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Parent Ratings of Executive Functioning in Children Adopted from Psychosocially Depriving Institutions

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Abstract

Background—Previous studies have found that post-institutionalized (PI) children are particularly susceptible to attention problems and perform poorly on executive functioning (EF) lab tasks.

Methods—Parent ratings of EF were examined in 288 school-age and 130 preschool-age children adopted from psychosocially depriving Russian institutions that provided adequate physical resources but not one-on-one interactions with a consistent set of responsive caregivers.

Results—Results revealed a step-like association between age at adoption and EF deficits; school-age children adopted after 18 months of age had greater EF difficulties than younger-adopted children and the never-institutionalized normative sample. The onset of adolescence was associated with a greater increase in EF deficits for children adopted after 18 months than for younger-adopted children. Preschool-age children were not found to have greater EF difficulties than the normative sample.

Conclusions—These findings suggest that prolonged early psychosocial deprivation may increase children's risk of EF deficits and that the developmental stresses of adolescence may be particularly challenging for older-adopted PI children.

Keywords

early institutional deprivation; executive functioning

In the last 20 years, more than 300,000 children were adopted internationally into the United States (US Department of State, 2009). Many of these children were raised in institutions which may be characterized by a lack of physical resources, such as nutrition and health care, and psychosocial deficiencies, including frequent changes in caregivers and low levels of responsive caregiving. Following adoption, marked improvements in physical, social, and cognitive development are generally observed, yet many older-adopted post-institutionalized (PI) children display persistent attention problems (Stevens et al., 2008) and perform poorly on tasks assessing *executive functioning* (EF), the higher-order cognitive skills that facilitate goal-directed behavior (Bauer et al., 2009). Given that under typical family rearing conditions certain caregiving practices that occur within a parent-child relationship may promote EF development in young children (Bernier, Carlson, & Whipple, 2010), the current study is an investigation into whether children adopted from institutions characterized primarily by psychosocial deficiencies display EF deficits according to parent report.

Executive Functioning

EF components include working memory, inhibitory control, planning, and set-shifting. *Working memory* is defined as the ability to store and manipulate information in mind over brief periods of time, and *inhibitory control* as suppressing prepotent or automatic responses

that are not relevant to the task at hand. *Set-shifting* refers to the ability to shift cognitively-represented rules and behavior in response to changes in the task or environment. EF components are typically measured using lab tasks, such as the Stroop, Wisconsin Card Sort, and Tower of Hanoi tasks. Performance on EF lab tasks is mediated by neural circuitry involving the prefrontal cortex (e.g., Casey et al., 1997). EF skills may contribute to children's ability to sustain attention, ignore distractions, and succeed academically. For example, children with attention-deficit/hyperactivity disorder (ADHD) are consistently found to perform poorly on tasks assessing inhibitory control and working memory, even after accounting for general cognitive ability (e.g., Willcutt et al., 2005).

While lab tasks are the standard method of assessing EF, parent and teacher ratings of children's EF in naturalistic settings have increased ecological validity. The Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) measures EF deficits via parent ratings of a school-age child's everyday behavioral difficulties in areas such as inhibitory control, working memory, and planning. Parent-reported EF has also been associated with attention and academic outcomes. For example, children with ADHD are found to have greater EF deficits on the BRIEF than typically-developing children (Alloway et al., 2009; Mahone et al., 2002). Associations with prefrontal cortical functioning have been found for parent ratings on the BRIEF Working Memory scale (Mahone, Martin, Kates, Hay, & Horska, 2009). The BRIEF-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003) is a similar rating scale intended for 2- to 5-year-old children.

Executive Functioning in Post-Institutionalized (PI) Children

PI children between the ages of 6 and 11 perform poorly on EF lab tasks relative to children reared in their biological families and to children adopted at young ages from non-institutional settings, specifically with respect to working memory (Bauer, Hanson, Pierson, Davidson, & Pollak, 2009; Bos, Fox, Zeanah, & Nelson, 2009; Pollak et al., 2010), inhibitory control (Colvert et al., 2008; Pollak et al., 2010), planning, and set-shifting (Bauer et al., 2009). However, few studies have examined whether these deficits are similarly reflected in parent ratings of PI children's everyday behavior (Groza, Ryan, & Thomas, 2008; Jacobs, Miller, & Tirella, 2010). For example, PI children were found to score poorly on an inhibitory control composite, which included parent ratings of inhibitory control and several performance-based measures, relative to children adopted at young ages from non-institutional settings (Bruce, Tarullo, & Gunnar, 2009).

Early Psychosocial Deprivation

Under typical family rearing conditions, caregiving practices that occur within the context of a caregiver-child relationship are theorized to promote the development of EF in young children. Attachment theorists propose that caregivers initially act as external regulators of the infant's functioning, gradually facilitating the child's increasing capacity to self-regulate. Supportive caregiving practices include sensitive responsiveness and scaffolding or offering children age-appropriate problem-solving strategies (Bernier, Carlson, & Whipple, 2010). Caregiver contingent responsiveness is thought to provide infants with successful experiences of impacting the social environment which promote the emergence of agency or self-efficacy, and scaffolding to ensure that the child plays an active role in the successful completion of tasks which supports the child's autonomy, goals, choices, and sense of volition. Consistent with this theory, studies of non-adopted children reared from birth in families have found that responsive caregiving during infancy is positively associated with children's inhibitory control abilities and EF development, although effect sizes are small and few studies have examined prediction to EF development in middle childhood or older

(e.g., Kochanska, Murray, & Harlan, 2000; Landry, Smith, & Swank, 2006; Olson, Bates, Sandy, & Schilling, 2002).

