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Age at adoption from institutional care as a window into the lasting effects of early experiences

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Abstract

One of the major questions of human development is how early experience impacts the course of development years later. Children adopted from institutional care experience varying levels of deprivation in their early life followed by qualitatively better care in an adoptive home, providing a unique opportunity to study the lasting effects of early deprivation and its timing. The effects of age at adoption from institutional care are discussed for multiple domains of social and behavioral development within the context of several prominent developmental hypotheses about the effects of early deprivation (cumulative effects, experience-expectant developmental programming, and experience-adaptive developmental programming). Age at adoption effects are detected in a majority of studies, particularly when children experienced global deprivation and were assessed in adolescence. For most outcomes, institutionalization beyond a certain age is associated with a step-like increase in risk for lasting social and behavioral problems, with the step occurring at an earlier age for children who experienced more severe levels of deprivation. Findings are discussed in terms of their concordance and discordance with our current hypotheses, and speculative explanations for the findings are offered.

Keywords

Age at adoption; institutional deprivation; orphanage; early experience; developmental programming

The first months and years of life have long been regarded as crucial to later development; infancy is characterized by rapid neurological and behavioral development, and while some children are remarkably resilient, deprivation at such early ages can be particularly damaging. Examining the lasting effects of atypical early experiences informs our understanding of what experiences are necessary for typical development to proceed, how early experience produces lasting effects, and whether later positive experiences can be remediating. Further, if developmental outcomes systematically vary based on *when* an experience occurs, it implies that not only are certain experiences necessary to development, but their effects are uniquely potent during certain critical time windows. These questions are addressed via both animal and human studies; this review utilizes studies of children who experienced institutional rearing to inform our understanding of the lasting effects of early experience, particularly with regard to several prominent theories of early development.

Animal models are often used to better understand the lasting effects of atypical early relationship experience. Studies of monkeys demonstrated that the drive for maternal comfort is strong, and being reared in isolation produces atypical behaviors like self-

mutilation and stereotypies (i.e., repetitive or ritualistic movements, postures, or utterances). While isolation lasting 6 months produced extensive deficits, the effects were more marked after 12 months of isolation, and only partial recovery was possible after rehabilitation (Anderson & Mason, 1974; Harlow, 1958; Kraemer, 1992; Rowland, 1964, as cited in Novak & Harlow, 1975). Neuroanatomical and physiological changes are evident long after isolation ceases (Parker & Maestriperi, 2011). Furthermore, if typical experiences are provided before a period of isolation, effects on monkeys' behavior are less extreme, pointing to the importance of experience in the first months or years of life (Harlow & Novak, 1973; Suomi, 2003).

Rodent research has advanced our understanding of potential mechanisms to account for the importance of early experience. During the first two weeks of life, rodents' glucocorticoid responses (which are maladaptive at higher levels, and particularly harmful during this age span) are maintained at a low level through maternal licking and grooming (Gunnar, 2003; Gunnar, Fisher, & The Early Experience, Stress, and Prevention Network, 2006). Maternal licking and grooming have also been associated with epigenetic effects that are related to gene expression and neural function into adulthood (Meaney, 2010). Thus, sensitive maternal behavior might serve a protective role, particularly during an early sensitive period; in humans, the age of 6 to 12 months might constitute a similar period, but evidence is limited (Gunnar, 2003).

Animal models allow us to study early deprivation through experimental paradigms that eliminate many of the confounds in naturalistic studies, but there are limitations to this approach. Primate research has typically focused on extreme levels of deprivation that are rarely found outside scientific laboratories; these findings are less informative about levels of deprivation that would be found for humans, and often cannot distinguish between the effects of the absence of a primary caregiver or the complete lack of social experience (Parker & Maestriperieri, 2011).

In human research, orphanage institutions constitute an unfortunate, but unique, early rearing environment that informs our understanding of early development and the influence of timing of early experience. While studies of institutionalization lack the experimental control available in animal studies, they represent a natural experiment of how development may proceed when the typical parent-child relationship is absent, but varying degrees of other social experience are available. Children leave institutions at different ages for more supportive environments (typically, adoptive homes), so institutionalization offers a prime opportunity to study the effects of timing of early experience; there are few other natural circumstances in which children experience such a drastic shift in their quality of care. Studying post-institutionalized (PI) children can shed light on whether the effects of institutionalization (and more generally, early deprivation) are hard-wired in the first years of life, or are subject to change with later experience.

When institutionalization was first studied, psychoanalytically oriented researchers like Bowlby pointed to the role of a lack of mothering (e.g., tender and affectionate care), particularly between 6 to 12 months of age, in producing long-term deficits in PI children (Bowlby, 1951). Bronfenbrenner (1979) noted that researchers who were trained in laboratory research, on the other hand, attributed difficulties to a lack of environmental stimulation, and more recently, both factors are thought to contribute to the lasting effects of institutionalization (van IJzendoorn et al., 2011). Bronfenbrenner concluded, based on (somewhat limited) empirical evidence, that children are most vulnerable to long term negative effects of institutionalization in the first 6 months of life, and this risk decreases with older ages of admission into institutions. Moving to a more developmentally supportive

environment was thought to allow some of the negative effects of institutionalization to be avoided.

Post-Institutionalized Children

While the early studies that informed Bowlby and Bronfenbrenner's ideas (e.g., Goldfarb, 1943, 1944, 1945, 1947, 1955; Spitz, 1945a, 1945b) called attention to the potentially damaging and lasting effects of residing in a depriving environment in the early years of life, many of these studies were methodologically weak; the institutional environments were not often described in much (or any) detail, and it was sometimes unclear how many children were tested, what assessments were used and at what ages (MacLean, 2003). More recently, the research base has expanded, and while some methodological problems persist, the field has advanced to a point where a number of conclusions can be stated with some certainty.

First, internationally adopted children¹ typically have more behavior problems than non-adopted parent-reared children, although the effect sizes are small (Juffer & van IJzendoorn, 2005). Children adopted after 12 months of age are less securely attached to their parents than non-adopted children ($d = 0.80$; van den Dries, Juffer, van IJzendoorn, & Bakermans-Kranenburg, 2009). At the time of adoption, they lag substantially behind their non-adopted peers in height ($d = -2.43$), weight ($d = -2.60$), and head circumference ($d = -2.39$), but these differences decline after several years in the adoptive home ($d_s = -1.56$ to -0.57 ; van IJzendoorn, Bakermans-Kranenburg, & Juffer, 2007). While gender differences are rarely assessed in this population, a meta-analysis detected no significant differences between male and female international adoptees for behavior problems (Juffer & van IJzendoorn, 2005).

Second, while the rates of problems are higher in PI children than in parent-reared children, most PI children fall in the normal range of adjustment; PI children often show remarkable resiliency, despite the challenges they faced early in life. When PI children have problems, they are most often in specific domains that are likely related to their early experience. PI children are more likely to demonstrate disinhibited social behavior; quasi-autism, or autistic-like features; inattention/overactivity; behavior problems, especially externalizing problems, stereotyped behavior, and eating problems; and cognitive impairment (Beckett et al., 2002; MacLean, 2003; Merz & McCall, 2010, 2011; Rutter et al., 2010; Sonuga-Barke et al., 2008; Verhulst, Althaus, & Versluis-Den Bieman, 1990; Vorria, Rutter, Pickles, Wolkind, & Hobsbaum, 1998a). Cognitive impairment may be a consequence of residing in a depriving environment, rather than a consequence of group rearing (Castle et al., 1999; Rutter, 2005b).

Third, the severity of deprivation relates to the extent to which early institutionalization influences later development. There is a clear trend in the literature for children adopted from qualitatively better Chinese and Korean orphanages to have more moderate effects including behavior problems, social problems, and inattention/overactivity (e.g., Dalen, 2001; Tan, Marfo, & Dedrick, 2007, 2010), and children from globally depriving 1990s Romanian institutions to have more significant and lasting effects including stunted physical growth, autistic-like features, and stereotyped behaviors along with behavior problems, social problems, and inattention/overactivity (e.g., Rutter et al., 2010). When institutions are improved (The St. Petersburg-USA Orphanage Research Team, 2008) or when children are moved from institutions to better quality foster care (Smyke, Zeanah, Fox, & Nelson, & Guthrie, 2010), developmental and behavioral outcomes improve as well.

¹These meta-analyses utilized an internationally adopted sample that was not exclusively institution-reared, but most studies included a majority of institution-reared children.

Effects of the timing of early institutionalization have been a focus in the literature (e.g., Bowlby, 1951; Bronfenbrenner, 1979; Gunnar, 2001; MacLean, 2003); age at adoption is typically the most ready index of how long children were exposed to depriving circumstances and the ages at which they were exposed to deprivation. While some studies find that later-adopted children have a higher rate of problems than earlier-adopted children (e.g., Bruce, Tarullo, & Gunnar, 2009; Camras, Perlman, Wismer Fries, & Pollak, 2006; Kreppner et al., 2007; Rutter et al., 2010), other studies find no effect of a child's age at adoption (e.g., Miller, Chan, Tirella, & Perrin, 2009; Rojewski, Shapiro, & Shapiro, 2000; Tizard & Hodges, 1978). The inconsistency in effects across studies may be due to factors including the severity of deprivation, the specific outcome domains and assessments, or the age at assessment.

Hypotheses of How Early Deprivation Affects Development

It is clear that early institutionalization affects children's development and that some of these effects are evident when children are adopted into families, but it is less clear how these effects come to be. Research on PI children has often lacked a basis in developmental theory (McCall, 2011), but some researchers (e.g., Rutter, O'Connor, & the ERA Study Team, 2004) have proposed several potential explanations for the effects of institutionalization and its timing.

Cumulative Effects

The cumulative effects hypothesis (O'Connor, 2003), also referred to as the continuation of adversity hypothesis (Rutter et al., 2004) or the cumulative deficit hypothesis (Jensen, 1974), posits that early experiences affect later outcomes largely through the continuation of depriving circumstances. A change in the quality of the environment should be accompanied by a change in the developmental trajectory, with near complete recovery possible over time. The timing of experience should have minimal influence relative to the duration and intensity of the experience. The cumulative effects hypothesis was favored in this field in its earlier years (Rutter, 1981), and some early experience researchers (e.g., Clarke & Clarke, 2000; Schaffer, 2000) still favor this hypothesis.

Thus, duration of institutionalization should relate to a child's outcomes, but the specific ages of exposure should not; accordingly, age at adoption is expected to relate linearly to outcomes. When children are adopted into supportive homes, near complete recovery should be possible; the most problems might be found soon after adoption, with problems declining over time as children adapt more to their improved environment. Variations in care quality in the institution and in the adoptive home should contribute to individual differences.

Developmental Programming

Developmental programming suggests that effects of experience are "programmed" into the brain during certain sensitive developmental periods. Experience during sensitive periods (when somatic structures are being built) is crucial, and later experience is likely to have only a limited effect on outcomes (Rutter et al., 2004). There are two distinct developmental programming hypotheses.

Experience-expectant developmental programming—The experience-expectant hypothesis (Greenough, Black, & Wallace, 1987; Rutter et al. 2004; also discussed within the sensitive periods hypothesis in O'Connor, 2003) proposes that certain experiences are required within specific sensitive periods of development in order for normal development to occur. No child who lacks this necessary experience will have typical later development, and the effects are "hard wired" so that later experience can have only a minimal effect. The

experiences that are thought to be necessary for typical development occur in a broad range of expectable environments; variations within the normal range aren't thought to have a meaningful effect.

It follows that this hypothesis might predict that the specific ages of exposure to institutionalization (and thus, the age at adoption) should be crucial to predicting outcomes; if children are institutionalized during a sensitive period and do not have the necessary expected experiences, permanent effects should result for all children. A step function might be predicted to emerge for the age at adoption effect. In other words, there is expected to be a "threshold" such that age at adoption after that point is associated with increased risk for problems with no further increase in risk with even later ages at adoption. More time in a supportive home environment, or an older age at assessment, should not be associated with fewer problems. The criteria for "necessary experience" are not specified by this hypothesis, but children reared in institutions might lack an early caregiver-child relationship, care that is contingent on the child's behavior, opportunity to freely explore the environment, or, in some cases, proper nutrition and medical care. It is possible that there will be a threshold of severity of deprivation such that only children who are "sufficiently deprived" would demonstrate effects.

Experience-adaptive developmental programming—The experience-adaptive hypothesis (Rutter et al., 2004; also referred to as experience-dependent in Greenough et al., 1987, or biological or developmental programming in O'Connor et al., 2003) suggests that during certain sensitive phases of development, an individual adapts to the specific circumstances of their environment, such that they are especially well suited to that environment. This adaptation gets "locked in" and does not change if the child's environment later changes. Unlike the experience-expectant hypothesis, it is not only aberrant experiences that affect the course of development—an individual will adapt to *any* experience within a sensitive period.

In some respects, the predictions for the experience-expectant and experience-adaptive hypothesis are similar; both predict the effects of institutionalization to be long lasting and more time in the adoptive home or an older age at assessment shouldn't substantially lessen the effects. An age at adoption effect is expected, and again it is likely to be a step rather than a continuous function. But in the case of the experience-adaptive hypothesis, there may be variations in outcomes relative to the severity of deprivation experienced in an institution, and the specific outcomes children experience are likely to be adaptive in the institutional environment.

Summary

The above hypotheses all predict that early institutionalization should have a negative impact on development (or, at least make a child ill-adapted for life outside the institution), but they differ in how long the effects are expected to last, and whether specific age periods are important. These hypotheses give direction to our study of the effects of early experience, but lack predictions about specific domains of outcomes, and in fact it is possible that one hypothesis accounts for one domain of outcomes whereas another accounts for other domains of outcomes.

The Current Review

The purpose of this review is to assess the effects of the timing of institution rearing, specifically with respect to social and behavioral outcomes. Age at adoption, a proxy for length of time in the institution, is perhaps the only widely known measure of the institutional experience. To the extent that age at adoption relates to outcomes, it suggests

that institutionalization is likely to be a causal factor. Given that the nature of the institutional experience is often not well described, it is particularly crucial to understand the nature of the effect of age at adoption on various outcomes and for various subsamples. While the diversity of studies that address this question and the lack of information that is provided in some studies can hinder definitive conclusions, an analysis of the large number of studies that are available to date serves as a necessary first step to understanding what the current literature suggests about the influence of age at adoption and gives direction to future research that will address this question.

Studies were obtained through searches in PsychInfo (key terms: “age at adoption”, “age at placement”, “length of institution*”, “duration of placement*”, “duration of institution*”) and through references of selected studies. Studies were included if at least half of the sample was likely to have been reared in an institutional setting, and analyses addressed the relation between age at adoption and social or behavioral development. Dissertations were not included in this review. While a meta-analytic approach has its benefits, it is not an ideal strategy for the current review. Many studies lack the information necessary to calculate effect sizes (e.g., they may simply contain a sentence – without any statistics – stating that age at adoption did not relate to the outcome measure). Furthermore, this review seeks to examine whether effects relate to specific outcomes, measurement and analysis strategies, sample characteristics, and the interaction of these variables. In order to adequately address these questions, a meta-analytic approach would often leave only 1–2 studies in each category, whereas the current systematic review approach is not hindered by the heterogeneity in this set of studies.

Studies from the Bucharest Early Intervention Project are included because the age at transition from an institution into a more supportive foster care (not adoptive home) environment was examined. Studies of institutionalized children are included when the age at admission to an institution or duration of institutionalization was examined with respect to social and behavioral outcomes. It is beyond the scope of this review to consider age at adoption effects for intellectual development.

Before age at adoption effects are considered, this set of studies will be reviewed with respect to variables that contribute to our knowledge of a child’s early circumstances, and our ability to attribute children’s outcomes to age at adoption and institutional experience. This section also highlights the degree to which studies provide, or fail to provide, the information that would be necessary in order to draw conclusions about early experience from their findings.

