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Adoption and Cognitive Development: A Meta-Analytic Comparison of Adopted and Nonadopted Children's IQ and School Performance

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This meta-analysis of 62 studies (N = 17,767 adopted children) examined whether the cognitive development of adopted children differed from that of (a) children who remained in institutional care or in the birth family and (b) their current (environmental) nonadopted siblings or peers. Adopted children scored higher on IQ tests than their nonadopted siblings or peers who stayed behind, and their school performance was better. Adopted children did not differ from their nonadopted environmental peers or siblings in IQ, but their school performance and language abilities lagged behind, and more adopted children developed learning problems. Taken together, the meta-analyses document the positive impact of adoption on the children's cognitive development and their remarkably normal cognitive competence but delayed school performance.

Keywords: meta-analysis, adopted children, academic adjustment, learning problems, IQ

Is the cognitive development of adopted children more advanced compared with that of children who remain in institutional care or in the birth family? Do adopted children show a less advanced cognitive development compared with their current, environmental nonadopted siblings or peers? Several studies indicate that adopted children show externalizing and internalizing behavior problems to a larger extent than do their environmental peers (e.g., Brodzinsky, Schechter, Braff, & Singer, 1984). These socioemotional problems, however, appear to be present in a relatively small subset of adopted children, whereas the large majority of them function well (Bimmel, Juffer, Van IJzendoorn, & Bakermans-Kranenburg, 2003). The central issue for this meta-analytic review is whether the problems of adopted children are unique to the socioemotional domain or can also be found in the domain of cognitive development.

The Theory of Risk and Protective Mechanisms Applied to Adoption

The theory of risk and protective mechanisms (Rutter, 1990) assumes that an accumulation of risk factors results in less optimal development in children, although protective factors may buffer the negative effects of the risks. The experience of being adopted involves both protective and risk factors. Adoption means a positive change, or protective mechanism, for children who are adopted. They move from a deprived institutional setting or from an overburdened biological family to an adoptive family. A trajectory that was bound to show cumulative risk factors (because of maltreatment, neglect, or understimulation) is changed to a positive direction, one with a greater likelihood of healthy adjustment (Rutter, 1990).

However, several risk factors related to adoption or the preadoptive background of the child also have been identified to explain the higher incidence of problems during the life course of adoptees (Brand & Brinich, 1999; Brodzinsky, 1990; Haugaard, 1998). Risks may be found in adoptees' genetic, prenatal, or preadoptive background. For example, there may have been a psychiatric disorder in the birth family (Bohman & von Knorring, 1979; Cadoret, 1990), birth complications, or deprivation in the adoptee's home, including malnutrition, neglect, or abuse (Dennis, 1973; McGuinness & Pallansch, 2000; O'Connor et al., 2000; Rutter et al., 1998). Boys might be more impacted by such adversities than girls (Rutter & Sroufe, 2000).

From a stress and coping perspective, Brodzinsky (1987, 1990) proposed a psychosocial model of adoption adjustment. He suggested that the experience of adoption exposes parents and children to a unique set of psychosocial problems or tasks that may interact with or complicate normative developmental family tasks. For example, the child must cope with the loss of the birth parents.

Risks to Cognitive Development

Predictions about a more problematic socioemotional development of adopted children have been derived from these models of risk and protective mechanisms. However, it is less clear whether adopted children's cognitive development is at risk in similar ways. Here, the question is whether adopted children show similar

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rates of developmental problems in the cognitive domain as in the socioemotional domain.

In the current series of meta-analyses, we examine studies that compared adopted children with their peers and siblings on measures of cognitive functioning, as defined by IQ and school performance. As described above, many adopted children have experienced some hardships during their first years of life, including malnourishment, neglect, and/or maltreatment in their family of origin or in the institutional setting from which they were adopted (Johnson, 2000; Verhulst, Althaus, & Versluis-den Bieman, 1992). Therefore, we might expect their cognitive development to be at risk (Colombo, de la Parra, & Lopez, 1992; Lien, Meyer, & Winick, 1977; O'Connor et al., 2000; Rutter et al., 1998; Rutter, Kreppner, & O'Connor, 2001). Studies have shown that orphanages offer fewer opportunities for young children to acquire or practice new skills than do home environments, which results in deficits in social and cognitive functioning (e.g., Kaler & Freeman, 1993). Children are often confined to their crib and lack opportunities to play with toys, interact with adults, or practice locomotion (Dennis, 1973; Johnson, 2000). Several studies have demonstrated that poor nutrition or malnourishment during infancy is associated with cognitive problems or delays (Colombo et al., 1992; Winick, Meyer, & Harris, 1975), probably resulting from delayed brain growth.

Adoption and Cognitive Development

The association between adoption and cognitive development has been investigated in behavior genetics studies (Bouchard & McGue, 1981; Dumaret, 1985; Horn, Loehlin, & Willerman, 1979; Neiss & Rowe, 2000; Plomin, Fulker, Corley, & DeFries, 1997). The absence of a genetic relationship between adopted children and their adoptive parents provides a unique opportunity to study the influence of family environment without the contamination of genetic factors. Adoptive families are mostly well above average socioeconomically (e.g., Maughan, Collishaw, & Pickles, 1998; Verhulst, Althaus, & Versluis-den Bieman, 1990), and the socioeconomic status of the biological parents is often rather low (e.g., Colombo et al., 1992; Schiff et al., 1978). Therefore, adoption might be conceptualized as a natural quasi-experiment in which one can look for positive changes in IQ caused by positive changes in the environment. Of course, this quasi-experiment is certainly not designed with the inferential power derived from random assignment to conditions. Adopted children may have been adopted for reasons or causes related to their preadoption cognitive status. However, some studies were able to compare the IQ of adopted children with the IQ of their biological siblings who stayed behind and with the IQ of the birth parents. Therefore, it may be possible to estimate the influence of genetic and environmental factors more precisely than can be accomplished with common between-families studies. More often, however, adopted children have been compared with their genetically unrelated siblings in the adoptive family.

Neiss and Rowe (2000), for example, compared adopted children and matched birth children—unrelated to the adopted children—to estimate the genetic and environmental effect of the mother's and father's years of education on children's verbal intelligence, as assessed by knowledge of vocabulary words. Adolescent adopted and birth children in the National Longitudinal Study of Adolescent Health were matched for gender, age, parental education, and ethnicity. The adolescents all resided with two parents. The mother–child and father–child correlations in biological families were substantially higher than in adoptive families (.41 and .36, respectively, vs. .16 and .18), indicating both genetic and shared environmental influences. The authors concluded that parental education exerts a modest shared environmental effect, explaining no more than 3%–4% of the variation in adopted children's verbal intelligence.

On the basis of earlier studies, Munsinger (1975) already had suggested that the adoptive parents' home environment has only a modest effect on their adopted children's cognitive development, whereas the heredity and environment of the birth parents exert a profound influence. It should be noted, however, that larger variations in the child-rearing environment might lead to smaller influences of genetic factors (Plomin et al., 1997).

Drastic Changes of Environment

Comparisons of the IQ of adopted children with that of their nonadopted birth siblings may provide information on the effects of adoption even without a complete behavior genetic design. Unfortunately, we found only a few studies that compared adoptees' IQ with the IQ of their nonadopted birth siblings or nonadopted peers from the same institution. The French Adoption Study by Schiff et al. (1978) and Colombo et al.'s (1992) study from Chile both found a higher mean IQ for the adopted siblings. In the Schiff et al. (1978) study, school failure rates and the percentage of IQ scores below 95 were collected for a sample of 32 adopted children placed at approximately 4 months of age. Both percentages were significantly smaller than those expected from the social class of birth (13% vs. 55% and 17% vs. 51%, respectively) and the percentages observed in a control group of nonadopted birth siblings (56% and 49%, respectively). However, the percentages were close to those expected from the social class of the adoptive families (both 15%; Schiff, Duyme, Dumaret, & Tomkiewicz, 1982).

