the test. For each question, one point was given when the two correct alternatives were chosen. The number of total points constituted the final score.

The Standard Progressive Matrices (SPM; Raven 1976; Raven et al. 1998) measures eductive abilities, i.e., the ability to think clearly and make sense of complexity. It consists of 60 problems divided into five equal sets. For each problem, an incomplete figure is shown and participants have to identify the missing part among the options provided. The test shows good reliability and validity (e.g., Raven et al. 1998). The total number of correct answers constituted the final score.

Procedure

The first part of the study consisted of a phone interview conducted by a member of the research team. Once participants expressed oral consent, they were interviewed about their biological and adoptive families, and search status (biological family found, search in progress, not searching). The second part consisted of sending by mail a written consent form, a questionnaire package for participants, a questionnaire package for one or two nominated friends (data not included in this report), and self-addressed return envelops. After 10 days, a follow-up call was made to verify that the package was received, and to answer any question. The third part was conducted only for participants who had returned the completed questionnaire package, and only for those who agreed to an in-person meeting. It consisted of the administration of a battery of cognitive tests at the participants' home or another location chosen by participants. Participation in all three parts took about 4 h. Participants received $25 CDN as a thank you. The procedures were approved by the local Research Ethics Board.

Analytic Plan

Outliers were defined as z scores ≥ 3.29. A total of 23 outliers were found (20 adoptees and 3 non-adoptees). Only two participants had more than one outlier score (one had three outlier scores and one had four outlier scores). The outlier scores were changed to the next highest score (of the same adoption group and sex) plus one unit (or the next lowest score minus one unit, when the outlier was in the lower end of the distribution).

We conducted independent t test to compare adoptees recruited from support organization for adoptees and family and adoptees recruited from other methods. Bivariate correlations among all study variables for both adoptees and non-adoptees were also performed, followed by analyses of variance for the four domains (personality, aggression and delinquency, psychological health, and cognitive abilities) by adoption status (adoptees and non-adoptees) and sex (male and female), and using appropriate covariates for each analysis. Simple effects analyses were performed when significant interaction effects were found between adoption status and sex. Visual and distributional analyses were then conducted with outcome variables that showed significant group differences. Furthermore, we conducted regression analyses to examine potential moderation effects of the age of participants at the time they completed the questionnaires. Lastly, partial correlations between age at adoption (as a continuous variable) and the outcome variables were performed, while controlling for the age of participants, and ANOVAs were performed to compare adoptees who had not attempted to discover their biological family and adoptees who had. α was set at .05 (two-tailed).

Results

Characteristics of Participants

Biographic characteristics of adopted and non-adopted participants are displayed in Table 1. The two groups did not differ on age, number of children, age of children, marital status, and employment status, but did differ with regard to sibship size (smaller families for adoptees), the representation of each sex (more women in the adoptee group), and the recruitment method (more adoptees from a support organization for adoptees and family). Most of the adoptees were adopted at 12 months old or earlier (87%).

Psychological Adjustment of Participants

Table 2 shows the group means, standard deviations, and independent t test for the four domains (personality, aggression and delinquency, psychological health, and cognitive

Table 1 Sociodemographic characteristics

Variables	Adoptees		Non-adoptees		*t*	*p*
	N	*M* (SD)	*N*	*M* (SD)		
Age (years)	318	42.6 (9.3) [25–68]	131	40.9 (13.3) [24–75]	1.29	.198
Sibship size	318	1.8 (2.1)	131	3.7 (3.5)	− 5.87	.0001
Number of children	317	1.5 (1.2)	131	1.3 (1.3)	1.93	.055
Age of children (years)	238	17.1 (9.2)	82	17.4 (12.8)	− 0.15	.878
Age of adoption (months)	318	7.0 (8.6) [0–60]				
Variables	Adoptees		Non-adoptees		χ^2	*p*
	N	%	*N*	%		
Marital status						
Married/common-law	202	63.9	91	69.5	1.55	.461
Separated/divorced/widow	60	19.0	19	14.5		
Single	54	17.1	21	16.0		
Employment status						
Unemployed/student	50	15.8	14	10.7	1.99	.158
Employed	266	84.2	117	89.3		
Sex						
Male	118	37.1	65	49.6	6.02	.014
Female	200	62.9	66	50.4		
Recruitment method						
Support organization for adoptees and family	164	51.6	12	9.2	70.02	< .0005
Other	154	48.4	119	90.8		

Numbers in parentheses are standard deviations and in square brackets are ranges

abilities) by recruitment method (recruited from support organization for adoptees and family and others) for adoptees. For most variables, adoptees recruited from support organization for adoptees and family did not differ from adoptees recruited from other methods. They did differ on four variables: adoptees recruited from support organization for adoptees and family reported less verbal aggression and fewer social symptoms, and lower spatial and eductive abilities than adoptees recruited from other methods. Table 3 shows bivariate correlations among all study variables for both adoptees (top half) and non-adoptees (bottom half). Statistically significant coefficients ranged between .18 and .74.

Table 4 shows the group means, standard deviations, and analyses of variance for the four domains (personality, aggression and delinquency, psychological health, and cognitive abilities) by adoption status (adoptees and non-adoptees) and sex (male and female). Analyses were performed within each domain using data from participants having less than 20% of missing data for all scales in a particular domain; sample size, therefore, varied from one domain to another but is the same for all comparisons within a domain. MANCOVAs (with Wilk's criterion) including all variables within each domain were performed, followed by individual ANCOVAs for each variable. All analyses used age, sibship size, and recruitment method as covariates, except for the EIHM subscales (verbal and non-verbal), for which only sibship size and recruitment method were used as covariates (the EIHM scores already take age into account). Significant interaction effects of adoption status and sex are presented in Fig. 1.