In contrast, institutions tend to be characterized by psychosocial deprivation involving a highly regimented daily schedule, frequent changes in caregivers, and few opportunities for one-on-one, child-directed interactions with responsive caregivers (Tirella et al., 2008). Exposure to these rearing conditions during early childhood may disrupt EF development. Children adopted from institutions that were acceptable with respect to physical resources but deficient in psychosocial care have been found to demonstrate attention and other behavior problems suggestive of EF deficits. For example, children adopted after 2 to 3 years from English institutions characterized by a child-to-caregiver ratio of 3:1 but frequent changes in caregivers were found to have more teacher-reported attention, externalizing, and peer problems than their non-adopted, working-class classmates at both 8 (Tizard & Hodges, 1978) and 16 years of age (Hodges & Tizard, 1989).

More recent studies have focused on children adopted from Russian institutions that provided adequate material resources including nutrition, health care, sanitation, toys, supplies, and daily activities. Yet, these institutions were characterized by frequent changes in caregivers who rarely initiated social interactions, did not respond to social bids or emotional distress, and provided little warmth and affection (St. Petersburg-USA Orphanage Research Team, 2005). Children adopted after 18 months of age from these institutions were at increased risk of attention problems and other behavioral difficulties according to parent report (Merz & McCall, 2010). Based on these studies, early exposure to institutions characterized primarily by psychosocial deficiencies is expected to be associated with EF impairment.

PI children may be exposed to other pre-adoption risk factors that contribute to their EF deficits. In particular, poor birth circumstances may also increase PI children's risk of EF impairment (Bos et al., 2009), although several studies have not found birth circumstances to be associated with outcomes in this population (Bruce et al., 2009; Rutter et al., 2007). Therefore, we also examined the role of poor birth circumstances in PI children's EF impairment.

Age at Adoption

PI children adopted at older ages after more prolonged institutional deprivation often have higher rates of cognitive, behavioral, and social problems (MacLean, 2003). Likewise, age at adoption effects have been found for children's performance on EF tasks (Colvert et al., 2008) and parent and teacher ratings of child EF (Groza et al., 2008; Jacobs et al., 2010), although some results have been non-significant or inconsistent (Bos et al., 2009; Pollak et al., 2010), perhaps because the PI groups in these studies were restricted to children adopted after 9–12 months of age.

Findings for children adopted from severely depriving Romanian institutions in the early 1990s have indicated a step-like relation between age at adoption and problems with inhibitory control (Colvert et al., 2008) and attention (Stevens et al., 2007). Specifically, children adopted after 6 months of age had greater deficits than a non-institutionalized adopted comparison group but children adopted before 6 months did not, and additional exposure beyond the first 6 months was not associated with further increases in inhibitory control problems. Results from studies of children adopted from less severely depriving institutions also reveal step functions for behavior problems but at older ages at adoption (Gunnar et al., 2007; Merz & McCall, 2010).

Age at Assessment

Less is known about whether PI children younger and older than 6–11 years of age show EF deficits. Some studies of preschool-age PI children have indicated higher rates of behavior problems (MacLean, 2003), but others have not (Rutter et al., 2007). One pilot study found that 11% of the total sample of 4- to 5-year-old PI children adopted before 24 months had clinical range EF scores on the BRIEF-P, but the rate of clinical range scores increased with age at adoption (Jacobs et al., 2010). Therefore, older-adopted preschool-age children may demonstrate precursors to EF difficulties that become more extreme with age.

Rates of behavior problems are typically found to increase as school-age PI children approach adolescence (Gunnar et al., 2007; Hodges & Tizard, 1989) and face transitions including increased hormone levels, greater independence, less supervision, more conflict with adults, and heightened focus on peer relationships. Older-adopted PI adolescents may be particularly likely to display behavior problems relative to younger PI children and younger-adopted adolescents (Merz & McCall, 2010).

Current Study

The current study examined parent-reported EF deficits in children across a broad age range (2–18 years) adopted from psychosocially depriving institutions. EF difficulties were examined separately in preschool-age (2–5 years) and school-age children (6–18 years) because EF behaviors might be different in these two age groups and because the prior literature yielded inconsistent findings on whether preschool-aged PI children show problems. In contrast, school-age children were expected to show EF deficits compared to the standardization sample of never-institutionalized children reared from birth in families. It was predicted that EF deficits would be associated with an ADHD diagnosis and receiving learning support services for an education disability, consistent with prior findings showing links between EF and these outcomes.

Predictors of EF deficits were then examined. Based on the prior literature, it was tentatively predicted that poor birth circumstances (low birth weight and prematurity) would not be associated with EF deficits. EF difficulties were compared among children adopted within four different age ranges: <9, 9–17, 18–26, and ≥27 months. Given that this PI sample was not exposed to severe deprivation including a lack of physical resources, it was expected that the level of EF difficulties would be increased only among school-age children adopted after 18 or 27 months of age. Further, there might be an age at adoption × age at assessment interaction indicating the heightened vulnerability of older-adopted children to the developmental stresses of adolescence.

Preschool-age children exposed to early psychosocial deprivation were tentatively expected to have a higher mean level of EF deficits than the normative sample. Further, it was predicted that EF deficits would increase with age at adoption and age at assessment.

