Executive function in young children with experience of institutional social-emotional deprivation in a program of early intervention

Background and conceptual framework

Research data on developmental outcomes in postinstitutionalized (PI) children demonstrate that institutional settings, usually characterized by minimal resources, non-permanent staff of the institution, and inadequate socio-emotional interaction between caregiver and a child (IJzendoorn et al., 2011; Muhamedrahimov et al., 2009) are associated with significant alterations in biological outcomes such as gene expression (McGowan et al., 2015; Naumova et al., 2012), telomere shortening (Blaze et.al., 2015; Grosa et al., 2008), hormone production (Doom et al., 2013; Gunnar, 2001), and specific structural and functional disturbances in different brain areas (Bick et al., 2015; Eluvathingal et al., 2006), as well as severe lags in physical, language, socioemotional, and cognitive development (Nelson et al., 2007; Rutter et al., 2010). Significant deficits are apparent in PI children even after years of adoption with delays persisting into adolescence and young adulthood (Colvert et al., 2008; Merz et al., 2011; Pollak et al., 2010).

Executive function (EF) studies hold a special place in developmental research devoted to the outcomes of adversity, neglect and social deprivation (including rearing in institutions) in early childhood since it is considered that EF has a particular influence on different aspects across the lifespan (mental health, physical health, quality of life, school readiness and school success, job success, marital harmony) (Diamond, 2013). Early childhood is the most vulnerable period of EF development with children who have experienced early maltreatment more likely to exhibit deficits in EF (Merz et al., 2013; Sanchez, 2009; Vasilyeva et al., 2017).

EF refers to the set of higher order cognitive processes involved in conscious control of thoughts, actions and emotions; key brain regions involved in EF include not only the prefrontal cortex, but also the anterior cingulate, parietal cortex, as well as limbic structures (Diamond, 1988; Rothbart et al., 2005). According to traditional view, there are three core EFs: cognitive flexibility, working memory and inhibitory control. Nevertheless, recent theorists proposed that there are two distinct EF aspects (subcomponents) that operate differently in different contexts (Hongwanishkul et al., 2005; Zelazo et al., 2011). The "Hot" (affective) subcomponent predominantly engages emotion/motivation regulation skills and "cool" (cognitive) subcomponent is mostly associated with the performance on abstract, emotionally neutral and context-isolated tasks (Hongwanishkul et al., 2005; Kim et al., 2013; Zelazo et al., 2011). The cool-hot distinction has important implications for research into child development, particularly for populations that experienced early life adversity (e.g., children reared in institutional care) as EF was found to be a strong predictor of children's later behavior and academic outcomes. Studies on children from intact biological families show that cool EF task performance significantly predicts school readiness, academic, math and learning skills, while scores on hot EF measures at early childhood are significantly associated with further behavioral problems during school period, in particular, with externalizing disorders in preadolescents and coping strategies in adolescents (Kim et al., 2013, Kochanska et al., 2013).

PI children of school age often show pervasive perturbations in specific EF skills such as inhibitory control (Colvert et al., 2008; Pollak et al., 2010), conflict resolution (Loman et al., 2013), working memory, executive attention, and task switching (Colvert et al., 2008). Moreover, deficits on hot EF measures predict children's social-emotional adjustment and further risk for psychopathology problems (Colvert et al., 2008; Bos et al., 2009). Yet the information concerning EF in young children with the history of institutionalization is limited. Among studies of EF in young PI children, there have been no studies of which I am aware focused on cool/hot EF subcomponents. Further consideration of cool/hot subcomponents model of EF might be useful in predicting diverse developmental outcomes in children living in non-optimal environments at early ages. Moreover, given the consideration of EF as a heterogeneous construct, it is quite useful to investigate what EF aspects would be most vulnerable to the effects of institutional care and what EF aspects could most effectively be remediated. Questions about the degree of reversibility of postinstitutional problems in early cool and hot EF skills also remain open.