Personality

On the Personality domain, the MANCOVA revealed a significant main effect of adoption status and sex and no interaction effect between adoption status and sex. The ANCOVAs revealed a significant effect of adoption status for neuroticism and a significant effect of sex for agreeableness. There were no other significant differences between groups. Overall, adopted participants reported significantly higher emotional instability than non-adopted participants but did not differ significantly on extraversion, openness to experience, agreeableness, and conscientiousness. Women reported significantly more agreeableness than men.

Table 2 Means, standard deviations, and independent *t* test for each of the four domains by Recruitment Method for Adoptees

Variables	Support organization for adoptees and family		Others		*t*	*p*
	N	*M* (SD)	*N*	*M* (SD)		
Personality	163		146			
Neuroticism		92.3 (23.5)		93.1 (25.8)	0.28	.780
Extraversion		107.2 (19.2)		110.6 (20.0)	1.52	.131
Openness to experience		113.9 (17.9)		117.9 (19.6)	1.90	.059
Agreeableness		128.9 (15.9)		125.6 (17.3)	− 1.73	.084
Conscientiousness		123.1 (19.0)		121.9 (21.3)	− 0.52	.604
Aggression and delinquency	164		149			
Buss–Perry-Total		69.9 (17.6)		72.6 (17.7)	1.37	.170
Physical aggression		17.8 (7.3)		18.1 (7.0)	0.40	.693
Verbal aggression		14.3 (4.0)		15.7 (3.9)	**3.21**	.001
Anger		18.7 (5.5)		19.5 (6.1)	1.26	.208
Hostility		19.1 (6.5)		19.2 (6.3)	0.21	.833
CAPS Total		2.1 (2.7)		2.4 (2.6)	0.81	.419
Psychological health	163		150			
HPSI-Total		37.8 (10.4)		38.9 (11.6)	0.88	.381
Depression		17.6 (6.4)		17.2 (6.7)	− 0.53	.596
Psychiatric symptoms		10.5 (4.5)		10.7 (5.5)	0.33	.739
Social symptoms		9.7 (4.3)		11.0 (4.5)	**2.58**	.010
Cognitive abilities	121		110			
EIHM Global		100.7 (13.5)		103.5 (12.5)	1.65	.100
EIHM Verbal		103.5 (14.4)		106.3 (12.8)	1.53	.127
EIHM Non-verbal		97.5 (15.9)		99.3 (13.9)	0.94	.350
WLT		3.3 (3.0)		4.1 (3.0)	**2.05**	.042
MRT		4.6 (3.2)		5.3 (3.8)	1.40	.162
SPM		46.1 (7.6)		48.3 (6.9)	**2.22**	.028
Level of education (years)[a]		12.7 (2.5)		13.3 (2.7)	1.86	.064

t with $p \leq .05$ are in boldface. Subscales are indented under the relevant test. Due to missing data, sample size varies

Buss–Perry Buss–Perry Aggression Questionnaire, *CAPS* Childhood and Adolescent Psychopathy Scale, *HPSI* Holden Psychological Screening Inventory, *EIHM* Épreuve Individuelle d'Habileté Mentale, *WLT* Water Level Test, *MRT* Mental Rotation Test, *SPM* Standard Progressive Matrices, *-Total* total score

[a]The level of education is calculated in years, based on the Quebec education system: less than 7th grade = 6 years, 7th grade = 7 years, secondary 1 = 7 years, secondary 2 = 8 years, secondary 3 = 9 years, secondary 4 = 10 years, secondary 5 = 11 years, CEGEP = 13 years, university certificate = 14 years, bachelor degree = 16 years, master degree = 18 years, and doctoral degree = 21 years

Aggression and Delinquency

On the Aggression and delinquency domain, the MANCOVA revealed a significant main effect of adoption status and sex and no interaction effect between adoption status and sex. The ANCOVAs revealed significant main effects of adoption status and sex for the Buss–Perry and the CAPS total scores. Adopted participants reported significantly more overall aggression and childhood and adolescence antisocial behaviors than non-adopted participants. Men reported significantly more overall aggression and childhood and adolescence antisocial behaviors than women.

The ANCOVAs on the Buss–Perry subscales revealed a significant main effect of adoption status for physical aggression, anger, and hostility subscales, and a significant main effect of sex for physical aggression and verbal aggression. A significant interaction between adoption status and sex was also revealed for the verbal aggression subscale.

Simple effects analysis on the verbal aggression subscale revealed a significant effect of adoption status in women, $F(1, 439) = 7.10$, $p = .008$, but not in men, $F(1, 439) = 0.003$, $p = .955$; women who were adopted reported significantly more verbal aggression than women who were not adopted. Furthermore, adopted participants reported significantly more physical aggression, anger, and hostility than

