



# Early Caregiver–Child Interaction and Children’s Development: Lessons from the St. Petersburg-USA Orphanage Intervention Research Project

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## Abstract

We review a series of interrelated studies on the development of children residing in institutions (i.e., orphanages) in the Russian Federation or placed with families in the USA and the Russian Federation. These studies rely on a single population, and many potential parameters that typically vary in the literature are similar across studies. The conceptual focus is on the role of early caregiver–child interactions and environmental factors that influence those interactions in children’s development. Generally, children residing in institutions that provided minimal caregiver–child interactions displayed delayed physical, cognitive, and social-emotional development. Children and adolescents adopted from such institutions at 18 months of age or older had higher rates of behavioral and executive function problems, even many years after adoption. An intervention that improved the institutional environment by increasing the quality of caregiver–child interactions—without changes in nutrition, medical care, sanitation, and safety—led to substantial increases in the physical, cognitive, and social-emotional development of resident children with and without disabilities. Follow-up studies of children in this intervention who were subsequently placed with USA and Russian families revealed some longer-term benefits of the intervention. Implications are discussed for theoretical understanding of the role of early caregiver–child interactions in development as well as for practice and policy.

**Keywords** Early experience · Russian orphanage children · Orphanage intervention · Post-institutionalized children · Age at placement

The role of early experience is a crucial target of investigation in human development. But it is often challenging to

study because early human experience is difficult to experimentally manipulate and children’s early environments are correlated with many confounding variables, including their later environments. However, in the early 1990s, European and North American parents adopted large numbers of Romanian children from extremely adverse institutions as well as children from institutions in other countries, particularly those in Eastern Europe, Asia, and Latin America. These children were exposed to atypical, often extremely neglectful, early experiences and were then placed into supportive family environments. This situation provided new opportunities for scholars to study development following exposure to early adversity and to design strategies to support children at risk for negative outcomes.

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## General Research Approaches and Themes

Studies of children who have experienced early institutionalization represent four general research approaches: (1) assessments of infants and young children residing in institutions; (2) assessments of children who resided in institutions and were subsequently placed into families (usually through adoption but sometimes through foster care or re-unification with their biological families) (i.e., post-institutionalized [PI] children); (3) assessments of infants and young children who experienced interventions designed to improve institutional care or provide high-quality family care; and (4) follow-up assessments of children who experienced these interventions after having been placed into families.

A large literature has accumulated across these research approaches (e.g., McCall and Groark 2015; McCall et al. 2011) that generally documents the deleterious effect institutional rearing can have on children's development (e.g., Van IJzendoorn et al. 2008, 2011), the very substantial developmental catch-up that occurs in PI children placed into families (Van IJzendoorn and Juffer 2006), the large positive effects on children's development that interventions within institutions and in family care can produce (Nelson et al. 2007, St. Petersburg-USA Orphanage Research Team 2008), and the potential for institutions and welfare systems to maintain the interventions on local budgets (Groark et al. 2013a; McCall et al. 2013).

## The Role of Caregiver–Child Interaction

Although institutions tend to be deficient in a variety of different respects, one common theme is the lack of warm, sensitive, responsive caregiver–child interactions especially from a few, consistent caregivers. As a consequence, children do not receive much cognitive stimulation (McCall 2011; McLaughlin et al. 2014), do not form secure or even organized relationships and attachments with caregivers (Bakermans-Kranenburg et al. 2011), and may experience chronic stress (Johnson and Gunnar 2011; Tottenham 2012a, b). This has led some (e.g., Bowlby 1952, 1958; McCall 2011; Rutter et al. 2010) to hypothesize that the crucial mechanism through which early institutionalization exerts its effects on children's development is the lack of sensitive, responsive interactions with a few consistent caregivers.

## Major Research Groups

These generalizations have emerged from a vast literature that contains a great many inconsistent findings, perhaps in part because of methodological differences across studies and variability in sample characteristics and the nature

of the institutions represented. However, this literature is dominated by a few research groups that have pursued one or two of these research approaches extensively.

Several groups studied PI children. One of the first was the Tizard group in London (e.g., Tizard and Rees 1974) that conducted a longitudinal study of children from English institutions, adopted or not, compared to non-institutionalized English children. Subsequently, the Canadian Romanian Adoption Project (Audet and LeMare 2011; Chisholm 1998; MacLean 2003) and the English and Romanian Adoptees Study (Rutter et al. 2010) conducted longitudinal studies of the development of children from severely or “globally” depriving Romanian institutions adopted in the early 1990s by Canadian and British parents, respectively. These globally depriving institutions were profoundly lacking in their physical resources (e.g., physical facility, nutrition, sanitation, safety) in addition to being extremely deficient in caregiving quality (Gunnar 2001; Rutter 1998). The ongoing Minnesota International Adoption Project (e.g., Gunnar et al. 2007) recruited a large sample of parents who adopted children from all over the world but mostly South Korea and China. These projects used predominantly structured behavioral, observational, and neurobiological assessments and employed early- versus later-adopted and non-institutionalized children as comparison groups.

The ongoing Bucharest Early Intervention Project (BEIP; e.g., Almas et al. 2016; Nelson et al. 2014, 2007) randomly assigned more contemporary institutionalized Romanian children to either high-quality foster care or continued institutional care and compared these groups with never-institutionalized children in Romania. Children were then followed longitudinally with a variety of behavioral and neurobiological assessments.

In our work on the St. Petersburg-USA Orphanage Intervention Research Project, we sought to complement and extend these major projects by applying all four approaches to the study of children originating predominately from the same institutions (either the same ones or those with the same level of deprivation). The Project revolved around an adoption agency operating in the Pittsburgh area that placed children from predominately three institutions in St. Petersburg, Russian Federation, but also some children from similar institutions in St. Petersburg and elsewhere in the Russian Federation. The agency's mailing list provided the population of parents who responded to questionnaires on the development of their PI adopted children. We implemented an intervention using the three institutions to study the effects of improving the quality of caregiver–child interactions. The baseline assessments from this study constituted our description of institutions for children birth to 4 years of age. Follow-up assessments of children who experienced the interventions who were subsequently placed in USA or Russian families provided data on the longer-term consequences

of the intervention. Details of these circumstances are provided in the reviews of each of these approaches.