For the last decade, significant changes associated with the reduction in the number of institutions for infants and young children in the Russian Federation (i.e., the number of these institutions decreased from 254 with 20,621 children in 2005 to 161 with 8,575 children in 2016) - and the transfer of most of these children to substitute families occurred in the Russian child welfare system. At the same time there are no evidence-based intervention programs implemented for substitute families in RF, and the percentage of children returned to institutions is substantial. To assess whether increasing parental sensitivity would result in increased permanency, the intervention, Attachment and Biobehavioral Catch-up intervention

(ABC) (Dozier et al., 2006), was implemented with a subset of parents fostering children leaving institutional care. ABC is an evidence based intervention program with evidence of efficacy at both the behavioral and biological level. One of the effects of the ABC intervention program is improving EF in young children who experienced early maltreatment living in foster families (Dozier, 2011; Lind, 2017). Nevertheless, there is a lack of research data devoted to ABC intervention influence on EF in young children transferred from institutions into domestic foster families. The current study sought to eliminate the aforementioned gap and to expand knowledge through studying early stages of cool and hot EF subcomponents development after intervention in substitute families. We hypothesized that we would observe differences in EF subcomponents in children living in different social conditions (institutions vs. substitute vs. biological families), and specific changes in both cool and hot EF measures will be evident in children after ABC intervention program.

Current Study

The main aim of the present study was to examine cool and hot EF development in young children with a history of institutionalization who participate in ABC intervention relative to EF subcomponents in young children living in institutions, young children living in their biological families, and in substitute families who did not participate in ABC intervention program.

Method

Participants

Participants were 58 (boys=31) typically developing children (56 in analyses) with and without institutional experience living in Russian Federation. Children with institutional experience were those transferred from typical Russian institutions for young children (called Baby Homes) to domestic post-institutional (PI) families (including adoption, nonrelative guardianship and foster care), or those who were living in Baby Homes (BH). These Baby Homes are characterized by adequate medical care and physical resources (The St. Petersburg-USA Orphanage Research Team, 2008), and after implementation of a Resolution of the Russian Federation Government (№481, 2014) by improved caregiving environment with smaller (up to 6) children per group integrated by age and disability status, no "graduations" of children to new groups, primary caregivers appointed to each group with more consistent working hours during the week, fewer number of caregivers per group, and "family hour" established twice daily in which visitors were prohibited and children spent time with their caregivers.

PI children in analyses (N = 24) were 24 to 55 months at assessment, M (SD)= 38.8 (9.6), 0 to 22 months in residence in the institution, M(SD)= 9 (7.6), and 7 – 45 months in PI family, M (SD)= 26.7 (11.3). Children who were enrolled in the ABC intervention program (PI-ABC group, n=13 (boys=5)) were 24-55 months at assessment, M (SD)= 39.4 (11.3), 2 to 18 months in residence in the institution, M(SD)= 6 (4.8), 18 – 45 months in PI family, M (SD)= 31.5 (9,6), and 5 to 16 months after intervention, M(SD)= 12.3 (2.8). Children who were enrolled in not-ABC intervention program (PI-not-ABC group, n=11 (boys=5)) were 28-52 months at assessment, M (SD)= 38 (7.8), 0 to 22 months in residence in the institution, M(SD)= 11.8 (9.2), 7 – 45 months in PI family, M (SD)= 21 (10.8), and 2 to 16 months after intervention, M(SD)= 7.5 (5.1).

BH children (N = 14) were 21 to 36 months at assessment, M (SD)= 28.4 (4.8), and with 2 to 23 months in residence in the institution, M(SD)= 7.1 (5.7). Therefore, the middle age in BH group was lower than in all the other groups.

The non-institutional group consisted of 18 children living in their biological families and having no institutional experience (BF group) at the age of 24-58 months at assessment, M (SD)= 40.2 (10.7). Characteristics (means, standard deviations, and differences) of the PI groups (PI combined, PI-ABC, PI-not-ABC), institutional (BH) and non-institutional (BF) groups are given in Table 1.