Table 3 Correlations between the four domains for adoptees and non-adoptees

Domains and variables	1	2	3	4	5	6	7	8	9	10	11	12
Personality												
(1) Neuroticism	–	**– .43**	– .04	**– .38**	**– .51**	**.62**	**.31**	**.16**	**.56**	**.74**	**.23**	**.59**
(2) Extraversion	**– .37**	–	**.25**	**.22**	**.28**	**– .14**	.04	.07	– .07	**– .42**	.10	**– .38**
(3) Openness to experience	– .06	**.31**	–	– .01	– .09	.04	.07	**.14**	.03	– .08	.06	– .03
(4) Agreeableness	**– .28**	.08	.06	–	**.25**	**– .58**	**– .42**	**– .44**	**– .46**	**– .45**	**– .31**	**– .33**
(5) Conscientiousness	**– .52**	.15	– .17	**.30**	–	**– .29**	– .11	– .11	**– .32**	**– .31**	**– .21**	**– .30**
Aggression and delinquency												
(6) Buss–Perry-Total	**.60**	– .16	– .06	**– .56**	**– .35**	–	**.77**	**.62**	**.86**	**.73**	**.43**	**.55**
(7) Physical aggression	**.29**	– .02	– .12	**– .37**	**– .29**	**.74**	–	**.33**	**.53**	**.33**	**.47**	**.30**
(8) Verbal aggression	.12	**.18**	**.20**	**– .50**	– .17	**.60**	**.34**	–	**.49**	**.26**	**.24**	**.27**
(9) Anger	**.59**	– .09	.07	**– .39**	**– .31**	**.83**	**.44**	**.47**	–	**.54**	**.37**	**.47**
(10) Hostility	**.68**	**– .43**	**– .23**	**– .41**	**– .25**	**.76**	**.38**	**.17**	**.53**	–	**.18**	**.58**
(11) CAPS Total	.12	.13	.07	**– .33**	**– .21**	**.38**	**.34**	**.39**	**.33**	.12	–	**.25**
Psychological health												
(12) HPSI-Total	**.62**	**– .29**	.12	**– .30**	**– .36**	**.47**	**.25**	**.20**	**.40**	**.48**	**.27**	–
(13) Depression	**.23**	**– .25**	.09	– .04	– .12	.02	– .09	– .06	– .02	.16	– .05	**.65**
(14) Psychiatric symptoms	**.68**	**– .24**	– .03	– .10	**– .26**	**.43**	**.18**	.01	**.45**	**.53**	.10	**.66**
(15) Social symptoms	**.27**	– .03	.17	**– .48**	**– .34**	**.54**	**.48**	**.52**	**.43**	**.25**	**.54**	**.54**
Cognitive abilities												
(16) EIHM Global	**– .27**	– .05	**.27**	**.25**	.01	**– .27**	– .13	– .07	**– .24**	**– .31**	– .10	– .19
(17) EIHM Verbal	**– .30**	– .08	**.20**	**.35**	.13	**– .38**	**– .23**	– .12	**– .37**	**– .37**	– .15	– .19
(18) EIHM Non-verbal	– .16	.01	**.24**	.02	– .10	– .06	.01	– .01	– .02	– .14	– .02	– .14
(19) WLT	– .02	– .03	**.25**	– .15	– .14	.07	.17	.11	.02	– .05	.16	– .01
(20) MRT	– .04	.04	.15	**– .25**	**– .21**	.13	.17	**.19**	.11	– .04	**.28**	.04
(21) SPM	.05	– .03	**.35**	– .06	– .16	.01	.10	.08	.02	– .15	– .01	.08
(22) Level of education (years)[a]	– .15	.08	**.40**	.17	– .04	**– .19**	– .08	.01	– .05	**– .32**	– .10	**– .25**

Domains and variables	13	14	15	16	17	18	19	20	21	22
Personality										
(1) Neuroticism	**.25**	**.63**	**.37**	**– .13**	**– .14**	– .06	.02	.02	– .02	– .10
(2) Extraversion	**– .26**	**– .36**	**– .14**	.01	– .02	.02	.01	.11	.01	– .03
(3) Openness to experience	**– .14**	– .07	**.24**	**.29**	**.33**	.13	.08	**.16**	**.25**	**.43**
(4) Agreeableness	**– .11**	**– .16**	**– .46**	– .08	– .01	**– .13**	**– .23**	**– .14**	– .08	– .09
(5) Conscientiousness	– .11	**– .27**	**– .29**	.01	.01	.01	– .04	– .08	– .12	– .02
Aggression and delinquency										
(6) Buss–Perry-Total	**.22**	**.43**	**.54**	– .01	– .08	.07	.12	.10	.02	– .05
(7) Physical aggression	**.12**	**.15**	**.39**	.05	– .01	.09	**.14**	**.14**	.04	– .05
(8) Verbal aggression	.07	**.15**	**.39**	.11	.06	.10	**.15**	.09	**.13**	.09
(9) Anger	**.17**	**.40**	**.46**	– .03	– .11	.05	.08	.07	.06	– .05
(10) Hostility	**.28**	**.57**	**.40**	**– .13**	**– .16**	– .03	– .01	– .01	– .13	– .09
(11) CAPS Total	.07	**.12**	**.37**	– .04	**– .14**	.07	.10	.13	.09	– .09
Psychological health										
(12) HPSI-Total	**.74**	**.68**	**.63**	**– .16**	**– .13**	– .10	.02	– .08	**– .14**	– .09
(13) Depression	–	**.19**	**.16**	**– .25**	**– .19**	**– .19**	– .08	**– 16**	**– .25**	**– .11**
(14) Psychiatric symptoms	.07	–	**.30**	**– .15**	**– .14**	– .07	.01	.01	– .12	**– .19**
(15) Social symptoms	– .08	**.25**	–	.11	.10	.12	**.15**	.03	**.14**	**.15**
Cognitive abilities										
(16) EIHM Global	– .07	**– .27**	.01	–	**.83**	**.81**	**.42**	**.26**	**.54**	**.43**
(17) EIHM Verbal	– .03	**– .29**	– .05	**.83**	–	**.38**	**.24**	.07	**.33**	**.52**
(18) EIHM Non-verbal	– .11	– .17	.08	**.80**	**.36**	–	**.47**	**.35**	**.55**	**.20**
(19) WLT	– .05	– .14	**.24**	**.46**	**.27**	**.45**	–	**.31**	**.44**	**.13**
(20) MRT	.04	– .18	**.27**	**.23**	.04	**.32**	**.42**	–	**.25**	.01
(21) SPM	– .04	.01	**.21**	**.47**	**.25**	**.48**	**.50**	**.32**	–	**.33**
(22) Level of education (years)[a]	– .09	**– .30**	– .09	**.47**	**.33**	**.42**	**.26**	**.19**	**.47**	–

Table 3 (continued)

Top half indicates correlations for adoptees and bottom half indicates correlations for non-adoptees. Correlations based on Kendall Tau *b*
Bolded correlations = $p < .05$

non-adopted participants. Men reported significantly more physical aggression and verbal aggression than women.