## The Current Review

In this article, we review and synthesize the results of the St. Petersburg-USA Orphanage Intervention Research Project, a unique set of interrelated studies conducted over nearly 20 years on some of the largest samples in the literature. This body of work has a number of strengths. First, this research focuses conceptually on the potential role of early sensitive and responsive caregiving in child development. Second, it includes all four of the research approaches mentioned above, and thus addresses research questions about the role of early social-emotional experience from a number of different research perspectives. Third, these studies focus primarily on children residing in or adopted from relatively similar institutions in the Russian Federation and the former Soviet states, especially children from three specific institutions in St. Petersburg. These St. Petersburg institutions and the children who resided there are the most comprehensively and empirically described in the literature, and thus we know a great deal about the nature of the children's early experiences. Finally, as a group, these studies rely on a common population and many potential parameters are similar across studies and research approaches, which minimize sources of variability that exist in the broader literature.

In this article, we review our studies in four major sections corresponding to the four research approaches described above. First, we describe the nature of the institutions with regard to the amount and quality of caregiver–child interactions and the inconsistency of care, as well as the development of resident children. Second, we report on the development of post-institutionalized children adopted into families in the USA and potential moderators of the effects of early institutionalization on children's development (e.g., age at adoption, severity of deprivation, age at assessment). Third, we summarize the effects of a quasi-experimental intervention that focused on improving the quality of caregiver–child interactions without changing nutrition, medical care, sanitation, or safety within institutions. Fourth, we review the longer-term effects of this intervention on the development of children who were subsequently placed into Russian and American families. Finally, we integrate findings across these approaches, and point to theoretical and practical implications for the role of early caregiver–child interactions in children's development.

Of course, while the similarity of circumstances across these studies has the benefit of reducing extraneous variability, it also has the potential to produce unique results tied specifically to those characteristics. Consequently, in each section, we cite studies from the broader literature that used

similar approaches and assessments. We have not attempted a comprehensive literature review of all studies, but rather have focused on demonstrating that the findings from our studies are generally similar to results from the broader literature of comparable studies. Readers interested in more comprehensive reviews might consult Berens and Nelson (2015), Hermanau et al. (2016), Juffer and Van IJzendoorn (2005), McCall and Groark (2015), McCall et al. (2011), Van IJzendoorn and Juffer (2006), and the meta analysis reviews by Van IJzendoorn and colleagues cited in the reference list.

## The Institutional Environment and the Development of Resident Children

We conducted a comprehensive empirical study of children approximately birth to 4 years of age residing in three institutions in St. Petersburg, Russian Federation (St. Petersburg-USA Orphanage Research Team 2005) to determine their experience prior to placement in the institution, the type and quality of care they received in the institution, and their development within this environment. This study contributed substantially to the empirical description of the major independent variable of this literature, namely early institutional experience.

### Children's Experiences Prior to Placement in an Institution

Relatively little is known about the children who are relinquished to institutions. Children in the three targeted institutions arrived at the institutions between 1 and 39 months of age ( $M = 5.5$  months). Approximately half came directly from a hospital, but 30% spent some time with a family before intake. Administrators indicated that the primary reasons children are placed in institutions are poverty, inability of the parent to care for the child (e.g., parental substance abuse and/or mental health problems), unwillingness to rear a child with a disability, and involuntary removal of a child because of abuse and neglect.

Children had higher rates of perinatal complications (e.g., preterm birth, low birth weight) and were smaller physically than is typical of Russian births (see for details, St. Petersburg-USA Research Team 2005). Many studies, including some of our own (e.g., Merz and McCall 2010, 2011) and those of others (Kreppner et al. 2007; Miller et al. 2009), have not often found long-term relations between these perinatal factors and PI children's development. The preponderance of evidence suggests that these perinatal factors can influence the development of children in residence in an institution, but they have not been demonstrated to be consistent major contributors to PI children's development.

## Care in the Institutions

Most descriptions of institutions around the world are narrative reports, sometimes second hand (but see Johnson et al. 2010; Juffer et al. 2017; Smyke et al. 2007; Tirella et al. 2008). The St. Petersburg institutions in our empirical studies were identified as “social-emotionally depriving”; that is, they provided adequate physical resources, but there was low quantity and quality of caregiver–child interactions (Muhamedrahimov 2000, St. Petersburg-USA Orphanage Research Team 2005).

Similar to institutions for infants and young children described elsewhere in the narrative literature (Van IJzendoorn et al. 2011), these institutions had large group sizes (11–13 children per group), high children-to-caregiver ratios (6–8:1 during waking hours), homogeneous ages and disability status within a group, and periodic transitions of children from one group of peers and caregivers to another. They were also characterized by many and changing caregivers. For example, a single child would have about 12 caregivers per week and 60–100 over the course of 2 years; caregivers worked for 24 h and then were off for 72 h so a child did not see the same caregivers 2 days in a row. Caregivers received little training, and most of their training pertained to routine caregiving and basic physical health. Caregivers rarely initiated or maintained reciprocal social interactions with children or provided physical affection. Instead, caregivers used directive language and focused on providing the necessities (feeding, changing diapers, bathing) in a business-like, perfunctory manner with little eye contact, talking, or playing (Muhamedrahimov 2000, St. Petersburg-USA Orphanage Research Team 2005, 2008). Thus, although the physical resources were adequate in these institutions, children had few warm, sensitive, and responsive interactions with a few consistent caregivers.

## Institutionalized Children’s Development

The infants and young children in these institutions were markedly delayed in their physical growth and cognitive/behavioral development (St. Petersburg-USA Orphanage Research Team 2005). Specifically, more than one-third of children fell below the 10th percentile of Russian standards for height, weight, and head circumference. However, weight-relative-to-height was less deficient, consistent with the adequate nutrition provided, suggesting that a large part of the delayed physical growth was not obviously related to malnutrition. This result is consonant with the psychosocial short stature hypothesis that posits poor physical growth of children reared in inadequate social-emotional environments (Blizzard 1990; Johnson et al. 2010; Skuse et al. 1996).

In terms of general cognitive and behavioral development, 68% of resident children scored below the 10th percentile on

a USA standardized developmental assessment (i.e., Battelle Developmental Inventory; LINC Associates 1988). Poor performance occurred on all subscales including cognitive, language, adaptive, motor development, and especially pronounced on the personal-social behavior subscale. In addition, 85% of a sub-sample of children 11.5–18 months of age were classified as having disorganized attachment to their caregiver (St. Petersburg-USA Orphanage Research Team 2008). In general, 9 out of 10 children reared from birth in families would be more advanced developmentally than the average institution-reared child.