Colombo et al. (1992) studied 35 school-age children (5–21 years) with a history of early malnutrition. They compared three groups. The first group consisted of children who were raised after recovery by adoptive families ($n = 16$; placed for adoption before 12 months), the second group of children remained in institutional care ($n = 8$), and the third group consisted of children raised in their birth family ($n = 11$). Adopted children had IQs in the normal range, and they outperformed the other groups, in particular on the verbal subscale. The authors concluded that early undernourishment may not cause irreversible damage for children but instead can be negated by early, drastic, and stable environmental improvement. Similar findings have been reported by Tizard and Hodges (1978), Lien et al. (1977), Winick et al. (1975), and Dennis (1973).

The influence of the adoption experience may become larger when the change of environment becomes more drastic. Scarr and Weinberg (1976) studied the IQ and school achievement of 130 Black children adopted before the age of 12 months by advantaged White families. The adoptees from educationally average families scored above the average level of IQ and school achievement of the White population. The high IQ scores of the Black adoptees suggests that IQ is malleable under rearing conditions that are relevant to the tests and the schools and that deviate drastically from the preadoption social background. Because the preadoption cognitive status of these adoptees was not assessed, the study findings, although impressive, remain inconclusive.

Furthermore, the environmental influences of the adoptive family may fade as the adopted children grow older. In general, genetic and environmental factors may not operate on the same level across the life span. In longitudinal studies, the IQ of adopted children has been found to become more similar to the IQ of their birth parents with increasing age (Fulker, DeFries, & Plomin, 1988; Plomin et al., 1997), and in adulthood the correlation between the IQ of adopted children and that of their adoptive parents appears to be much lower than the correlation with the IQ of the biological parents (McGue, Bouchard, Iacono, & Lykken, 1993; Plomin et al., 1997).

Not only age at assessment but also age at adoption and previous adverse experiences or deprivation may make a substantial difference for the influence of the adoption experience. O'Connor et al. (2000) studied Romanian adopted children in the United Kingdom who had experienced early malnourishment and circumstances of severe deprivation, particularly in institutional care. They found that children adopted at older ages and institutionalized children had lower IQ scores than younger and noninstitutionalized adopted children. Extending previous research using data from the same children, Rutter et al. (1998) assessed the cognitive development of 6-year-old children adopted from Romania before they were 24 months old or when they were between 24 and 42 months old and nondeprived, domestic adoptees from the United Kingdom adopted before they were 6 months old. They found that later placed Romanian children caught up considerably from entry into the United Kingdom to age 6, but, as a group, the children exhibited lower cognitive scores and general developmental impairment compared with earlier adopted Romanian children. This may indicate that the positive outcomes of adoption may be hampered or reduced by severe negative experiences before adoption placement.

Hypotheses

In the current series of meta-analyses, we first examine whether adopted children show better cognitive development than their birth siblings or peers who stayed behind in their original, often deprived environment and who did not get the chance to grow up in an enriching adoptive family and school environment. Second, we test whether the cognitive and language development of adopted children lags behind compared with that of their nonadopted peers in the normal population, in their classrooms, or in their adoptive family. These cognitive and language delays may exist because of the preadoption hardships these children may have endured, in particular malnutrition, neglect, and abuse.

On the basis of the theory of cumulative risk and protective factors, we expect (a) older age at adoption (Howe, 1998), (b) experiences of serious deprivation before adoption (in particular, malnutrition, neglect, and abuse), and (c) a higher age at assessment (Plomin et al., 1997) to be associated with larger cognitive delays for adopted children compared with their nonadopted environmental siblings or peers. International adoptions may create more adaptation problems for the adopted children than domestic adoptions because issues of cultural and ethnic differences may arise less frequently or intensively in the latter case (Juffer, Stams, & Van IJzendoorn, 2004; Lanz, Iafrate, Rosnati, & Scabini, 1999). In the theory of cumulative risk and protective factors, gender of the developing child has often been found to be relevant: Adopted boys lag behind adopted girls in various domains of development, including socioemotional development (Earls, 1987; Eme, 1979; Rutter, 1990; Stams, Juffer, Rispens, & Hoksbergen, 2000; Verhulst et al., 1990). Thus, in the current meta-analytic review we test whether adopted boys fare less well than their female counterparts in the cognitive domain.

Method

Literature Search

We used three different search methods for identifying literature for the meta-analytic review (Cooper & Hedges, 1994; Mullen, 1989). First, we searched for literature in the electronic databases ERIC, PsycINFO, MEDLINE, Sociological Abstracts, and Current Contents. We used the keywords *adopt** (where an asterisk indicates that the search contained but was not limited to that word or word fragment), *adopted children*, and *adoption* in combination with the keywords *IQ*, *school results*, *academic adjustment*, and related terms, such as *academic achievement* and *cognitive ability*, in searching these databases. Second, we searched the references of the collected studies for relevant studies on academic achievement, IQ, and cognitive development of adopted children. Third, we contacted adoption researchers and asked them to share pertinent studies.

Studies were included in the meta-analysis if they (a) assessed IQ (using, e.g., the Wechsler Intelligence Scale for Children [WISC], as in Frydman & Lynn, 1989), presented scores for academic achievement measured by school results (e.g., school grades, as in Fan et al., 2002) or school competence (e.g., assessed with the Child Behavior Checklist, as in Pinderhughes, 1998), or contained information about school failures (e.g., Geerars, Hoksbergen, & Rooda, 1995), special education attendance (e.g., Verhulst et al., 1990), or learning problems (e.g., Silver, 1989); (b) used a nonadopted comparison group (e.g., classmates; e.g., Dalen, 2001) or included measures with standardized scores (e.g., O'Connor et al., 2000); and (c) reported sufficient data to permit the calculation of an effect size. We excluded studies that exclusively sampled adopted children in need of clinical treatment (e.g., Grotevant, McRoy, & Jenkins, 1988; Jerome, 1993), children exposed to drugs in utero (e.g., Loebstein & Koren, 1997; Moe, 2002; Thyssen Van Beveren, Spence, & Little, 2000), physically or mentally handicapped children, and other special needs children (e.g., Groze, 1996; J. A. Rosenthal, Groze, & Aguilar, 1991).

The selection procedure yielded 48 studies that used IQ scores as an outcome and 55 studies that used academic achievement as an outcome. Data on learning problems, in particular referrals to special education, were presented in 8 studies. In 14 studies we found results on language abilities of adopted children (e.g., school results on language, as in Maughan et al., 1998). In several studies, data on more than one aspect of cognitive development were presented. For example, scores on both IQ and school achievement were presented in 8 studies (Castle, Beckett, Groothues, & ERA Study Team, 2000; Leahy, 1935; Schiff et al., 1978; Stams et al., 2000; Teasdale & Owen, 1986; Tsitsikas, Coulacoglou, Mitsotakis, & Driva, 1988; Winick et al., 1975; Witmer, Herzog, Weinstein, & Sullivan, 1963), and we used these outcomes for the separate analyses on these different domains. We calculated effect sizes separately for subsamples when data were presented separately for boys and girls or for children at different ages at the time of adoption or time of the assessments. These subsamples were considered as independent data points in the meta-analysis. This is the reason why the number of publications often was smaller than the number of outcomes used in the meta-analyses. However, within the domains of IQ, school achievement, and learning problems, every child was included only once in the meta-analyses. Table 1 provides