Characteristics of Age at Adoption Studies

Studies that assess outcomes with respect to age at adoption (or, in a few cases, age at admission to an institution) are particularly well-suited to address questions related to the impact of early experience and its timing. But, because of the nature of children’s experience in institutions and the information available to parents and researchers, some conclusions can be limited. For instance, most children enter the institution in the first weeks of life, so it is often impossible to disentangle duration of exposure from specific ages of exposure. Parents may be provided with information about a child’s birthweight and prematurity status, but information about other aspects of a child’s prenatal experience (e.g., exposure to alcohol, tobacco, and poor nutrition), biological family, pre-institutional care, or age at admission to institutional care is typically not available. Further, as a field we typically lack information on a specific child’s quality of care. Parents may be asked to describe the quality of their child’s care in general terms (e.g., “Was your child a ‘favorite’

in the institution?” “Did you suspect your child was neglected?”), but more often the quality of care is generalized from what is typical in a given country.

The set of studies that examines age at adoption effects sometimes lacks information that would allow conclusions to be drawn about the effects of early experience on later development (Table 1). Of 66 studies (31 independent samples, plus 2 meta-analyses), only 8 studies (from 5 independent samples) reported any information about a child's birthweight, 31 studies (from 10 independent samples) included information about children's quality of care (of these, 17 studies from 3 independent samples included only a general description, e.g., “the conditions in the institutions were extremely bad”), 23 studies (13 independent samples) addressed whether children had also resided in other early rearing environments, and 23 studies (10 independent samples) reported an approximate age at admission into institutional care for their samples. In 12 studies (4 independent samples), a high correlation between age at adoption and time in institutional care suggests that most children had limited experience in other placements and entered institutional care at an early age. Details about the adoptive family were offered in 40 studies (18 independent samples); in 19 studies (7 independent samples) in which family variables were related to outcomes, findings were mixed, and there was no clear pattern across studies as to which family factors predict which outcomes.

In most cases, it is probable that information that was not reported in articles is simply not available, but in other cases, available information is not reported. For example, of the 15 studies of one sample from the ERA Study Team, only 3 included information about children's prenatal and birth experience. But, with one exception (Bos, Fox, Zeanah, & Nelson, 2009), studies have not found a relationship between birth variables and outcome variables (Kreppner et al., 2007; Merz & McCall, 2010, 2011; Sonuga-Barke et al., 2008). Of the set of 65 studies, 17 did not indicate whether children were reared in an institution; when possible, authors of these studies were contacted for further information, and information was obtained for 12 of these articles. The 3² articles for which no information was available (Decker & Omori, 2009; Kvifte Andresen, 1992; Rojewski et al., 2000) are excluded from further analyses so as to limit the discussion to the effects of early institutional care.

In Table 1, the institutions that were sufficiently described are broadly categorized as globally depriving, socially-emotionally depriving or adequate, roughly in accord with Gunnar's (2001) guidelines. Globally depriving institutions are those in which the care was deficient in most every respect that was mentioned. Socially-emotionally depriving institutions were deficient in some respects (e.g., routinized care that was insensitive to children's signals) but health and nutrition needs were met. Adequate institutions were described as mostly good quality, though new caregivers may rotate through quite frequently. Generally, the orphanages in 1990s Romania are described as globally depriving, those in Russia, Greece, and parts of Asia are described as socially-emotionally depriving, and those in parts of Western Europe and South Korea are described as adequate. Some studies assess children who had resided in institutions in a variety of countries as a set. While these studies are included in this review, it is recognized that combining children who were exposed to varying levels of deprivation is bound to blur any effects of age at adoption if age at adoption relates to severity of deprivation.

²An additional meta-analysis (van den Dries et al., 2009) did not report whether participants were institution-reared, but will still be included in this review because the majority of component studies focused on institution-reared children.

Age at Adoption

Age at adoption (and age at admission to institutions, when available) studies will be reviewed for attachment and parent-child relationships, disinhibited social behavior, theory of mind and quasi-autistic patterns, peer relationships, social competence and social problems, behavior problems, and attention problems. If outcomes relate to the age at which children enter or leave an institution, it most likely indicates that institutionalization has an effect on development, and the specific ages or duration of exposure to institutionalization is important. Within each category of outcomes, results will be addressed with respect to *severity of deprivation, age at assessment, methodological issues, the form of the relationship* between age at adoption and outcomes, and whether any *associated variables* relate to or account for the age at adoption effect.

Attachment & Parent-Child Relationships

Of the 19 studies that examined age at adoption effects for attachment and parent-child relationships, 6 (3 independent samples and 1 meta-analysis) found a significant effect, and in each case, later-adopted children had less favorable outcomes; 4 additional studies (3 independent samples) found effects for only some analyses (Table 2).

Severity of deprivation—Studies that found effects were more likely to be less severely depriving; however, this set of studies had substantially larger sample sizes than most studies that failed to detect an effect of age at adoption, so conclusions with regard to severity of deprivation cannot be made.

Age at assessment—Age at assessment does not appear to have an appreciable impact on whether studies found effects in this set of studies.

Methodological issues—Nearly every study that contained over 100 participants found a significant effect of age at adoption while nearly every study that included fewer participants failed to find an effect; in Tan's studies (Tan, 2006; Tan & Marfo, 2006; Tan et al., 2007, 2010) of relatively less depriving Chinese institutions, it is possible that the age at adoption effect was less pronounced such that only studies with over 300 participants had enough power to detect the effect.

Studies that used parent interviews were most likely to detect effects. In two samples (Habersaat et al., 2011; Smyke et al., 2010), age at adoption effects on attachment security are most evident when children adopted after 24 months of age are compared with those adopted earlier. Age at adoption effects for attachment organization, on the other hand, do not appear to be dependent on the specific age at adoption cut-offs that are utilized (Smyke et al., 2010). There was no apparent effect of the specific analyses used to examine the age at adoption effect, or the distribution of age at adoption.

Form of the relationship—While evidence of the form of the relationship between age at adoption and attachment outcomes is limited, one study (Smyke et al., 2010) suggests a possible linear relationship for attachment organization, but a deflection point at 24 months at adoption is evident for attachment security. An additional study from a different Romanian sample (Croft et al., 2001) noted that an age at adoption effect for the parent-child relationship was no longer significant once children adopted after 24 months of age were excluded.

Associated variables—One study (Croft et al., 2001) found that the effect of age at adoption on the parent-child relationship was mediated by cognitive ability.

Summary—Generally, later-adopted children have more difficulty with attachment and parent-child relationships, and effects were more evident in larger samples. Effects were also most evident through parent interviews, suggesting that while parent observation picks up on differences between earlier- and later-adopted children, these differences are not always apparent on standardized measures. The age at adoption effect may be linear for attachment organization and attachment security may be worse when children are adopted after 24 months of age from globally depriving Romanian institutions. Cognitive ability might serve as a mediator for age at adoption effects on the parent-child relationship.

Reactive Attachment Disorder (RAD) and Disinhibited Social Behavior (DSB)

Of the 15 studies (6 independent samples) that investigated the relationship between age at adoption and RAD or DSB (alternately called disinhibited attachment, indiscriminate friendliness, or over-friendliness), 7 (2 independent samples) found significant effects (Table 3); in each case, children adopted at a later age were more likely to demonstrate disinhibited social behavior. Two additional studies detected effects in some analyses, but not others. One study of institutionalized children in Portugal failed to detect effects for age at admission to the institution.

Severity of deprivation—Of two independent samples (ERA Study and Canada Study) of children adopted from globally depriving Romanian institutions, only one (ERA Study) detected significant effects of age at adoption in at least some of the analyses. An additional study of children adopted from socially-emotionally depriving institutions (Bruce et al., 2009) detected an age at adoption effect, while studies of children who experienced various levels of deprivation and adequate institutions failed to detect age at adoption effects.

Age at assessment—Age at assessment appears to have a limited effect, at best. In the ERA Study, disinhibited attachment may persist from age 4 to 6 years (O'Connor, Rutter, & The ERA Study Team, 2000; Rutter et al., 2004) and from age 6 to 11 years for children adopted after 6 months of age (Rutter et al., 2007). One BEIP study showed that children adopted after 24 months of age had higher levels of disinhibited RAD than earlier-adopted children at ages 30 and 54 months of age (the difference was nonsignificant at Baseline, 42 months, and 8 years; Smyke et al., 2012).

Methodological issues—Age at adoption effects were more likely to be detected with parent interviews than with observational measures, and when assessed with a 3-item parent interview (ERA Study) than with a 5-item parent interview (Canada Study). Because the 3-item and 5-item parent interviews are quite similar in content (see footnotes in Table 3), it is doubtful that the nature of the measures is responsible for whether studies find effects. One study found that while a correlation between age at adoption and disinhibited attachment was nonsignificant in the whole sample, it reached significance when earlier-adopted (< 6 months of age at adoption) children were excluded (Rutter et al., 2007). Furthermore, the BEIP demonstrated that age at adoption is related to the disinhibited, but not inhibited, type of RAD (Smyke et al., 2012). It is unclear whether the statistical tests used influenced whether studies found effects, largely because most studies with null results failed to specify the statistical tests that were used. With one exception (Bruce et al., 2009), each study that had fewer than 100 participants failed to find an effect of age at adoption, whereas each study that had more participants detected an age at adoption effect for disinhibited social behavior.

Form of the relationship—Two ERA Study papers (O'Connor, Bredenkamp, Rutter, & The ERA Study Team, 1999; O'Connor et al., 2000) suggest that there may be a linear relationship between age at adoption and DSB. In another paper by the same group, an effect

was only evident when earlier-adoptees (< 6 months of age at adoption) were excluded, suggesting that there is meaningful variability in disinhibited attachment from 6 to 42 months of age at adoption (Rutter et al., 2007).

Associated variables—Inhibitory control may mediate the relationship between age at adoption and disinhibited social behavior (Bruce et al., 2009). The possible role of head circumference (which may be a proxy for brain growth) as a mediator of the age at adoption effect on disinhibited social behavior was examined in several studies from the ERA Study Team. One study detected partial mediation, accounting for 20% of the total effect (Rutter et al., 2010), and another detected mediation only for children who had evidence of sub-nourishment (a small effect; Sonuga-Barke et al., 2008). Additional studies from the same group suggest that the age at adoption effect is not accounted for by nutritional deprivation, other behavioral or emotional problems, or cognitive ability (O'Connor et al., 1999, 2000).

Summary—Two of six samples that examined age at adoption effects for disinhibited social behavior found a significant effect, with later-adopted children faring more poorly. Most studies that detected an age at adoption effect on DSB were studies from the ERA Study team using parent interviews with over 100 participants adopted from globally depriving Romanian institutions. While evidence is limited, data from the ERA study suggests that the age at adoption effect may be linear, and it may be most evident when the earliest-adopted children (< 6 months of age at adoption) are excluded. The age at adoption effect on disinhibited social behavior may be mediated by inhibitory control; the potential mediation via head circumference is less clear. The age at adoption effect is not mediated by nutritional deprivation, other behavioral or emotional problems, or cognitive ability.

Quasi-Autism and Theory of Mind

The age at adoption effect for quasi-autistic features or theory of mind were examined in four studies, all from the ERA Study Team; the studies were consistent in finding that later-adopted children are more likely to have problems in these domains (Table 4). One study found that quasi-autism was present in 0.9% of children in a pooled comparison group (UK adoptees, non-PI Romanian adoptees, PI Romanian adoptees adopted before 6 months of age), and in 14.9% of PI children adopted after 6 months of age (Rutter et al., 2010).

Severity of deprivation, age at assessment, and methodological issues—

Because each study utilized the same Romanian sample, and each study found a significant effect, it is impossible to assess whether severity of deprivation, age at assessment, or methodological issues play a role in the pattern of findings.

Form of the relationship—In one study (Colvert et al., 2008b), children adopted before 6 months of age had fewer problems than later-adopted children, but variation in age at adoption after 6 months does not appear to be meaningful. While consistent with a step function, the authors did not explicitly discuss the form of the age at adoption function.

Associated variables—The age at adoption effect remained significant when IQ was entered as a covariate (Colvert et al., 2008b). Head circumference did not mediate the age at adoption effect for quasi-autistic features, and the effect was also independent of the effect of subnutrition (as indexed by weight; Rutter et al., 2010; Sonuga-Barke et al., 2008).

Summary—Only one sample of children addressed the question of whether age at adoption relates to quasi-autistic features or theory of mind, but it is clear that, at least for children from globally depriving institutions, children adopted after 6 months of age are at elevated risk for quasi-autistic features. The findings are consistent with a step function at 6 months

of age at adoption, and the effects are not accounted for by head circumference, IQ, or nutrition.

Peer Relationships

Of the 6 studies (4 independent samples) that examined age at adoption effects for peer relationships, 4 found peer relationships to be poorer for later-adopted children, and one found mixed results (Table 5). Of the 3 ERA Study team articles that addressed this topic, 2 detected age at adoption effects; it was not readily apparent what accounted for one study's failure to detect an effect. One study found null results for age at admission effects.

Severity of deprivation—There was not sufficient variability in severity of deprivation in these studies to determine whether this was a meaningful factor.

Age at assessment—One study found that while age at adoption effects on peer relationships were detected at each age (6, 11, and 15 years), there was a significant interaction between age at adoption and age at assessment (Rutter et al., 2010). Peer relationship problems significantly increased from age 6 to 11 years, with no further increase from age 11 to 15 years.

Methodological issues—The measures and statistical analyses do not clearly relate to whether studies found an age at adoption effect, but self-report measures may be somewhat more likely to detect effects. One study failed to detect an effect of age at admission into the institution using cut-offs of 3.5 years and 5.5 years (Vorría, Rutter, Pickles, Wolkind, & Hobsbaum, 1998b). It is possible that the null results were due to focusing exclusively on ages beyond the first two years of life.

Form of the relationship—The form of the age at adoption effect was not assessed.

Associated variables—The age at adoption effect on peer relationships may be mediated by attachment disturbance (O'Connor et al., 2000) or broader deprivation-specific problems (DSP; Rutter et al., 2010). In one study from Uganda, institutionalized children spent more time with another child if they were institutionalized less than 1 year with visits from relatives, or if they were institutionalized 2–3 years without family contact (Nielsen, Coleman, Guinn, & Robb, 2004).

Summary—Most studies detected an effect of age at adoption on peer relationships, with later-adopted children faring more poorly. Age at adoption effects may be more prominent among adolescent than childhood samples, and when self-report measures are used. It may be that peer problems become more evident as children enter the more socially complex adolescent years, and because much peer interaction occurs away from parents and teachers, PI children may be the best reporters on their own peer functioning. Attachment and DSP may be mediators of the age at adoption effect on peer relationships, and contact with relatives may moderate the effect of duration of institutionalization for institutionalized children. Age at admission effects were not detected, but this might be explained by the relatively later cut-off ages that were utilized.

Social Competence and Social Problems

Age at adoption effects on social competence and social problems were assessed in 13 studies (11 independent samples); 6 studies (5 independent samples) found that children adopted at relatively older ages have greater difficulties, and 3 studies (3 independent samples) found age at adoption effects only in some analyses (Table 6).

Severity of deprivation—Studies of children adopted from Eastern European globally or socially-emotionally depriving institutions appeared to be most likely to detect an age at adoption effect. Mixed or null effects tended to be found for studies of children adopted from China, though one study of children adopted from China³ or Eastern Europe did detect an effect of age at adoption (Camras et al., 2006).

Age at assessment—One study found that the effect of age at adoption on social problems is especially prominent for adolescents (Merz & McCall, 2010).

Methodological issues—The measures and statistical analyses used, the number of subjects, and distribution and measurement of age at adoption did not appear to have an appreciable impact on the likelihood of detecting an effect. While most studies utilized parent-report, results did not have an apparent relation to whether parents, teachers, or experimenters provided ratings of children's social behavior.