These developmental deficiencies are similar to those reported by others across a variety of institutions in many different countries. For example, direct assessments of the quality of caregiver–child interactions reveal relatively poor quality of care in our studies (St. Petersburg-USA Orphanage Research Team 2005, 2008) and those of others (Johnson et al. 2010). Meta-analyses indicate that institutionalized infants and young children from around the world are 1.0–1.5 SDs below USA standards for physical growth and general cognitive/behavioral development (Van IJzendoorn et al. 2007, 2008). Further, other studies report similar percentages of insecure and disorganized attachment (Bakermans-Kranenburg et al. 2011; Lionetti et al. 2015; Van IJzendoorn et al. 2011), although rates for these conditions are higher for children from Eastern Europe.

In sum, the children in the studies reviewed here come from Russian institutions that have many of the more common features of institutions described in the wider literature. The primary characteristic of such an environment is a lack of warm, sensitive, reciprocal interactions with a few consistent caregivers (Van IJzendoorn et al. 2011; Tottenham 2012a, b). Further, the poor general physical and behavioral development and attachment insecurity of children in these institutions parallels reports published elsewhere in the literature on institutionalized children, including children from institutions providing more severe deprivation. Together, these findings indicate that our population is not obviously atypical of the wider literature of institutionalized children, and they are consistent with the notion that marked deficiencies in the quantity and quality of caregiver–child interactions and relationships in institutions may contribute substantially to the children’s poorer development.

## The Development of Post-institutionalized Children Adopted into Families in the USA

Approximately 21% of the institutionalized St. Petersburg children described above were adopted into families in the USA (plus an additional 38% to other countries), 67% within their first year of life and 89% within 24 months (St. Petersburg-USA Orphanage Research Team 2005). Children



adopted to the USA were placed at an earlier age but otherwise were similar to those placed in Russia with respect to birth weight, length, head circumference, and rated condition at birth as well as their length of residency and their physical and behavioral development at departure from the institution (McCall et al. 2014a). Of course, other factors may influence these placements.

We examined the development of children adopted primarily from the three St. Petersburg institutions described above into USA families. In 2001, 2003, 2008, and 2010, a battery of questionnaires was mailed to all the adoptive parents on the mailing list of a USA-based adoption agency specializing in placing Russian children primarily but not exclusively from the three St. Petersburg institutions described above. This meant that the children were various ages at the time of each assessment, the specific questionnaires were different for children of different ages, the number of parents on the mailing list increased over the years, and some parents responded regarding the same child to more than one mailing. Return rates ranged from 31 to 51% and varied partly because of different reminder techniques employed in different years. We found little evidence of selective responding as a function of the child's adjustment (Hawk et al. 2013). Collectively, this represents one of the largest samples of PI children in the literature (total  $N = 1473$  children, but see Verhulst et al. 1990), especially adopted from one country. Parent reports on these questionnaires were the primary means of data collection, plus a sub-sample of children completed direct assessments of cognitive development and executive function (Merz et al. 2013) and another sub-sample of older children provided self-reports of the quality of their relationships (Hawk and McCall 2014).

## Emotional and Behavioral Problems

In the social-emotional domain, we examined behavior problems, social skills, and perceived relationship quality. In two studies, parent-reported behavior problems (measured using the Child Behavior Checklist [CBCL]; Achenbach and Rescorla 2001) in 6- to 18-year-old PI children ( $N = 342$ ) were compared to the CBCL standardization sample of non-institutionalized USA children (Hawk and McCall 2011; Merz and McCall 2010). Results indicated that PI children adopted before 18 months did not have higher than expected rates or levels of emotional or behavioral problems. However, PI children adopted after 18 months had significantly higher rates and levels of such problems, and the rate of longer-term problems increased rather precipitously at an age-at-adoption of 18 months. PI children assessed in adolescence had the highest levels of problems. This was true across all subscales of the CBCL, with the highest rates for attention

and externalizing problems. The rates of borderline and clinical scores for older-adopted children ranged from approximately 25–50%.

Further, older-adopted PI children tended to display extreme scores simultaneously on several CBCL subscales (i.e., co-occurring behavior problems), and a factor analysis revealed that most CBCL subscales (except Attention Problems) loaded on one factor (Hawk and McCall 2011). This suggests the possibility of a single mechanism underlying the development of persistent behavior problems, perhaps the neurobiological consequences of chronic stress in the institution (McCall 2011, 2013; McLaughlin et al. 2014).

## Social Skills and Perceived Relationship Quality

Parents also reported on the social skills of 341 5- to 19-year-old PI children using the Social Skills Rating System (Gresham and Elliott 1990). Similar to the results for behavior problems, social skills were worse for later-adopted children, and the relation was again a step-like increase at an age-at-adoption of 18 months. Further, social skills were quite good among elementary-school-aged PI children relative to USA never-institutionalized children; but secondary-school-aged PI females had significantly poorer social skills than non-PI children. Again, problems seemed to occur more frequently during adolescence for later-adopted PI children (Julian and McCall 2016).

Ten to seventeen-year-old PI children ( $N = 91$ ) rated the quality of their relationships with their mothers, siblings, and best friends (Hawk and McCall 2014). Again, children adopted after 18 months of age had poorer perceived relationship quality and more negative interactions with siblings and friends than those adopted before 18 months. Interestingly, this was not true if the PI child had an older sibling of the same gender. This latter result suggests that it may be helpful for the adoptive family to have older same-sexed children, adopted or biological, presumably to help socialize the adopted child into the family. Importantly, relationships with adoptive mothers were uniformly rated as “good” by all groups of PI children (Hawk and McCall 2014).

These results are consistent with the broader literature on children's social relationships. For example, others have observed poorer peer relationships in PI children adopted after 18 months, mediated in part by ADHD-like symptoms but lessened by higher quality parenting (Pitula et al. 2017). In addition, adopted children's relationships within the family were similar to those for non-adopted children (Lansford et al. 2001), and the current findings for sibling relationships are consistent with the beneficial effects of older and same-gender siblings among non-PI children (Furman and Buhrmester 1985; Karos et al. 2007).

## Executive Function

Parents of 418 2- to 18-year-old PI Russian children reported on their children's executive functioning using the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia et al. 2000). PI children who were younger than 11 years at assessment were rated similarly to non-PI comparison children, but 12- to 18-year-old PI children who were adopted after 18 months had more executive function difficulties compared to PI children adopted at younger ages and non-PI children. Again, the risk of longer-term executive function difficulties increased sharply after an age-at-adoption of 18 months (Merz and McCall 2011).