Table 1
Studies Included in the Meta-Analyses

Study	Country/region of study	Country/region of child's origin	Age at assessment (years)	Age at adoption (months)	Sample size: Adoption	Sample size: Comparison	Preadoption status	Comparison group	Outcome (*d*)
Andresen (1992)	Norway	Korea	12–18	12–24	135	135	Not reported	Classmates	School results 0.16 Language 0.09
Benson et al. (1994)	United States	United States	12–18	< 15	881	Norm	Not reported	Norm group	School results −0.36
Berg-Kelly & Eriksson (1997)	Sweden	Korea/India	12–18	< 12	125	9,204	Not reported	General population	School results 0.03 f/−0.04 m Language −0.02 f/−0.05 m
Bohman (1970)	Sweden	Not reported	12–18	< 12	160	1,819	Not reported	Classmates	School results 0.09 f/0.07 m Language 0.02 f/−0.02 m Learning problems 0.00
Brodzinsky et al. (1984)	United States	United States	4–12	< 12	130	130	Not reported	General population	School competence 0.62 f/0.51 m
Brodzinsky & Steiger (1991)	United States	Not reported	9–19		441	6,753	Not reported	Population %	School failure 0.76
Bunjes & de Vries (1988)	Netherlands	Korea India Bangladesh Colombia	4–12	12–24	118	236	Not reported	Classmates	School results 0.24 Language 0.22
Castle et al. (2000)	England	England	4–12	< 12	52	Norm	Not reported	Standardized scores	School results −0.47, IQ 0.47
Clark & Hanisee (1982)	United States	Vietnam Korea Cambodia Thailand	0–4	12–24	25	Norm	Not reported	Standardized scores	IQ −2.42
Colombo et al. (1992)	Chile	Chile	4–12	0–12	16	11	Undernutrition	Biological siblings	IQ −1.16
Cook et al. (1997)	Europe	Not reported	4–8	12–24	131	125	Not reported	General population	School competence 0.56 f/0.16 m
Dalen (2001)	Norway	Korea Colombia	12–18	0–12	193	193	Not reported	Classmates	School results 0.47 (Colombia), −0.07 (Korea) Language 0.43 (Colombia), −0.05 (Korea) Learning problems 0.50
Dennis (1973)	United States	Lebanon	2–18	> 24	85	51	Institute	Institute children	IQ −1.28 (intraracial), −1.36 (transracial)
De Jong (2001)	New Zealand	Romania/Russia	4–15	12–24	116	Norm	Some problems	General population	School competence 0.65
Duyme (1988)	France	France	12–18	< 12	87	14,951	Not reported	General population	School results 0.00
Fan et al. (2002)	United States	United States	12–18		514	17,241	Not reported	General population	School grades −0.02
Feigelman (1997)	United States	Not reported	8–21		101	6,258	Not reported	General population	Education level −0.03
Fisch et al. (1976)	United States	United States	4–12	< 12	94	188	No problems	General population	IQ 0.00 School results 0.50 Language 0.52
Frydman & Lynn (1989)	Belgium	Korea	4–12	12–24	19	Norm	Not reported	Standardized scores	IQ −1.68
Gardner et al. (1961)	United States	Not reported	12–18	< 12	29	29	Not reported	Classmates	School achievement 0.09
Geerars et al. (1995)	Netherlands	Thailand	12–18	< 12	68	Norm	Not reported	Population %	School results 0.19
Hoopes et al. (1970)	United States	United States	12–18		100	100	1–2 shifts in placement	General population	IQ 0.12
Hoopes (1982)	United States	United States	4–12	< 12	260	68	Nothing special	General population	IQ 0.18
Horn et al. (1979)	United States	United States	3–26	< 1	469	164	No problems	Environment siblings	IQ 0.17/0.34/−0.05
W. J. Kim et al. (1992)	United States	Not reported	12–18		43	43	Not reported	General population	School results 0.74

Table 1 (*continued*)

Study	Country/region of study	Country/region of child's origin	Age at assessment (years)	Age at adoption (months)	Sample size: Adoption	Sample size: Comparison	Preadoption status	Comparison group	Outcome (*d*)
W. J. Kim et al. (1999)	United States	Korea	4–12	< 12	18	9	Nothing special	Environment siblings	School competence −0.39
Lansford et al. (2001)	United States	Not reported	12–18		111	200	Not reported	General population	School grades 0.46
Leahy (1935)	United States	United States	5–14	< 6	194	194	Not reported	General population	School grades 0.00 IQ −0.06
Levy-Shiff et al. (1997)	Israel	Israel South America	7–13	< 3	5050	Norm Norm	Not reported	Standardized scores	IQ −1.10 f/−2.00 m
Lien et al. (1977)	United States	Korea	12–18	> 24	240	Norm	Undernutrition	Standardized scores	IQ 0.00
Lipman et al. (1992)	Canada	Not reported	4–16		104	3,185	Not reported	General population	School performance −0.05 f/0.16 m
McGuinness & Pallansch (2000)	United States	Soviet Union	4–12	> 24	105	1,000	Long time in orphanages	Norm group	School competence 0.46
Moore (1986)	United States	United States	7–10	12–24	23	Norm	Not reported	Standardized scores	IQ −0.00 f/−1.00 m
Morison & Ellwood (2000)	Canada	Romania	4–12	12–24	59	35	Orphanages	General population	IQ 1.45 (combined)
Neiss & Rowe (2000)	United States	75% United States	12–18		392	392	Not reported	General population	IQ 0.08
O'Connor et al. (2000)	England	Romania	6	0–42	207	Norm	Orphanage	Standardized scores	IQ −0.56 (combined)
Palacios & Sanchez (1996)	Spain	Spain	4–12	> 24	210	314	Not reported	Institute children	School competence −0.18
Pinderhughes (1998)	United States	United States	8–15	24–48	66	33	Older children	General population	School competence 0.64 (combined)
Plomin & DeFries (1985)	United States	United States	1	0–5	182	182	Not reported	General population	IQ 0.14
Priel et al. (2000)	Israel	75% Israel	8–12	12–24	50	80	Not reported	General population	School competence 0.77 f/1.12 m
Rosenwald (1995)	Australia	73% Korea Asia South America	4–16	< 12	283	2,583	Not reported	General population	School performance −0.18
Scarr & Weinberg (1976)	United States	88% United States	4–16	<12	176	145	Not reported	Environment siblings	IQ 0.75 (combined)
Schiff et al. (1978)	France	France	4–12	<12	32	20	Not reported	Biological siblings	School results −0.70 IQ −1.14
Segal (1997)	United States	United States	4–12	< 12	6	6	Not reported	Environment siblings	IQ 2.67
Sharma et al. (1996)	United States	81% United States	12–18	12–24	4,682	4,682	Not reported	General population	School results 0.37 (combined)
Sharma et al. (1998)	United States	United States	12–18	< 12	629	72	Not reported	Environment	School competence −0.45 f/−0.61 m
Silver (1970)	United States	Not reported	4–12	< 3	10	70	Not reported	General population	Learning problems 1.21
Silver (1989)	United States	Not reported	4–12		39	Perc.	Not reported	General population	Learning problems 1.38
Skodak & Skeels (1949)	United States	Not reported	12–18	< 6	100	100	Not reported	Standardized scores	IQ −1.12
Smyer et al. (1998)	Sweden	Not reported	Adults	< 12	60	60	Not reported	Biological (twin siblings)	Education level −0.82
Stams et al. (2000)	Netherlands	Sri Lanka Korea Colombia	4–12	< 6	159	Norm	Not reported	Standardized scores	School results 0.33 IQ −0.34 f/−0.73 m Learning problems −0.05
Teasdale & Owen (1986)	Denmark	Not reported	Adults	< 12	302	4,578	Not reported	General population	IQ 0.35 Education level 0.32
Tizard & Hodges (1978)	England	Not reported	8	> 24	25	14	Not reported	Restored children	IQ −0.40 (older), −0.62 (younger)
Tsitsikas et al. (1988)	Greece	Greece	5–6	< 12	72	72	Not reported	Classmates	IQ 0.64, school performance 0.29 Language 0.30