Form of the relationship—Two studies of one sample of children from socially-emotionally depriving institutions in Russia are consistent with a step function at 18 months of age at adoption (Hawk & McCall, 2011; Merz & McCall, 2010); additional time in the institution beyond 18 months of age does not appear to further increase the risk of social problems.

Associated variables—When range of facial expressions and affect variability were observed in Ugandan institutionalized children, there was a multivariate interaction between duration of institutionalization and visits from relatives; no univariate effects were significant (Nielsen et al., 2004).

Summary—Generally, children adopted at later ages have poorer social competence and more social problems. Effects were more likely to be detected in studies of children adopted from Eastern Europe who were globally or socially-emotionally deprived. There is some evidence of a step function at 18 months of age for children adopted from socially-emotionally depriving Russian institutions.

Behavior Problems

Age at adoption effects on behavior problems were examined in 32 studies (19 independent samples and 1 meta-analysis), and age at admission effects were examined in 3 studies (Table 7). A significant age at adoption effect was detected in 11 studies (7 independent samples), and in each case, later-adopted children had more problems; effects were found in only some analyses or subgroups in 8 additional studies (6 independent samples). A meta-analysis failed to detect an effect, and this may be because studies were grouped as to whether they contained earlier- or later-adopted children and whether PI differed from non-PI children instead of examining the age at adoption effect within studies.

Severity of deprivation—The pattern of effects was highly related to the children's region of origin. Of 13 studies (from 6 independent samples, including the ERA Study) of typically globally-depriving Eastern-European institutions, 7 studies (from 4 independent samples) demonstrated age at adoption effects in each analysis that was reported. Three additional Eastern-European studies (from 2 independent samples, including the ERA Study) detected effects in some analyses, but not others. Of 8 studies (from 5 independent samples) of children adopted from Asia, 2 studies from the same sample detected effects in

³Over half of the Chinese sample experienced an average of 8.4 months of foster care, so it is possible that this Chinese sample was less deprived than otherwise might be expected.

only some analyses, and the remainder found only null results. A sample of children adopted from Western Europe (2 studies) failed to detect effects, and 1 study of children adopted from Uganda found mixed results. Because many studies don't describe the quality of care provided in the institutions, the pattern of results with regard to severity of deprivation is consistent with expectations but less clearly defined.

Of two studies with a higher proportion of non-institutionalized children in their samples, one (Elmund, Lindblad, Vinnerljung, & Hjern, 2007) detected an age at adoption effect, and one (Marcovitch, Cesaroni, Roberts, & Swanson, 1995) detected an effect only for some domains of behavior problems.

Age at assessment—Several studies found age at adoption effects to be more predominant for children who were older at assessment (Hawk & McCall, 2011; Merz & McCall, 2010; Rutter et al., 2010; Verhulst et al., 1990). In one study, Romanian PI children had more externalizing and internalizing problems at age 11 and 15 than at age 6, though an age at adoption effect was detectable at each age at assessment (Rutter et al., 2010). When internalizing and externalizing behavior were examined separately, age at adoption interacted with age at assessment for internalizing, but not externalizing problems (Verhulst et al., 1990); in line with other studies, more problems were found at older ages at assessment.

Methodological issues—Whereas 11 of 15 studies that used the CBCL found significant effects for at least some analyses (8 out of 10 independent samples), only 1 of 7 studies (1 of 3 independent samples) that used the Rutter parent and teacher scales detected an effect. The CBCL and Rutter scales both tap into children's externalizing and internalizing behavior problems and are highly correlated with each other (overall correlation $r = 0.79$; Fombonne, 1989 as cited in Elander & Rutter, 1995), so it is unclear why effects were more robust in studies using the CBCL. For studies that examined specific domains of behavior problems (e.g., subscales of the CBCL), there was no apparent pattern across studies as to which specific problems were more likely to show age at adoption effects. There was no apparent relationship between the likelihood of detecting an effect of age at adoption and the reporter (e.g., parent, teacher), number of subjects, the statistical analyses used, or the distribution or measurement of age at adoption.

Form of the relationship—Studies of children adopted from socially-emotionally depriving Russian institutions detected a step around 18 months of age at adoption (Hawk & McCall, 2011; Merz & McCall, 2010), but studies of children adopted from globally depriving Romanian institutions observe a similar step at 6 months of age at adoption (Kreppner et al., 2007; Rutter et al., 2010). One study of children adopted from a variety of countries detected a sharp increase in rates of problems for those adopted after 24 months of age at adoption (Verhulst et al., 1990). On the other hand, the age at adoption effect was linear for Romanian PI children for rocking, self-injury, and problems with chewing and swallowing (Beckett et al., 2002). In this same study, the age at adoption effect was a step function for unusual sensory interests (i.e., "an unusual interest in the feel and smell of persons or objects and unusual preoccupations with visual sensations") assessed at 6 years of age; this behavior was significantly more common among children adopted after 6 months of age, consistent with other studies of children adopted from globally depriving Romanian institutions.

Associated variables—Age at adoption did not interact with whether a child had been reared in an institution or not (Gunnar, Van Dulmen, & The IAP Team, 2007), but because children in this study were from a variety of countries and levels of deprivation, the effects,

if present, may be blurred. Age at adoption also did not appear to relate to subnutrition in Romanian PI children (Kreppner et al., 2007; Rutter et al., 2010). Brain growth, on the other hand, may relate to the effects of institutionalization on behavior problems; Rutter et al. (2010) found that DSP, which is elevated in children adopted after 6 months of age, is significantly related to head circumference. DSP mediated the age at adoption effect for internalizing, but not externalizing, behavior problems. One study reported that while age at adoption does relate to the level of maladjustment, the effect is better accounted for by abuse, neglect, and number of placements (Verhulst, Althaus, & Versluis-den Bieman, 1992).

In observations of institutionalized Ugandan children, longer institutionalization and visits from relatives were associated with aggressiveness toward adults; a similar multivariate interaction was detected for negative affect and crying, but no univariate effects were significant (Nielsen et al., 2004). The age at adoption effect was moderated by maternal interaction style, but not attachment, for adolescents adopted from multiple countries (Habersaat et al., 2011).

Age at admission effects—Children who enter institutions after 2 years of age may be less likely to demonstrate behavior problems than those who enter earlier; when age at admission cut-offs of 3.5 and 5.5 years were used, no age at admission effects were detected (Vorría et al., 1998b). One study found an age at admission effect for CBCL behavior problems (Lee, Seol, Sung, Miller, & Minnesota IAP Team, 2010), and one failed to detect age at admission effects for the Rutter scales (Vorría et al., 1998b); this pattern parallels the findings for age at adoption effects. An additional study assessed behavior problems with a parent interview and found that an age at admission effect (< 2 years, > 2 years) was detected for disinhibition, but not for antisocial disorder, stealing, lying, destructiveness, or fighting; effects were only evident in the older (8–12 years) age at assessment group (Wolkind, 1974), consistent with age at adoption findings.

Summary—Most studies found behavior problems to be more predominant for later-adoptees. Effects were more likely to be detected in studies of socially-emotionally or globally deprived children adopted from Eastern Europe, in subsamples assessed in adolescence rather than childhood, and when studies utilized the CBCL rather than the Rutter scales to assess behavior problems. The most commonly reported form of age at adoption effect appears to be a step function; the step seems to occur at 6 months of age at adoption for globally deprived Romanian children, and at 18 months of age at adoption for socially-emotionally deprived Russian children. But, for atypical behavior problems, there may be a linear relationship with age at adoption. Age at adoption effects do not appear to be accounted for by subnutrition or attachment, but head circumference, DSP, and maternal interaction style may play a role; contact with relatives may be a moderator for institutionalized children. While only limited evidence is available, children who enter institutional care in the first two years of life may have a higher risk for behavior problems than those who enter at a later age.

Attention Problems and Executive Function

Age at adoption effects for attention problems and executive function were assessed in 17 studies (10 independent samples); significant effects were found in 12 studies from 7 independent samples, and 4 studies (4 independent samples) found effects for only some analyses or subsamples (Table 8). In each case, later-adopted children had poorer outcomes.

Severity of deprivation—Severity of deprivation did not appear to differentiate between studies that detected effects of age at adoption and those that did not.

Age at assessment—One sample found age at adoption effects in older (12–18 year old, and 5–18 year old), but not younger (6–11 year old, and 2–5 year old) subsamples (Merz & McCall, 2010, 2011). In two additional samples, the age at adoption effect did not attenuate over time (Audet & LeMare, 2010; Kreppner, O'Connor, Rutter, & The ERA Study Team, 2001).

Methodological issues—The only study that failed to detect an effect of age at adoption on executive function (Bos et al., 2009) assessed 8-year-old Romanian PI children with the CANTAB, which is a touch-screen automated neuropsychological battery that taps into visual memory, visual attention, and planning/working memory; it could be that this measure did not assess the specific deficits exhibited by this population. In this study, children moved from institutions to foster care (not adoptive homes), and children departed the institutions at 9 to 33 months of age (mean = 23.6 months). The most probable explanation for the null findings is that this sample was adopted too late (i.e., after 6 months of age) to detect age at adoption effects.

An additional study (Barcons-Castel, Fornieles-Deu, & Costas-Moragas, 2011) found that while later-adopted children had poorer scores on the attentional problems subscale of the BASC than earlier-adopted children, there was no difference on the hyperactivity subscale. Note, however, that a study that used the Rutter scales did find an age at adoption effect for hyperactivity (Dalen, 2001). There was no apparent relationship between the likelihood of detecting an age at adoption effect and the reporter (e.g., parent, teacher), number of subjects, the statistical analyses, or the measurement of age at adoption.

Form of the relationship—For children adopted from globally depriving Romanian institutions, a step function occurs around 6 months of age at adoption (Colvert et al., 2008b; Stevens et al., 2008). Children adopted from socially-emotionally depriving Russian institutions appear to have a step at 18 months of age at adoption (Hawk & McCall, 2011; Merz & McCall, 2010, 2011). While the level of deprivation was not reported, a study of children adopted from Colombia and Korea reported data consistent with a step function around 24 months of age at adoption, although a step function was not explicitly tested (Dalen, 2001).

Associated variables—Age at adoption effects were independent of IQ (Colvert et al., 2008b; Kreppner et al., 2001) and developmental level at adoption (Kreppner et al., 2001). Weight at adoption appeared to mediate the age at adoption effect for teacher-reported, and not parent-reported, inattention/overactivity (I/O; Kreppner et al., 2001). Age at adoption did not interact with subnutrition, but there was evidence of head circumference as a mediator of the age at adoption effect on I/O for subnourished (but not non-subnourished) children (Sonuga-Barke et al., 2008). Parenting variables like warmth, stimulation in the adoptive home, and attachment, are related to I/O after taking into account age at adoption and earlier I/O (Audet & LeMare, 2010). Further, for earlier-adopted children, authoritarian parenting positively predicted I/O, but for later-adopted children, authoritarian parenting negatively predicted I/O. One study found that odds ratios for the age at adoption effect on rates of ADHD medication use were similar for boys and girls (Lindblad, Weitoft & Hjern, 2010).

Summary—The vast majority of studies detected an age at adoption effect for attention and executive function, with later-adoptees faring more poorly. Age at adoption effects may be more likely to be detected in adolescence, and less likely in analyses of Romanian adoptees that include only children adopted after 6 months of age. The age at adoption effect appears to be a step function, with a step occurring at 6 months of age at adoption for globally deprived Romanian adoptees, 18 months of age at adoption for socially-emotionally

deprived Russian adoptees, and 24 months of age at adoption for adoptees from Colombia and Korea. The age at adoption effect was not accounted for by developmental level, IQ, or subnutrition, but it may be partially mediated by head circumference in a subnourished subgroup.

Discussion

Age at adoption effects were detected in most studies across multiple outcome domains, but roughly a third of studies did not detect an effect; thus, a number of factors can be identified that relate to the likelihood of detecting age at adoption effects. Studies of globally-deprived children are most likely to find age at adoption effects, and in each study where age at adoption effects are detected, later-adoptees have more difficulties. Several independent samples (ERA Study, St. Petersburg USA Study Team, Verhulst's studies) found that the age at adoption effect is more likely to be detected in adolescent than preschool and middle-childhood samples, so the effects do not seem to fade with increased age or time in the adoptive home. Age at adoption effects for behavior problems were more evident on the CBCL than on the Rutter scales, parent interviews were more likely than observational or self-report measures to detect age at adoption effects for attachment and RAD/DSB, and self-report measures were most likely to detect age at adoption effects for peer relationships.

With few exceptions, each study that examined the form of the age at adoption effect detected a step-like relationship between age at adoption and outcomes. Children adopted before a certain cut-off age are generally similar to parent-reared children in the problems they experience, but children adopted after that point have elevated rates of problems; continued institutionalization beyond this point does not seem to contribute to further increases in problems. Note, however, that research on the form of the age at adoption effect after about 42 months of age at adoption is rare, so conclusions only apply to children adopted before that age. Likewise, research is limited with regard to the age that children were admitted to the institution. While age at adoption and time in institution are typically highly correlated (see Table 1), most studies do not report whether children were institutionalized for the entirety of the period of time that may encompass a sensitive period.

The specific age at which the step occurred differed across studies in accord with the severity of deprivation and/or the country of origin. Studies of children adopted from globally depriving Romanian institutions tended to find a step function at 6 months of age at adoption, and studies of children from socially-emotionally depriving Russian institutions detected a step function at about 18 months of age at adoption. There were two main exceptions to this rule. First, the age at adoption effect for attachment and parent-child relationships may be linear, and some evidence suggests that effects are due to the contrast between children who leave the institution before versus after 24 months of age, even for globally-deprived children. Further, atypical behavior problems (e.g., rocking, self-injury, and problems with chewing and swallowing) may be linearly related to age at adoption. The etiology of these problems may differ from that of those problems that did have a clear step-like relationship to age at adoption.

Several studies examined the role of other variables in mediating or moderating the effect of age at adoption on outcomes. Cognitive ability, IQ, and developmental level at adoption failed to consistently account for age at adoption effects. For both disinhibited social behavior and attention and executive function outcomes, subnutrition did not interact with age at adoption, but there was some evidence that within a subnourished subsample, head circumference may mediate the age at adoption effect. Additionally, the effect of age at adoption on disinhibited social behavior was mediated by inhibitory control. This, in conjunction with the finding that age at adoption effects were most robust for attention and

executive function compared to other outcomes, suggests that attention and executive function may represent a sort of “core deficit” that contributes to PI children’s deficits in other domains.

In order to have a complete understanding of the influence of the timing of early experience, it is essential to know when such experience started in addition to when it ended. Unfortunately, information on age at admission to institutional care is seldom available or studied. The data that are available suggests that children who enter before 2 years of age have more problems than children who enter after this age. Deprivation within the first two years of life seems to be particularly important to children’s development, so it is likely that timing of deprivation rather than simple duration of exposure, contributes to problems later on. This is consistent with primate research that shows that earlier social deprivation has much more devastating effects than later deprivation (Harlow & Novak, 1973; Suomi, 2003). Thus, a child who experienced deprivation from birth to 2 years of age might be expected to have more difficulties later on than a child who experienced similar levels of deprivation from 2 to 4 years of age.

Reconsidering Hypotheses of How Early Deprivation Affects Development

Cumulative Effects—According to the cumulative effects hypothesis, individuals are the product of their environment and are highly malleable, so the effects of institutionalization should increase linearly with duration of institutionalization and fade with increased age or time in the adoptive home. But, institutionalization in the first two years of life seems to be particularly detrimental, and increased time in the institution beyond this point does not seem to further contribute to risk of additional problems. The form of the age at adoption effect appears to be a step-function, not linear, for most outcomes. While some studies have detected age at adoption effects soon after adoption (e.g., Tan’s studies), most studies find that problems are more evident in adolescence.