In a follow-up study, parent-reported executive function on the BRIEF was compared between children adopted from severely depriving 1990s Romanian orphanages and those in our population adopted from less severely depriving (i.e., socially emotionally depriving) Russian institutions. While children adopted from globally depriving institutions had higher rates of executive function problems even at young ages at assessment, both groups displayed an increase in executive function problems after an age-at-adoption of 18 months (Merz et al. 2013).

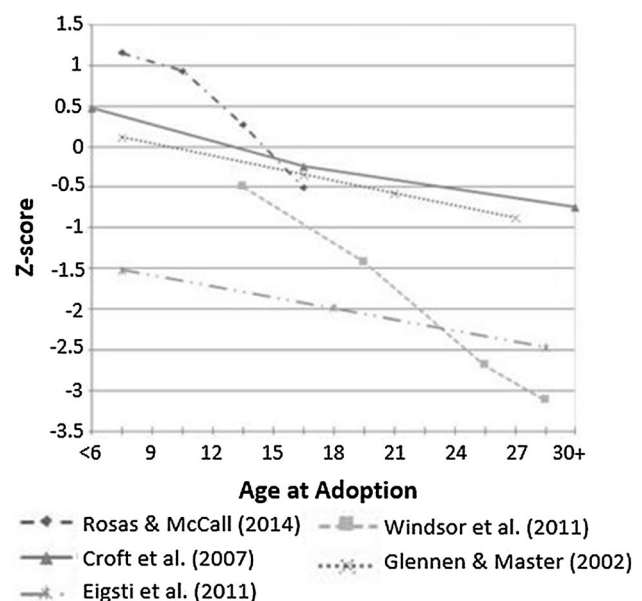
Although parent reports have the advantage of ecological validity, direct assessments are likely more sensitive and precise. Thus, direct assessments of working memory and inhibitory control were administered to 75 8- to 17-year-old PI Russian children adopted before 9 months or after 14 months (these ages were used instead of 18 months to maximize sample size). Specifically, children completed computerized tasks from the Cambridge Neuropsychological Test Automated Battery (CANTAB; Cambridge Cognition, UK). Older-adopted children displayed lower inhibitory control (i.e., stop-signal task) and poorer working memory (i.e., spatial span task) than children adopted at younger ages, but the groups did not differ significantly on a spatial self-ordered search task, which measures spatial working memory. Also, parent-reported executive function on the BRIEF correlated significantly with inhibitory control and working memory task performance on the CANTAB, providing some cross-assessment validity for both measures (Merz et al. 2013). These results are generally consistent with studies of executive function in other samples of PI children (Merz et al. 2016; Berens and Nelson 2015).

## Language Development

Parents of 104 15- to 48-month-old PI Russian children reported on their children's language development using the Child Development Inventory (Ireton 1992). Although PI children's mean expressive and receptive language scores fell within the normal range, there were differences as a function of age at adoption. Children adopted before

12 months of age displayed levels of expressive and receptive language skills at least through 4 years of age that were no different than those of USA non-PI comparison children. In contrast, language proficiency was lower for children adopted after 12 months of age in both the expressive and receptive domains (Rosas and McCall 2014). Similarly, in another study, a sub-sample of 73 8- to 17-year-old PI Russian children completed the Vocabulary subtest of the Wechsler Intelligence Scales for Children-Fourth Edition (Wechsler 2003). Children adopted after 14 months of age had lower vocabulary compared to children adopted before 9 months of age (the only age-at-adoption cutoff ages investigated; Merz et al. 2013).

These results parallel those found in other studies in the literature. For example, Fig. 1 presents results for our own study (Rosas and McCall 2014) and those for four other studies of PI children (Croft et al. 2007; Eigsti et al. 2011; Glennen and Master 2002; Windsor et al. 2011) in which expressive language proficiency was assessed at different ages through mid-childhood as a function of age at adoption. Despite differences in samples, specific language assessment instruments (some parent report, others direct child assessments), and ages at assessment, PI children adopted at around 12 months of age and progressively later did not attain typical language proficiency in early and mid-childhood. Note that the general level of language performance varies between studies, perhaps as a function of the quality of the institutional and adoptive home environments and assessment instrument. Nevertheless, across studies, longer-term language performance is a roughly linear declining



**Fig. 1** Expressive language in childhood as a function of age at adoption for five studies of different samples, different assessment instruments, and different ages at the childhood language assessment

function of age at adoption especially between 12 and 24 months, not the precipitous drop at 18 months that occurs for social-emotional and behavior problems (see above). Other studies also indicate that this deficiency lasts at least through mid-childhood (Scott et al. 2011).

### Academic Performance

PI Russian children adopted after 14 months of age had higher rates of using learning support services compared to those adopted before 9 months of age (the only age-at-adoption cutoff ages investigated). Further, vocabulary scores partially mediated the association between early deprivation and the use of learning support services (Merz et al. 2013). These results are consistent generally with the literature of lower cognitive scores and poorer academic performance for later-adopted PI children (Van IJzendoorn et al. 2005) and, more specifically, with greater use of learning support services as a function of age at adoption (Sonuga-Barke et al. 2017).

### Moderators of the Effects of Early Institutionalization on Children's Development

In our studies, PI children's outcomes were found to vary based on age at adoption, severity of deprivation, and age at assessment. These moderating factors may also explain differences in results across studies of PI children in the wider literature, given differences in sample characteristics across studies.

#### Age at Adoption

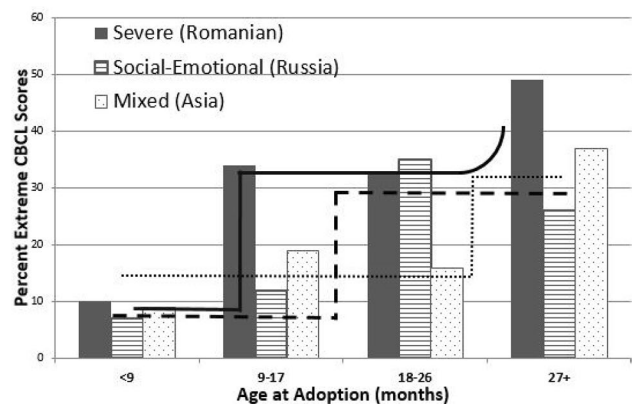
In most studies of PI children, age at adoption is a crucial predictor of outcome, and it is usually used as a proxy for the timing and/or duration of exposure to the institutional environment (Julian 2013). Further, most studies treat age at adoption as a dichotomous or as a continuous variable, so the form of the relation of age at adoption and a childhood outcome is not available. In contrast, we examined the form of this function. As described above, rates of behavior problems and poorer executive function, social skills, and perceived relationship quality for our PI children adopted before 18 months were not higher than for non-PI children. However, rates of these adverse outcomes increased precipitously—in a step function—at an age-at-adoption of 18 months—and did not increase with additional exposure to the institution. However, longer-term language skills declined linearly, rather than precipitously, from an age-at-adoption of 12 to 24 months (see Fig. 1).