(*table continues*)

Table 1 (*continued*)

Study	Country/region of study	Country/region of child's origin	Age at assessment (years)	Age at adoption (months)	Sample size: Adoption	Sample size: Comparison	Preadoption status	Comparison group	Outcome (*d*)
Verhulst et al. (1990)	Netherlands	Europe Korea Colombia India	12–18	> 24	2,148	933	Not reported	General population	Perc. special education 0.25 f/0.29 m
Versluis-den Bieman & Verhulst (1995)	Netherlands	Europe Korea Colombia India	12–18	> 24	1,538	Norm	Not reported	General population	School competence 0.28 f/0.41 m
Wattier & Frydman (1985)	Belgium	Korea 89%	4–12	12–24	28	Norm	Not reported	Standardized scores	IQ −0.06
Westhues & Cohen (1997)	Canada	Korea 40% India 40% South America	12–18	12–24	134	83	Not reported	Environment siblings	School performance 0.13
Wickes & Slate (1997)	United States	Korea	> 18	> 36	174	Norm	Not reported	Norm group	School results 0.09 f/0.07 m Language 0.07 f/0.03 m
Winick et al. (1975)	United States	Korea	4–12	> 24	112	Norm	Malnourished	Standardized scores	School performance 0.00 IQ 0.00
Witmer et al. (1963)	United States	United States	12–18	< 12	484	484	Nothing special	Classmates	School performance 0.00 IQ 0.00

Note. More information about the individual studies is available on request. Country/region of study is the country or region in which the adopted children were living at the time the study was conducted; country/region of child's origin is the country or region from which the children were adopted. Preadoption status of the adopted children is given if any information was available. Effect sizes are given in Cohen's *d* separately for female (f) and male (m) adoptees when possible. Norm = test norm; Perc. = percentage.

an overview of the collected studies and the variables derived from each study.

Coding System

The coding system for design and sample characteristics is presented in Table 2. The design characteristics included sample size, type of publication outlet, year of publication, and kind of comparison group. Most studies were published in refereed scientific journals, but the meta-analytic review also included unpublished reports, books, and book chapters. Therefore, we examined whether effects found in scientific journals differed from effects found in nonrefereed reports or books and book chapters. We also contrasted recent publications (1990 and later) with older publications (before 1990).

We coded for the kind of comparison group. We hypothesized that it would make a difference whether adopted children were compared with (a) nonadopted birth siblings who remained with or were restored to the birth parents (e.g., Colombo et al., 1992) or their institutionalized peers who remained in the institutional setting where the adopted children once lived (e.g., Palacios & Sanchez, 1996), (b) classmates (e.g., Tsitsikas et al., 1988), (c) environmental siblings unrelated to the adopted children but in the adoptive family (e.g., Westhues & Cohen, 1997), (d) the general population (e.g., Duyme, 1988), or (e) norms on standardized tests—for example, in one study adopted children were assessed with the WISC—Revised (as in Levy-Shiff, Zoran, & Shulman, 1997), and the standardized IQ mean of 100 (SD = 15) was used for comparison. We wished to examine whether different effect sizes for cognitive development of adopted children could be attributed to the different kinds of comparison groups. In particular, we were interested in the contrast between adopted children and children left behind (nonadopted birth siblings or institutional peers) and in the contrast between adopted children and their environmental comparisons (classmates, unrelated siblings, the general population, and standardized test norms).

The number of studies comparing adopted children with their nonadopted birth siblings or institutional peers was rather small (Colombo et al., 1992; Dennis, 1973 [with domestic and intercountry adoptions]; Pala-

Table 2
Coding System for Studies on Adopted Children

Variable	Coding system
Sample	
Age at adoption	1 = 0–12 months
	2 = 12–24 months
	3 = > 24 months
	4 = not reported
Age at assessment	1 = 0–4 years
	2 = 4–12 years
	3 = 12–18 years
	4 = >18 years
	5 = not reported
Gender of comparison groups	1 = male
	2 = female
	3 = mixed
Domestic or international adoption	1 = domestic (inside birth country)
	2 = international (outside birth country)
	3 = not reported
Extreme deprivation or abuse	1 = no samplewide certified abuse, neglect, or malnourishment
	2 = majority of participants in a sample were abused, neglected, or malnourished
Design	
Sample size	Sample size of adopted children, nonadopted children (control group), and total sample size for which results are reported[a]
Publication outlet (refereed journal or other publication)	1 = journal article
	2 = other publication (book, book chapter, report, dissertation)
Comparison group	1 = general population (e.g., Cook et al., 1997)
	2 = classmates (e.g., Andresen, 1992)
	3 = birth siblings (e.g., Colombo et al., 1992) or institutional peers (e.g., Dennis, 1973)
	4 = environmental siblings (unrelated siblings in the adoptive family; e.g., Sharma et al., 1998)
	5 = standard scores[b] (e.g., Stams et al., 2000) or percentage comparisons[c] (percentage of school failures; e.g., Geerars et al, 1995)
Year of publication	1 = before 1960
	2 = 1960–1969
	3 = 1970–1979
	4 = 1980–1989
	5 = 1990 or later

[a] If the control group was compared with two or more groups of adopted children, the control group was split up accordingly (see Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003). [b] Standard scores means that the IQ mean of the adopted children in the research group was compared with the standardized scores of an IQ test (M = 100, SD = 15). [c] Percentage comparisons means the percentage of adopted children in the research group was compared with the percentage of adopted children in the general population.

cios & Sanchez, 1996 [for the meta-analysis on school achievement]; Schiff et al., 1978; Smyer, Gatz, Simi, & Pedersen, 1998 [for the meta-analysis on school achievement]; Tizard & Hodges, 1978 [with children adopted at a younger or older age]). It was therefore unwise to conduct moderator analyses on this set of studies. Because this set of studies was different from the majority of adoption studies comparing adopted children with their environmental siblings or peers, we decided to separate the two sets and to conduct moderator analyses only on the large set of comparisons with environmental siblings or peers.

We coded the age of the children when they were adopted, age at assessment, gender, and whether the children were adopted internationally or domestically. We examined meta-analytically whether early adoptions (until 1 year of age) resulted in different effects compared with later adoptions. In view of the growing genetic influences on adopted children's cognitive development in adolescent years and later (e.g., Fulker et al., 1988; Plomin et al., 1997), we contrasted studies with assessment ages of younger and older than 12 years. Also, we coded whether the adopted children experienced deprivation. Deprivation was coded in cases of documented malnutrition (e.g., Colombo et al., 1992), neglect, and/or abuse (e.g., De Jong, 2001; Dennis, 1973) or a combination of these circumstances (e.g., McGuinness & Pallansch, 2000; O'Connor et al., 2000).

All studies were coded by two coders. The average agreement between the two coders across the moderator variables was 95%.

Meta-Analytic Procedures

We conducted four meta-analyses, one for IQ scores as indexed by formal IQ tests, one for school achievement as indicated by school grades and parent or teacher ratings of school competence, one for language abilities as indicated by specific language tests and parent or teacher ratings of language development, and one for learning problems as indicated by school failure and enrollment in special education.