Most PI families (83,3%; 69.2% of PI-ABC, and 83.3% of PI-not-ABC) and 83,3% of Non-I families (BF) had a two-parent household. The families' income per month (converted from Russian Federation rubles to U.S. dollars) was $500 to $1500 across families. Of PI-mothers, 87.5% (84.6% of PI-ABC and 83.3% of PI-not-ABC) had at least college degree of education, as compared with 92% of the non-PI mothers. Thus, as is shown in Table 1, there were no significant differences between PI-ABC, PI-not-ABC and BF groups in number in the household, mother's degree, family income and living conditions.

TABLE 1. Descriptive Data on Children in Postinstitutional (PI Combined, PI-ABC, PI-not-ABC), Institutional (BH) and Non-Institutional (BF) Groups

Group Characteristics	PI Groups			BH	BF	Differences
	PI-Combined	PI-ABC	PI-not-ABC			
N (male)	*25 (10)*	*13(5)*	*12(5)*	*14(10)*	*19(11)*	-
N(male) in analysis	*24(10)*	*13(5)*	*11(5)*	*14(10)*	*18(10)*	-
M (SD) Age at Assessment (months)	*38.8 (9.6)*	*39.4 (11.3)*	*38 (7.8)*	*28.4 (4.8)*	*40.2 (10.7)*	BH vs. PI-Combined**, PI-C**, PI-ABC**, PI-not-ABC**, BF **
M (SD) Length in BH Residence (months)	*9 (7.6)*	*6 (4.8)*	*11.8 (9.2)*	*7.1 (5.7)*	-	PI-ABC vs. PI-not-ABC†
M (SD) Months in PI Family (months)	*26.7 (11.3)*	*31.5 (9,6)*	*21 (10.8)*	-	-	PI-ABC vs. PI-not-ABC**
M (SD) months after intervention (months)	*7.1 (5)*	*12.3 (2.8)*	*7.5 (5.1)*	-	-	PI-ABC vs. PI-not-ABC**
Two-Parent Household	*83,33%*	*69.2%*	*83.3%*	-	*83,3%*	NS
Mothers With College Degree or More	*87,5%*	*84,6%*	*83.3%*	-	*92%*	NS
Families living in own apartment or house	*95,8%*	*92.3%*	*100%*	-	*100%*	NS
Family income (monthly) **less than $500** **$500-$1000** **$1000-$1500** **more than $1500**	*8,3%* *33,3%* *45,8%* *16,7%*	*7.7%* *23.1%* *61.5%* *7.7%*	*8.3%* *33,3%* *25%* *25%*	-	*27,8%* *27,8%* *22,2%* *22,2%*	NS

*Note: †p < .10, *p < .05, **p < .01*

Procedure

Intervention.

ABC-intervention

The ABC intervention program was designed to help children develop regulatory capabilities and targeted helping caregivers to a) nurture children thus enhancing the formation of secure attachments, b) follow children's lead and thus increase children's regulatory skills, and c) avoid frightening children (Dozier et al., 2011). The intervention included a manualized curriculum and interactive 1-hour home sessions once a week during 2.5 months (10 session) provided by a parent coach. Within the framework of scientific cooperation between SPBGU and the University of Delaware, 4 coaches were trained and supervised as they implemented ABC in Russian Federation. Parent coaches worked to change parenting behaviors through special techniques such as "in the moment" feedback about parents' interactions with their children during the session, video feedback, manualized discussion of research as well as discussion of parent's own childhood experience (their "voices from the past") to override their automatic behavior.

Not-ABC-intervention

The Not-ABC intervention program included a common and accessible program of parent and child consultation with a pre-school psychologist or special teacher on issues of child's development (cognitive,

language and motor skills) with or without preliminary assessment of the child's development by using the KID/RSDI scales (Ireton, 1992; Reuters, 1997).