The prediction of this hypothesis that quality of care should relate to outcomes seems to be partially met by the available data; it takes less time in a globally depriving institution than in a socially-emotionally depriving or adequate institution to produce noticeable effects on the risk of problems in adopted children. But, evidence is mixed as to whether quality of care in the adoptive home contributes significantly to outcomes.

The cumulative effects hypothesis may hold true for some children, or for some outcomes. Massive catch-up growth occurs in the first few years after adoption (van IJzendoorn et al., 2007; van IJzendoorn & Juffer, 2006), attesting to the benefits provided by moving to a supportive environment. However, benefits do not continue to grow with more time in the adoptive home. This is not to say that the adoptive home environment doesn’t matter after the initial adjustment period (it does—see Audet & LeMare, 2010), but rather that the *duration of time* in the adoptive home fails to account for outcomes. It remains possible that for some children, problems were evident soon after adoption, but faded with increased time in a supportive home environment, consistent with the predictions of the cumulative effects hypothesis.

As predicted, a linear age at adoption effect was found for some atypical behavior problems, attachment disorder behavior, and possibly for attachment organization. For atypical behavior problems, there tended to be fewer problems at older ages at assessment, consistent with the hypothesized decline in problems with more time in a supportive environment. While the cumulative effects hypothesis was not supported for most outcome variables, this hypothesis may contribute to our understanding of the effects of institutionalization on attachment and atypical behavior problems.

Developmental Programming—The two developmental programming hypotheses (experience-expectant and experience-adaptive) predict that more time in a supportive adoptive home or an older age at assessment should not be linked to fewer problems because the effects of institutionalization are thought to be permanent, and they propose that there may be sensitive periods of exposure, so a step function would be likely. These predictions are largely met by the data. Early institutional experience is related to elevated rates of problems, and when deprivation is severe, problems often result even when exposure is limited to the first 6–12 months of life. Moreover, the effects of institutionalization are detected years after adoption, and age at adoption effects are somewhat more likely to be detected in adolescence than in childhood; while the effects of institutionalization appear to be permanent, there may be a sleeper effect. A step function is evident in most studies that described the form of the age at adoption function, but the specific age at which the step occurs varies according to the severity of institutional deprivation.

Experience-expectant developmental programming: The experience-expectant developmental programming hypothesis posits that there are specific “necessary experiences” that a child must have in order for development to proceed properly, and permanent deficits will necessarily result if these experiences are not had. The available evidence does not fit these expectations. For studies of socially-emotionally deprived (Hawk & McCall, 2011) and globally deprived (Colvert et al., 2008a; Kreppner et al., 2007) children, only up to half of later-adopted children have problems. It is possible that only some children lacked “necessary experience” in an institution, but it is more likely that some children are resilient in the face of deprivation.

Experience-adaptive developmental programming: The experience-adaptive developmental programming hypothesis suggests that during early sensitive periods, children adapt to the environment they reside in, such that a drastic change in environment (e.g., by adoption) could render a child maladapted to his new environment. For most outcomes, this hypothesis is not supported; difficult parent-child relationships, poor theory of mind or quasi-autistic patterns, peer problems, social problems, behavior problems, and executive function problems do not seem likely to be helpful to a child residing in an institution, so these behaviors are not expected to be the consequence of appropriate adaptation to the institutional environment. Disinhibited social behavior might represent a behavior that is adaptive in the institution because it can help a child gain attention from caregivers, but if this behavior is, in fact, rooted in difficulties with inhibitory control (Bruce et al., 2009), it is less likely to be an adaptive response. The experience-adaptive hypothesis also suggests that variations in the specific level and type of deprivation that a child experiences could relate to outcomes. This prediction appears to be met because the levels of problems tend to vary on a continuum according to the level of deprivation children experienced in the institution.

Summary—None of the above hypotheses fully account for the effects of early institutionalization on development. The cumulative effects hypothesis appears to fit for some atypical behavior problems and for some attachment outcomes, and many aspects of developmental programming are supported by the available data, but the specific hypotheses (experience-expectant and experience-adaptive) fall short. Consistent with the developmental programming hypotheses, institutionalization effects are long-lasting, and the ages of exposure are important in predicting risk of problems. But, several questions remain.

Issues to Consider

Sensitive periods—The current review suggests that sensitive periods⁴ may play a role in social and behavioral development because when studies examined the form of the age at

adoption function, they tended to find a step function. Traditional notions of sensitive periods specify that there is a distinct period of elevated vulnerability to environmental influences, and this period is universal within a species. For institutional deprivation, however, the boundaries of the period of vulnerability vary with the severity of institutional deprivation to which a child is exposed. While most accounts of sensitive periods describe the temporal boundaries to be inflexible, more recent accounts suggest that sensory deprivation can prolong the opening of a sensitive period, or compensatory processes can mask the closing of a sensitive period (Knudsen, 2004; Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011). It is possible that such processes contribute to the variability in the temporal boundaries of sensitive periods that is suggested by this review.

The existence of a sensitive period in itself does not imply a particular causal mechanism, but the step function may imply some kind of intraorganismic change (Kreppner et al., 2007). There is insufficient evidence to be certain about the changes that mark the end of a potential sensitive period, but epigenetic effects are likely to be partially responsible. Early elevated stress levels are linked to epigenetic changes (Shonkoff, Boyce, & McEwen, 2009) that, in animal studies, are associated with prolonged stress responses, changes in brain architecture and chemistry, and behaviors resembling depression and anxiety (National Scientific Council on the Developing Child, 2010). If a similar model exists for humans, a certain amount of deprivation might be required before epigenetic changes take place; this threshold may be reached at an earlier age (e.g., 6 months) in globally depriving institutions, and a later age (e.g., 18 months) in socially-emotionally depriving institutions. While the cumulative effects hypothesis alone did not adequately account for the data, cumulative exposure in a broad sensitive period of the first two years of life might contribute to the lasting effects of early experience.

Resilience and individual differences—Our current hypotheses propose that anyone exposed to deprivation, especially severe deprivation, should exhibit its negative effects. In fact, only a portion of children, even from the most depriving institutions, demonstrate negative outcomes. PI children are remarkably resilient despite the severity of their deprivation.

Several factors might account for the resiliency of children adopted from depriving institutions. Individual differences in quality of care relate to individual differences in outcomes (Smyke et al., 2007), so children who have better outcomes may be those who were “favorites” in the institution. But, particularly in globally depriving institutions, this is unlikely to account for the positive outcomes of many children. Animal models suggest that positive experiences prior to deprivation might buffer children from poor outcomes, but most children enter institutional care very early in life, so this again is unlikely to account for the positive outcomes of many children. It is possible that better prenatal circumstances might contribute to resilience in some children, but most studies find that broad factors like birthweight or prematurity do not significantly account for differences in outcomes among this population (Kreppner et al., 2007; Merz & McCall, 2010, 2011; Sonuga-Barke et al., 2008). It remains possible that other prenatal factors (e.g., nutrition, stress, alcohol/substance use, etc.) may play a role, but more research is needed.

A final possibility is that genetic factors contribute to resilience (Caspi et al., 2003). Genotype by duration of institutionalization interactions may play a role for some domains of problems (e.g., attention or emotional problems; van IJzendoorn et al., 2011). Genes may

⁴A strict understanding of sensitive periods suggests that sensitive periods lie at the level of circuits, not complex behaviors like those described here (Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011). While this discussion considers only complex behaviors, it is understood that multiple circuit-level sensitive periods underlie these behaviors.

also play a role in determining the degree to which a child is sensitive to the environment (National Scientific Council on the Developing Child, 2005), such that children who are resilient to the effects of institutionalization may be those who are genetically least vulnerable to environmental effects (Rutter, 2003; Rutter, Moffit, & Caspi, 2006).

Sleeper effects—Age at adoption effects, and thus effects of institutionalization, appear to be most evident among adolescent samples, suggesting that institutionalization-related problems are not simply the persistence of learned behaviors; it is more likely that problems are reflective of underlying deficits in certain basic skills that are not evident until relatively later in development (Zeanah et al., 2011). Apparent sleeper effects have previously been detected for effects of intervention programs (Reynolds & Robertson, 2003; Olds et al., 1997) and variously attributed to increases in statistical power over time (Mersky, Topitzes, & Reynolds, 2011), or the likelihood that some intervention effects simply take time to emerge (Reynolds & Robertson, 2003). Alternatively, early neural changes may contribute to sleeper effects. For example, early visual deprivation might be associated with a failure to establish optimal neural architecture for future visual development (Maurer, Mondloch, & Lewis, 2007). Thus, a lack of specific types of early experience might lead to neural changes or prevent neural architecture from developing in expected ways, and these changes may affect the development of certain skills that do not emerge until later on in development. Alternatively, it could be that problems emerge for this population in adolescence due to the elevated social and behavioral demands and expectations at this point in development. Residence in a supportive adoptive home environment may provide adoptees with the necessary support and guidance to prevent many of these issues from becoming problematic in their early years. When adults begin to pull back their support, as is typical for any child entering adolescence, more problems may emerge.

What is it about the institution?

It is widely accepted that institutionalization is associated with risk for poor developmental outcomes, but less is known regarding what, specifically, it is about the institution that produces such negative effects on development. The behavioral environment of institutions (specifically the lack of caregiver-child relationships), is typically hypothesized to be causally related to outcomes, but other potential explanations must be addressed as well. First, it could be that the less healthy children are adopted at later ages. But, age at adoption effects are evident for 1990s Romanian adoptees, and these children were adopted en masse after the fall of the Ceausescu regime; thus, in studies of Romanian adoptees, age at adoption is largely a function of a child's age at the fall of the Ceausescu regime rather than any characteristics of the child (see p. 6, Rutter et al., 2010). Furthermore, most studies have not detected a significant relationship between birthweight or prematurity and outcome variables (Kreppner et al., 2007; Merz & McCall, 2010, 2011; Sonuga-Barke et al., 2008; but see also Bos et al., 2009). Prenatal factors might account for some between-country differences; because many Chinese children are abandoned due to the One Child Policy, they may have had better prenatal circumstances than children who were relinquished due to poverty or drug abuse (Cohen & Farnia, 2011), and this could partially account for the relatively more favorable outcomes for Chinese PI children. There also may be between-country differences in the age at which children are admitted to institutions and the quality of care children receive prior to admission, but little is currently known about these factors.

While globally depriving institutions such as those in Romania were nutritionally and medically deficient in addition to being socially-emotionally deficient, it is not likely that these factors are primary in producing effects of institutionalization. Subnutrition was not found to account for age at adoption effects, and lasting effects of institutionalization are found even for children who resided in institutions with adequate nutrition and medical care.

It is possible, however, that children who had poorer nutrition (e.g., those in globally depriving Romanian institutions) were more vulnerable to the negative effects of institutionalization (Rutter, 2005b).

Another possibility is that the institutional experience is quite stressful for infants and young children, and the biological and psychological sequelae of early stressful experiences contribute to children's poor developmental outcomes. Early sensitive and responsive caregiving, which is lacking in institutions, maintains a hyporesponsive neuroendocrine stress system (Gunnar et al., 2006). Early stressful experiences, particularly in the absence of a secure attachment relationship, are linked to disturbances in diurnal cortisol patterns (Kertes, Gunnar, Madsen, & Long, 2008) and problems with executive function and emotion regulation (which are also deficient in PI populations), and can produce effects that last through childhood and adulthood (National Scientific Council on the Developing Child, 2008, 2010, 2011). This is likely to account for some of the difficulties encountered by children reared in institutions, but it is unable to account for problems like disinhibited social behavior, which are relatively common in PI populations, but rare in other populations that experience early stress (Rutter, 2005b).

Given the evidence, it is likely that the distinct lack of early caregiver-child relationships in institutions is a primary contributor to the lasting problems that PI children experience. Even in institutions where medical, nutrition, and safety needs are met, there tend to be many and changing caregivers who provide care in a perfunctory way. Children typically do not see the same caregivers from day to day, and caregiver-child relationships rarely develop. Caregiver-child relationships are fundamental to early development; children seek comfort and emotional support from caregivers, and also learn basic skills like an understanding of contingencies, social cues, and social agency from stimulation and interactions with a sensitive and responsive caregiver (Sroufe & Waters, 1977). Deficient early caregiver-child relationships are likely to contribute to the lack of social inhibition and awareness that characterizes disinhibited social behavior. Relationship deprivation also contributes to elevated stress levels in infants and limits the amount and quality of their environmental and relationship stimulation. Furthermore, individual differences in quality of care are related to individual differences in outcomes (Smyke et al., 2007), and when early caregiver-child relationships are improved through an institutional intervention (The St. Petersburg-USA Orphanage Research Team, 2008) or through transfer to foster care (Smyke et al., 2010), developmental outcomes improve remarkably.

Limitations

Several limitations are apparent with respect to the data available to address the major questions of this review. First, most children enter institutional care in the first weeks or months of life, so it is impossible to separate ages of exposure from duration of institutional deprivation. While there are a few studies of age at admission that suggest that children in the first two years of life are particularly vulnerable to the effects of institutionalization, most research is unable to make such a distinction. While the current literature suggests a possible sensitive period, it is often not known whether children resided in an institution for the entirety of that period or experienced other placements. Further research is needed to tease apart ages and duration of exposure and their relation to outcomes. Similarly, most research focuses exclusively on the timing and effects of earlier negative experiences but not later positive experiences; while development is a product of both negative and positive experiences, this latter component of experience is rarely thoroughly addressed. Little to no data tends to be available regarding children's pre-institutional experience, including other placements (e.g., hospitals, foster care, other institutions) and prenatal experience, so these factors cannot be ruled out as contributors to the effects of institutionalization and age at adoption. But, studies of domestic adoption show that even when prenatal experience is

quite poor (e.g., in the case of prenatal drug exposure), postnatal experience plays a primary role in children's outcomes (Rutter, 2005a). Additionally, information is often not available about specific characteristics of various institutions, much less about a specific child's experience in the institution, so it is impossible to determine whether individual differences in outcomes relate to individuals' different experiences in institutions.

Furthermore, a large number of studies were included in this review, but a smaller number of independent samples are available. Conclusions about the relationship between age at adoption and other variables and the form of the age at adoption effect have largely not been replicated in independent samples and are based on a limited number of studies. When the form of the age at adoption function was examined, it was not always fully examined; studies that reported a linear relationship did not always test whether a step function (or another function) fit better, and vice versa.

Conclusions

Despite these limitations, the message from this set of studies is clear. Children adopted from institutions have higher rates of problems when they are adopted at later ages, and for most outcomes, institutionalization beyond a certain age is associated with a step-like increase in risk for lasting social and behavioral problems. The age at which a step occurs seems to vary with the severity of the institutional deprivation, with a step apparent at 6 months of age at adoption for globally deprived Romanian adoptees and 18 months of age at adoption for socially-emotionally deprived Russian adoptees. A later age at admission into an institution is associated with lower rates of problems, suggesting the importance of experience in the first two years of life (rather than simple duration of experience) in predicting later outcomes. The step function suggests that sensitive periods may play a role, and evidence suggests that many (even later-adopted) children are remarkably resilient, but these findings are not well explained by our current hypotheses. More research is needed to separate the effects of ages and duration of exposure to the institutional environment.

The current state of the literature does not support firm conclusions about causes for the patterns detected in the data, but some speculative explanations can be offered. In institutions, deficient caregiver-child relationships are likely to contribute to children's limited environmental and relationship stimulation, which likely relates to the disinhibited social behavior that is often seen in PI populations. Relationship deprivation is also expected to contribute to a diminished buffering of institutionalized children's stress response, which means children would be exposed to elevated cortisol levels at a time when they are particularly vulnerable. Early stress experience is known to relate to later attention, executive function, and emotion regulation problems, which are common problems in PI populations and may contribute to other behavior problems.