But age at adoption is only an approximate indicator of time in the institution. For example, in one of our studies (Hawk et al. 2012), age at adoption was indeed very strongly

related to duration of institutionalization, but departing the institution at an older age was also associated with a greater likelihood that the child had spent time in a family before coming to the institution, and some of these children had been abused or neglected. Conversely, earlier adoption was associated with somewhat higher birth weight and length as well as height at departure but not developmental scores. However, rates of these other correlates did not occur as a step function of age at adoption, so they are unlikely to fully explain why the risk for several longer-term adverse outcomes increases so suddenly and completely at an age-at-adoption of approximately 18 months for these PI children (Hawk et al. 2012).

#### Severity of Deprivation

The age-at-adoption effect appears to interact with the severity of the institutional environment (Julian 2013) as depicted for behavior problems in Fig. 2, with the step occurring at younger ages for children from the most adverse institutions (McCall 2013; Merz and McCall 2010). Specifically, two independent samples of children from the severely and globally depriving 1990s Romanian institutions using different measures of behavior problems (Kreppner et al. 2007; Groza and Ryan 2002) revealed the step-wise increment at 6 months. The current studies of children from less severe social-emotionally depriving Russian institutions show the threshold at 18 months for various social/behavioral and executive function outcomes but not language (Hawk and McCall 2011; Julian and McCall 2016; Merz and McCall 2010, 2011). A study of international adoptions in Minnesota (Gunnar et al. 2007) consisting mostly of children from China and South Korea, which countries are thought to have relatively better institutions, reveals the step function at



**Fig. 2** Percentage of extreme CBCL scores as a function of age-at-adoption for children from severely and globally depriving institutions (solid line; Groza and Ryan 2002), socially emotionally depriving institutions (dashed line; Merz and McCall 2010), and mixed levels of deprivation (dotted line; Gunnar et al. 2007)

approximately 24 months (Merz and McCall 2010). The few studies of children who do not enter institutions until after 2 years of age suggest that exposure to the institution beginning after 2 years of age is less damaging than exposure at younger ages (McCall 2011).

This confluence of evidence suggests that approximately the first 2 years of life represents a sensitive period for the development of certain functions. Additionally, a cumulative deficit phenomenon seems to exist such that an earlier and shorter exposure to severe deprivation is sufficient but a more prolonged exposure to a less severely depriving environment is necessary to produce some adverse longer-term consequences for several types of behaviors. The timing and function may be different for different skills (e.g., language development vs. social-emotional and behavior problems, executive function).

### Age at Assessment

There is a tendency for negative outcomes in our studies (Merz and McCall 2010, 2011) and those of others (Sonuga-Barke et al. 2010) to be more prevalent in later-adopted children assessed during adolescence than during childhood (but see Juffer and Van IJzendoorn 2005). This provokes the hypothesis that problems in such children become worse as the children mature into adolescence. But most of these reports represent cross-sectional studies of age differences, not longitudinal studies of developmental age changes. Only a few of the latter studies exist (Juffer et al. 2011), and the results are mixed, with some showing increases in problem behaviors, especially internalizing rather than externalizing problems, and others not showing such increases (Sonuga-Barke et al. 2010, 2017; Van der Vegt et al. 2009; Verhulst et al. 1990). Similarly, we found longitudinal increases in internalizing but not externalizing or attention problems in our PI sample (Hawk and McCall 2016).

These problems are not likely to be simply an extreme but temporary period of adolescent “storm and stress,” because analogous problems for PI children in the general literature (Julian 2014; Sonuga-Barke et al. 2017; Van der Vegt et al. 2009) seem to persist at higher-than-expected rates into adulthood in terms of divorce, substance abuse, conduct disorders, anxiety and mood disorders, antisocial behavior and crime, autism spectrum disorder, attention problems, and job instability, especially for those who experienced more extremely depriving institutions.

Although these findings and those of others (Hawk and McCall 2010; Humphreys et al. 2017) emphasize the longer-term behavioral problems that PI children display after adoption, these conclusions need to be tempered somewhat with results from the broader literature. For example, on the one hand, our children adopted before 18 months did not have higher rates of problems, and rates of extreme behavior

problem scores for the higher-risk, later-adopted children were 30–50%, meaning that more than half of these children did not have such problems. Moreover, only approximately half of the parents who had a child in the borderline or clinical range (most extreme 15%) on the CBCL found the condition sufficiently extreme to seek professional help (Merz and McCall 2011), and only approximately half the parents in another study indicated that extreme-scoring children disrupted the life of the family (Miller et al. 2009). Further, in one other study, the vast majority of adoptive parents reported being satisfied with the placement (Hellerstedt et al. 2008). Thus, although there certainly are higher than expected rates of long-term behavior problems among later-adopted PI children, most PI children do not display such problems, testifying to substantial resilience and adaptability despite severe early neglect at least through adolescence. But on the other hand, rates of long-term behavioral problems are higher for children who experienced more severe institutions, and the rate of some problems increases, and even new problems can arise, in adulthood (Sonuga-Barke et al. 2017; Van der Vegt et al. 2009).

### Gender

Although we have not found many gender differences in our studies (e.g., girls poorer in social skills; Julian and McCall 2016), others have found girls to increase more than boys in internalizing problems during adolescence (Robinson et al. 2015). Also, the Bucharest Project (BEIP) found the longitudinal effects of their foster care intervention to interact with gender for some behavioral outcomes (Humphreys et al. 2017).

## Interventions to Improve Caregiver–Child Interactions and Relationships in Institutions

Early scientific attempts to improve institutions for infants and toddlers consisted of adding very specific and limited cognitive stimulation provided by the investigator, research assistants, psychology students, or specially trained supplementary caregivers. These interventions tended to produce modest and short-lived improvements in children’s development or prevented developmental declines in children (St. Petersburg-USA Orphanage Research Team 2008). More intense and prolonged interventions designed to improve children’s cognitive development succeeded somewhat more extensively (Sparling et al. 2005). However, the St. Petersburg-USA intervention was based on the belief that larger and more persistent benefits for children might be produced by intervening with regular staff within the entire institution.