Assessments and procedures.

All assessments were provided in testing rooms organized with minimum distractions. An assessor conducted all the procedures of executive function measures. Before the assessment parents were informed about the project and assigned all the necessary documents. All sessions were video recorded. Families were compensated in the amount of $15 and also compensated for taxi fare if necessary.

Executive Function Measures

The four executive functioning tasks administered in our study were modified from a variety of tasks that has been frequently used to assess executive functioning cool and hot skills in young children: Reverse Categorization (Carlson et al., 2004), Spin the Pots (Hughes et al., 2005), Snack Delay (Kochanska et al., 2000) and Gift Wrap & Gift Delay (Kochanska et al., 2000). In our study these four aforementioned tasks were combined together and implemented as developmentally sensitive EF measures for children at early ages. The tasks were presented in a fixed order (Reverse Categorization, Snack Delay, Spin the Pots and Gift Wrap & Gift Delay) that alternated difficulty levels. These tasks took approximately 30-40 minutes. Parents or baby home medical staffers, nurses, special teachers (hereafter referred to as the caregivers) stayed in the testing room during all sessions, sitting near the child. A short verbal instruction with description of each episode and special rules for caregiver was given prior to the beginning of the assessment to minimize interference. The assessor monitored child's state during session ensuring that the child was quiet and alert before a new episode begins, and provide brief rests between episodes, if needed.

Cool Executive Function Measures

Reverse Categorization (adapted from Carlson et al., 2004). In this task children were asked to sort big and small blocks according to their size into big and small buckets and then to change (reverse) this categorization rule and to sort the big blocks into the small bucket and vice versa. The assessor demonstrated six preswitch trials (3 of each size): on each trial he repeated the rule (e.g., "Big block goes in the big bucket") and identified the size of the current block. Then child was required to sort the remaining 6 blocks. For all preswitch trials assessor gave positive feedback to the child or corrected his response. After that assessor proposed a ''silly game'' and suggested to put the big blocks in the small bucket and the small blocks in the big bucket. 12 postswitch trials were administered with rule reminder and identification the size of the block before each trial. No feedback was given. *Scoring:* responses were coded live and the proportions of correct responses in pre- and postswitch trials were considered.

Spin the Pots (adapted from Hughes et al., 2005). In this task children were presented with Lazy Susan, eight pots painted in different colors, 6 small toys and a top. Children were then asked to help the assessor with hiding every toy under the pots on Lazy Susan (2 pots remains empty). After that Lazy Susan with pots was covered with a top and rotated in 360 degrees. Children were asked to find one toy after every rotation. The task ended when children found all hidden toys or when the maximum number of spins (16) was reached. *Scoring*: 16 minus the total number of errors made; the number of found toys**.**

Hot Executive Function Measures

Snack Delay (adapted from Kochanska et al., 2000). In this task the child had to wait for a signal (bell ringing by assessor) to retrieve the snack (little cracker) from under a transparent plastic cup. After a training phase, 4 trials with delays of 10, 20, 30 and 15 seconds were administered. The child was reminded of the rule on every trial, with no feedback given. *Scoring:* child's behavior during the waiting and time child waited before retrieving the snack.

Gift Wrapped & Gift Delay (adapted from Kochanska et al., 2000). In this task the child had to wait for a gift. According to the rule, the child couldn't take the present before assessor finished wrapping (at the 1st task phase) and turned back to a room with a bow (at the 2d phase). *Scoring:* child's behavior, peeking and waiting time.

Results

Preliminary analysis

Children's executive function problems were not associated significantly with their gender (coded as male=1, female=0) but associated significantly with their age at the time of the assessment ($F(1, 51) = 33.350$; $p < .001$, $\eta^2 = .395$). Thus, age at assessment was included as a covariate in analyses of both cool and hot EF subcomponents. Controlling for child age, there was a modest but statistically significant effect of social-emotional environment type on EF measures.