Psychological Health

On the Psychological health domain, the MANCOVA revealed a significant main effect of adoption status and sex and no interaction effect between adoption status and sex. The ANCOVA performed on the HPSI total score revealed a significant main effect of adoption status. The main effect of sex and the interaction between adoption status and sex were not significant. Therefore, adopted participants reported significantly more overall psychological symptoms than non-adopted participants.

The ANCOVAs performed on the HPSI subscales revealed a significant main effect of adoption status for the depression and psychiatric symptoms subscales and a significant main effect of sex for the psychiatric and social symptoms subscales. There was also a significant interaction between adoption status and sex for the depression subscale. Simple effects analysis performed on the depression subscale revealed that the effect of adoption status was significant in men, $F(1, 439) = 19.23$, $p < .0005$, but not in women, $F(1, 439) = 1.46$, $p = .228$; men who were adopted reported significantly more depressive symptoms than men who were not adopted. Furthermore, participants who were adopted reported significantly more psychiatric symptoms than participants who were not adopted but did not differ significantly on social symptoms. Men reported significantly fewer psychiatric and social symptoms than women.

Cognitive Abilities

On the Cognitive abilities domain, the MANCOVA revealed a significant main effect of sex but no main effect of adoption status. The interaction effect between adoption status and sex was significant. The ANCOVAs revealed a significant main effect of adoption status for the EIHM total score and level of education and a significant main effect of sex for the EIHM, the WLT, and the MRT total scores. A significant interaction between adoption status and sex was found for the EIHM total score and level of education. Simple effects analysis performed on the EIHM total score revealed that the effect of adoption status was significant in women, $F(1, 329) = 8.59$, $p < .0045$, but not in men, $F(1, 329) = 0.01$, $p = .914$; female participants who were adopted showed significantly lower global intellectual abilities than female participants who were not adopted. Furthermore, there was no difference between adopted and non-adopted participants on spatial and eductive abilities and on level of education. Men showed significantly better spatial abilities than women but similar eductive abilities.

The ANCOVAs performed on the EIHM verbal and non-verbal subscales revealed a significant main effect of adoption status for the EIHM non-verbal and a significant main effect of sex for the EIHM verbal. The interaction effect between adoption status and sex was significant for the EIHM non-verbal. Simple effects analysis revealed that the effect of adoption status was significant in women, $F(1, 330) = 17.26$, $p < .0005$, but not in men, $F(1, 330) = 0.15$, $p = .702$; women who were adopted showed significantly lower non-verbal abilities than women who were not adopted. Adopted and non-adopted participants did not differ on verbal abilities. Men reported significantly higher verbal abilities than women.

Visual and Distributional Analyses

As suggested by Haugaard (1998) and following Miller et al. (2000) and Sharma et al. (1998), distributional differences between adopted and non-adopted participants were examined. In addition to visual inspection of the distributions, we calculated the proportions of adopted and non-adopted participants who scored at or above five progressively higher percentile points (50th, 75th, 85th, 90th, and 95th) for each of the 11 outcome variables that showed significant group differences. Percentile points were calculated based on the combined distribution. Because significant sex differences were found in many domains and variables, analyses were performed separately for men and women. Table 5 shows the results for two outcome variables: Psychiatric symptoms (an HPSI subscale) and physical aggression (a Buss–Perry subscale). Similar results were found for the other outcome variables. In general, and for both men and women, the proportions of adopted and non-adopted participants falling at or above the 50th and the 75th percentile point of the combined distribution were very similar and the ratios were therefore near 1:1. However, progressively larger proportions of adopted participants compared to non-adopted participants are observed as the percentile points approached the most extreme part of the upper tails. For the outcome variables in the Cognitive abilities domain, the pattern is the same but reversed: smaller proportions of adopted participants compared to non-adopted participants are observed as the percentile points approached the very upper tail. Highest ratios at the very upper tails of the distribution were found for

Table 4 Means, standard deviations, and analyses of covariance (MANCOVA, ANCOVA) for each of the four domains by Adoption Status and Sex