Method

Sample Description

In the spring of 2008, questionnaires were sent to all adoptive parents on the list of an adoption agency specializing in the placement of Russian children with US families, and 512 surveys were returned (51% response rate). School-age PI children were 6–18 years of age at assessment and 5–60 months of age at adoption ($N=288$), and preschool-age PI children were 2–5 years of age at assessment and 5–27 months of age at adoption ($N=130$). These children were adopted from institutions that were carefully screened for relatively high quality by the adoption agency. Most of the children in the school-age sample were

adopted from institutions in St. Petersburg, Russia that were evaluated in a prior study (St. Petersburg-USA Orphanage Research Team, 2005) and described in the introduction, and many of these children were previously studied with regard to behavior problems (Merz & McCall, 2010). Children were excluded if they had an incomplete BRIEF/BRIEF-P ($n=4$) or marked functional deficits (nine children diagnosed with autism and two with severe cognitive impairment). Children were excluded from the preschool-age sample if they were adopted from institutions in St. Petersburg, Russia following the implementation of an intervention to improve caregiving quality ($n=75$). Characteristics of the PI groups are given in Table 1.

Survey Description

The questionnaires mailed to families contained a battery of numerous assessments, including a 111-item questionnaire used in the International Adoption Project (IAP; Gunnar et al., 2007), the BRIEF or BRIEF-P, an instruction sheet, a consent form, and a stamped return envelope. The instruction sheet described the purpose of the study and assured parents of confidentiality.

Behavior Rating Inventory of Executive Functioning (BRIEF)—The BRIEF (Gioia, Isquith, Guy, & Kenworthy, 2000) asks parents to rate 86 EF problems in their 5- to 18-year-old children as occurring *never*, *sometimes*, or *often*. Responses are summed to form eight scales. The *Inhibit* scale (10 items) measures the ability to control impulses and to stop behavior at the appropriate time. The *Shift* scale (8 items) assesses the abilities to transition, move freely from one activity or aspect of a problem to another as the situation demands, and solve problems in a flexible manner. The *Emotional Control* scale (10 items) reflects the ability to modulate emotional responses appropriately. The *Initiate* scale (8 items) measures the ability to begin a task or activity and to generate ideas independently. The *Working Memory* scale (10 items) assesses the ability to hold information in mind to complete an assignment. The *Plan/Organize* scale (12 items) assesses abilities to anticipate future events, set goals, develop appropriate steps ahead of time, complete tasks in a systematic manner, and understand and communicate a main idea. The *Organization of Materials* scale (6 items) measures the ability to keep work and play areas orderly. The *Monitor* scale (8 items) asks about abilities to check work, assess performance, and to keep track of one's own actions. These scales yield two general indices: the *Behavioral Regulation Index (BRI)*, composed of the Inhibit, Shift, and Emotional Control scales; and the *Metacognition Index (MI)*, composed of the Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor scales. The BRI and MI are combined to form the *Global Executive Composite (GEC)*.

BRIEF scales and indices yield *T* scores (with population $M=50$, $SD=10$) based on age and gender. Higher scores indicate more EF problems, with scores 1.5 *SD* above the normative mean of potential clinical significance. The BRIEF standardization sample ($N=1419$) was 5–18 years at assessment ($M=11$) and 43% male. Given that children with any history of developmental delays were excluded from this sample, it is unlikely to have included any children adopted from institutions.

The BRIEF has adequate reliability and validity (Strauss, Sherman, & Spreen, 2006). The Cronbach alpha measure of internal consistency ranges from .80–.98 for both clinical and normative samples, and the test-retest reliability correlation was .81 (range: .76–.85) for an average two-week interval (Gioia et al., 2000). However, some studies have failed to find significant associations between parent and teacher ratings on the BRIEF and children's performance on EF tasks (Mahone et al., 2002; see review McAuley, Chen, Goos, Schachar, & Crosbie, 2010) while others have found such relations (e.g., Toplak, Bucciarelli, Jain, &

Tannock, 2009). One possible explanation is that the BRIEF measures different components of EF than those measured by performance-based EF tests. Alternatively, tasks may assess underlying EF skills whereas the BRIEF assesses the manifestation of those skills at home and at school (McAuley et al., 2010).

Behavior Rating Inventory of Executive Functioning – Preschool Version (BRIEF-P)

—The BRIEF-P (Gioia, Espy, & Isquith, 2003) contains 63 items about 2- to 5-year-old children which are summed to form five scales: *Inhibit* (16 items), *Shift* (10 items), *Emotional Control* (10 items), *Working Memory* (17 items), and *Plan/Organize* (10 items). These scales yield three composite indices: *Inhibitory Self-Control Index (ISCI)* (Inhibit + Emotional Control), *Flexibility Index (FI)* (Shift + Emotional Control), and *Emergent Metacognition Index (EMI)* (Working Memory + Plan/Organize). The overall composite index is the *Global Executive Composite (GEC)*. BRIEF-P scales and indices yield *T* scores (with population $M=50$, $SD=10$) based on age and gender. Higher scores indicate more EF problems. The nationally representative standardization sample of 2- to 5-year-old children ($N=460$) was 54% male.