For each study, we calculated an effect size: the standardized difference between the means of two groups (Cohen's d). Effect sizes indicating delays in adopted children's development got a positive sign (as we expected that adopted children would be outperformed by their nonadopted environmental peers or siblings), whereas effect sizes indicating better cognitive development for adopted children (as we expected in the case of comparisons with peers or siblings who stayed behind) got a negative sign. When in an article more than one outcome was reported for the same domain—for example, two IQ tests—we averaged these outcomes within the study to have one effect size per study (Cooper & Hedges, 1994; Mullen, 1989). Because the studies included in the meta-analysis reported various statistics, we used Mullen's (1989) Advanced Basic Meta-Analysis program to transform all results into Cohen's d. Mullen (1989) and Mullen and Rosenthal (1985, Chapter 6) provided the formulas for transformation of t, r, and F statistics into Cohen's d.

The resulting study effect sizes were analyzed with Borenstein, Rothstein, and Cohen's (2000, Version 1.025) Comprehensive Meta-Analysis (CMA) program. CMA allows for computation of combined effect sizes via random effects error models. Significance tests and moderator analysis in fixed models may be regarded as applying only to the specific set of studies at hand (Cooper & Hedges, 1994). In random effects models (Hedges & Olkin, 1985), generalization is to the population of studies from which the current set of studies was drawn (R. Rosenthal, 1995). Our goal was to make summary statements about likely differences between adopted and nonadopted children's cognitive development even when the sources of discrepancies between study results were poorly understood (Raudenbush, 1994).

Some extremely large sample sizes were winsorized in the weighting function to prevent the results from being unduly determined by only one outlying study (Hampel, Ronchetti, Rousseeuw, & Stahel, 1986). No outlying effect sizes ($z < -3.26$ or $z > 3.26$; Tabachnick & Fidell, 2001) were detected in any of the meta-analytic data sets after conversion into Fisher's z (Mullen, 1989).

We computed the Q statistics to test the homogeneity of the specific set of effect sizes (Borenstein et al., 2000). We also computed 85% confidence intervals (CIs) around the point estimate of each set of effect sizes. Depending on the homogeneity of the set, the CIs were based on either fixed or random estimates. When we tested moderators, inspection of the overlap between the CIs provided a test of the differences among the combined effects of subsets of study effect sizes grouped by moderators. In the case of combined effect sizes in heterogeneous sets of study outcomes, this approach of comparing 85% CIs served as the significance test under a random error model (Goldstein & Healy, 1995). Nonoverlapping 85% CIs indicated a significantly different effect size in moderator-determined subsets of study outcomes.

We used the trim and fill method (Duval & Tweedie, 2000a, 2000b) to calculate the effect of potential data censoring on the outcome of the meta-analyses. According to this method, a funnel plot is constructed of each study's effect size against the sample size or the standard error. These plots should be shaped like a funnel if no data censoring is present. However, because smaller or nonsignificant studies are less likely to be retrieved, studies in the bottom left-hand corner of the plot are often omitted (Sutton, Duval, Tweedie, Abrams, & Jones, 2000). For the meta-analyses on IQ, school achievement, and language, the rightmost studies considered to be symmetrically unmatched were trimmed. The trimmed studies could then be replaced and their missing counterparts imputed or filled as mirror images of the trimmed outcomes. This allows for the computation of an adjusted overall CI (Gilbody, Song, Eastwood, & Sutton, 2000; Sutton et al., 2000). Analyses were conducted with the S-Plus trim and fill program (B. Biggerstaff, personal communication, September 19, 2004; E. Dusseldorp, personal communication, September 20, 2004; S. Duval, personal communication, September 22, 2004).

Results

IQ

Comparison of adopted children's IQ with IQ of siblings or peers who stayed behind. The comparison of the adopted children with their nonadopted peers who stayed behind in their family or institution (birth siblings or institutionalized peers) showed a large and significant effect size ($d = -1.17$) in favor of the adopted children in a homogeneous set of six studies ($n = 253$), $Q(5) = 3.8$, $p = .58$. That is, the negative combined effect size means that the adopted-away children showed higher IQ scores than their nonadopted siblings and peers who stayed behind. In contrast, the comparison between the IQ of adopted children and that of their environmental siblings or peers was not significant ($d = 0.13$, $p = .19$, $k = 42$, $n = 6{,}411$) in a heterogeneous set of studies, $Q(41) = 275.6$, $p < .01$.[1]

The difference in effect sizes for the two different comparison groups was significant. The 85% CI around the point estimate involving siblings or peers who stayed behind ($d = -1.17$, CI $= -1.36, -0.99$) did not overlap with the CI for the environmental siblings or peers ($d = 0.13$, CI $= -0.01, 0.26$). Thus, the adopted children (a) outperformed their siblings or peers who were left behind and (b) performed as well as their environmental siblings, their classmates, and their peers in the general population of their

[1] Because Teasdale and Owen's (1986) study included the outlying number of 4,450 participants, we decided to winsorize this sample size before computing the combined effect size (Hampel et al., 1986) and to divide both the number of adopted and the number of comparison children in this study by 5. The combined effect sizes with and without winsorizing were similar.

current environment. Further, the magnitudes of effect revealed by these comparisons were different.

Comparison of adopted children's IQ with IQ of environmental siblings or peers. Because the set of studies comparing adopted children's IQ with the IQ of children who stayed behind was too small for further moderator analyses ($k = 6$), we continued with the set of studies comparing adopted children's IQ with that of environmental siblings or peers. As noted above, the combined effect size in this set of studies indicated the absence of a difference in IQ between adopted children and their environmental siblings or peers. It should be noted, however, that the comparison with the general population ($d = 0.34$, CI = 0.18, 0.50) and with environmental peers ($d = 0.79$, CI = 0.48, 1.11) significantly favored the nonadopted peers, whereas analyses that used average population IQs showed an advantage for the adopted children of three quarters of a standard deviation ($d = -0.75$, CI = −0.96, −0.53). However, because of the possible Flynn (1987; see below) effect, this comparison might be somewhat inflated (O'Connor et al., 2000).

In the set of studies comparing adoptees with environmental peers, the contrast for publication outlet was not significant. The 85% CIs for the effect sizes were largely overlapping, indicating that journal articles showed IQ score differences between adopted and nonadopted children that were similar to those of other publications ($d = 0.12$, CI = 0.05, 0.29; and $d = 0.08$, CI = 0.00, 0.15, respectively). Contrast for year of publication (before 1990 vs. 1990 and later) was not significant either ($d = 0.14$, CI = −0.01, 0.28; and $d = 0.06$, CI = −0.27, 0.39, respectively).

IQ differences between the adopted and comparison children were not significantly different when we contrasted early arrivals (before 12 months old) with later arrivals. The CI for the combined effect size of studies on children adopted before 12 months ($d = 0.14$, CI = −0.03, 0.31) was largely overlapping with the intervals for the older ages (combined across adoptions after 12 months, $d = 0.07$, CI = −0.20, 0.34). Contrasting samples of children who were younger than 12 years at IQ assessment ($d = 0.12$, CI = −0.03, 0.28) with the other samples ($d = 0.20$, CI = −0.16, 0.56) did not yield a significant difference. The only effect size for a moderator subgroup that was significant was associated with adult samples ($d = 0.87$; $k = 4$; $n = 937$, winsorized; $p < .05$). However, the 85% CI for this effect size (CI = 0.28, 1.45) overlapped with the CI for the samples assessed at age 12 or younger ($d = 0.15$, CI = −0.01, 0.32; and $d = -0.28$, CI = −0.90, 0.33, for ages 4–12 years and 0–4 years, respectively).

Type of adoption—domestic versus international—was not related to the effect sizes of the studies; the 85% CIs for both estimates were largely overlapping ($d = 0.21$, CI = 0.04, 0.37; and $d = -0.19$, CI = −0.58, 0.20, respectively). Nor did we find differences in effect sizes between samples with male versus female adopted children ($d = 0.45$, CI = −0.06, 0.96; and $d = 0.41$, CI = −0.05, 0.87, respectively). Eleven samples included adoptees who had been abused, neglected, and/or malnourished. These samples showed a somewhat larger combined effect size ($d = 0.27$, CI = −0.26, 0.80) than the other studies ($d = 0.05$, CI = −0.08, 0.19), but the CIs were large and overlapping.