Domains and variables	Adoptees			Non-Adoptees			df	Error	Group		Sex	
	All	Men	Women	All	Men	Women						
	M (SD)	*M* (SD)	*M* (SD)	*M* (SD)	*M* (SD)	*M* (SD)			*F*	*p*	*F*	*p*
Personality	*N* = 312	*N* = 115	*N* = 197	*N* = 129	*N* = 64	*N* = 65	5	430	**2.50**	.030	**6.71**	< .0005
Neuroticism	92.6 (24.6)	91.5 (25.9)	93.3 (23.8)	84.5 (24.7)	80.9 (25.5)	88.0 (23.5)	1	434	**10.84**	.001	3.53	.061
Extraversion	108.9 (19.6)	108.6 (19.8)	109.0 (19.6)	113.7 (18.0)	116.1 (17.7)	111.2 (18.0)	1	434	1.48	.225	0.89	.345
Openness to experience	115.8 (18.8)	116.2 (20.3)	115.5 (17.9)	116.0 (18.7)	114.–5 (18.4)	117.4 (19.0)	1	434	0.81	.368	0.70	.403
Agreeableness	127.5 (16.8)	123.1 (16.6)	130.0 (16.4)	128.2 (15.4)	124.8 (14.3)	131.6 (15.7)	1	434	1.06	.303	**16.26**	< .0005
Conscientiousness	122.4 (20.1)	121.5 (21.9)	122.9 (19.1)	124.4 (18.0)	123.1 (17.7)	125.6 (18.3)	1	434	1.80	.180	0.69	.406
Aggression and delinquency	*N* = 316	*N* = 116	*N* = 200	*N* = 130	*N* = 64	*N* = 66	6	434	**3.21**	.004	**11.52**	< .0005
Buss–Perry-Total	71.1 (17.5)	74.4 (18.3)	69.2 (16.8)	66.5 (15.3)	70.3 (16.1)	62.8 (13.6)	1	439	**10.60**	.001	**12.07**	.001
Physical aggression	17.9 (7.0)	20.0 (7.3)	16.7 (6.5)	16.5 (5.5)	18.3 (6.0)	14.7 (4.2)	1	439	**5.66**	.018	**26.24**	< .0005
Verbal aggression	15.0 (4.0)	15.9 (3.9)	14.4 (4.0)	14.9 (3.8)	16.4 (3.5)	13.5 (3.5)	1	439	2.89	.090	**27.66**	< .0005
Anger	19.1 (5.8)	19.4 (6.2)	18.9 (5.6)	17.3 (5.3)	17.8 (5.4)	16.8 (5.1)	1	439	**11.75**	.001	1.22	.269
Hostility	19.1 (6.4)	19.0 (6.5)	19.2 (6.4)	17.9 (6.0)	17.8 (5.8)	17.9 (6.3)	1	439	**4.15**	.042	0.05	.820
CAPS Total	2.3 (2.7)	3.0 (3.0)	1.8 (2.4)	1.5 (2.0)	2.3 (2.3)	0.8 (1.3)	1	439	**13.14**	< .0005	**26.90**	< .0005
Psychological health	*N* = 316	*N* = 117	*N* = 199	*N* = 130	*N* = 65	*N* = 65	4	436	**4.85**	.001	**12.90**	< .0005
HPSI-Total	38.3 (11.0)	39.4 (12.1)	37.7 (10.3)	34.3 (9.5)	33.8 (10.1)	34.7 (8.9)	1	439	**16.91**	< .0005	0.04	.837
Depression	17.4 (6.5)	18.0 (7.2)	17.0 (6.1)	15.1 (6.1)	14.0 (6.0)	16.2 (6.1)	1	439	**14.27**	< .0005	0.91	.340
Psychiatric symptoms	10.6 (4.9)	9.7 (4.9)	11.1 (4.9)	9.3 (4.8)	8.6 (4.4)	10.0 (5.1)	1	439	**6.93**	.009	**8.27**	.004
Social symptoms	10.3 (4.4)	11.6 (5.0)	9.5 (3.8)	9.9 (4.3)	11.2 (4.7)	8.6 (3.4)	1	439	2.49	.115	**27.19**	< .0005
Cognitive abilities	*N* = 231	*N* = 82	*N* = 149	*N* = 105	*N* = 53	*N* = 52	7	323	1.44	.190	**12.64**	< .0005
EIHM Global	102.0 (13.0)	106.7 (12.8)	99.5 (12.4)	105.4 (11.4)	105.6 (11.6)	105.2 (11.4)	1	329	**3.98**	.047	**7.74**	.006
EIHM Verbal	104.8 (13.7)	108.8 (13.9)	102.7 (13.2)	106.3 (11.7)	107.5 (12.0)	105.0 (11.2)	1	330	0.20	.888	**7.20**	.008
EIHM Non-verbal	98.4 (14.9)	102.7 (13.7)	96.0 (1501)	103.9 (14.0)	102.5 (14.3)	105.3 (13.7)	1	330	**9.07**	.003	1.80	.180
WLT	3.7 (3.0)	5.4 (2.7)	2.8 (2.8)	4.3 (3.1)	5.1 (3.0)	3.4 (3.0)	1	329	1.08	.299	**43.75**	< .0005
MRT	4.9 (3.5)	6.1 (4.4)	4.3 (2.7)	5.8 (4.0)	7.2 (4.6)	4.3 (2.6)	1	329	1.79	.182	**34.80**	< .0005
SPM	47.2 (7.2)	48.3 (7.5)	46.5 (7.0)	48.7 (7.5)	48.3 (8.1)	49.1 (6.9)	1	329	1.18	.278	0.40	.526
Level of education (years)[a]	13.0 (2.6)	13.6 (2.8)	12.6 (2.4)	13.6 (2.6)	13.5 (2.6)	13.7 (2.6)	1	329	3.50	.062	1.93	.166

F with $p \leq .05$ are in boldface. Subscales are indented under the relevant test. Due to missing data, sample size varies. Analyses were performed within each domain. MANCOVAs (first line on each domain) including all scores within each domain were performed, followed by individual ANCOVAs for each of the scores. The interaction between adoption status and sex is not included in the table. It is significant for the Cognitive abilities domain [$F(7, 323) = 2.34$, $p = .024$], the Verbal aggression score [$F(1, 439) = 4.03$, $p = .045$], the Depression score [$F(1, 439) = 6.02$, $p = .015$], EIHM total score [$F(1, 329) = 4.43$, $p = .036$], and the EIHM non-verbal score [$F(1, 330) = 7.83$, $p = .005$]

Buss–Perry Buss–Perry Aggression Questionnaire, *CAPS* Childhood and Adolescent Psychopathy Scale, *HPSI* Holden Psychological Screening Inventory, *EIHM* Épreuve Individuelle d'Habileté Mentale, *WLT* Water Level Test, *MRT* Mental Rotation Test, *SPM* Standard Progressive Matrices, *-Total* total score

[a]The level of education is calculated in years, based on the Quebec education system: Less than 7th grade = 6 years, 7th grade = 7 years, secondary 1 = 7 years, secondary 2 = 8 years, secondary 3 = 9 years, secondary 4 = 10 years, secondary 5 = 11 years, CEGEP = 13 years, university certificate = 14 years, bachelor degree = 16 years, master degree = 18 years, and doctoral degree = 21 years