Furthermore, genetic factors may relate to the step function that is detected and to the resilience of some children. Because of their genetic make-up, some children may be less vulnerable to the effects of their environment, rendering them less likely to show negative effects of institutionalization in the long-term. For those who are more vulnerable to environmental influences, epigenetic changes may be triggered once a certain threshold of deprivation has been reached. Globally deprived Romanian children may experience epigenetic changes as early as 6 months of age, whereas similar epigenetic changes may not occur until closer to 18 months of age when the deprivation is solely social-emotional in nature.

Future Directions

Several factors should be addressed in order for future studies to more completely address the question of the impact of early experience on later development. When possible, studies should examine the potential influence of prenatal and pre-institutional circumstances, other placements, and individual differences in quality of care received on the later development of PI children. When there is sufficient variability in age at admission to the institution, age at admission effects should be examined to contribute to our understanding of the importance of specific ages of exposure to deprivation, and efforts should be made to distinguish the effects of duration of exposure from specific ages of exposure to institutionalization. Future studies should provide more thorough and complete assessments of the effects of age at adoption; for example, studies could test both linear and step functions (using multiple possible “cut-off” ages at adoption) for multiple outcome measures, and include tests to determine the best fitting form of the age at adoption function.

More research is needed to explore potential mechanisms to account for sensitive periods and resiliency in this population of children. Specifically, future studies should explore the possible influence of stress hormones and genetics and the role they may play in producing a step function for age at adoption and individual differences between children. Our understanding of the processes of development would benefit from studies aimed to measure children’s development during the time they reside in an institution; ideally, such studies would identify when specific aspects of development and biology change, and connect these data to outcomes in childhood and adolescence.

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Abbreviations

PI	post-institutionalized
DSP	deprivation-specific problems
I/O	inattention/overactivity

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Characteristics of Age at Adoption Studies

Table 1

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Romania Canada Study										
Ames (1997)	—	age at adoption & time in institution ^a ; r (46) = .97, p < .01	Md = 1m	yes	Romania	specific-globally depriving	adoptive families in Canada	yes	yes	46
Audet & LeMare (2010)	—	age at adoption & time in institution ^a ; r (46) = .97, p < .01		Yes	Romania	—	adoptive families in Canada	yes	yes	46
Chisholm (1998)	—	age at adoption & time in institution ^a ; r (46) = .97, p < .01		yes	Romania	general-globally depriving	adoptive families in Canada	yes	yes	46
Chisholm, Carter, Ames, & Morison (1995)	birthweight	age at adoption & time in institution ^a ; r (46) = .97, p < .01		yes	Romania	—	adoptive families in Canada	yes	yes	46
Fisher, Ames, Chisholm, & Savoie (1997)	—	age at adoption & time in institution ^a ; r (46) = .97, p < .001	M = 1m	yes	Romania	general-globally depriving	adoptive families in Canada	yes	—	46
English and Romanian Adoptees (ERA) Study										
Beckett, Bredenkamp, Castle, Groothues, O'Connor, Rutter, and the ERA Study Team (2002)	—	5 children had 1y + with bio family before institution	—	yes	Romania	specific-globally depriving	adoptive families in UK	—	—	144
Colvert, Rutter, Beckett, Castle, Groothues, Hawkins, Kreppner, O'Connor, Stevens, & Sonuga-Barke (2008a)	—	—	—	yes	Romania	—	adoptive families in UK	yes	ns	144
Colvert, Rutter, Kreppner, Beckett, Castle, Groothues, Hawkins, Stevens, & Sonuga-Barke (2008b)	—	—	Usually in neonatal period	yes	Romania	—	Adoptive families in UK	yes	—	144
Croft, O'Connor, Keaveney, Groothues, Rutter, and the ERA Study Team (2001)	—	age at adoption & time in institution ^a ; r = .83	most in first weeks of life	87%	Romania	general-globally depriving	adoptive families in UK	yes	ns	165
Kreppner, O'Connor, Rutter, & The ERA Study Team (2001)	—	—	most in first weeks of life	yes	Romania	general-globally depriving	adoptive families in UK	yes	ns	137
Kreppner, Rutter, Beckett, Castle, Colvert, Groothues,	birthweight +	age at adoption & time in institution ^a ; r	M = .34m, SD = 1.26	yes	Romania	general-globally depriving	adoptive families in UK	yes	ns	144

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Hawkins, O'Connor, Stevens, & Sonuga-Barke (2007)		= .94, $p < .001$, $N = 144$								
O'Connor, Bredenkamp, Rutter, & the ERA Study Team (1999)	—	—	97% by 3rd month	91%	Romania	General-globally depriving	adoptive families in UK	yes	—	111
O'Connor, Marvin, Rutter, Olrick, Briner, & The ERA Study Team (2003)	—	—	85% within first month	yes	Romania	general-globally depriving	adoptive families in UK	—	—	111
O'Connor, Rutter, & The ERA Study Team (2000)	—	—	85% within first month	87%	Romania	general-globally depriving	adoptive families in UK	yes	ns	165
Rutter, Colvert, Kreppner, Beckett, Castle, Groothues, Hawkins, O'Connor, Stevens, & Sonuga-Barke (2007)	—	age at adoption & time in institution ^a ; $r = .89$, $p < .001$; 80 spent 100%, 53 > 50%, 11 < 50% life in institutions	$M = .34m$, $SD = 1.28m$	yes	Romania	general-globally depriving	adoptive families in UK	yes	ns	144
Rutter, Kreppner, & O'Connor (2001)	—	—	$M = 0.34m$	80% most of life	Romania	general-globally depriving	adoptive families in UK	—	—	165
Rutter, O'Connor, & the ERA Study Team (2004)	—	—	85% within first month	yes	Romania	general-globally depriving	adoptive families in UK	—	ns	144
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell (2010)	birthweight +	85% whole life in institution; 95.8% at least half life	85% in first 2 weeks	yes	Romania	general-globally depriving	adoptive families in UK	yes	ns	144
Sonuga-Barke, Beckett, Kreppner, Castle, Colvert, Stevens, Hawkins, & Rutter (2008)	birthweight	—	—	yes	Romania	general-globally depriving	adoptive families in UK	—	—	138
Stevens, Sonuga-Barke, Kreppner, Beckett, Castle, Colvert, Groothues, Hawkins, & Rutter (2008)	—	—	most within first 2 weeks	yes	Romania	general-globally depriving	adoptive families in UK	—	—	144
Bucharest Early Intervention Project (BEIP)										
Bos, Fox, Zeanah, & Nelson (2009)	birthweight	Many in maternity hospital before institution	0–17.49m; $M = 3.03m$, $SD = 4.14m$	yes	Romania	—	FC (randomized from institution)	—	—	< 93
Snyke, Zeanah, Fox, Nelson, & Guthrie (2010)	—	—	—	yes	Romania	—	FC (randomized from institution)	—	—	68
Snyke, Zeanah, Gleason, Drury, Fox, Nelson, & Guthrie (2012)	—	—	—	yes	Romania	—	FC (randomized from institution)	—	—	68

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Marcovitch Studies										
Marcovitch, Cesaroni, Roberts, & Swanson (1995)	—	56% whole life in institution; others: FC, maternity hospital, other institution, or bio family before institution	56% at birth	54.7 %; others adopted from bio families	Romania	genera l-globally depriving	adoptive families in Canada	yes	—	130
Marcovitch, Goldberg, Gold, Washington, Wasson, Krekewich, & Handle y-Derry (1997)	—	age at adoption & time in institution ^a ; $r = .86$		yes	Romania	general-globally depriving	adoptive families in Canada	yes	—	56
Ellis, Fisher, & Zaharie (2004)	—	—	0–4y; $M = 4m$	yes	Romania	—	institutions in Romania	n/a	n/a	51
Other Eastern Europe										
St. Petersburg-USA Orphan age Research Team (St. Pete Study)										
Hawk & McCall (2011)	—	age at adoption & time in institution ^d ; $r = .86$, $p < .001$		yes	mostly Russia	specific-socially-emotionally depriving	adoptive families in USA	—	—	316
Merz & McCall (2010)	birthweight +	age at adoption & time in institution ^d ; $r = .77$, $p < .001$		yes	Russia ^b	specific-socially-emotionally depriving	adoptive families in USA	yes	—	342
Merz & McCall (2011)	birthweight +	age at adoption & time in institution ^d ; $r = .77$, $p < .001$		yes	mostly Russia	specific-socially-emotionally depriving	adoptive families in USA	yes	—	418
Miller, Chan, Tirella, & Perrin (2009)	—	—	—	yes ^c	Eastern Europe/Forme r Soviet Union	—	adoptive families in USA	yes	—	50
Oliveira, Soares, Martins, Silva, Marques, Baptista, & Lyons-Ruth (2012)	+	26% had no prior placements	26% at birth, 24% <5m, 23% 5–12m, 16.2% 12–18m, 10.8% 18–24m	yes	Portugal	—	institutions in Portugal	n/a	n/a	74
Western Europe										
Tizard Studies										
Tizard & Hodges (1978)	all healthy	—	< 4m	yes	UK	specific-adequate	adoptive families in UK	yes	—	25
Tizard & Rees (1975)	all healthy	—	< 4m	yes	UK	specific-adequate	adoptive families in UK	yes	—	24
Vorria, Rutter, Pickles, Wolkind, & Hobsbaum (1998a,b) ^d	—	18 lived with bio family, 18 lived in another residential unit	nearly half admitted around 5–6y; 16 admitted < 3.5y	yes	Greece	specific-socially-emotionally depriving	institutions in Greece	n/a	n/a	41
Wolkind (1974) ^d	—	58.7% in institution over half life	< 2y, > 2y	yes	UK	—	institutions in UK	n/a	n/a	92

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Middle East										
Gleitman & Savaya (2011)	+	count of pre-adoption placements	—	about 50%	Israel	specific-adequate	adoptive families in Israel	—	—	169
Africa										
Nielsen, Coleman, Guinn, & Robb (2004)	—	—	—	yes	Uganda	specific-quality of care varies by institution	institutions in Uganda	n/a	n/a	33
China										
Tan Studies										
Tan (2006)	—	some spent time in FC ^c	—	yes	China ^e	—	adoptive families in USA	yes	—	115
Tan & Camras (2011)	—	some spent time in FC ^c	—	yes ^c	China ^e	—	adoptive families in USA	yes	—	869
Tan, Camras, Deng, Zhang, & Lu (2012)	—	some spent time in FC ^c	—	yes ^c	China ^e	—	adoptive families in USA	yes	mixed	133
Tan & Marfo (2006)	—	some spent time in FC ^c	—	yes ^c	China ^e	general-socially-emotionally depriving	adoptive families in USA, Canada, Western Europe, and Australia	yes	—	695
Tan, Marfo, & Dedrick (2007)	—	some spent time in FC ^c	—	yes ^c	China ^e (specialneeds adoptions)	specific-socially-emotionally depriving	adoptive families in USA	yes	mixed	1093
Tan, Marfo, & Dedrick (2010)	—	some spent time in FC ^c	—	yes ^c	China ^e	specific-socially-emotionally depriving	adoptive families in USA	yes	mixed	452
Cohen & Farnia (2011)	—	18% orphanage care & FC; FC duration: M = 5.91m, SD = 4.11m; 4.3% FC only	—	77% orphanage care only	China ^e	—	adoptive families in Canada	yes	—	70
Dalen & Rygold (2006)	—	—	—	yes ^c	China ^e	—	adoptive families in Norway	—	—	77
Elliott & McMahon (2011)	—	—	—	87%	China ^e	—	adoptive families in Australia	yes	—	59
Rojewski, Shapiro, & Shapiro (2000)	—	—	—	—	China ^e	—	adoptive families in USA	yes	—	45
Other Asia										
Goldney, Donald, Sawyer, Kosky, & Priest (1996)	—	—	—	100% ^c	Indonesia	—	adoptive families in Australia	—	—	34
Lee, Seol, Sung, Miller, & the Minnesota International	—	Some lived with bio family, FC, or in hospital	<2y, >2y	yes	South Korea	specific-adequate	institutions in South Korea	n/a	n/a	612

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Adoption Project Team (2010) ^d										
Multiple Countries										
Barcons Studies										
Barcons, Abrines, Brun, Sartini, Fumadó, & Marre (2012)	—	—	—	86.2%	28% Asia, 47% Eastern Europe, 14% Latin America, 11%	—	adoptive families in Spain	—	116	
Barcons-Castel, Fornieles-Deu, & Costas-Moragas (2011)	—	14% family care, 14% foster care	—	92.3%	51.9% Asia, 26.9% Eastern Europe, 15.4% Central and South America, 5.8% Africa	—	adoptive families in Spain	yes	52	
Intl. Adoption Project (IAP) Team										
Bruce, Tarullo, & Gunnar (2009)	birthweight +	At least 70% of life in institution; < 6m family care before adoption	—	yes	Institution: Eastern Europe, China ^e ; FC: South Korea	specific-socially-emotionally depriving	adoptive families in USA	—	40	
Gunnar, Van Dulmen, & the International Adoption Project Team (2007)	—	75% of life in institutions before adoption	—	yes	29.6% Russia/Eastern Europe, 49.3% Asia, 20.2% Latin America/Caribbean	—	adoptive families in USA (Minnesota)	yes	899	
Verhulst, Althaus, & Versluis-Den Bieman (1990)	—	—	—	80.1% ^c	multiple	—	adoptive families in the Netherlands	—	2148	
Verhulst Studies										
Verhulst, Althaus, & Versluis-Den Bieman (1992)	—	—	—	80.1% ^c	32.0% Korea, 14.6% Colombia, 9.5% India, 7.9% Indonesia, 6.7% Bangladesh, 4.9% Lebanon, 50% Austria, 4.2% other European countries, 15.2% other non-European countries	—	adoptive families in the Netherlands	yes	2148	
Lindblad studies										
Elmund, Lindblad, Vinnerljung, & Hjern (2007)	—	some lived with bio family or FC	—	about 50%	27% South Asia, 30.7% East Asia, 27% Latin America, 2.3% Africa, 3.3% Middle East	—	adoptive families in Sweden	yes	16522	
Lindblad, Weitoft & Hjern (2010)	—	—	—	about 50% ^c	Far east, South Asia, Latin America, Eastern Europe, Middle East/Africa	—	adoptive families in Sweden	yes	161 34	
Camras, Perlman, Wismer Fries, & Pollack (2006)	—	15 Chinese children had FC, duration: M = 8.4m	—	yes	China ^e , Eastern Europe	—	adoptive families in USA	—	41	
Cederblad, Höök, Irhammer, & Merke (1999)	—	—	—	some	36% India, 15% Thailand, 15% Chile, 2% Ethiopia; 32% other Asia or Latin-America	—	adoptive families in Sweden	yes	147	

Reference	Prenatal/birth experience	Other placements	Age at admission	Institution-reared	Country of origin	Description of institution	Environment at time of testing			Sample size of target group
							Setting	Specific family characteristics described	Relation to outcomes	
Dalen (2001)	—	—	—	yes ^c	Colomb ia, Korea	—	adoptive families in Norway	—	—	193
Decker & Omori (2009)	—	—	—	— ^c	—	—	—	—	—	141
Habersaat, Tessier, & Pierreh umbert (2011)	—	—	—	yes ^c	Eastern Europe, East Asia, Latin America ^c	—	adoptive families in Canada	—	—	350
Kvifte Andresen (1992)	—	—	—	—	South Korea, Other	—	adoptive families in Norway	yes	—	151
Niemann & Weiss (2012)	—	For institution, FC, and bio family, 23% 1 type care, 65% 2 types, 14% 3 types	—	some	68% Asia, 14% Africa, 14% Central America, 5% Russia/ Eastern Europe	—	adoptive families in USA	yes	ns	22
Meta-analyses Juffer & van Ijzendoorn (2005)	—	—	—	some	multiple	—	adoptive families in multiple countries	—	—	14581 in 29 studies
van den Dries, Juffer, van Ijzendoorn, & Bakermans-Kranenburg (2009)	—	—	—	some ^f	multiple	—	adoptive families in USA, Canada, Europe, or Australia	—	—	722 in 17 studies