## The St. Petersburg-USA Orphanage Research Team Intervention

This intervention, the most comprehensive in the literature designed to improve caregiving within institutions (Hermanau et al. 2016), focused on improving caregiver–child interactions and relationships without changing the children’s diet, medical care, toys/supplies, and the sanitation or safety of the physical environment (The St. Petersburg-USA Orphanage Research Team 2008). Specifically, three institutions in St. Petersburg, Russian Federation (the ones described above) participated. Each institution was assigned to a different condition: (1) Training plus Structural Changes (T+SC), (2) training but no structural changes or Training Only (TO), or (3) No Intervention or care-as-usual (NoI). Training consisted of 12–14 sessions (approximately 60 h total) teaching caregivers to interact with children in a more “parent-like” manner by providing more warm, sensitive, and contingently responsive care to children. Structural changes were designed to create a more “family-like” environment within the institution. These changes were designed to support caregiver–child interactions and relationships, and included reducing the number of caregivers per group, appointing primary caregivers who worked more consistently during the week, reducing group sizes, integrating groups by age and disability status, stopping periodic “graduations” of children to new rooms with new caregivers and peers, appointing a few consistent substitute caregivers for each group, and establishing “family hour” twice daily in which visitors were prohibited and children spent time with their caregivers.

Children in the T+SC group showed the largest developmental gains, followed by those in the TO group, which in turn improved more than the NoI group. Specific areas of improvement included physical growth, cognitive and social-emotional development, and attachment quality to caregivers. Children improved more the longer they resided in the intervention institutions, and this was true for children with and without disabilities. For example, children exposed to 9+ months of the T+SC intervention improved from an average Battelle Developmental Quotient (DQ) of 57–92; children with disabilities increased from a DQ of 23–42 (St. Petersburg-USA Orphanage Research Team 2008). Children in the intervention institutions also gained more than those in NoI in height, weight, and chest circumference, and they progressively displayed fewer functional limitations; again gains were greater the longer children were in the intervention.

The improvements in DQ points represent some of the largest improvements of any intervention, and the effect size ( $d = 1.05$ ) approached that found for adoption ( $d = 1.17$ ) (Bakermans-Kranenburg et al. 2008; Hermanau et al. 2016). The fact that a strictly behavioral intervention

improved physical growth provides good evidence for the psycho-social short stature hypothesis. Further, other interventions with a similar focus on improving the quality of caregiver–child interactions have also reported cognitive, behavioral, and physical growth benefits for children in China (Wang et al. 2017), Latin America (Groark et al. 2013a, b; McCall et al. 2010), Russia (Solodunova et al. 2017), and elsewhere (Hermanau et al. 2016).

### A Focus on Caregiver–Child Interactions

Several studies have examined the mediating mechanisms through which the St. Petersburg-USA intervention improved children’s development, and these have focused on several aspects of caregiver–child interactions as a potential mediator.

For example, 40% of the intervention effects on children’s cognitive/behavioral scores were found to be mediated by differences in caregiver–child interactions and the improved institutional environment as reflected on the HOME Inventory (Bradley et al. 2003; Rosas et al. 2014). Further, the quality of caregiver–child interactions mediated intervention effects on attachment security, and caregiver–child interactions together with the number of caregivers mediated intervention effects on head circumference (Warner et al. 2017).

Caregiver sensitivity was related to increased children’s cognitive development, but better caregiver sensitivity plus caregiver consistency was associated with higher social-emotional development (Hawk et al. 2018). This result hints that the cognitive and sensory stimulation received in sensitive interactions with a caregiver improves cognitive development, but the consistency of having the same few caregivers over time, which presumably supports relationships, contributes to social-emotional development.

Some children in the intervention were exposed to additional caregiver interactions of unknown quality within their families prior to entering the institution, whereas others came directly from their birth hospital. The more time children spent with families before intake the better their baseline social-emotional development and the better quality of interactions they had with caregivers in the institution (Hawk et al. 2018). But having experienced a family was not consistently related to larger or smaller improvements associated with the intervention. This suggests that on balance these children benefited from the time in their families and did not display significant enduring effects of the change or disruption of caregiver between family and institution.

Another component of the intervention was the cessation of routine transitions to new groups of peers and caregivers, which could disrupt emerging relationships with caregivers. McCall et al. (2012) plotted children’s general cognitive developmental scores longitudinally, lining up those children in TO and NoI over the age at which they experienced a

group transition and comparing them at the same ages with children from T + SC who did not experience a group transition. These developmental profiles showed that children who did not experience a transition (i.e., T + SC) made steady linear developmental improvement across age, but the scores of those children who did transition (i.e., TO) increased before and after but not during the age period when they were transitioned to a new group. Scores for children in NoI did not change before, during, or after a ward transition. This result is consistent with a study in Central America that showed children benefited markedly more from a conceptually similar intervention if they did not make a group transition during the intervention than those who did (McCall et al. 2010). Together, these results show that changing caregivers and peers mutes the potential benefits of improved caregiving, consistent with the contribution of having fewer and more consistent caregivers. Taken together, these studies reveal that various components of the intervention, especially those that pertain to caregiver–child interactions and relationships, contributed to the improvements in children’s development.

### Sustainability and Scale-Up

The intervention and its benefits for children were sustained on the institution’s regular government budget for at least 10 years after it was completed. Specifically, after 6 years, both the improved environment and caregiver behavior in T + SC (as measured by the HOME Inventory) was maintained, and children in T + SC and TO had better physical growth and general cognitive performance at departure from these institutions than children in NoI (McCall et al. 2013). Further, 10 years after the intervention formally terminated, children in T + SC had better scores on an assessment of caregiver–child interaction and better adaptive behavior and emotional expressions than children in NoI (Muhamedrahimov 2016). This maintenance was likely due to having deliberately planned the intervention (e.g., train the trainers, no additional staff) so it could be maintained more easily and by providing modest support activities during the follow-up interval.

Similar interventions have been implemented in 15 institutions and more than 300 caregivers have been trained elsewhere in the Russian Federation with positive results (e.g., Muhamedrahimov et al. 2009; Solodunova et al. 2017). Moreover, the Russian government mandated changes comparable to our structural changes (but not the training) in all institutions for children younger than 4 years of age in the Russian Federation (Solodunova et al. 2017).