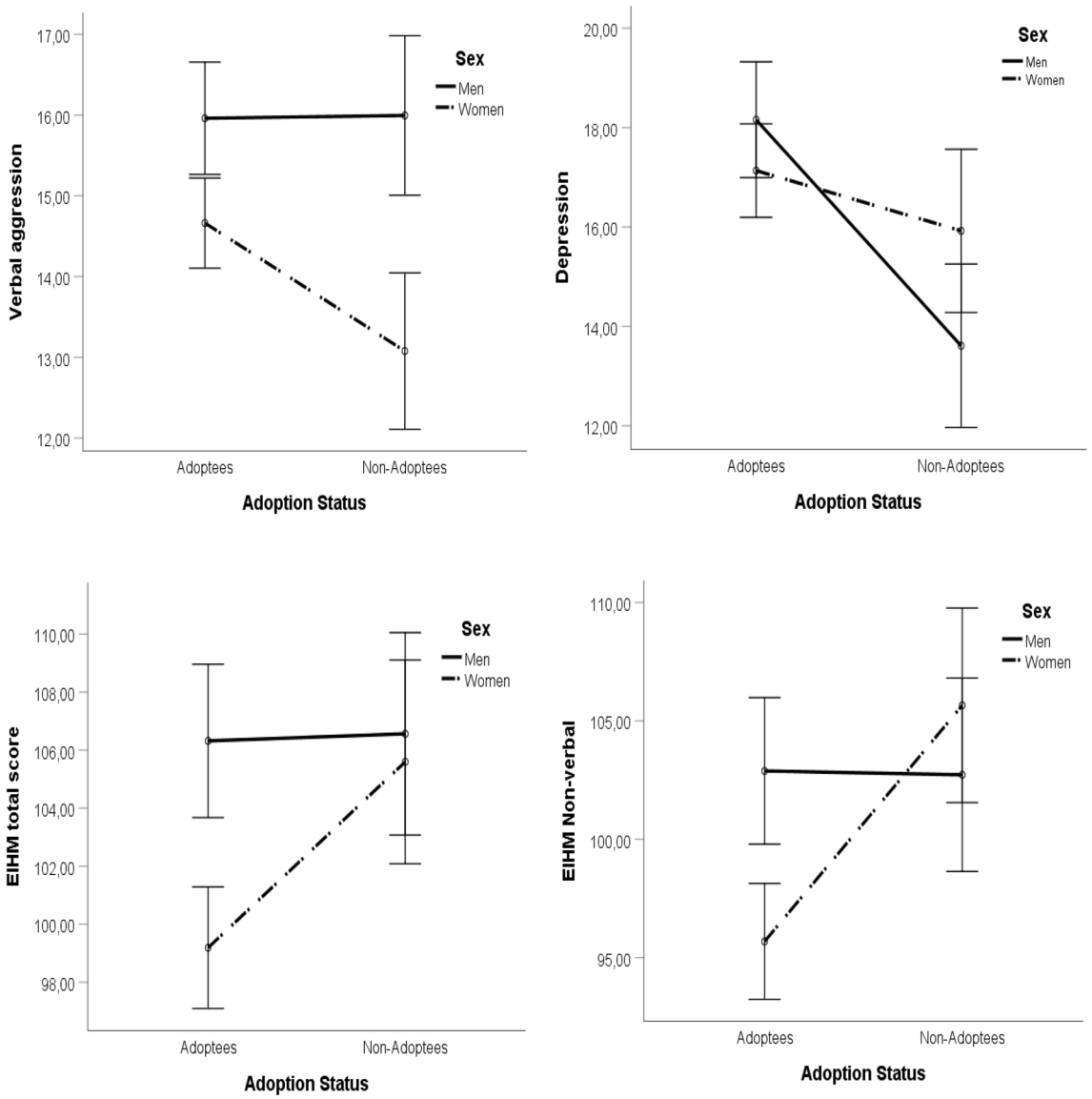


Fig. 1 *EIHM* ÉpreuveIndividuelle d'Habileté Mentale. Significant interaction effects of adoption status and sex are controlled for age, sibship size, and recruitment method. Bars indicate 95% confidence intervals

Table 5 Percentages and ratios of adoptees and non-adoptees in upper tails of the combined distribution

Variables	Adoption status	Men: percentile points					Women: percentile points				
		50%	75%	85%	90%	95%	50%	75%	85%	90%	95%
HPSI psychiatric symptoms	Adoptees	57.3	26.5	18.8	12.0	10.3	56.8	32.2	15.1	11.6	7.5
	Non-adoptees	43.1	21.5	15.4	7.7	4.6	43.1	26.2	15.4	10.8	6.1
	Ratio	1.3	1.2	1.2	1.6	2.2	1.3	1.2	1.0	1.0	1.2
Buss–Perry physical aggression	Adoptees	56.9	32.8	12.9	19.0	9.4	53.3	31.7	14.1	20.6	12.0
	Non-adoptees	49.2	22.2	7.9	4.8	3.2	47.0	16.7	6.1	1.5	0
	Ratio	1.2	1.5	1.6	4.0	2.9	1.1	1.9	2.3	13.7	…

Numbers represent the proportions and the ratios of the proportions of adoptees and non-adoptees who scored at or above each percentile point of the combined distribution. Suspension points mean that ratio cannot be computed because the denominator of the equation is 0

the outcome variables in the Aggression and Delinquency domain, with ratios becoming as high as 14:1.