The BRIEF-P has adequate reliability and validity (Sherman & Brooks, 2010). Each of the scales demonstrated strong internal consistency; Cronbach alphas were high ($r = .80-.90$). Test-retest reliability coefficients were generally high (.80-.89) to very high (.90+) for an average four-week interval indicating high temporal stability (Gioia et al., 2003). Preschool-age children diagnosed with ADHD had significantly higher BRIEF-P scores than typically-developing children, but BRIEF-P scores had low, non-significant correlations with performance-based measures of working memory and inhibitory control (Mahone & Hoffman, 2007).

Pre-adoption history—*Age at adoption* was defined as the age at which the child came into the parents' full-time care. Parent-reported time in an institution was strongly correlated with age at adoption, $r=.77$, $p<.001$, reflecting that most children were placed in institutions in the first few months of life. Age at adoption was used in analyses rather than time in an institution because it was more frequently and likely more accurately reported.

Parents provided their child's birth weight. *Low birth weight (LBW)* was defined as weighing less than 2500 grams (5 pounds 8 ounces). BW was available for 61% of the school-age PI children and 64% of the preschool-age PI children. School-age children whose parents did not provide BW were older at adoption and assessment than children with BW data, $t(286)=2.82-4.93$, $p<.01$. Preschool-age children with and without BW information did not differ significantly on age at adoption or age at assessment, $t(128)=-.28-.82$, *ns*.

Parents also reported on whether their child's birth was premature. *Prematurity* was strongly associated with LBW in the school-age PI sample, $\chi^2(1, N=149)=40.96$, $p<.001$, and in the preschool-age PI sample, $\chi^2(1, N=72)=32.51$, $p<.001$. Prematurity information was available for 73% of the school-age children and 80% of the preschool-age children. School-age children whose parents did not provide this data were older at adoption and assessment than those with this data, $t(286)=2.55-5.42$, $p<.05$. Preschool-age children with and without prematurity data did not differ significantly on age at adoption or age at assessment, $t(128)=-.32-.56$, *ns*. Differences between responders and non-responders may be a result of birth data having been less frequently available to parents who adopted years ago. Nevertheless, conclusions regarding birth condition must be tempered by this sampling difference.

Post-adoption history—Parents reported on whether their child had been professionally diagnosed with *ADHD* and had ever received learning support services for an educational disability (as specified on their child's Individualized Education Plan). Several additional

measures (years post-adoption, parent(s) with 4-year college degree or greater education, family income, two-parent household) were used to characterize the sample (see Table 1) but were not used in analyses; details about these measures are given in Merz and McCall (2010).

Results

Preliminary analyses indicated that BRIEF *T* scores were not associated with gender. Thus, main analyses did not account for gender.

Aim 1: EF Deficits in School-Age PI Children

Table 2 presents the mean *T* scores on each of the BRIEF scales for the school-age PI group. PI children had a higher mean score on the Global Executive Composite (GEC) than the never-institutionalized standardization sample mean of 50. They had a higher mean score on the Metacognition Index (MI), and the Behavioral Regulation Index (BRI) approached significance. They also had higher mean scores on the Inhibit, Working Memory, Plan/Organize, Organization of Materials, and Monitor scales. Scoring in the clinical range on the BRIEF GEC was associated with an ADHD diagnosis ($\chi^2(1, N=288)=40.53, p<.001$) and receiving learning support services for an educational disability ($\chi^2(1, N=288)=20.79, p<.001$).

Aim 2: Association Between EF Impairment and Poor Birth Circumstances

EF problems were not significantly correlated with either LBW ($r = -.06-.03, ns$) or prematurity ($r = -.05-.09, ns$).

Aim 3: EF Impairment as a Function of Age at Adoption

Table 3 shows mean BRIEF *T* scores of school-age PI children adopted <9, 9–17, 18–26, and ≥ 27 months. Significant group differences were found for all of the BRIEF scales and indices. For the GEC and MI, pairwise comparisons indicated that PI children adopted <9 months did not differ from those adopted between 9–17 months, PI children adopted between 18–26 months had higher GEC and MI scores than those in both of the younger-adopted groups, and children adopted at 27 months or older did not significantly differ from any of the other groups.

For the BRI, PI children adopted <9 months did not differ from those adopted between 9–17 months. Both groups of children adopted ≥ 18 months of age had higher BRI scores than the two younger-adopted groups. Children adopted between 18–26 months did not significantly differ from those adopted ≥ 27 months.

In addition, pairwise comparisons indicated that children adopted <9 months did not have significantly different mean scores than children adopted between 9–17 months on any of the BRIEF scales. PI children adopted between 18–26 months had higher mean scores than those adopted <9 months on the Inhibit, Shift, Emotional Control, Working Memory, Plan/Organize, and Monitor scales and higher mean scores than those adopted between 9–17 months on the Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, and Monitor scales. PI children adopted ≥ 27 months had higher mean scores than those adopted <9 months on the Inhibit and Monitor scales and higher mean scores than those adopted between 9–17 months on the Inhibit and Initiate scales. PI children adopted between 18–26 months did not have significantly different mean scores than those adopted ≥ 27 months on any of the BRIEF scales. Finally, Table 3 also shows the general trend for only PI children adopted after 18 months to have higher mean scores than the never-institutionalized standardization sample mean of 50.