In summary, this research demonstrates that improving the quality of caregiver–child interactions and relationships in institutions can improve children’s physical and behavioral development, even without changing nutrition, medical care, or material resources. Such changes produced

improvements for children with and without disabilities, and were greater the longer the children were in the intervention. Further, increased caregiver sensitivity, fewer and more consistent caregivers, and the cessation of group transitions were found to mediate intervention effects on several developmental outcomes. Finally, the intervention and its benefits were maintained for at least 10 years with no additional funding (McCall et al. 2013), interventions with generally similar emphases on improving caregiver–child interactions have been implemented in other institutions in Russia and elsewhere with generally similar results (Groark et al. 2013a, b; Muhamedrahimov et al. 2009; Wang et al. 2017), and structural changes comparable to those implemented in the intervention are now mandated in institutions across the Russian Federation (Solodunova et al. 2017).

### Follow-up of Children Who Experienced Intervention Institutions

Two studies were aimed at examining longer-term intervention effects in children who were subsequently either adopted into USA families or placed into different kinds of family care in St. Petersburg, Russian Federation. Studying USA adoptees afforded a very large non-intervention comparison sample of PI Russian children adopted into the USA; studying intervention children placed into Russian families represents one of the few assessments of family placements of any kind in a country that only recently began to emphasize family care alternatives.

Two preliminary studies were necessary. The first, described above, established that the intervention effects on children were basically maintained for at least 6 years after the intervention project was formally terminated (McCall et al. 2013), and T + SC and TO children were both developing better at departure from the institutions than NoI children. This permitted following graduates of the institutions over a 10-year period of time (i.e., the intervention period plus 6 years afterward) to increase the sample size of those transitioning to families.

Further, children who were placed into USA versus different types of domestic families were not obviously different at least on the basis of their birth circumstances or developmental status at departure from the institutions. In our work assessing this possibility, children were compared in terms of their physical and behavioral development as a function of whether they were placed with USA adoptive families, St. Petersburg adoptive or foster families (i.e., non-relatives), or St. Petersburg biological parents or relatives (i.e., relatives; McCall et al. 2014a). There were no differences between these groups, except that children placed into USA adoptive homes arrived and departed from the institutions at younger ages, although they spent the same length of time

in residence as those placed with non-relatives and relatives in St. Petersburg (McCall et al. 2014a). Children in these two groups could be different on other characteristics not measured in this study.

### Children Adopted into USA Families

In the USA follow-up (Julian et al. 2018), there were 53 children from the T + SC group, 114 children from the TO group, and a NoI comparison group of 220 Russian children adopted by USA parents who did not experience any intervention. Children varied in age at adoption from 4 months to 4 years, were in their adoptive homes for 1 month to 6.5 years, and were 9 months to 7 years old at assessment; these variables were included in the analyses.

Depending on the age of the child, the assessments included a 23-item attachment questionnaire (Chisholm 1998) taken from the Attachment Q-Sort; a 5-item measure of indiscriminate friendliness (i.e., disinhibited social behavior; Chisholm 1998); the BRIEF-Preschool assessment of executive function (Gioia et al. 2000); the Infant-Toddler Social Emotional Assessment (ITSEA) of early emotional and behavioral problems and competencies (Carter et al. 2003); the CBCL 1.5–5 years assessment of behavior problems (Achenbach and Rescorla 2001), and the Impulsivity, Inhibitory Control, and Attentional Focusing subscales of the Child Behavior Questionnaire (Rothbart et al. 2001) as measures of early effortful control.

Children from one or both intervention institutions (i.e., T + SC and TO) displayed better attachment behavior, lower levels of indiscriminate friendliness, and better scores on the ITSEA dysregulation scale and behavior problems on the CBCL than children from the Combined NoI, although some effects interacted with age at adoption. All these group means were within normal ranges (Julian et al. 2018).

### Children Placed into Russian Families

In this follow-up study, participants were 149 parents of Russian children who had spent at least 3 months in one of the three intervention institutions (T + SC, TO, or NoI) and subsequently lived with families in St. Petersburg for at least 1 year (McCall et al. 2016a, b). These children had been placed with non-relative families (i.e., primarily adoptive and foster) or relatives (i.e., biological mother or relatives). They were placed at an average age of 24.7 months, resided in the families for an average of 43.2 months, and were between 1.5 and 10.7 years of age at assessment. Parents rated their children's indiscriminate friendliness, social-emotional skills (ITSEA), behavior problems (CBCL), and attention regulation (CBQ) during home visits. In addition, a comparison group of parents of 83 Russian children of

similar ages was recruited from well-baby clinics and who had never been institutionalized.

Children from the T + SC group displayed less indiscriminate friendliness than children from the other groups and were less aggressive/defiant on the CBCL the longer they were in the institution, presumably because of the better caregiver–child interactions in the T + SC institution (McCall et al. 2016a, b).

Taken together, these follow-up studies indicated that most children adapted to their new families and did not show seriously deviant behavior. For example, children appeared to form attachments with their new parents or caregivers within the first year of placement, but indiscriminate friendliness persisted and even increased with time in the family, perhaps because parents and other adults rewarded it.

Intervention children in particular had better attachment, less indiscriminate friendliness, and fewer social-emotional and behavioral problems, varying with sample and sometimes interacting with age at placement, but as a group, the intervention children were not as profoundly and uniformly better than NoI children on most measures as might have been expected. This observation may reflect the substantial catch-up growth commonly observed in PI children transferred to advantaged families (Van IJzendoorn and Juffer 2006). Further, many of the longer-term adverse outcomes for PI children reported elsewhere in the literature occur predominately in children adopted at ages older than most of the children in the USA follow-up and assessed at older ages than in both follow-up studies (e.g., Hawk and McCall 2011; Merz and McCall 2010; Sonuga-Barke et al. 2010). The intervention may produce developmental advantages in later-adopted children assessed in adolescence.

## Conclusions

Several overarching conclusions and hypotheses can be drawn from this set of studies when placed in the context of the literature.

### Consistency Across Research Approaches

A main purpose of this review was to determine the consistency of major findings in the broader literature across research approaches (e.g., development of institutionalized children, development of PI children, effects of interventions improving the institutional environment on children's contemporary and longer-term development). Research in these domains is typically conducted on very different samples with a variety of diverse parameters varying between domains that potentially influence the results. In contrast, the results reviewed here derive from a single population with many potential parameters more-or-less similar across

studies and domains. The fact that the results reported here are consonant with major themes in the broader literature suggests that those themes are not uniquely associated with potential parameters that may differ between studies and research domains. Specifically, some of these major themes include the following.