The set of IQ studies did not show a bias against locating studies with small effect sizes and a small number of participants ($L_0 = 0$; $R_0 = 0$).

School Achievement

Comparison of adopted children's school achievement with achievement of siblings or peers who stayed behind. Similar to the IQ meta-analyses, the comparison with the nonadopted siblings or peers who stayed behind showed favorable school achievement of the adopted children ($d = -0.55$, $p < .05$, $k = 3$, $n = 523$). However, this set of studies was small, and the CI was rather large. The 85% CI of the negative combined effect size ($d = -0.55$, CI = −0.88, −0.21) did not overlap with that of the comparison with the environmental siblings and peers ($d = 0.19$, CI = 0.14, 0.25). Again, similar to the IQ comparisons, the adopted-away children outperformed their nonadopted siblings and peers who were left behind. However, in contrast with IQ, adoptees' school achievement did not catch up completely with that of their environmental siblings or peers.

Comparison of adopted children's school achievement with achievement of environmental siblings or peers. With the exclusion of the studies that compared adopted children with their siblings or peers who were left behind, the combined effect size for the remaining set of studies was 0.19 ($p < .01$, $k = 52$, $n = 78{,}662$). Adopted children did less well in school than nonadopted peers in their environment. In the comparisons with peers from the general population ($d = 0.26$, $p < .01$, $k = 31$, $n = 69{,}085$) as well as with classmates ($d = 0.13$, $p < .05$, $k = 9$, $n = 3{,}721$), this lagging behind of adopted children's school achievement was significant.

Age at adoption appeared to be important. For studies with children who were adopted in the 1st year of their life, the difference with environmental peers was minimal ($d = 0.09$, $p = .22$, $k = 26$, $n = 37{,}991$). For studies with children adopted in the 2nd year of life, the combined difference was significant ($d = 0.32$, $p < .01$, $k = 10$, $n = 11{,}059$), as it was for studies with children adopted after the age of 2 years ($d = 0.42$, $p < .01$, $k = 10$, $n = 5{,}742$). Contrasting samples of children who were adopted before 12 months of age ($d = 0.09$, CI = 0.00, 0.17) with the other samples ($d = 0.28$, CI = 0.22, 0.35) showed no overlap between 85% CIs and, thus, a significant larger combined effect in the latter samples. Only later adoption (after the 1st year of life) appeared to be associated with a delay in school achievement.

The 85% CIs for the combined effect size of samples with assessment of school achievement before age 12 ($d = 0.22$, CI = 0.13, 0.31) versus the other samples ($d = 0.18$, CI = 0.10, 0.25) were largely overlapping. Both studies with domestically adopted children and studies with internationally adopted children showed significant combined effect sizes in the same range ($d = 0.22$ and $d = 0.15$, respectively), with largely overlapping 85% CIs (CI = 0.14, 0.30; and CI = 0.06, 0.24, respectively). We did not find differences in effect sizes between samples with male ($d = 0.14$, CI = 0.02, 0.27) and samples with female adopted children ($d = 0.07$, CI = −0.05, 0.19). Although only three samples with abuse, neglect, and/or malnourishment were included in this meta-analysis, this set showed a significantly larger combined effect size ($d = 0.46$, CI = 0.31, 0.60) than the other studies ($d = 0.19$, CI = 0.13, 0.24), as the 85% confidence boundaries did not show any overlap.

Studies published in journals ($d = 0.21$, CI = 0.15, 0.27) showed a larger effect size than studies reported in other outlets ($d = 0.03$, CI = −0.05, 0.11), with no overlap between CIs. Year of publication did not affect the difference, as the 85% CIs for the studies published before 1990 (d = 0.20, CI = 0.11, 0.29) overlapped with those of the studies published in 1990 or later (d = 0.19, CI = 0.12, 0.26). The set of school achievement studies did not show a publication bias ($L_0 = 0$; $R_0 = 1$).

Language Abilities

Studies comparing language development of adopted and nonadopted siblings or institutional peers were missing entirely. In 14 studies we found specific information on language abilities of adopted children compared with their nonadopted environmental peers. The combined effect size was small but significant ($d = 0.09$, $p < .05$, $k = 14$, $n = 15{,}418$), and the studies were homogeneous, $Q(13) = 18.6$, $p = .14$. Adopted children appeared to show some delay in language development.

We found no significant moderators of the language effect (see Table 3). This set of studies contained no abused or malnourished samples. The set of language studies did not show a publication bias ($L_0 = 0$; $R_0 = 3$; but the number of studies was rather small, and L_0 therefore was the preferred estimator).

Learning Problems

A total of eight study outcomes ($N = 13{,}291$; $n = 3{,}018$ adopted children) were used for this meta-analysis. All studies compared adopted children with nonadopted, environmental peers. The combined effect size was significant ($d = 0.55$, $p < .01$). The 85% CI ranged from 0.35 to 0.75 in a heterogeneous set of studies, $Q(7) = 119.9$, $p < .01$. The adopted children showed significantly more learning problems for which special treatment was needed. To further specify this elevated risk for learning problems in adopted children, we computed the percentage of adopted children referred to special education in four studies (Bohman, 1970; Brodzinsky & Steiger, 1991; Stams et al., 2000; Verhulst et al., 1990), which amounted to 11.2% ($n = 2{,}873$ adopted children). In two studies, the exact numbers of referrals for both the adopted and the nonadopted pupils were available. Bohman (1970) reported on 125 adopted (7 referrals, 5.6%) and 2,232 nonadopted children (132 referrals, 5.9%) in Sweden. Verhulst et al. (1990) reported on 2,148 adopted children (284 referrals, 13.2%) and 933 nonadopted children (41 referrals, 4.4%). Combining the two studies, we found 12.8% referrals to special educational services in the adopted group ($n = 2{,}273$) and 5.5% referrals in the nonadopted group ($n = 3{,}165$). Thus, in these two studies there was a twofold increase in special education referrals for adopted children compared with nonadopted comparisons.

Because the data set contained only eight studies, we did not conduct moderator analyses. The set of studies on learning problems did not show a publication bias ($L_0 = 0$; $R_0 = 1$; but the number of studies was rather small, and L_0 therefore was the preferred estimator).

Discussion

Our first hypothesis concerned the potential cognitive advantages of adoption over remaining with an overburdened family or in a deprived institution. With regard to IQ scores, the adopted children outperformed their siblings or peers who were left behind. In terms of school achievement, the adopted children also outperformed their left-behind siblings and peers. Unfortunately, the number of comparisons is rather small, as only six studies presented pertinent data on birth siblings or peers who remained in their own environment (Colombo et al., 1992; Dennis, 1973; Palacios & Sanchez, 1996; Schiff et al., 1978; Smyer et al., 1998; Tizard & Hodges, 1978). Nevertheless, these unique studies are consistent with the possibility that adopted children are able to profit from the positive change of environment offered by adoption and their subsequent upbringing in educationally more stimulating adoptive families.

Our second hypothesis concerned the potential cognitive delays of adopted children compared with their current, environmental siblings or peers. Overall, we found that studies reported a negligible difference in the IQ of adopted children and their nonadopted environmental siblings or peers. Comparing their school achievement, we documented that the adopted children did somewhat less well in school, but the effect size was rather small. Their language abilities also showed a small but significant delay compared with the abilities of their environmental siblings or peers, but, again, the effect size was small. The largest delay was found in a set of eight studies comparing the learning problems of adopted children with those of their environmental peers. The percentage of adopted children struggling with learning problems was significantly larger than that of nonadopted children. We found a twofold increase in special education referrals in adopted children compared with nonadopted comparisons in the same countries of study. However, it should be noted that the percentage of children with learning problems who needed treatment or referral to special education was generally rather small, in the adopted group as well as in the general population, and that this finding is based on a small number of studies.