Aim 4: Linear Regression Analyses: Prediction of EF Problems by Age at Adoption, Age at Assessment, and Age at Adoption $\times$ Age at Assessment

Hierarchical multiple regressions were conducted. Scores on the BRIEF indices and scales were regressed on age at adoption (0=younger than 18 months; 1=18 months or older), age at assessment (0=6–11 years; 1=12–18 years), and their interaction. Predictors were entered in the following order: age at assessment, age at adoption, age at assessment $\times$ age at adoption. Results of these analyses are presented in Table 4. All of the regression models were significant. The interaction between age at adoption and age at assessment accounted for unique variance in GEC, BRI, Inhibit, and Plan/Organize difficulties. It approached significance for the MI and several additional scales. Follow-up analyses indicated that the onset of adolescence corresponded to higher EF difficulties among children adopted ≥ 18 months. However, there was a weaker association between age at assessment and EF difficulties among children adopted < 18 months of age (see Figure 1). Note that the onset of adolescence was defined by age (12+ years) and not biological markers.

Aim 5: EF Impairment in Preschool-Age PI Children

Table 2 presents the mean *T* scores on the BRIEF-P. Preschool-age PI children did not have significantly higher scores than the standardization sample on any of the BRIEF-P indices or scales, although their scores on the Inhibit scale were marginally higher ($p < .10$). Preschool-age PI children had significantly lower scores on the Flexibility Index composed of the Shift and Emotional Control scales.

There were no significant correlations between age at adoption and BRIEF-P scores ($r = -.03$ to $-.17$, *ns*). Age at assessment was significantly positively associated with scores on the Inhibitory Self-Control Index, $r = .22$, $p < .05$, and the Inhibit, $r = .18$, $p < .05$, and Emotional Control scales, $r = .22$, $p < .05$. There were no significant associations between LBW and scores on any of the BRIEF-P indices or scales ($r = -.02$ – $.03$, *ns*) or between prematurity and BRIEF-P scores ($r = -.02$ – $.07$, *ns*).

Discussion

The PI children in this study were adopted from psychosocially depriving institutions that provided adequate physical resources but failed to provide one-on-one interactions with a consistent set of responsive caregivers. Results revealed that older-adopted school-age children had greater parent-reported EF deficits than younger-adopted children and the never-institutionalized standardization sample, consistent with prior studies of EF in PI children (e.g., Bauer et al., 2009). Prolonged but not brief exposure to institutional deprivation during early childhood was associated with later EF problems, while poor birth circumstances (prematurity, LBW) were not correlated with EF deficits. These findings suggest that in addition to performing poorly on EF tasks in a lab setting, older-adopted PI children may demonstrate EF difficulties in naturalistic settings. Although alternative explanations cannot be entirely ruled out (see limitations section), these results suggest that early psychosocial deprivation may have contributed to EF difficulties. Based on theory and prior studies of non-adopted children, we can speculate that the lack of responsiveness and scaffolding from a consistent caregiver in the early rearing environment may have disrupted EF development in these PI children.

Results also suggest that there might be a step-like relation between age at adoption from psychosocially depriving institutions and EF difficulties. EF deficits were higher than expected in children adopted after 18 months but not in younger-adopted children, and children adopted after 27 months did not have greater EF difficulties than those adopted between 18–26 months. A step-like relation has been found at 6 months for inhibitory

control in children adopted from severely depriving institutions (Colvert et al., 2008). Thus, in comparison, it may be that a slightly longer duration of exposure may be required for less severe early deprivation to result in later EF problems, which might be due to the relative influences of physical plus psychosocial deprivation versus primarily psychosocial deprivation. In addition, the step function suggests that exposure in early childhood may be particularly detrimental relative to deprivation continuing into older ages. This would be consistent with other findings suggesting that early childhood may be a “sensitive period” for development in various domains (Marshall & Kenney, 2009), although the study of PI children has limitations as a method of investigating sensitive periods (MacLean, 2003).

EF difficulties were significantly predicted by an interaction between age at adoption and age at assessment, such that school-age PI children adopted after 18 months demonstrated a greater increase in EF problems during adolescence than those adopted before 18 months. Prolonged early exposure to psychosocially depriving institutions may lead to an underlying vulnerability to EF problems which only emerge in the presence of additional risk factors, such as developmental stresses occurring during adolescence. For instance, older-adopted PI children might be predisposed to self-regulatory problems which then emerge during adolescence when they are expected to be more independent than younger ages. Nevertheless, it should be noted that the interaction accounted for a small portion of the variance in PI children's EF deficits.

In contrast to the results for school-age PI children, preschool-age PI children did not have greater parent-reported EF difficulties than the normative sample, and EF problems did not increase with age at adoption. In fact, the preschool-age sample as a whole had significantly lower scores on several scales. These findings are consistent with prior studies that have not found greater behavior problems in preschool-age PI children (Rutter et al., 2007) but diverge from a recent study of preschool-age PI children showing age at adoption effects on the BRIEF-P (Jacobs et al., 2010). These results could be due to the young age of the preschool-age PI children consistent with findings indicating increased EF problems with age at assessment. Further, the preschool-age PI children had spent less time in their adoptive homes and thus their behavior may have been influenced by their relatively recent transition from an institution to a family. In particular, their behavior may have reflected adaptation to a highly regimented institutional environment that required children to conform to adult direction. In addition, parents had less time to observe their preschool-age PI child's behavior. These results could also be due in part to methodological factors. Parent-report measures may not have been sensitive enough to detect EF problems in this particular group, or parents may have interpreted these questions in a different manner from what was expected. Also, it is possible that the small number of preschool-age PI children adopted after 18 months of age ($n=14$) was not representative of the overall population.