“+” = other prenatal information, BEIP = Bucharest Early Intervention Project, FC = Foster Care m = months, y = years, M = mean, Md = median, SD = standard deviation

^aThe high correlations suggest that limited time is left unaccounted for, so children were likely admitted to the institution early in life and experienced limited alternative placements

^bData from other countries was also included in this study, but age at adoption analyses were only included for Russian adoptees

^cThis article did not specify whether children were institution-reared; article authors were contacted to obtain this information

^dThese studies examined age at admission into institutional care in addition to or in lieu of examining age at adoption effects

^eThe vast majority of children adopted from China are female

^fThis meta-analysis did not specify whether children were institution-reared, but many of the studies that were analyzed included institution-reared children

Attachment & Parent-Child Relationships

Table 2

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Cederblad, Höök, Inhammar, & Merke (1999)	Multiple	—	13–27y	147	presence or absence of attachment with parent or sibs	parent interview	54% < 7m; 30% > 1y	< 1y, > 1y at adoption and < 6m or > 6m in institution	—	yes, but no statistical test	—	—
Gleitman & Savaya (2011)	Israel	Adequate	11–19.5y	169	communication with parents	Family/Parental Relationships module of Student Questionnaire (self-report)	0–9y; 57.4% < 2y, 42.6 2–9.5y	Continuous	correlation	yes	—	—
Tan & Marfo (2006)	China ¹	Socially-emotionally depriving emotionally depriving	1.5y–11y (retrospective)	695	initial rejecting behaviors (early relationship with adoptive mother)	parent interview	preschool: M = 14.2m, SD = 8.3m; school-age: M = 18.5m, SD = 23.7m	continuous, log transformed	correlation	yes	—	—
Tan, Marfo, & Dedrick (2007)	China ¹	Socially-emotionally depriving	1.5y–5y (retrospective)	SN = 63 Non-SN = 689	initiala dapitation to adoption (early relationship with adoptive mother)	parent interview	SN: M = 25.85, SD = 10.82; Non-SN: M = 12.71, SD = 4.87	continuous	multiple regression	yes	—	—
	China ¹	Socially-emotionally depriving	6y–15.7y (retrospective)	SN = 61 Non-SN = 280	initial adaptation to adoption (early relationship with adoptive mother)	parent interview	SN: M = 46.98, SD = 37.45; Non-SN: M = 15.61, SD = 15.80	continuous	multiple regression	yes	—	—
Tan, Marfo, & Dedrick (2010)	China ¹	Socially-emotionally depriving	1.5y–5y (retrospective)	452	initial adaptation to adoption (early relationship with adoptive mother)	parent interview	3–50m; M = 13.1m, SD = 5.1m	continuous, natural log transformed	correlation	yes	—	—
van den Dries, Juffer, van IJzendoorn, & Bakermans-Kranenburg (2009)	Multiple	—	all ages	17 studies, 722 participants	attachment security	various measures	—	< 12m, > 12m	Q (compared effect sizes)	yes	—	—
Mixed Results												
Croft, O'Connor, Keaveney, Groothues, Rutter, & the ERA Study Team (2001)	Romania	Globally depriving	4y, 6y	165	parent-child relationship	coded observations: Parent Positivity, Parent Negativity, Child Positivity, Child Negativity	52 < 6m, 586–24m, 482–42m	continuous and < 6m, 6–24m, > 24m	correlation; multiple regression	yes, effect disappears when later-adoptees (> 24m) are removed from analyses	—	mediated by cognitive ability
O'Connor, Marvin, Rutter, Olrick, Brimer, & the ERA Study Team (2003)	Romania	Globally depriving	4y	111	attachment security	separation and reunion procedure	58 < 6m, 597–24m	continuous and < 6m, 7–24m	chi-squared	no	—	—
	Romania	Globally depriving	4y	111	attachment organization ²	separation and reunion procedure	58 < 6m, 597–24m	continuous and < 6m, 7–24m	chi-squared	yes	—	—
Hobbsaat, Tessier, & Pierrehumbert (2011)	Multiple	—	12–18y	350	attachment security	parent questionnaire (measure not named)	83 < 6m, 526–12m, 4312–24m, 172 > 24m	< 6m, 6–12m, 12–24m, > 24m	—	yes for < 6m and > 24m; no for < 12m and > 12m	—	—
Snyke, Zeanah, Fox, Nelson, & Guthrie (2010)	Romania	Globally depriving ³	3.5y	68	attachment security	separation and reunion procedure	> 6m ⁴	dichotomized at various points (18m, 20m, 22m, 24m, 26m, 28m)	chi-squared	yes, only for cut-offs of 24m and later	deflection point (24m) evident	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
	Romania	Globally depriving ³	3.5y	68	attachment organization ²	separation and reunion procedure	> 6m ⁴	dichotomized at various points (18m, 20m, 22m, 24m, 26m, 28m)	chi-squared	yes (at all age at adoption cutoffs)	possibly linear	—
Null Results												
Anes (1997)	Romania	Globally depriving	most 4.5y; some 5.5-9y	46	attachment security	separation and reunion procedure	8–68m; Md = 18.5m ⁵	continuous ⁵	—	no	—	—
Chisholm, Carter, Anes, & Morrison (1995)	Romania	Globally depriving ³	1y5m–6y4m	46	attachment security	23-item Attachment Q-sort (parent-report)	8–68m; Md = 18.5m	continuous	correlation	no	—	—
	Romania	Globally depriving ³	1y5m–6y4m	46	parent's attachment to child	Parenting Stress Index parent attachment subscale (parent-report)	8–68m; Md = 18.5m	continuous	correlation	no	—	—
Barcons, Abriees, Brun, Sartini, Fumadó, & Marre (2012)	Multiple	—	8–11y	116	attachment security	Friends and Family Interview (self-report)	1–103m; M = 30.61m, SD = 21.94m	< 12m, 13–36m, > 36m	chi-squared	no	—	—
	Multiple	—	8–11y	116	relationship with parents	BASC subscale (self-report)	1–103m; M = 30.61m, SD = 21.94m	continuous	linear regression	no	—	—
Cohen & Farnia (2011)	China /	—	8m–4y	70	attachment security	23-item Attachment Q-sort (parent-report)	18–21m; M = 13m	continuous	regression	no	—	—
Marcovitch, Goldberg, Gold, Washington, Wassenaar, Krakovich, & Handley-Derry (1997)	Romania	Globally depriving	3–5y	56	attachment organization ²	separation and reunion procedure	0–48m; 37 < 6m, 19 > 6m	—	—	no	—	—
Nielsen, Coleman, Gunn, & Robb (2004)	Ug and a	Various levels of deprivation	1–3y	33	child's need for physical contact with adult	observation of free play	3m–3y; M = 1.5y, SD = .67y ⁶	< 1y, 1–2y, 2–3y ⁶	MANCOVA	no	—	—
Nienham & Weiss (2012)	Multiple	—	1–2y	22	attachment security	90-item Attachment Q-sort (experimenter tested)	6–19m; M = 12.27m	continuous	correlation	no	—	—
Tan (2006)	China /	Socially-emotionally depriving ²	6–8y (retrospective)	115	initial rejecting behaviors (early relationship with adoptive mother)	parent interview	< 2y; M = about 9m, SD = about 4.5m	continuous	multiple regression	no	—	—
Tizard & Hodges (1978)	UK	Adequate	8y	25	attachment security	parent interview	most 2–4y; 54.5–7.5y	—	—	no	—	—

Note. Top section includes positive results, middle section includes mixed results, bottom section indicates null results

SN = special needs, m = months, y = years, M = mean, Md = median, SD = standard deviation, BASC = Behavior Assessment System for Children

¹The vast majority of children adopted from China are female

² Attachment Organization refers to the distinction between MacArthur's categories of secure (B), avoidant (A), and ambivalent-dependent (C), vs. disorganized-controlling (D) and insecure-other (I-O)

³This article did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation.

⁴In this study, children moved from an institution to foster care (not an adoptive home) at this age

⁵ This study used time in the orphanage instead of age at adoption; these two variables were correlated at $r = .97$.

⁶ This study assessed children who were still institutionalized, so duration of institutionalization was assessed rather than age at adoption.

Table 3

Reactive Attachment Disorder and Disinhibited Social Behavior

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Bruce, Tarullo, & Gunnar (2009)	Eastern Europe, China /	Socially-emotionally depriving	6–7y	40	disinhibited social behavior	observational measure; parent interview ²	< 36m	continuous	correlation	yes	—	mediated by inhibitory control
O'Connor, Bredenkamp, Rutter, & The ERA Study Team (1999)	Romania	Globally depriving	4y	111	disinhibited or inhibited attachment behavior	3-item parent interview ³ ; additional items for inhibited attachment	< 24m	continuous and < 6m, 7–24m	correlation	yes	linear	not mediated by nutritional deprivation or cognitive impairment
O'Connor, Rutter, & The ERA Study Team (2000)	Romania	Globally depriving	4y, 6y	165	disinhibited or inhibited attachment behavior	3-item parent interview ³ ; additional items for inhibited attachment	58 < 6m, 59 6–24m, 48 > 24m	continuous and < 6m, 6–24m, > 24m	correlation, chi-squared	yes	linear	not accounted for by other behavioral or emotional problems, or by cognitive ability; stable from 4y to 6y
Rutter, Kreppner, & O'Connor (2001)	Romania	Globally depriving	6y	165	disinhibited or inhibited attachment behavior	3-item parent interview ³ ; additional items for inhibited attachment	58 < 6m, 59 6–24m, 48 > 24m	< 6m, 6–24m, > 24m	chi-square trends	yes	—	—
Rutter, O'Connor, and the ERA Study Team (2004)	Romania	Globally depriving	4y, 6y	144	disinhibited attachment	3-item parent interview ³	45 < 6m, 54 6–24m, 45 > 24m	< 6m, 6–24m, > 24m	chi-square; correlation	yes	—	—
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell (2010)	Romania	Globally depriving	6y, 11y, 15y	144	disinhibited attachment	3-item parent interview ³	58 < 6m, 59 6–24m, 48 > 24m	< 6m (combined with non-PI), > 6m	Fisher's exact test	yes	—	partial mediation by head circumference (20% of total effect)
Sonuga-Barke, Beckett, Kreppner, Colvert, Stevens, Hawkins, & Rutter (2008)	Romania	Globally depriving	11y	138	disinhibited attachment	3-item parent interview ³	.5–3y7m	< 6m, > 6m	ANOVA; regression	yes	—	overall sample; not mediated by head circumference; sub-nourished subgroup: possibly mediated by head circumference
Mixed Results												
Rutter, Colvert, Kreppner, Beckett, Castle,	Romania	Globally depriving	4y, 6y, 11y	111	disinhibited attachment	3-item parent interview ³	44 < 6m, 88 6–42m	continuous and < 6m, 6–42m	chi-square; phicoefficient (contrast); t-test	yes, for persistence of DA over	—	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Groothues, Hawkins, O'Connor, Stevens, & Sonuga-Barke (2007)										time, and for correlation among 6–42m at adoption group, but ns for correlation of whole sample		
Snyke, Zeanah, Gleason, Drury, Fox, Nelson, & Guthrie (2012)	Romania	Globally depriving ⁴	6m–8y	68	disinhibited attachment disorder	Disturbances of Attachment Interview (first 5 items) 5 (parent-report)	Md = 24m ⁶	< 24m, > 24m ⁶	repeated-measures ANOVA	yes	—	interaction with age at assessment
	Romania	Globally depriving ⁴	6m–8y	68	inhibited attachment disorder	Disturbances of Attachment Interview (last 3 items) 7 (parent-report)	Md = 24m ⁶	< 24m, > 24m ⁶	repeated-measures ANOVA	no	—	—
Null Results												
Ames (1997)	Romania	Globally depriving	most 4.5y, some 5.5–9y	46	indiscriminate friendliness	5-item parent interview ⁸	8–68m; Md = 18.5m ⁹	continuous ⁹	—	no	—	—
Chisholm (1998)	Romania	Globally depriving	1y5m–9y2m	46	indiscriminate friendliness	5-item parent interview ⁸	8–68m; Md = 18.5m ⁹	— ⁹	—	no	—	—
Chisholm, Carter, Ames, & Morison (1995)	Romania	Globally depriving ⁴	1y5m–6y4m	46	indiscriminate friendliness	5-item parent interview ⁸	8–68m; Md = 18.5m	continuous	correlation	no	—	—
Nielsen, Coleman, Guinn, & Robb (2004)	Ug and a	Various levels of deprivation	1–3y	33	discriminating social behavior	observation of free play	3m–3y; M = 1.5y, SD = .67y ¹⁰	< 1y, 1–2y, 2–3y ¹⁰	ANCOVA	no	—	—
Tizard & Hodges (1978)	UK	Adequate	8y	25	“over-friendliness”	parent interview or observations	2y–7.5y	—	—	no	—	—
Tizard & Rees (1975)	UK	Adequate	4.5y	24	“over-friendliness” or “indiscriminately affectionate”	observations	M = 3.11y; SD = .69	—	—	no	—	—
							Age at admission: Distribution	Age at admission: Measurement		Significant effect of age at admission		
Oliveira, Soares, Martins, Silva, Marques, Baptista, & Lyons-Ruth (2012)	Portugal	—	11–30m	74	indiscriminate behavior	RISE (observational measure based on SSP)	26% at birth, 24% < 5m, 23% 5–12m, 16.2% 12–18m, 10.8% 18–24m	continuous and various cutoff points	correlation, other tests not listed	no	—	—

DA = disinhibited attachment, RISE = Rating of Infant and Stranger Engagement, SSP = Strange Situation Procedure, m = months, y = years, M = mean, Md = median, SD = standard deviation

¹The vast majority of children adopted from China are female

²Items were: child too eager to approach, made personal comments to adults, initiated physical contact with unfamiliar adults

³Items were: definite lack of differentiation among adults with respect to the child's social response to them, clear indication that the child would readily go off with a stranger, definite lack of checking back with parent in anxiety-provoking situations

⁴This article did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation.

⁵Items were: whether the child has developed a preference for a specific caregiver, approaches the caregiver for comfort, responds to comfort when offered, engages in reciprocal social interaction, regulates emotions well

⁶In this study, children moved from an institution to foster care (not an adoptive home) at this age

⁷Items were: whether the child checks back with the caregiver when exploring, shows age-appropriate reticence around strangers, demonstrates willingness to "go off" with a stranger

⁸Items were: child wandered without distress, child would be willing to go home with a stranger, child was friendly to strangers, child was ever shy, what a child typically did upon meeting new adults

⁹This study used time in the orphanage instead of age at adoption; these two variables were correlated at $r = .97$

Quasi-Autism and Theory of Mind

Table 4

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Rutter, Kreppner, & O'Connor (2001)	Romania	Globally depriving	6y	165	Quasიაutistic features	ASQ, ADI-R (parent-report, experimenter tested)	58 < 6m, 59 6–24m, 48 24–42m	< 6m, 6–24m, > 24m	chi square trends	yes	—	—
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsia, Schlotz, Stevens, & Bell (2010)	Romania	Globally depriving	6y, 11y, 15y	144	Quasიაutism	SCQ for screening, then ADI-R and ADOS (parent-report, experimenter tested)	58 < 6m, 59 6–24m, 48 24–42m	< 6m, > 6m	none (listed % with problems in each group); regression	yes	—	not mediated by head circumference
Sonuga-Barke, Beckett, Kreppner, Castle, Colvert, Stevens, & Rutter (2008)	Romania	Globally depriving	11y	138	Quasიაutistic features	SCQ (parent-report)	.5m–3y7m	< 6m, > 6m	ANOVA	yes	—	Effect was independent of subnutrition status; not mediated by head circumference
Mixed Results												
Colvert, Rutter, Kreppner, Beckett, Castle, Groothues, Hawkins, Stevens, & Sonuga-Barke (2008b)	Romania	Globally depriving [/]	11y	144	Theory of mind	Strange Stories Task (experimenter tested)	58 < 6m, 59 6–24m, 48 24–42m	continuous, < 6m, > 6m	correlation, ANOVA, ANCOVA	yes; ns when correlated only within > 6m group	probable step function at 6m	still significant after co-varying IQ

Note. Top section includes positive results, bottom section includes mixed results

ASQ = Autism Screening Questionnaire, ADI-R = Autism Diagnostic Interview – Revised, SCQ = Social Communication Questionnaire, ADOS = Autism Diagnostic Observation Schedule, m = months, y = years

[/] This article did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation.