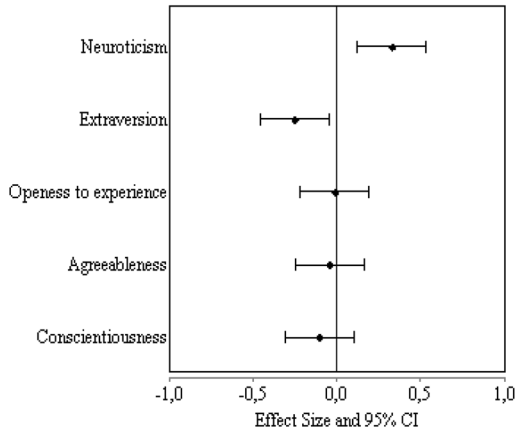
Effect Size Analyses

Panels a–d of Fig. 2 illustrate the effect sizes and the 95% confidence intervals (CIs) for each domain and outcome variable. We used Cohen's *d* for calculating effect sizes: the standardized mean difference between adopted and non-adopted participants [(mean adoptees − mean non-adoptees)/pooled standard deviation]. Cohen's *d* scores and 95% CIs of *d* scores were calculated with Comprehensive Meta-Analysis (CMA) program, Version 2.2.064 (2011; Borenstein et al. 2005). Figure 2 is produced using Metadata viewer, Version 1.05 (2011; Boyles et al. 2011).

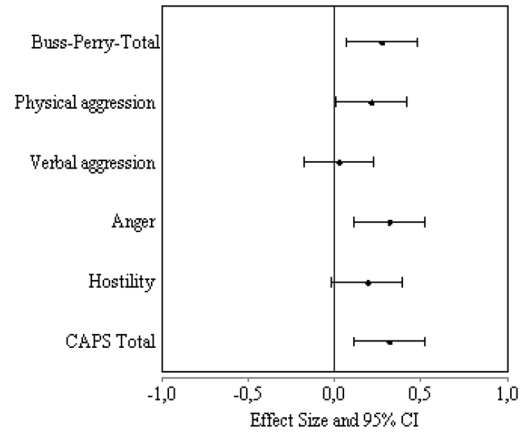
As illustrated and using Cohen's suggested criteria (1988; 0.20 small, 0.50 medium, and 0.80 large), more than half of them are smaller than 0.20. The highest *d* scores (negative or positive) were found for the following variables: overall psychological symptoms (+ 0.38), non-verbal abilities (− 0.38), depression (+ 0.36), neuroticism (+ 0.33), and anger (+ 0.32).

Age at the Time of Participation in the Study

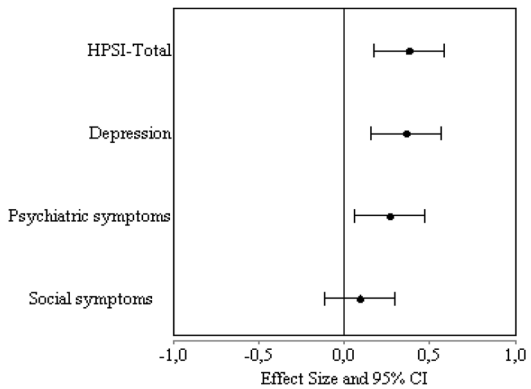
We examined whether the age of participants at the time they completed the questionnaires moderated the relations observed between the adoption status and the outcome variables. Moderation effects were estimated by conducting regression analyses with PROCESS macro (Version 2.16.2; Hayes 2013) implemented in SPSS. A moderation effect is observed when the interaction between the independent variable (adoption status) and the potential moderator variable (age of participants) is significant. Sibship size and recruitment method were used as covariates. We conducted the analyses separately for men and women.



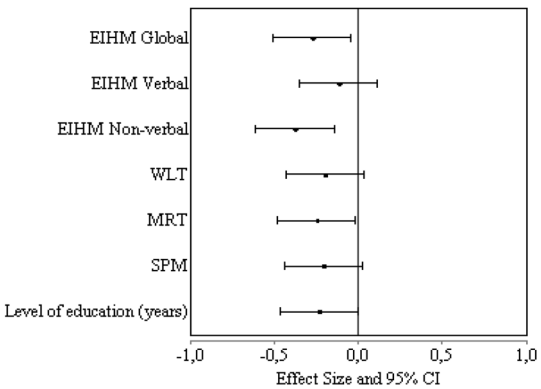
a Personality



b Aggression and delinquency



c Psychological health



d Cognitive abilities

Fig. 2 *Buss–Perry* Buss–Perry Aggression Questionnaire, *CAPS* Childhood and Adolescent Psychopathy Scale, *HPSI* Holden Psychological Screening Inventory, *EIHM* Épreuve Individuelle d'Habileté Mentale, *WLT* Water Level Test, *MRT* Mental Rotation Test, *SPM* Standard Progressive Matrices, *-Total* totalscore. Subscales are indented under the relevant test. Positive effect size (Cohen's *d*) indicates that adoptees scored higher than non-adoptees. Bars indicate 95% confidence intervals

There was only one significant interaction effect and it was for women: the age of female participants moderated the relationship between adoption status and childhood and adolescence behaviors, $\beta = .09$, $p < .0005$: There were differences between the groups at younger age but not at older age.

Age at Adoption

We conducted partial correlations between the age at adoption (as a continuous variable) and the outcome variables while controlling for the age of participants. We conducted these analyses separately for men and women. The only significant correlations were for men and in the domain of Cognitive abilities. As the age at adoption increased, there was a decrease in global (EIHM Global), $r(66) = -.45$, $p < 0.0005$, spatial (WLT), $r(66) = -.31$, $p = 0.011$, eductive SPM), $r(66) = -.47$, $p < 0.0005$, non-verbal (EIHM Non-verbal), $r(66) = -.30$, $p = 0.014$, and verbal abilities (EIHM Verbal), $r(66) = -.44$, $p < 0.0005$. There were 44 correlations calculated, so these results must be interpreted with caution. It is intriguing, though, that all significant correlations are in one domain and for one gender.