Taken together, this series of meta-analyses documents the potential positive impact of the adoption experience on the adopted children's cognitive development compared with that of the children left behind. The studies also show the nearly normal cognitive competence and only somewhat delayed school performance of adopted children. However, it is not possible to draw a firm conclusion from the present meta-analysis that adoption has a positive impact on the cognitive development of adopted children. Information on the cognitive development of the adopted children in their preadoption living arrangements is absent, and longitudinal information on the cognitive abilities of children who were not adopted and remained in the birth family or institution is also lacking. Obviously, the natural adoption quasi-experiment is not as capable of revealing causal effects as are true experimental trials using pre- and posttests and randomized control groups. Therefore, it cannot be ruled out that (some) adopted children were selected for adoption because they seemed brighter or had better social skills than children not selected for adoption. Without tests before and after adoption placement, we cannot be certain about the explanation of the positive effects found in our meta-analyses.

That being said, consistent with concluding a positive effect of adoption, there is empirical evidence pointing to positive effects of adoption placement and positive influences of (short) interventions in institutions (e.g., Spira et al., 2000). For example, Morison, Ames, and Chisholm (1995) found that, according to the parents, Romanian children exhibited delays in all areas of development but that 11 months postadoption many delays had disappeared. A

Table 3
Meta-Analyses of Studies Comparing Cognitive Development of Adopted and Nonadopted Children

Study characteristic	Meta-analytic results on IQ					Meta-analytic results on school achievement					Meta-analytic results on language				
	k	*n*	*d*	85% CI	*Q*	*k*	*n*	*d*	85% CI	*Q*	*k*	*n*	*d*	85% CI	*Q*
Comparison group															
Siblings/peers left behind	6	253	−1.17**	−1.36, −0.99	3.8	3	523	−0.55*	−0.88, −0.21	10.6					
Current siblings/peers	42	6,411	0.13	−0.01, 0.26	275.6**	52	78,662	0.19**	0.14, 0.25	279.9**	14	15,418	0.09*	0.04, 0.14	18.6
General population	10	3,313	0.34**	0.18, 0.50	54.9**	31	69,085	0.26**	0.19, 0.33	206.9**	5	9,841	0.08	−0.03, 0.15	8.7
Classmates	2	773	0.27	−0.19, 0.73	5.2*	9	3,721	0.13*	0.05, 0.21	12.0	7	3,022	0.12	0.04, 0.19	9.3
Environment siblings	10	965	0.79**	0.48, 1.11	52.1**	4	916	−0.31	−0.61, −0.01	13.9**					
Standard scores/percentage	20	1,360	−0.75**	−0.96, −0.53	36.2**	8	4,940	0.19	0.05, 0.34	10.2	2	2,555	0.06	−0.05, 0.18	0.1
Publication outlet															
Journal article	38	4,816	0.12	−0.05, 0.29	272.0**	47	75,010	0.21**	0.15, 0.27	265.5**	12	13,439	0.11*	0.05, 0.17	17.2
Other publication	4	1,595	0.08	0.00, 0.15	2.2	5	3,652	0.03	−0.05, 0.11	0.9	2	1,979	0.00	−0.12, 0.12	0.1
Year of publication															
Before 1960	2	588	−0.58	−1.35, 0.18	37.3**	1	384	0.00	−0.15, 0.15						
1960–1969	1	720	0.00	−0.11, 0.11		2	738	0.00	−0.10, 0.11	0.0					
1970–1979	13	1,683	0.40**	0.22, 0.57	36.3**	4	2,233	0.18	0.03, 0.34	5.3	3	2,119	0.15	−0.06, 0.37	7.6
1980–1989	9	1,746	0.00	−0.25, 0.25	27.2**	6	20,108	0.30**	0.18, 0.43	12.9*	2	407	0.23*	0.08, 0.38	0.1
1990 and later	17	1,674	0.06	−0.27, 0.39	131.1**	39	55,199	0.19**	0.12, 0.26	244.1**	9	12,892	0.06	−0.00, 0.12	8.7
Gender															
Male	5	1,267	0.45	−0.06, 0.96	54.3**	9	14,952	0.14	0.02, 0.27	34.3**	4	7,610	−0.01	−0.11, 0.09	0.1
Female	6	590	0.41	−0.05, 0.87	24.3**	9	9,748	0.07	−0.05, 0.19	27.3**	4	6,625	0.03	−0.06, 0.11	0.5
Mixed	31	4,554	0.03	−0.13, 0.19	195.6**	34	53,962	0.25**	0.18, 0.33	206.9**	6	1,183	0.24**	0.14, 0.31	9.6
Age at adoption															
0–12 months	26	4,550	0.14	−0.03, 0.31	199.8**	26	37,991	0.09	0.00, 0.17	99.5**	10	12,239	0.09	−0.00, 0.18	17.1*
12–24 months	8	525	−0.45	−1.02, 0.11	33.2**	10	11,059	0.32**	0.28, 0.37	14.9	2	624	0.16	0.04, 0.28	0.6
>24 months	6	352	0.37	−0.55, 1.30	27.2**	10	5,742	0.42*	0.26, 0.57	36.4**	2	2,555	0.06	−0.05, 0.18	0.1
Not reported	2	984	0.09	−0.00, 0.18	0.1	6	23,870	0.17	0.01, 0.32	18.7**					
Age at assessment															
0–4 years	3	452	−0.28	−0.90, 0.33	13.4**										
4–12 years	31	3,704	0.15	−0.01, 0.32	174.9**	27	12,544	0.22**	0.13, 0.31	92.6**	7	2,898	0.12	−0.03, 0.19	10.0
12–18 years	4	1,318	−0.26	−0.75, 0.23	61.0**	21	56,502	0.18	0.10, 0.27	156.2**	5	9,965	0.08	−0.01, 0.16	8.3
>18 years	4	937	0.87*	0.28, 1.45	9.2**	4	9,616	0.15	0.02, 0.28	7.6	2	2,555	0.06	−0.05, 0.18	0.1
Domestic or international adoption															
Domestic	23	3,689	0.21	0.04, 0.37	156.3**	22	47,652	0.22**	0.14, 0.30	129.1**	6	2,544	0.10	−0.01, 0.17	8.8
International	17	1,048	−0.19	−0.58, 0.20	103.7**	18	19,429	0.15*	0.06, 0.24	63.3**	8	12,874	0.09	0.03, 0.16	9.8
Not reported	2	1,674	0.19	−0.00, 0.38	2.9	12	11,581	0.23*	0.06, 0.40	70.7**					
Deprivation or abuse															
No abuse or malnourishment	31	5,892	0.05	−0.08, 0.19	213.7**	49	77,325	0.19**	0.13, 0.24	274.2**					
Abuse or malnourishment	11	519	0.27	−0.26, 0.80	42.8**	3	1,337	0.46**	0.31, 0.60	0.5					

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$.

small group of 16 children had been assessed with the Revised Gesell Developmental Schedules more than once by coders unaware of the child's status, and, on average, children progressed two developmental quotient points per month in their adoptive home. Similarly, Rutter et al. (2000) described a dramatic catch-up for Romanian adoptees from the time of adoption placement (mean IQ just above 60) to 4 years of age (mean IQ above 100), assessed with parent report. Interventions within the institutional setting also have shown positive effects on children's growth and development (Hakimi-Manesh, Mojdehi, & Tashakkori, 1984; T. I. Kim, Shin, & White-Traut, 2003; Spira et al., 2000).