Table 5

Peer Relationships

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Barcons, Abrínes, Brun, Sartini, Fumadó, & Marre (2012)	Multiple	—	8–11y	116	social stress	BASC subscale (self-report)	1–103m, M = 30.61m, SD = 21.94m	continuous	linear regression	yes	—	—
	Multiple	—	8–11y	116	interpersonal relations with peers	BASC subscale (self-report)	1–103m, M = 30.61m, SD = 21.94m	continuous	linear regression	yes	—	—
Cederblad, Höök, Irhammer, & Merke (1999)	Multiple	—	13–27y	147	relations to others	Self-esteem questionnaire 'I think I am' (self-report)	54% < 7m; 30% > 1y	< 6m, > 6m;	—	yes	—	—
O'Connor, Rutter, & The ERA Study Team (2000)	Romania	Globally depriving	6y	165	peer relationship disturbance	parent interview	58 < 6m, 59 6–24m, 48 > 24m	continuous	correlation	yes	—	mediated by attachment disturbance
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell (2010)	Romania	Globally depriving	6y, 11y, 15y	144	peer difficulties	Rutter/SDQ subscales (parent & teacher-report)	58 < 6m, 59 6–24m, 48 > 24m	< 6m, > 6m	chisquare; ANOVA	yes, for parent and teacher report	—	significant at all ages at assessment, but significant interaction with age at assessment: problems increase from 6y to 11y, no further increase from 11y to 15y; evidence of mediation by DSP
Mixed Results												
Nielsen, Coleman, Guinn, & Robb (2004)	Ug and a	Various levels of deprivation	1–3y	33	time spent with peers, adults, or alone	observation of free play	3m–3y; M = 1.5y, SD = .67y ¹	< 1y, 1–2y, 2–3y ¹	MANCOVA	yes; only for interaction	—	interaction between duration of institutionalization and contact with relatives; spent more time with another child if < 1y in institution and contact with

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
												relatives, or 2–3y in institution and no contact with relatives
Null Results												
Rutter Kreppner, & O'Connor (2001)	Romania	Globally depriving	6y	144	peer difficulties	Rutter parent and teacher scales; parent interview	58 < 6m, 59 6–24m, 48 > 24m	< 6m, 6–24m, > 24m	chisquare trends	no	—	—
							Age at admission: Distribution	Age at admission: Measurement		Significant effect of age at admission?	—	—
Vorria, Wolkind, Rutter, Pickles, & Hobsbaum (1998b)	Greece	Socially-emotionally depriving	9–11y	41	peer relationships	parent interview	half admitted around 5–6y, 16 admitted before 3.5y	< 3.5y, 3.5y–5.5y, > 5.5y	—	no	—	—

Note. Age at adoption findings are listed above age at admission findings. Within age at adoption section, top section includes positive results, middle section includes mixed results, and bottom section includes null results.

BASC = Behavior Assessment System for Children SDQ = Strengths and Difficulties Questionnaire, DSP = Deprivation-specific psychological patterns, m = months, y = years

/ This study assessed children who were still institutionalized, so duration of institutionalization was assessed rather than age at adoption

Social Competence and Social Problems

Table 6

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Ames (1997)	Romania	Globally depriving	most 4.5y; some 5.5–9y	46	adaptive and personal-social problems	Gesell test (experimenter tested)	8–68m; Md = 18.5m /	continuous /	correlation	yes	—	—
	Romania	Globally depriving	most 4.5y; some 5.5–9y	46	social behavior problems	Factor derived from SSRS, PBQ, & CBCL (parent-report)	8–68m; Md = 18.5m /	continuous /	correlation	yes	—	—
Cantzas, Perlman, Wisner Fries, & Pollack (2006)	China ² , Eastern Europe	—	4–5.5y	41	emotion identification	Emotion Situation Task; Emotion Identification Task (experimenter tested)	Chinese: M = 14m, SD = 4.9m; Eastern European: M = 19.1m, SD = 11.6m	continuous	correlation	yes	—	—
Cederblad, Höök, Ihmanner, & Merke (1999)	Multiple	—	13–27y	147	social problems	CBCL subscale (parent-report)	54% < 7m; 30% > 1y	< 6m, > 6m;	ANOVA	yes	—	—
Gunnar, van Dulmen, & the International Adoption Project Team (2007)	Multiple	—	4–18y	899	social problems	CBCL subscale (parent-report)	M = 29.5m, SD = 30.7m	< 24m, > 24m	logistic regression	yes	—	—
Hawk & McCall (2011)	mostly Russia	Socially-emotionally depriving	6–18y	316	social problems	CBCL subscale (parent-report)	3.3–57.7m; M = 16m, SD = 11.4m	< 18m, > 18m	ANOVA, MANOVA, not specified	yes	step function at 18m	—
Merz & McCall (2010)	mostly Russia	Socially-emotionally depriving	6–18y	342	social problems	CBCL subscale (parent-report)	M = 16.4m, SD = 11.75m	< 9, 9–17m, 18m; < 18m, > 18m	chi square; hierarchical multiple regression	yes	probable step function at 18m	effect is especially prominent for older-at-assessment group (12–18y)
Mixed Results												
Habersaat, Tessier, & Pierrehumbert (2011)	Multiple	—	12–18y	350	social problems	CBCL subscale (parent-report)	83 < 6m, 52 6–12m, 43 12–24m, 172 > 24m	< 6m, 6–12m, 12–24m, > 24m	—	yes, for < 6m and > 24m; no for < 12m and > 12m	—	—
Nielsen, Coleman, Guinn, & Robb (2004)	Ug and a	Various levels of deprivation	1–3y	33	range of facial expressions; affect variability	observation of free play	3m–3y; M = 1.5y, SD = .67y ³	< 1y, 1–2y, 2–3y ³	MANCOVA	yes: only for interaction	—	multivariate interaction between duration of institutionalization and contact with relatives;

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
												univariate effects were ns
	Ug and a	Various levels of deprivation	1–3y	33	prosocial behavior	observation of free play	3m–3y: M = 1.5y, SD = .67y; ²	< 1y, 1–2y, 2–3y; ³	ANCOVA	no	—	—
Tan & Camras (2011)	China ²	Socially-emotionally depriving ⁴	M = 6.9y, SD = 2.9y	869	social skills	SSRS (parent-report)	M = 15.6m, SD = 13.9m	continuous	regression	Total score: marginal, yes for some subscales	—	—
	China ²	Socially-emotionally depriving ⁴	M = 6.9y, SD = 2.9y	869	social skills	SSRS (teac herreport)	M = 15.6m, SD = 13.9m	continuous	regression	Total score: yes, yes for some subscales	—	—
Null Results												
Barcons-Castel, Fornieles-Detu, & Costas-Moragas (2011)	Multiple	—	6–11y	52	social skills	BASC subscale (parent & self-report)	8–84m: M = 28.75m, SD = 21.42m	< 12m, 13–36m, > 37m	unifactorial ANOVA	no	—	—
	Multiple	—	6–11y	52	leadership	BASC subscale (parent & self-report)	8–84m: M = 28.75m, SD = 21.42m	< 12m, 13–36m, > 37m	unifactorial ANOVA	no	—	—
Dalen & Rygold (2006)	China ²	—	7–13y	77	social skills	SSRS (teacherreport)	2m–52m: M = 6.88, SD = 9.28	—	—	no	—	—
Tan (2006)	China ²	Socially-emotionally depriving ⁴	6–8y	115	social problems	CBCL subscale (parent-report)	< 2y	continuous	regression	no	—	—
Verhulst, Althaus, & Versluis-Den Bieman (1990)	Multiple	—	6–21y	16,134	social competence	CBCL subscale (parent-report)	513 0–6m, 221 7–12m, 329 13–24m, 25–36m, 37–48m, 25–36m, 278 37–48m, 198 49–60m, 156 61–72m, 142 73–125m	< 6m, 7–12m, 13–24m, 25–36m, 37–48m, 49–60m, 61–72m, 73–125m	ANCOVA	no	—	—

Note. Top section includes positive results, middle section includes mixed results, and bottom section includes null results.

SSRS = Social Skills Rating System, PBQ = Preschool Behavior Questionnaire, CBCL = Child Behavior Checklist, BASC = Behavioral Assessment System for Children, m = months, y = years, M = mean, Md = median, SD = standard deviation

¹This study used time in the orphanage instead of age at adoption; these two variables were correlated at r = .97

²The vast majority of children adopted from China are female

³This study assessed children who were still institutionalized, so duration of institutionalization was assessed rather than age at adoption

⁴These articles did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation

Behavior problems

Table 7

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Anes (1997)	Romania	Globally depriving	most 4.5y; some 5.5–9y	46	stereo typed behavior problems	parent interview	8–8m; Md = 18.5m <i>I</i>	continuous <i>I</i>	correlation	yes	—	—
	Romania	Globally depriving	most 4.5y; some 5.5–9y	46	behavior problems	CBCL (parent-report)	8–8m; Md = 18.5m <i>I</i>	continuous <i>I</i>	correlation	yes, for Total, Internalizing, and Externalizing	—	—
Fisher, Anes, Chisholm, & Savoe (1997)	Romania	Globally depriving	18–76m	46	behavior problems	CBCL (parent-report)	806m; M = 18.5 <i>I</i>	continuou <i>I</i>	correlation	yes for Total and Internalizing, marginal for Externalizing	—	—
	Romania	Globally depriving	18–76m	46	rate of improvement in stereo typed behavior problems	parent interview	8–6m; M = 18.5 <i>I</i>	continuous <i>I</i>	correlation	yes	—	—
Beckett, Bredenkam, Castle, Groothues, O'Connor, Rutter, & The ERA Study Team (2002)	Romania	Globally depriving	6y	144	Rocking, self-injury, unusual sensory interests, problems with chewing and swallow wing	parent interview	45 0–6m, 19 6–2m, 35 12–24m, 45 24–42m	< 6m, 6–12m, 12–24m, 24–42m	chi square trends, ANOVA	yes	linear, step function at 6m	—
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell (2010)	Romania	Globally depriving	6y, 11y, 15y	144	Deprivation Specific Psychological Patterns	most extreme 15% for cognitive impairment, quasitautistic patterns, inattention/over activity, and disinhibited attachment (parent & teacher-report)	58 < 6m, 59 6–24m, 48 > 24m	< 6m (combined with UK adoptees and non-PI Romanian adoptees), > 6m	logistic regression, Fisher's exact test	yes	past work suggests step function at 6m	subnutrition did not relate to DSP independently or through an interaction with age at adoption; DSP was related to head circumference
	Romania	Globally depriving	6y, 11y, 15y	144	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent & teacher-report)	58 < 6m, 59 6–24m, 48 > 24m	< 6m (combined with UK adoptees and non-PI Romanian adoptees), > 6m	ANOVA; path analysis	yes	past work suggests step function at 6m	no effect of gender; effect present at all ages, but interaction with age at assessment: more problems at 11 and 15 than at 6; mediated by DSP
Ellis, Fisher, & Zaharie (2004)	Romania	—	2–6y	51	anxiety/affective symptoms	ECI-4 (parent-report)	1m–5.5y; M = 2.5y <i>2</i>	continuous <i>2</i>	multiple regression	yes	—	—
Elmund, Lindblad, Vinnerljung, & Hjerm (2007)	Multiple	—	No info	16,522	out of home care due to child's behavior	rates of out of home care in national database	78% before age 2y, 15.5% age 2–3y, 6.5% age 4–6y	0–1y, 2–3y, 4–6y	logistic regression	yes	—	—
Gunnar, von Dahlen, & the International	Multiple	—	4–18y	899	behavior problems	CBCL (parent-report)	M = 29.5m, SD = 30.7m; 38% were 24m	< 12m, > 12m; < 24m, > 24m	multivariate logistic regression	yes	—	no interaction between age at adoption and PI status