For data analyses the standardizing procedure using the z-score-transformation of the data was conducted due to the reason that the EF tasks had different measurement units (points; time in seconds).

For each test, a total indicator was obtained characterizing the level of performance of this test for each group of children (task z-score mean). Further, for each group of children, an average total indicator (group z-score mean) was obtained to reflect the level of cool and hot EF performance. The values of group z-score mean in cool and hot executive functions in groups of children from substitute families, baby homes and biological families are presented in Table 2.

Table 2. Composite z-scores in cool and hot EF tasks in PI-ABC, PI-not-ABC, BH and BF groups (M *(SD)*)

Z-scores in EF tasks	Groups					Differences
	PI-combined	PI-ABC	PI-not-ABC	BH	BF	
Hot EF z-score	0.08 *(0.68)*	0.04 *(0.63)*	0.13 *(0.76)*	-0.95 *(0.55)*	0.63 *(0.33)*	BH vs. PI-ABC**, PI-not-ABC**, BF***; PI-ABC vs. BF*; PI-combined vs. BH***, BF**
Cool EF z-score	0.16 *(0.77)*	0.26 *(0.76)*	0.04 *(0.79)*	-0.89 *(0.57)*	0.48 *(0.67)*	BH vs. PI-ABC*, BF**; PI-combined vs. BH*

*Note: *p < .05, **p < .01, ***p < .001*

Main analysis

Group differences in hot EF

Analyses of variance was performed with group (PI-combined, BH, and BF) as the independent variable and hot EF composite z-score as the dependent variable (ANCOVA-1; covariate/age at assessment). There was a main effect of group, F (2, 52) = 19.859; p≤0,001, ŋ2=0.433. Results revealed children in the PI-combined group (M=0.08, *SD=0.68*) had significantly lower composite z-scores than children in BF group (M=0.63, *SD=0.33*; p=0.007) and significantly higher hot EF composite z-scores than children in BH (M= -0.95, *SD=0.55*; p=0,001) group (Table 2; Figure 1a. Children from BH had the lowest composite z-score in EF hot measures.

Next analyses of variance were performed with group (PI-ABC, PI-not-ABC, BH, and BF) as the independent variable, and hot EF composite z-score as the dependent variable (ANCOVA-2; covariate/age). There was a main effect of group, F (3, 51) = 13,206; p≤0,001, ŋ2=0.437. Results showed that children from PI-ABC group differed significantly on hot EF composite from BH and BF groups: hot EF composite z-score in PI-ABC (M= 0.04, *SD=0.63*) group was higher than the BH (M= -0.95, *SD=0.55;* p=0.01) group and lower than the BF (M=0.63, *SD=0.33*; p=0.05) group. Results also showed that children from BH group (M=0.63, *SD=0.33*) performed significantly worse on hot EF than PI-not-ABC (M=0.13, *SD=0.76*; p=0.002) and BF (M=0.63, *SD=0.33*; p=0.001) groups. There were no significant differences between PI-ABC and PI-not-ABC groups on hot EF (Table 2, Figure 2a).