There are several limitations to this study. All of the children in the sample were adopted from Russia or nations that were formerly part of the Soviet Union. Such children have higher rates of behavior problems than those adopted from other regions (Gunnar et al., 2007), perhaps due to a higher likelihood of prenatal alcohol exposure (PAE), which is associated with EF deficits in never-institutionalized children (e.g., Rasmussen & Bisanz, 2009).

In addition, it was not ideal to compare the PI samples to the rating scale standardization samples because the groups were not assessed at the same time or using the same protocol. Also, the PI groups likely differed from these samples on variables beyond institutional exposure, such as genetic risk factors, prenatal care, birth circumstances, and the experience of adoption. However, poor birth circumstances were not found to be associated with EF deficits in the current study. In addition, older-adopted PI children had greater EF problems

than younger-adopted PI children who are likely similar to the older-adopted group on these potentially confounding variables but did not have higher EF problems than the normative sample.

This study employed a cross-sectional design, and thus it is possible that PI adolescents, who were adopted some years before the younger PI children, could have been exposed to more severe institutional deprivation. However, this is unlikely to explain the results for age because all of the children in the sample were adopted between 1993–2003 during which time no major changes were made in the quality or level of deprivation of institutions in Russia according to the directors of two of the institutions for young children represented here (N. Nikiforova and D. Penkov, personal communication, October 16, 2009).

In addition, the 51% response rate is lower than the 66% of one of the largest international adoption follow-ups (Gunnar et al., 2007) but higher than the 28–36% of the largest follow-up of children adopted from Romania (Groza, Ryan, & Thomas, 2008). Responders and non-responders did not differ significantly in the child's mean age at adoption (15.61 vs. 16.65 months; $t(988)=1.07$, ns). However, the children of responders were younger on average than the children of non-responders (7.66 vs. 9.22 years; $t(1009)=5.72$, $p<.001$). Given that EF problems increased with age at assessment, the sample in the current study may slightly underestimate the level of EF deficits in the larger group, but may be representative in terms of age at adoption.

Finally, measurement of IQ was not conducted so it was not possible to examine whether low IQ might have accounted for the group differences in EF. However, prior studies have found that PI children show EF deficits on lab tasks after accounting for IQ (Colvert et al., 2008), and children with ADHD have higher BRIEF scores than typically developing children after controlling for IQ (Toplak et al., 2009). Further examination of the specificity of EF deficits relative to impairment in general cognitive ability is warranted.

Key Points

- Previous studies show that post-institutionalized (PI) children are particularly susceptible to attention problems and perform poorly on executive functioning (EF) tasks
- School-age children adopted after 18 months from psychosocially depriving Russian institutions were found to have increased parent-reported EF difficulties relative to younger-adopted children and the never-institutionalized normative sample
- Older-adopted school-age PI children had greater increases in EF problems during adolescence than those adopted at younger ages
- Support services for PI children might target EF skills to improve academic performance, and older-adopted PI adolescents might have increased treatment needs

References

- Alloway TP, Gathercole SE, Holmes J, Place M, Elliott JG, Hilton K. The diagnostic utility of behavioral checklists in identifying children with ADHD and children with working memory deficits. *Child Psychiatry and Human Development*. 2009; 40(3):353–366. [PubMed: 19280339]

- Bauer PM, Hanson JL, Pierson RK, Davidson RJ, Pollak SD. Cerebellar volume and cognitive functioning in children who experienced early deprivation. *Biological Psychiatry*. 2009; 66(12): 1100–1106. [PubMed: 19660739]
- Bernier A, Carlson SM, Whipple N. From external regulation to self-regulation: early parenting precursors of young children's executive functioning. *Child Development*. 2010; 81(1):326–339. [PubMed: 20331670]
- Bos KJ, Fox N, Zeanah CH, Nelson CA. Effects of early psychosocial deprivation on the development of memory and executive function. *Frontiers in Behavioral Neuroscience*. 2009; 3:1–7. [PubMed: 19194528]
- Bruce J, Tarullo AR, Gunnar MR. Disinhibited social behavior among internationally adopted children. *Development and Psychopathology*. 2009; 21:157–171. [PubMed: 19144228]
- Casey BJ, Trainor RJ, Orendi JL, et al. A developmental functional MRI study of prefrontal activation during performance of a go-no-go task. *Journal of Cognitive Neuroscience*. 1997; 9:835–847.
- Colvert E, Rutter M, Kreppner J, Beckett C, Castle J, Groothues C, Hawkins A, Stevens S, Sonuga-Barke EJS. Do theory of mind and executive function deficits underlie the adverse outcomes associated with profound early deprivation?: Findings from the English and Romanian Adoptees Study. *Journal of Abnormal Child Psychology*. 2008; 36(7):1057–1068. [PubMed: 18427975]
- Gioia, GA.; Isquith, PK.; Guy, SC.; Kenworthy, L. The BRIEF professional manual. Psychological Assessment Resources; Odessa, FL: 2000.
- Gioia, GA.; Espy, KA.; Isquith, PK. The BRIEF-P professional manual. Psychological Assessment Resources; Odessa, FL: 2003.
- Groza V, Ryan SD, Thomas S. Institutionalization, Romanian adoptions and executive functioning. *Child & Adolescent Social Work Journal*. 2008; 25(3):185–204.
- Gunnar MR, van Dulmen MHM, The IAP Team. Behavior problems in post-institutionalized internationally adopted children. *Development and Psychopathology*. 2007; 19:129–148. [PubMed: 17241487]
- Hodges J, Tizard B. Social and family relationships of ex-institutional adolescents. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. 1989; 30:77–97.
- Jacobs E, Miller LC, Tirella LG. Developmental and behavioral performance of internationally adopted preschoolers: a pilot study. *Child Psychiatry Human Development*. 2010; 41(1):15–29.
- Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology*. 2000; 36(2): 220–232. [PubMed: 10749079]
- Landry SH, Smith KE, Swank PR. Responsive parenting: Establishing early foundations for social, communication, and independent problem-solving skills. *Developmental Psychology*. 2006; 42(4): 627–642. [PubMed: 16802896]
- MacLean K. The impact of institutionalization on child development. *Development and Psychopathology*. 2003; 15:853–884. [PubMed: 14984130]
- Mahone EM, Cirino PT, Cutting LE, Cerrone PM, Hagelthorn KM, Hiemenz JR, Singer HS, Denckla MB. Validity of the BRIEF in children with ADHD and/or Tourette syndrome. *Archives of Clinical Neuropsychology*. 2002; 17(7):643–662. [PubMed: 14591848]
- Mahone EM, Hoffman J. Behavior ratings of executive function among preschoolers with ADHD. *Clinical Neuropsychology*. 2007; 21(4):569–586.
- Mahone EM, Martin R, Kates WR, Hay T, Horska A. Neuroimaging correlates of parent ratings of working memory in typically developing children. *Journal of the International Neuropsychological Society*. 2009; 15(1):31–41. [PubMed: 19128526]
- Marshall PJ, Kenney JW. Biological perspectives on the effects of early psychosocial experience. *Developmental Review*. 2009; 29(2):96–119.
- McAuley T, Chen S, Goos L, Schachar R, Crosbie J. Is the BRIEF more strongly associated with measures of impairment or executive function? *Journal of the International Neuropsychological Society*. 2010; 16(3):495–505. [PubMed: 20188014]
- Merz EC, McCall RB. Behavior problems in children adopted from psychosocially depriving institutions. *Journal of Abnormal Child Psychology*. 2010; 38(4):459–470. [PubMed: 20084451]