Moderating Influences

The overall meta-analytic findings were moderated only by a few variables, and potential moderators such as the gender of the children and domestic versus international adoption did not appear to make a significant difference. Also, moderators such as publication outlet (journal articles vs. other publications) and year of publication were not associated with effect sizes, except for school achievement, for which journal articles documented larger delays in adopted children than did other publications. Publication bias and data censoring did not seem to be present in the current data set of adoption studies.

Age at assessment was not a significant moderator. However, in adult samples we found a rather large IQ difference between adopted and nonadopted adults. This is not inconsistent with findings from longitudinal behavior genetic studies, which have documented that, with growing age, adopted children show less IQ similarity to their adoptive parents and more similarity to their birth parents (McGue et al., 1993; Plomin et al., 1997). However, school performance and language differences were not associated with age at assessment. Because preadoption assessments are lacking, we can only speculate about the existence and size of age-specific developmental trends and whether they represent true developmental shifts or are the results of cohort differences at the time of adoption.

Moderators that did seem to have an important impact on the cognitive associations with adoption were the age at which the child was adopted and whether the adopted sample came from abusive and/or neglecting backgrounds. Age at adoption did not seem to matter for the IQ of the adopted children, but it did matter for their school achievement. Children adopted in their 1st year of life did not show any delays in school achievement, whereas children adopted after their first birthday lagged behind. Thus, early adoption may be a protective factor not so much for cognitive competence (IQ) as for cognitive performance (school achievement). This may occur because the positive effects of the adoption environment have greater impact during an important period in the children's life. It may also indicate the importance of the first attachment relationships (with the adoptive parents) developing around 10–14 months after birth (Main, 1999). These early attachment relationships may function as protective factors, buffering against the stress of adoption losses.

Another interpretation of the early adoption moderator effect is the relatively short duration of deprivation before adoption. Briefer preadoption time may imply shorter exposure to risk factors such as abuse or neglect. This interpretation converges with the significant effect we found for the impact of preadoption abusive or otherwise deprived background on school achievement. Adopted children who were exposed to severe abuse or neglect prior to adoption lagged further behind in school achievement than adopted children without such backgrounds, although their IQ scores did not show a similar difference. Of course, preadoption abuse or neglect is a major risk factor that appears to leave its marks on the children's school achievement even after adoption into less deprived social contexts. In fact, it is surprising that we did not find a similar negative effect on IQ.

The discrepancy between adopted children's positive attainment in terms of IQ and their somewhat delayed school achievement (in children adopted after their first birthday) may indicate an *adoption decalage*—that is, a gap between adopted children's competence and their actual school performance. In our meta-analyses, the adoption decalage was largest for those children who came from extremely deprived backgrounds, because their school achievements lagged further behind than those of adopted children from less deprived backgrounds, but their IQ was higher than that of their nonadopted comparisons. Adopted children appear to show the same cognitive potential as their environmental comparisons, as these two groups do not differ in IQ. However, they are not able to catch up completely in school achievement. A larger number of adopted children develop learning problems requiring referral to special educational or therapeutic services. This is parallel to the socioemotional problems present in a minority of adopted children (e.g., Bimmel et al., 2003).

We speculate that the adoption decalage is intensified by the socioemotional demands required by the achievement orientation in a group setting at school. In middle childhood, some adopted children may begin to struggle with the loss of their birth parents (Brodzinsky, Schechter, & Henig, 1992; Brodzinsky & Steiger, 1991; Leon, 2002), and the burden of grief may hamper or slow down their progress through school. Unresolved loss is associated with intrusions and ruminations that limit the ability to focus on the tasks at hand (Main, 1999). We suggest that adopted children are as competent as their nonadopted peers. However, in a small number of adopted children, school performance does not reach the expected level because the socioemotional problems related to their adoption status decrease their ability to concentrate on schoolwork.

An alternative explanation is that, in general, adopted children are able to profit from the favorable circumstances offered by the adoptive family (Schaffer, 1998) but that for some children catch-up is incomplete, in particular for children who experienced more extreme deprivation (e.g., malnourishment, neglect, and/or abuse; Rutter & O'Connor, 2004) or later adoption. Genetically determined problems and enduring effects of deprivation and institutionalization may result in concentration problems and cognitive delays, hampering successful progress at school. Moreover, adoptive parents may be more readily inclined to perceive learning problems, as they are often more aware of available services and more alert to potential problems (Warren, 1992). They may be more likely to seek special treatment or special education for their child.

Limitations

The current set of meta-analyses suffers from some weaknesses. The studies included in the current investigation are rather heterogeneous. For example, the measures used to assess IQ vary from the Stanford–Binet and the WISC to the California Mental Maturity tests. The children come from different countries and continents, and the age at adoption also widely differs. Although we did not find much systematic influence of these diverse factors, they nevertheless create more (error) variance than ideally one wants to see. The heterogeneity of the data sets forced us to use the more conservative approach of the random effects model instead of fixed effect models.

Another weakness is the comparison of the adopted children's IQ score with the average score (100) of a population (the standard scores approach). Flynn (1987) noted that intelligence tests tend to become outdated as people from Western countries increasingly profit from ongoing education and the information era, thus enhancing their intellectual potential (the Flynn effect). Therefore, older intelligence tests might give inflated profiles of one's intelligence as the average IQ level of a younger cohort becomes substantially higher than 100. Because of the Flynn effect (Flynn, 1987), therefore, the average IQ of 100 in our meta-analysis might underestimate the average IQ level of Western populations, which, during the past 5 decades, have shown remarkable increases in mean IQ scores (Flynn, 1987). Thus, similarity of adopted children's IQ with an average IQ of a measure that has not been updated during the last 10 or even 20 years may underestimate cognitive delays (O'Connor et al., 2000). This may be the reason that our comparison with standard mean scores shows a considerable advantage for the adopted children, whereas direct comparisons of their scores with scores of classmates or other comparison groups show adopted children to lag behind. Longitudinal studies, preferably using updated intelligence tests at multiple time points, are needed to determine whether the Flynn effect plays a role in explaining our finding. In our meta-analytic database we did not have a sufficiently large number of studies with multiple time points to address this issue adequately. Also, in longitudinal studies, loss of participants could be a potential problem (see, e.g., Hodges & Tizard, 1989).

Conclusions

In sum, our meta-analyses lead to three theoretically and practically important conclusions. First, for many adopted children, adoption involves a drastic change of environment, and this change may be an effective intervention that improves their cognitive development. In a cognitively richer and emotionally safer environment, on average, adopted children may recover and nearly get back on a normal track (see also Morison et al., 1995). Although it is possible that children with higher cognitive skills are more likely to be adopted, it is also plausible, and related evidence suggests, that adoption can be associated with a remarkable recovery from often extremely adverse preadoption circumstances and should be considered as evidence for children's resilience. It should be noted, however, that the number of studies comparing adopted children with their siblings or peers who stayed behind is small, and more research is needed to confirm the recovery hypothesis.

Second, adopted children do not completely catch up in school performance with their nonadopted environmental peers. The discrepancy between the adopted children's development in terms of IQ and their school achievement indicates an adoption decalage similar to the socioemotional problems presented by a minority of adopted children (e.g., Bimmel et al., 2003). Although the decalage is generally small, it is a robust finding.

Third, in a small set of studies we found that the percentage of adopted children who needed special education for their learning problems was about twice as large as the percentage of nonadopted children. This minority of adopted children with learning problems is clinically important because the children suffer from these problems and need special treatment. However, their difficulties should not be confused with those experienced by the average adopted child. Most adopted children do remarkably well, certainly much better than their siblings or peers who had to stay behind in poor institutions or deprived families.

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