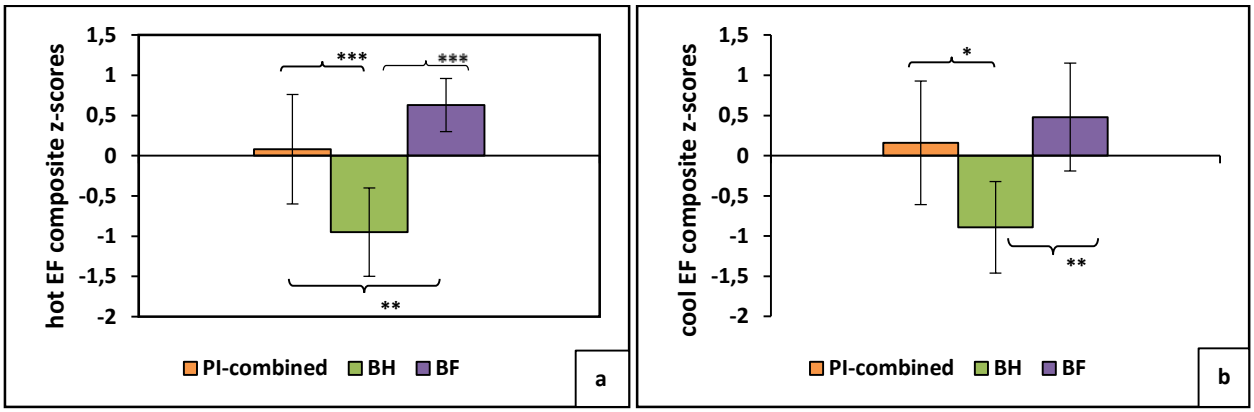

Figure 1. Hot (a) and cool (b) EF composite z-scores in PI-combined, BH and BF groups.
(Note: *p < .05, **p < .01, ***p < .001)

Group differences in cool EF

Analyses of variance was performed, with group (PI-combined, BH, and BF) as the independent variable, and cool EF composite z-score as the dependent variable (ANCOVA-1; covariate/age at

assessment). There was a main effect of group, F (2, 52) = 7.132; p≤0,01, ŋ2=0.215. Results revealed children in the PI-combined group (M=0.16, *SD=0.77*) had higher cool EF z-scores than children in BH (M= -0.89, *SD=0.57*; p=0.05) group (Table 2; Figure 1b) but had no significant differences with BF group.

Next analyses of variance were performed with group (PI-ABC, PI-not-ABC, BH, and BF) as the independent variable, and cool EF composite z-score as the dependent variable (ANCOVA-2; covariate/age). There was a main effect of group, F (3, 51) = 13,206; p≤0,001, ŋ2=0.437. Children from PI-ABC group differed significantly on cool EF composite in comparison to BH and BF groups: cool EF composite z-score in PI-ABC (M= 0.16, *SD=0.77*) group was higher than the BH group (M= -0. 89, *SD=0.57;* p=0.01). Results indicated children from BH group (M= -0. 89, *SD=0.57*) performed significantly worse on cool EF measures than children in BF group (M=0.63, *SD=0.33*; p=0.01). There were no significant differences between PI-ABC, PI-not-ABC and BF groups on cool EF (Table 2, Figure 2b).