- Olson SL, Bates JE, Sandy JM, Schilling EM. Early developmental precursors of impulsive and inattentive behavior: From infancy to middle childhood. *Journal of Child Psychology and Psychiatry*. 2002; 43(4):435–448. [PubMed: 12030590]
- Pollak SD, Nelson CA, Schlaak MF, Roeber BJ, Wewerka S, Wiik K, et al. Neurodevelopmental effects of early deprivation in post-institutionalized children. *Child Development*. 2010; 81(1): 224–236. [PubMed: 20331664]
- Rasmussen C, Bisanz J. Executive functioning in children with Fetal Alcohol Spectrum Disorders: profiles and age-related differences. *Child Neuropsychology*. 2009; 15(3):201–215. [PubMed: 18825524]
- Rutter M, Beckett C, Castle J, Colvert E, Kreppner J, Mehta M, et al. Effects of profound early institutional deprivation: An overview of findings from a UK longitudinal study of Romanian adoptees. *European Journal of Developmental Psychology*. 2007; 4(3):332–350.
- Sherman EM, Brooks BL. BRIEF-P: Test Review and Clinical Guidelines for Use. *Child Neuropsychology*. 2010:1–17.
- St. Petersburg-USA Orphanage Research Team. Characteristics of children, caregivers, and orphanages for young children in St. Petersburg, Russian Federation. *Journal of Applied Developmental Psychology: Special Issue on Child Abandonment*. 2005; 26:477–506.
- Stevens SE, Sonuga-Barke ES, Kreppner JM, Beckett C, Castle J, Colvert E, et al. Inattention/overactivity following early severe institutional deprivation: Presentation and associations in early adolescence. *Journal of Abnormal Child Psychology*. 2007; 36:385–398. [PubMed: 17965931]
- Strauss, E.; Sherman, EMS.; Spreen, O. BRIEF. In: Strauss, E.; Sherman, EMS.; Spreen, O., editors. *A compendium of neuropsychological tests: Administration, norms, and commentary*. Oxford University Press; New York: 2006. p. 1090-1099.
- Tirella LG, Chan W, Cermak SA, Litvinova A, Salas KC, Miller LC. Time use in Russian baby homes. *Child: Care, Health and Development*. 2008; 34(1):77–86.
- Tizard B, Hodges J. The effect of early institutional rearing on the development of eight-year-old children. *Journal of Child Psychology and Psychiatry and Allied Disciplines*. 1978; 19:99–118.
- Toplak ME, Bucciarelli SM, Jain U, Tannock R. Executive functions: Performance-based measures and the BRIEF in adolescents with ADHD. *Child Neuropsychology*. 2009; 15(1):53–72. [PubMed: 18608232]
- US Department of State. Immigrant visas issued to orphans coming to the U.S. 2009 [Accessed 6/12/2010]. Available at <http://www.travel.state.gov/pdf/MultiYearTableXIII.pdf>.
- Willcutt EG, Doyle AE, Nigg JT, Faraone SV, Pennington BF. Validity of the executive function theory of ADHD: A meta-analytic review. *Biological Psychiatry*. 2005; 57:1336–1346. [PubMed: 15950006]

Figure 1.
Predicted levels of EF impairment as a function of age at assessment for children who were <18 and ≥18 months of age at adoption

Table 1

Sample characteristics of 130 preschool-age and 288 school-age post-institutionalized children