We also examined whether the differences we found between adopted and non-adopted participants (see Table 4) remain after adjusting for age at adoption. We did so by re-running the same analyses but by including only adoptees adopted before 7 months old in the comparison to non-adopted participants. All differences remained but one: there was no longer a significant difference between adopted and non-adopted participants on global intellectual abilities, $F(1, 260) = 1.44$, $p = 0.232$.

Search Status

Within each domain, individual ANCOVAs for each of the total and subscale scores were performed to compare the adjustment of adoptees who had not attempted to discover their biological family (non-searchers; $N = 36$) and adoptees who had (reunited or searchers; $N = 282$). Because of small N among the non-searchers, analyses could not be performed separately for men and women. Again, all analyses were two-tailed and used age as covariate, except for the EIHM subscales. Only two univariate differences were significant. Adoptees who had not attempted to discover their biological family reported more openness to experience, $F(1, 309) = 7.24$, $p = .008$, and higher education level, $F(1, 228) = 3.98$, $p = .047$, than adoptees who had. Considering the number of comparisons, it is possible that these two findings are Type 1 errors.

Discussion

Using a large and homogenous group of adult, Caucasian, domestic adoptees and a similar group of non-adoptees, this study showed that adopted participants differed significantly from non-adopted participants on 11 out of the 22 scales and subscales examined across the four domains studied. Overall, adopted participants reported higher emotional instability, more overall aggression, more childhood and adolescence antisocial behaviors, more physical aggression, more anger, more hostility, more overall psychological symptoms, more depressive symptoms (men only), and more psychiatric symptoms. Adopted women showed lower global and non-verbal intellectual abilities and lower level of education. Adopted and non-adopted participants did not differ on extraversion, openness to experience, agreeableness, conscientiousness, verbal aggression, social symptoms, or on spatial, eductive, and verbal abilities. These results were not moderated by the age of participants at the time they completed the questionnaires.

These results suggest that adoptees are at higher risk for psychological, behavioral, and cognitive maladjustment in adulthood compared with non-adoptees. However, results obtained from distributional and effect size analyses suggest that many of the effect sizes are small and that most adoptees score very similarly to non-adoptees on most variables. Indeed, the proportions of adopted and non-adopted participants falling at or above the 50th and the 75th percentile point of the combined distribution are very similar. A progressively larger proportion of adopted participants compared to non-adopted participants are observed in the most extreme (maladjusted) parts of the tails. Altogether, these results suggest that the adult adjustment of adopted and non-adopted participants is very similar for the most part, and that the mean differences observed between adopted and non-adopted participants can be attributed to a few adopted participants who have extreme scores.

These results paint a rather positive picture of the adjustment of our adopted participants and suggest that the negative outcomes seen in samples of children and adolescent may very well diminish with time, except for a few individuals. Indeed, meta-analytic and longitudinal studies show that group differences tend to diminish with age or even completely disappear by young adulthood (Bohman 1970; Bohman and Sigvardsson 1978, 1979, 1980, 1990; Maughan and Pickles 1990; Wierzbicki 1993).

It is likely that our selection criteria are partly responsible for the overall small group differences observed. Adopted participants had only one family of adoption, diminishing the chances of pre-adoption stressors and adversity prior to final adoption. Also, most of our

participants were adopted as infants, at 12 months old or earlier, lowering the chances of exposure to abuse or neglect (Gleitman and Savaya 2011). At the same time, most of our adopted participants had actively searched for their biological families, and such individuals may report more difficulties.

This study does not allow us to determine the causes of the group differences that were observed, but two classes of influences are possible. The first has to do with the adoptees themselves. For example, genetic transmission of certain characteristics (from biological parents to children) that led to the adoption in the first place (e.g., psychological difficulties, sexual impulsivity) could produce some of the differences observed (see Cadoret 1990). For another example, adverse prenatal experiences may be more common among women who place their child for adoption. A second class of influences has to do with the adoptive context and environment. Families with adoptive children may differ from other families; for example, these families may have more permissive attitudes. Similarly, a person who knows that they have been adopted might be less conforming. Research designs that control for genes (e.g., comparing biological siblings who are adopted or not) or the environment (e.g., comparing fraternal sibling who are adopted or not) would be necessary to better establish the causal status of adoption.

A strength of our study is that we included information about the age at adoption and the search status of adoptees. Later age at adoption was associated with more problematic outcomes, especially in men and in the area of cognitive development. This is consistent with many studies (e.g., van Ijzendoorn et al. 2005; Sharma et al. 1996). The fact that the age at adoption was not significantly correlated with many of our variables might be explained by the fact that all of our adopted participants had only one placement before adoption and that most of them (87%) were adopted at 12 months old or earlier. It is also possible that the effect of the age at adoption on someaspects of development diminish with age.

Searching for one's biological family is generally associated with worse developmental outcomes (e.g., Aumend and Barrett 1984; Cubito and Brandon 2000; Sobol and Cardiff 1983). Adopted participants in our study who had attempted to discover their biological family were in fact very similar to those who had not. It is possible that search status is more relevant for younger samples (but see Levy-Shiff 2001).

Conclusion

Studies tend to find that adoption status is associated with more difficult psychological adjustment in childhood and adolescence, and perhaps in adulthood as well. Our study adds to this body of knowledge by showing that adult adopted participants do indeed differ from adult non-adopted participants on several variables, but the effect sizes are small, and the average group differences may be caused by just a few individuals with extreme scores. Our study was relatively large, well-controlled, and used a non-clinical sample. Future research should focus on the reason adoption leads to difficult outcomes for some individuals (e.g., early health problems, maternal or paternal health problems, pre-adoption neglect, adjustment difficulties in adoptive parents, context of adoption). Future research should also focus on the reasons why group differences are less common in adult samples. For example, perhaps families with adopted children are more likely to seek services than other families, explaining the group differences found in epidemiological studies (e.g., Warren 1992).

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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