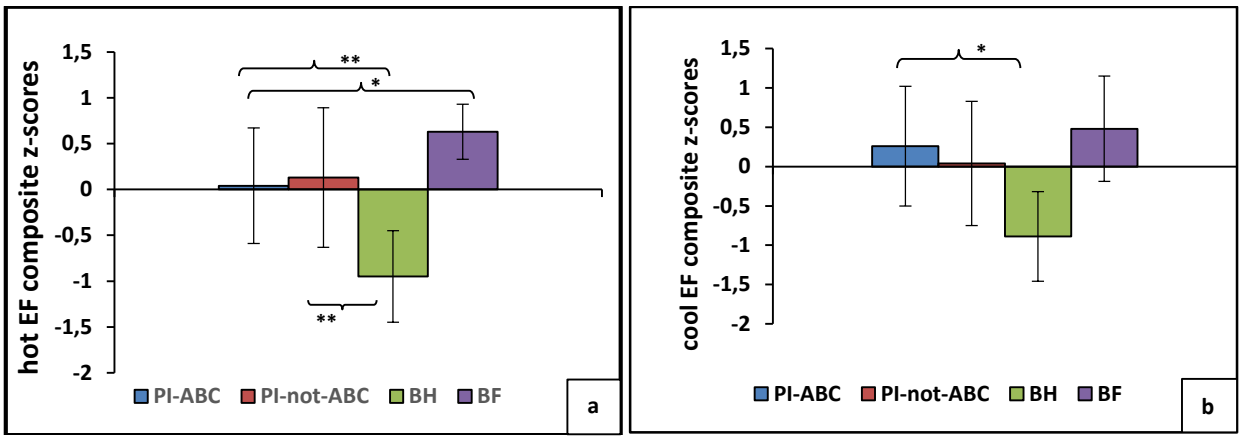

Figure 2. Hot (a) and cool (b) EF composite z-scores in PI-ABC, PI-not-ABC, BH and BF groups. (Note: *p < .05, **p < .01, ***p < .001)

Discussion

The primary goal of this study was to examine cool and hot EF development in young children (2-4,5 years old) living in different social-emotional conditions (substitute families, baby homes and biological families) with looking specifically at children with a history of institutionalization who participated in ABC intervention relative to children with a history of institutionalization who participated in not-ABC intervention program. We also expected differences in EF subcomponents in children living in different social conditions (institutions vs. substitute vs. biological families), and specific changes in both cool and hot EF measures would be evident in children after participation in the ABC intervention program. The results showed that children from substitute families (ABC and not-ABC) demonstrated no significant differences in cool EF but performed worse in hot EF when compared to their peers from biological families. More specifically, we found that children in substitute families who participated in ABC showed no significant differences from low-risk children in cool EF but showed lower hot EF than children living in biological families. There were no differences between children from substitute families (ABC and not-ABC groups) who participated in different intervention programs. Children in Baby Homes demonstrated the lowest EF performance relative to other groups of children.

Early deprivation experience and Hot and Cool EF development

The results of the current study extend prior findings regarding to self-regulation impairment and emotional/behavioral problems in post-institutionalized children. The previous studies indicated that post-institutionalized children show alterations in brain regions (Eluvathingal et al., 2006; Bick et al., 2015) underlying attention and executive function deficits (Colvert et al., 2008; Pollak et al., 2010; Vasilyeva et al., 2017). These specific morphological and cognitive impairments are considered to be a link between early negative life experience and deficits in social-emotional, cognitive development (Nelson et al., 2007; Rutter et al., 2010), and psychopathology (Zeanah et al., 2016), particularly externalizing disorders (Kim et al., 2013, Kochanska et al., 2013).

Cool and hot EF can contribute differently in future social-emotional and behavioral problems and academic performance. However, research data have contradictory information. Some studies show that cool EF is a predictor for school readiness and academic success, particularly in math, reading and writing

skills in typically developed children (Brock et al., 2009). But one recent study (Backer-Grøndahl et al., 2018) revealed that both hot and cool EF subcomponents development in 4 years old children were significantly related to academic performance in the first and the second grade. The results of this study revealed that only hot EF was significantly related to externalizing problems but both hot and cool EF were significantly related to academic performance. In addition, there were conflicting results regarding the association of cool EF and behavioral problems (Kim et al., 2013). At the same time, the studies revealed that the child's ability to wait during hot delay tasks could predict later behavioral problems and externalizing problems (Kim et al., 2013; Backer-Grøndahl et al., 2018).

The current study results also extend prior findings regarding self-regulation impairment and emotional/behavioral problems in post-institutionalized children by demonstrating that children in substitute families perform more poorly in hot EF tasks than children from biological families. The hot EF task performance is associated with the functioning of the orbitofrontal cortex. It is known that damage to this area often leads to disruption of social and/or emotional behavior. In addition, a number of studies have shown that prolonged exposure to deprivation in an orphanage can also be the cause of specific structural and functional changes in these areas of the brain. In particular, neuroimaging methods revealed a pathological decrease in glucose metabolism in the orbitofrontal region and limbic circle structures (Chugani et al., 2001; Eluvathingal et al., 2006), changes in the volume of the amigdala and hippocampus, as well as microstructural anomalies of the white matter of the conductive fibers of the limbic system (Tottenham et al., 2010; Bick et al., 2015), observed in children with institutionalization experience. It is assumed that the orbitofrontal cortex and its associated structures can be increasingly vulnerable to adverse deprivation conditions, which in turn can manifest itself in a violation of the mechanisms of voluntary control and affective regulation.