	Post-institutionalized children	
	Preschool-age (2–5 years)	School-age (6–18 years)
Mean(<i>SD</i>) years of age	4.03(1.01)	10.45(3.49)
Boys/girls	59/71	121/167
Mean(<i>SD</i>) months at adoption	12.09(4.12)	15.70(11.40)
Birth country	Russia(115)	Russia(244)
	Belarus(15)	Belarus(35)
		Other FSU(9)
Mean(<i>SD</i>) years post-adoption	3.02(1.23)	9.14(3.29)
Two-parent household	92%	88%
Parent(s) with 4-year college degree or higher education	93%	90%
Mean income	\$100,000–\$125,000	\$100,000–\$125,000
ADHD diagnosis	2%	21%
Ever received learning support services for educational disability	--	39%

Note. FSU, former Soviet Union; '4-year college' was coded if *either* parent had attained this level of education.

Table 2

Mean level of executive functioning problems in school-age (BRIEF; N=288) and preschool-age post-institutionalized children (BRIEF-P; N=130)

BRIEF/BRIEF-P scale/index	Post-institutionalized children					
	School-age			Preschool-age		
	M	SD	t(287)	p	M	SD t(129) p
Inhibit	53.92 ***	13.67	4.86	.00	51.76 ⁺	10.63 1.88 .06
Shift	49.40	11.42	-.13	.89	47.08 ***	7.86 4.24 .00
Emotional Control	49.91	11.52	-.89	.38	47.78 *	10.18 2.49 .01
Initiate	51.07	11.95	1.52	.13	--	-- -- --
Working Memory	53.66 ***	13.05	4.76	.00	50.56	11.01 .58 .57
Plan/Organize	52.17 **	13.06	2.82	.01	48.45 ⁺	10.43 1.70 .09
Organization of Materials	51.56 *	10.30	2.56	.01	--	-- -- --
Monitor	53.04 ***	13.68	3.78	.00	--	-- -- --
Behavioral Regulation	51.27 ⁺	12.34	1.75	.08	--	-- -- --
Metacognition	52.86 **	13.07	3.72	.00	--	-- -- --
Inhibitory Self-Control	--	--	--	--	50.08	10.69 .08 .93
Flexibility	--	--	--	--	46.94 ***	8.65 4.04 .00
Emergent Metacognition	--	--	--	--	49.71	11.12 .30 .76
Global Executive Composite	51.92 *	12.63	2.59	.01	49.31	10.64 .73 .47

Note. Bolded means are significantly higher and italicized means significantly lower than the non-PI population mean of 50(SD=10).

⁺ $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 3

Mean level of executive functioning problems in the school-age post-institutionalized group by age at adoption

BRIEF scale/index	Age at adoption (months)				F(3,281)
	<9	9–17	18–26	≥27	
	n=78	n=139	n=32	n=39	
	M(SD)	M(SD)	M(SD)	M(SD)	
Inhibit	51.67(11.83)	51.62(11.72)	62.25 (7.39)	59.77 (16.07)	8.46***
Shift	48.37(10.17)	47.45(9.80)	57.19 (14.58)	52.03(13.42)	7.54***
Emotional Control	48.12(9.93)	48.61(10.86)	55.81 (14.36)	53.28(12.30)	5.02**
Initiate	49.78(11.35)	49.42(10.92)	56.50 (12.62)	55.10 (14.09)	4.72**
Working Memory	51.24(12.05)	52.58 (12.71)	61.06 (15.06)	56.23 (12.26)	4.80**
Plan/Organize	50.65(12.24)	50.12(12.32)	60.47 (15.39)	55.64 (12.22)	6.53***
Organization of Materials	50.34(9.08)	50.76(10.41)	55.68 (10.54)	53.54(11.20)	2.96*
Monitor	50.44(11.95)	51.41(13.73)	61.09 (14.66)	57.44 (12.85)	6.83***
Behavioral Regulation	49.29(10.18)	49.22(10.82)	59.50 (16.64)	55.77 (13.71)	8.60***
Metacognition	50.82(11.86)	51.14(12.84)	60.78 (14.46)	56.59 (12.19)	6.59***
Global Executive Composite	49.99(11.24)	50.29(11.89)	59.31 (15.47)	55.56 (12.77)	6.68***

Note. Bolded values are significantly higher than the non-PI population mean of 50 (at the .05 level).

*
p<.05

**
p<.01

p<.001

Table 4

Hierarchical regression analyses: Predicting executive functioning problems from age at adoption, age at assessment, and age at adoption $\times$ age at assessment.

Predictor	BRIEF index/scale															
	GEC		BRI		MI		Inhibit		Shift		Emotion Control		Initiate		WM	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Age at assessment ^a	.23	.05***	.14	.02**	.26	.07***	.09	.01	.14	.02*	.15	.02**	.21	.04***	.20	.04**
Age at adoption ^b	.19	.03**	.26	.06***	.18	.03**	.28	.07***	.23	.05***	.19	.03**	.17	.03**	.16	.02*
Age at assessment $\times$ age at adoption	.51	.02*	.43	.01*	.39	.01+	.48	.02*	--	--	.36	.01+	.39	.01+	--	--

Note. GEC, Global Executive Composite; BRI, Behavioral Regulation Index; MI, Metacognition Index; WM, Working Memory; Org. of Materials, Organization of Materials.

^a categorical variable (6–11, 12–18 years)

^b categorical variable (<, $\geq$ 18 months)

+ $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

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