Julian

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Adoption Project Team (2007)												
Hawk & McCall (2011)	mostly Russia	Socially-emotionally depriving	6–18y	316	behavior problems	CBCL (parent-report)	3.3–57.7m; M = 16.0m, SD = 11.4	< 18m, > 18m; < 6m, 6–11m, 12–17m, 18–23m, 24m +	ANOVA, MANOVA	yes	step function at 18m	effects only present at older age at assessment (12–18y)
Merz & McCall (2010)	mostly Russia	Socially-emotionally depriving	6–18y	342	behavior problems	CBCL (parent-report)	M = 16.4, SD = 11.75	< 9m, 9–17m, 18m	chi square; hierarchical multiple regression	yes	step function at 18m	effects only present at older age at assessment (12–18y)
Verhulst, Althaus, & Versluis-Den Bieman (1990)	Multiple	—	10–15y	2148	behavior problems	CBCL (parent-report)	513 0–6m, 221 7–12m, 329 13–24m, 311 25–36m, 278 37–48m, 198 49–60m, 156 61–72m, 142 73–125m	< 6m, 7–12m, 13–24m, 25–36m, 37–48m, 49–60m, 61–72m, 73–125m	chi square; ANCOVAs	yes, for extreme scores (total sample), internalizing, and externalizing	sharp increase in problems after 24m	interaction with age at assessment for internalizing but not externalizing
Verhulst, Althaus, & Versluis-Den Bieman (1992)	Multiple	—	9–17y	3519	behavior problems	CBCL (parent-report)	0–10y; majority < 4y	< 6m, 7–12m, 13–24m, 25–36m, 37–48m, 49–60m, 61–72m, 73–125m	log-linear analyses	yes	—	effect is over and above that of age at assessment and gender; effect is better accounted for by abuse, neglect, and number of placements
Mixed Results												
Cederblad, Höök, Irhamner, & Merke (1999)	Multiple	—	13–27y	147	behavior problems	CBCL (parent-report)	54% < 7m; 30% > 1y	< 1y, > 1y at adoption	ANOVA	yes, for 1 subscale	—	—
	Multiple	—	13–27y	147	behavior problems	CBCL (parent-report)	54% < 7m; 30% > 1y	< 6m or > 6m in institution or foster care	ANOVA	yes, for total score and 4 subscales	—	—
Häbersaat, Tessier, & Pierrehumbert (2011)	Multiple	—	12–18y	350	behavior problems	CBCL (parent-report)	83 < 6m, 52 6–12m, 43 12–24m, 172 > 24m	< 6m, 6–12m, 12–24m, > 24m	—	yes, for < 6m and > 24m; no for < 12m and > 12m	—	moderated by maternal solicitations style; not moderated by attachment
Kreppner, Rutter, Beckett, Castle, Colvert, Groothues, Hawkins, O'Connor, Stevens, & Sonuga-Barke (2007)	Romania	Globally depriving	6y, 11y	144	impairments	most extreme 15% for cognitive impairment, quasiantisocial patterns, inattention/over activity, disinhibited attachment, conduct problems, emotional problems, peerrelationship problems (parent & teacher-report)	0–42m	continuous; < 6m, 6–24m, > 24m	chi square; binary logistic regression	yes, but only < 6m, > 6m comparison	step function at 6m	no interaction with weight at adoption (subnutrition)
Rutter, Kreppner, & O'Connor (2001)	Romania	Globally depriving	6y	165	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent & teacher-report)	58 < 6m, 59 6–24m, 48 > 24m	< 6m, 6–24m, 24–42m	chi square trends	no	—	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
	Romania	Globally depriving	6y	165	dysfunction	problems in attachment, attention, emotional, autism, cognition, peer or conduct domains (parent & teacher-report)	58 < 6m, 59 6–24m, 48 > 24m	< 6m, 6–24m, 24–42m	—	yes	—	—
Nielsen, Coleman, Gunn, & Robb (2004)	Ug and a	Various levels of deprivation	1–3y	33	temperament	care giver interview	3m–3y; M = 1.5y, SD = .67y ²	< 1y, 1–2y, 2–3y ²	MANCOVA	no	—	—
	Ug and a	Various levels of deprivation	1–3y	33	aggressiveness toward other children, objects, and adults	observation of free play	3m–3y; M = 1.5y, SD = .67y ²	< 1y, 1–2y, 2–3y ²	MANCOVA	yes: only for interaction	—	interaction between duration of institutionalization and contact with relatives; longer institutionalization and contact with relatives was associated with aggressiveness toward adults
	Ug and a	Various levels of deprivation	1–3y	33	negative affect, crying	observation of free play	3m–3y; M = 1.5y, SD = .67y ²	< 1y, 1–2y, 2–3y ²	MANCOVA	yes: only for interaction	—	interaction between duration of institutionalization and contact with relatives; only multivariate effect reached significance
	Ug and a	Various levels of deprivation	1–3y	33	positive affect	observation of free play	3m–3y; M = 1.5y, SD = .67y ²	< 1y, 1–2y, 2–3y ²	MANCOVA	no	—	—
Macovitch, Cesaroni, Roberts, & Swanson (1995)	Romania	Globally depriving	7m–11y	130	Behavior problems	questionnaire designed for current study (parent-report)	100 < 2y, 30 > 2y	< 2y, > 2y	—	yes, for some domains (but no statistical test)	—	—
Tan, Marfo, & Dedrick (2007)	China ³	Socially-emotionally depriving	1.5y–5y	SN = 63 Non-SN = 689	behavior problems	CBCL 1.5–5y (parent-report)	SN: M = 23.85, SD = 10.82; non-SN: M = 12.71, SD = 4.87	continuous	multiple regression	no	—	—
	China ³	Socially-emotionally depriving	6y–15.7y	SN = 61 Non-SN = 280	behavior problems	CBCL (parent-report)	SN: M = 46.98, SD = 37.45; non-SN: M = 15.61, SD = 15.80	continuous	multiple regression	yes, for Total problems (but small correlation)	—	—
Tan, Marfo, & Dedrick (2010)	China ³	Socially-emotionally depriving	1.5y–5y	452	behavior problems	CBCL (parent-report)	3–50m; M = 13.1m, SD = 5.1m	continuous, natural log transformed	correlation, regression	yes for correlations at Time 2; only for Total (not internalizing, externalizing) at Time 1; for regression, only T2 Externalizing and Total were	—	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
										significant (small magnitude)		
Null Results												
Barcons-Castel, Fomelos-Deu, & Costas-Moragas (2011)	Multiple	—	6–11y	52	behavior problems	various BASC subscales (parent & self-report)	8–84m; M = 28.75m, SD = 21.42m	< 12m, 13–36m, > 37m	unifactorial ANOVA	no	—	—
Colvert, Rutter, Beckett, Castle, Groothues, Hawkins, Kreppner, O'Connor, Stevens, & Sonuga-Barke (2008a)	Romania	Globally depriving ⁴	6y, 11y	144	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent & teacher-report)	< 43m	continuous; < 6m, > 6m	t-test, chi square	no	—	—
Kreppner, O'Connor, Rutter, & The ERA Study Team (2001)	Romania	Globally depriving	4y, 6y	137	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent & teacher-report)	0–42m	continuous; < 6m, 6–24m, > 24m	correlation	no	—	—
Cohen & Fania (2011)	China ³	—	1.5–4y	70	behavior problems	CBCL (parent-report)	8–21m; M = 13m	continuous	regression	no: ns for internalizing, marginal for externalizing	—	—
Dalen & Rygold (2006)	China ³	—	7–13y	77	problem behavior	Rutter scales (teacher-report)	2–52m; M = 6.88m, SD = 9.28m	—	step-wise multiple regression	no	—	—
Elliott & McMahon (2011)	China ³	—	3–8y	59	anxiety	PAS, SCAS-P (parent-report)	6–54m; M = 14.71m, SD = 7.66m	continuous	correlation	no	—	—
Goldney, Donald, Sawyer, Kosky, & Priest (1996)	Indonesia	—	M = 15.2y, SD = 2.1y	34	behavior problems	CBCL (parent-report)	1m–7.5y; M = 17m, SD = 1.7y	continuous	correlation	no	—	—
	Indonesia	—	M = 15.2y, SD = 2.1y	34	behavior problems	YSR (self-report)	1m–7.5y; M = 17m, SD = 1.7y	continuous	correlation	no	—	—
Juffer & van Ijzen doorn (2005)	Multiple	—	all ages	29 studies, 14,581 participants	behavior problems	various	45% of studies 0–12m; 21% of studies 12–24m; 24% of studies > 24m; 10% of studies not reported	< 12m, > 12m; < 24m, > 24m	meta-analysis	no for Total, Internalizing, and Externalizing	—	—
Miller, Chan, Tirella, & Perrin (2009)	Eastern Europe	Globally depriving	8–10y	50	behavior problems	BASC (parent & teacher-report)	4–55m; 50% < 18m	continuous	correlation	no	—	—
Tan, Camras, Deng, Zhang, & Lu (2012)	China ³	Socially-emotionally depriving ⁴	2–6y	133	behavior problems	CBCL (parent-report)	8–31m; M = 12.8m	continuous	correlation	no for Total, Internalizing, and Externalizing	—	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Tan & Marfo (2006)	China, ³	Socially-emotionally depriving	1.5y–11y	695	behavior problems	CBCL (parent-report)	preschool: M = 14.2m, SD = 8.3m; school-age: M = 18.5m, SD = 23.7m	continuous, log transformed	correlation, hierarchical regression	no for Total, Internalizing, and Externalizing	—	—
Tizard & Hodges (1978)	UK	Adequate	8y	25	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent-report)	most between 2y and 4y; 5 between 4.5y and 7.5y	—	point biserial correlation	no	—	—
Tizard & Rees (1975)	UK	Adequate	4.5y	24	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent-report)	Mean = 3.11y, SD = .69y	—	—	no	—	—
							Age at admission: Distribution	Age at admission: Measurement		Significant effect of age at admission?		
Lee, Seol, Sung, Miller, & the Minnesota International Adoption Project Team (2010)	South Korea	Adequate	4–8y	382	behavior problems	CBCL (care giver-report)	M and SD for children with relinquishing parent, living parent, living parent, and deceased/unknown parent were 0.96y (0.64), 4.69y (1.50), 4.47y (1.46)	< 2y, > 2y	ANCOVA	yes	—	—
Wolkind (1974)	UK	—	5y–12y	92	antisocial disorder, stealing, lying, destructiveness, fighting, disinhibition	caregiver interview	49 < 2y, 43 > 2y	< 2y, > 2y	chi square, Fisher exact test	yes, only for disinhibition	—	effect for disinhibition only significant in older at assessment group (> 8y)
Vorria, Rutter, Pickles, Wolkind, & Hobsbaum (1998b)	Greece	Socially-emotionally depriving	9–11y	41	emotional (internalizing) and conduct (externalizing) problems	Rutter Scales (parent & teacher-report)	nearly half admitted around 5–6y; 16 admitted before 3.5y	< 3y6m, 3y6m–5y6m, > 5y6m	—	no	—	—

Note. Age at adoption findings are listed above age at admission findings. Within each portion of table, top section includes positive results, middle section includes mixed results, bottom section includes null results.

CBCL = Child Behavior Checklist, ECI-4 = Early Childhood Inventory-4, PAS = Preschool Anxiety Scale, SCAS-P = Spence Children’s Anxiety Scale-Parent Report, YSR = Youth Self Report, BASC = Behavioral Assessment System for Children, SN = special needs, DSP = Deprivation-specific psychological patterns

m = months, y = years, M = mean, Md = median, SD = standard deviation

¹This study used time in the orphanage instead of age at adoption; these two variables were correlated at r = .97

²These studies assessed children who were still institutionalized, so duration of institutionalization was assessed rather than age at adoption

³The vast majority of children adopted from China are female

⁴These articles did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation.

Attention and Executive Function

Table 8

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Positive Results												
Audet & LeMare (2010)	Romania	Globally depriving ¹	most 4.5y; some 5.5–9y	46	inattention/overactivity	CBCL subscale (parent-report)	8–68m, Md = 18.5m	continuous	correlation	yes	—	no attenuation of effect overtime; role of parenting and attachment depend on duration of deprivation
Dalen (2001)	Colombia, Korea	—	11–16y	193	hyperactive behavior	Rutter scales subscale (teacher-report)	2–81m, M = 16.28m	0–4m, 5–12m, 13–24m, 25m +	—	yes	possible step function at 24m, but not tested	—
Gunnar, van Dulmen, & the International Adoption Project Team (2007)	Multiple	—	4–18y	899	attention problems	CBCL subscale (parent-report)	M = 29.5m, SD = 30.7m; 38% were 24m	< 24m, > 24m	logistic regression	yes	—	—
Habersaat, Tessier, & Pierre humbert (2011)	Multiple	—	12–18y	350	attention problems	CBCL subscale (parent-report)	83 < 6m, 52 6–12m, 43 12–24m, 172 > 24m	< 6m, 6–12m, 12–24m, > 24m	—	yes, for < 6m and > 24m and < 12m and > 12m	—	—
Hawk & McCall (2011)	mostly Russia	Socially-emotionally depriving	6–18y	316	attention problems	CBCL subscale (parent-report)	3.3–57.7m; M = 16.0m, SD = 11.4	< 18m, > 18m; < 6m, 6–11m, 12–17m, 18–23m, 24m+	oneway ANOVA	yes	possible step function at 18m, but not tested	—
Merz & McCall (2010)	mostly Russia	Socially-emotionally depriving	6–18y	342	attention problems	CBCL subscale (parent-report)	M = 16.4, SD = 11.75	< 9m, 9–17m, 18m	chi square	yes	step function at 18m	age at adoption effect for older (12–18y) but not younger (6–11y) subsample
Kreppner, O'Connor, Rutter, & The	Romania	Globally depriving	4y, 6y	137	inattention/overactivity	Rutter scales subscale (parent & teacher-report)	0–42m	continuous; < 6m, 6–24m, > 24m	correlation, Linear-by-Linear association test	yes	—	effects did not attenuate overtime; developmental

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
ERA Study Team (2001)												level at admission was not a mediator; weight at admission mediated teacher-reported I/O but not parent-reported I/O; effects significant when sample restricted to normal range IQ
Rutter, Kreppner, & O'Connor (2001)	Romania	Globally depriving	6y	165	inattention/overactivity	Rutter scales subscale (parent & teacher-report)	58 < 6m, 59 6–24m, 48 24–42m	< 6m, 6–24m, > 24m	chi square trends	yes	—	—
Rutter, Sonuga-Barke, Beckett, Castle, Kreppner, Kumsta, Schlotz, Stevens, & Bell (2010)	Romania	Globally depriving	6y, 11y, 15y	144	inattention/overactivity	Rutter scales subscale (parent & teacher-report)	58 < 6m, 59 6–24m, 48 24–42m	< 6m (combined with UK adoptees and non-PI Romanian adoptees), > 6m	ANOVA, chi square	yes	—	—
Sonuga-Barke, Beckett, Kreppner, Castle, Colvert, Stevens, Hawkins, & Rutter (2008)	Romania	Globally depriving	11y	138	inattention/overactivity	Rutter scales subscale (parent & teacher-report)	.5m–3y7m	< 6m, > 6m	ANOVA, mediational analyses, regression	yes	—	no interaction with subnutrition; overall sample: not mediated by head circumference; sub-nourished subgroup: possibly mediated by head circumference
Stevens, Sonuga-Barke, Kreppner, Beckett, Castle, Colvert, Groothues,	Romania	Globally depriving	11y	144	inattention/overactivity	Rutter scales subscale (parent & teacher-report)	42 < 6m, 49 6–24m, 40 24–42m	< 6m, 6–24m, > 24m	ANOVA, chi square, post-hoc Tukey's tests, t-test	yes	step function at 6m	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
Hawkins, & Rutter (2008)												
Lindblad, Weitoft, & Hjerm (2010)	Multiple	—	6–21y	16,134	ADHD	ADHD medication rates	70% < 2y	0y, 1y, 2–3y, 4–7y	logistic regression	yes	—	Odds ratios similar for boys and girls
Mixed Results												
Barcons-Castel, Formeles-Deu, & Costas-Moragas (2011)	Multiple	—	6–11y	52	attentional problems	BASC subscale (parent & self-report)	8–84m; M = 28.75m, SD = 21.42m	< 12m, 13–36m, > 37m	unifactorial ANOVA	yes	—	—
	Multiple	—	6–11y	52	hyper activity	BASC subscale (parent & self-report)	8–84m; M = 28.75m, SD = 21.42m	< 12m, 13–36m, > 37m	unifactorial ANOVA	no	—	—
Cederblad, Höök, Irtahmer, & Merke (1999)	Multiple	—	13–27y	147	attention problems	CBCL subscale (parent-report)	54% < 7m, 30% > 1y	< 1y, > 1y at adoption and < 6m or > 6m in institution or foster care	two-way ANOVA	yes, for time in institution or foster care (not age at adoption)	—	—
Colvert, Rutter, Kreppner, Beckett, Castle, Groothues, Hawkins, Stevens, & Sonuga-Barke (2008b)	Romania	Globally depriving [/]	11y	144	executive function	Stroop task (experimenter tested)	58 < 6m, 59 6–24m, 48 24–42m	continuous, < 6m, > 6m	correlation	yes for full sample, ns when restricted to > 6m	step function at 6m	not accounted for by IQ
Merz & McCall (2011)	mostly Russia	Socially-emotionally depriving	5–18y	288	executive function	BRIEF (parent-report)	5–60m, M = 15.7m, SD = 11.4m	< 9m, 9–17m, 18–26m, 27m	ANOVA, hierarchical multiple regression	yes	step function at 18m	interaction with age at assessment (highest risk: > 12y, adopted > 18m)
	mostly Russia	Socially-emotionally depriving	2–5y	130	executive function	BRIEF-P (parent-report)	5–27m, M = 12.09m, SD = 4.12m	< 9m, 9–17m, 18–26m, 27m	correlation	no	—	—
Null Results												
Bos, Fox, Zeanah, & Nelson (2009)	Romania	Globally depriving [/]	8y	< 93	executive function	CANTAB (experimenter tested)	9–33m, M = 23.6m ²	continuous; dichotomized at 2m intervals from 18m to 28m	independent samples t-tests; correlation	no	—	—

Study	Country of origin	Severity of deprivation	Age at assessment	N	Construct measured	Outcome measure	Age at adoption: Distribution	Age at adoption: Measurement	Statistical test	Significant effect of age at adoption?	Form of the relationship?	Relationship with other variables?
								(e.g., < 18m, > 18m; < 20m, > 20m) ²				

Note. Top section includes positive results, middle section includes mixed results, bottom section includes null results

CBCL = Child Behavior Checklist, BRIEF = Behavior Rating Inventory of Executive Function, BRIEF-P = Behavior Rating Inventory of Executive Function – Preschool Version, BASC = Behavioral Assessment System for Children CANTAB = Cambridge Neuropsychological Test and Automated Battery,

I/O = inattention/overactivity, m = months, y = years, M = mean, Md = median, SD = standard deviation

¹This article did not provide information about the conditions of these institutions, but other studies from the same authors on the same sample did describe the severity of the deprivation.

²In this study, children moved from an institution to foster care (not an adoptive home) at this age