Our study also was devoted to expanding the data relative to the earliest age of observation the hypothesized differences in hot and cool EF subcomponents. It is known that the development of EF is a prolonged process that lasts from birth into adulthood. Thus, EF is considered to be a unidimensional construct in early childhood that becomes more complex over time and can be divided into cool and hot subcomponents as children get older (Zelazo et al., 2012; Welsh et al., 2014). According to the previous studies, the earliest ages when we can observe cool and hot EF separately is 3-5 years old (Hongwanishkul et al., 2005; Willoughby et al., 2011; Backer-Grøndahl et al., 2018). Our results also support the prior findings as we revealed that children (2-4.5) with institutional experience manage cool tasks more successfully than hot tasks relative to children from biological family group.

Intervention and Hot and Cool EF

The current project confirms the results revealed in previous studies devoted to ABC intervention program effect on executive function development (Dozier et al., 2011; Lind et al., 2016). Lind and colleagues showed that ABC intervention have a positive effect on cognitive flexibility that is considered to be a measure of cool EF. Our findings do not reveal significant differences between ABC and not-ABC. The differences for cold EF were in the expected direction but effects were not significant. There were also no significant intervention effects on hot EF with differences not in the expected direction.

Questions about the degree of reversibility of post-institutional problems in early cool and hot EF skills after implementation of the intervention program remain open.

Limitations

This study is limited in several ways. First, the group size was very modest, not providing adequate statistical power to test some effects. A large percentage of substitute families refused to participate in the project, leading to differences in post-institutional groups characteristics (length in BH residence, time in PI family, time after intervention). There also were no typically developing children available at 36 and 48 months in BH, because children tend to leave BHs for substitute families (for the last decade, significant changes associated with the reduction in the number of institutions for infants and young children occurred in the Russian child welfare system). It is also possible that additional pre- and postnatal risk factors, not captured in this study (these data are often difficult to obtain, given that children are often placed in facilities shortly after birth) might contribute to the executive functioning problems observed in this sample.

Clinical implications

Despite the limitations, these findings advance our basic understanding of the significance of early life experiences in children's development of executive functioning capabilities. Prior research in this area emphasized that children with early institutional experience who are placed in foster families who did not receive any intervention programs had deficits in EF afters year of adoption relative to children from biological families (Hostinar et al., 2012; Bick et al., 2018). The current study extends this body of research.

Nevertheless, future studies are needed to identify the most effective intervention strategies with considering the specialty of hot EF subcomponents development in post-institutionalized children and to help these children avoid academicals and social-emotional problems in older ages.

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Financial report

The budget was spent according to the plan specified in grant application. Total budget is $5,000, budget spent during the year of the project - $5,000 (see Table 3).

TABLE 3. Budget spent during the first six months of the project

Item	Item specified	Total budget for each item requested	Budget spent during the first six months of the project
Equipment	Videocamera Full HD Sony HDR-CX625	$400	$444
	Tripod Rekam LightPod RT-L34G	$30	$34
	Notebook Lenovo V330-14IKB 14"	$850	$752
	External hard drive Toshiba USB 3.0 1Tb HDTB410EK3AA	$80	$61
	Printer Canon PIXMA G1410	$150	$155
	Memory card SDHC Micro SanDisk Ultra 128GB	$60	$64
Supplies	Gifts, packaging, bows, snacks	$1600	$1660
	Carpet	$80	$80
	Office supplies (pens, pencils, paper binders)	$150	$150
Other	Compensation for study participation	$1600	$1600
		Total budget: $5,000	**Budget spent: $5,000**