### **The Institutional Environment and Children's Development**

Most traditional institutions for infants and young children in the Russian Federation and elsewhere provide a rearing environment that does not support, and may compromise, children's development. Children in residence are typically 1–2 standard deviations below non-institutionalized parent-reared children in various aspects of physical growth and cognitive/behavioral development (Van IJzendoorn et al. 2007, 2008).

Evidence converges on the proposition that a major deleterious component of traditional institutional rearing is the relative lack of appropriate caregiver–child interactions and relationships. Interventions that promote warm, sensitive, responsive caregiver–child interactions and relationships (without changes in nutrition, medical care, toys/supplies, sanitation, or safety) produce substantial improvements in every domain of children's development. Studies also demonstrate that various aspects of the care environment and caregiver–child interactions mediate the intervention effects on several developmental outcomes. It is likely that the quality of early caregiver–child interactions is crucial to children's development regardless of the type of care environment (i.e., institutional, foster and kinship care, adoption; Hermanau et al. 2016; Li and Julian 2012).

However, making the structural environment of the institution more “family-like” by having fewer caregivers consistently interacting with individual children seems necessary to support the quality of caregiver–child interactions and relationships. It is difficult even for well-trained caregivers to provide children much individualized warm, sensitive, and responsive care if there are too many children per caregiver, and it is difficult for individual caregivers and children to form a relationship when children experience 60–100 different caregivers in the first 19 months of residency (St. Petersburg-USA Orphanage Research Team 2008).

### **The Longer-Term Developmental Consequences of Early Institutionalization**

Infants and toddlers who leave institutions, including those in the Russian Federation and in other countries around the world, at a relatively young age tend to not suffer long-term consequences of their early deprivation. This fact represents a testimony to human resilience and a profound

qualification on some historical emphases on the alleged crucial contribution of the first hours and months of life on later development.

But those who remain in institutions longer experience higher-than-expected rates of a variety of cognitive, language, attention, executive function, social-emotional, peer relations, and behavior problems that persist even years after placement into family care. The behavioral, executive function, and social problems appear correlated, and co-occurrence of these problems is common, suggesting a single underlying, perhaps neurobiological, mediator. How long is too long to remain in residence in any particular institution depends on the severity of deprivation in the institution. It can be as little as 6 months for children in very severe and globally depriving institutions, 18 months for those in social-emotionally depriving Russian institutions, and 24+ months for children from qualitatively better institutions.

Although the quality of the institution and the age at placement make a difference, many PI children placed with families develop within normal ranges, and families are generally satisfied with their placements. Such children adjust fairly rapidly to life in a family, display rapid and substantial catch-up growth in many developmental domains with the qualifications noted above, and may not display poorer adjustment relative to never-institutionalized children. Several cross-sectional studies find more behavioral adjustment problems for PI children during adolescence than childhood, especially for later-adopted children; a few longitudinal studies show only internalizing problems increased over age, but results are somewhat inconsistent. It appears that many physical and cognitive/behavioral problems of PI children tend to be displayed relatively early (Rutter et al. 2010), many persist and some increase through adolescence (Hawk and McCall 2016) and to adulthood (Julian 2014; Sonuga-Barke et al. 2017; Van der Vegt et al. 2009), and some new disorders may arise in adulthood (Van der Vegt et al. 2009).

Although parent-report assessments are often denigrated, the above results for Russian PI children obtained with parent report measures are, in our judgment, largely similar in broad strokes to those reported elsewhere in the literature using independent observations, objective tests, and neurobiological assessments.

A growing number of studies have examined the neurobiological mechanisms that might mediate the effects of early institutionalization. Consistent with the results reviewed here, there may be a sensitive period in roughly the first 2 years of life during which certain types of experience derived from responsive caregiver–child interactions are particularly important. In institutions, the inconsistency of caregivers and lack of warm, sensitive, responsive caregiver–child interactions deprives children of early relationships and produces chronic stress. Some children are



genetically more susceptible to such stress (Conradt 2017), and cumulative exposure to stress may produce epigenetic events that alter development in the prefrontal cortex, hippocampus, and amygdala plus reduced growth hormone production and less immunity (Berens and Nelson 2015; Johnson and Gunnar 2011; Nelson et al. 2011). Collectively, these stress-related neurobiological mechanisms may partially explain the adverse physical, behavioral, and health outcomes observed at higher rates in later-adopted PI children (Nelson et al. 2011).

## Practice and Policy Implications

Currently, there are widespread efforts to encourage the development of family alternatives to institutions. This is the ideal approach. But such efforts can face a variety of obstacles and often take time, and institutions may continue to be used as temporary housing until a family placement can be secured and as more permanent housing for hard-to-place children. The data on age at placement and severity of institutional rearing conditions provides a caution to using institutions as temporary residencies for infants and toddlers—one will never know for any particular institution how long is too long for an infant or toddler to reside there before the likelihood of adverse outcomes increases. So it is wise to do whatever can be done to eliminate or reduce barriers to early placement and/or develop a transition foster care program that houses children in families until permanent placements can be found.

At the same time, institutions do not have to operate in the traditional manner and some do not; the Russian intervention study demonstrated that they can be improved with substantial benefits to children (Groark and McCall 2011), and they can be maintained on a government budget and implemented elsewhere. The same intervention study, however, can be interpreted much differently. It demonstrated that making caregiver–child interactions more “parent-like” and the environment more “family-like” improved children’s development. Thus, it provides evidence that many characteristics of a good family are indeed related to better children’s development, even though this was demonstrated in the context of an institution.

Nearly all advocates agree that every child deserves a loving, stable family. It is a worthy goal, but while attaining it is possible (e.g., Greenberg and Partskhaladze 2014; Johnson et al. 2014), it can take time even under the best of circumstances (McCall et al. 2014b). Certainly, improving the institutions should not siphon off resources or social-political commitment to creating family alternatives, but efforts to improve a child welfare system should aim to provide the best care for *all* the vulnerable children, including those who must live in institutions, as soon as possible.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflicts of interest.

**Ethical approval** All procedures performed in studies involving human participation reviewed in this article were approved by and in accordance with the ethical standards of the relevant institutional research committees and with the 1964 Helsinki declaration and its later amendments.

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