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The Effect of a Social–Emotional Intervention on the Development of Preterm Infants in Institutions

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Abstract

This study examined the effect of a social-emotional intervention implemented in one St. Petersburg (Russian Federation) institution (called a Baby Home, BH) on the general behavioral development of preterm children (gestational ages of 30–36 weeks) during their first two years of life. The intervention consisted of training caregivers and implementing structural changes to create a more family-like environment. The study included preterm ($N = 56$) and full-term ($N = 93$) children from one BH that implemented the intervention and from another BH with no intervention. Children were assessed at 3, 6, 9, 12, 18 and 24 months of age with the Battelle Development Inventory (LINC Associates, 1988). The results showed that the intervention positively influenced the general behavioral development of BH preterm children throughout their first two years of life compared to preterms from the no-intervention BH. Also, results indicated that the intervention effect was developmentally similar for preterm and for full-term children, but preterm children consistently scored lower than full-terms during their first two years living in the BH. In general, our research emphasizes the crucial role of warm, sensitive, and responsive interactions with a constant and emotionally available caregiver for healthy child development for both term and preterm children.

Keywords

institutional care; orphanage; institutionalization; intervention; social-emotional; preterm children; infants

Children born preterm experience a variety of developmental deficits in different domains throughout infancy and early childhood compared to infants born at term, and they also stress their primary caregiver because of their biological immaturity (Ballantyne, Benzies, McDonald, Magill-Evans, & Tough, 2016; Baron & Rey-Casserly, 2010; Sansavini et al., 2011). To encourage early child development, the caregiver should react adequately to the child's signals and needs in a warm, sensitive, and responsive manner (Ainsworth, Blehar,

Waters, & Wall, 1978; Bowlby, 1969). This may be more difficult for mothers of preterm children (Eckerman, Oehler, Hannan, & Molitor, 1995; Field, 1977; Hsu & Jeng, 2013). Early intervention in the NICU or soon after hospital discharge positively influences the quality of child-caregiver interaction and also increases the level of child development (Butler & Als, 2008; Koldewijn et al., 2010; Landry, Smith, & Swank, 2006).

Ten percent of children are born preterm worldwide (World Health Organization, 2015), and the most recent data in the Russian Federation (RF) shows 4.3% are preterm (Skripnichenko, Baranov, & Tokovaya, 2014). Some studies reported that there is a substantial number of preterm children in institutions for children left without parental care (Chernego, 2015; The St. Petersburg-USA Orphanage Research Team, 2008; Vorria et al., 2003). In the RF in 2014, there were nearly 28 million children, 50,227 of them lived in 1076 institutions for children 0–18 years old, and 11,530 lived in Baby Homes (BH) for children 0–4 years old (Ministry of Labour and Social Protection of the Russian Federation, 2014). Estimated data showed that 25–38% of preterm children were annually placed in St Petersburg (RF) BHs during 2000–2004 and also in 2014 (Chernego, 2015). Today, Russian Federation policy is to reduce the number of institutions and actively support placing children into foster or adoptive families. But families prefer younger children without special needs (Muhamedrahimov, Grigorenko, 2015). Thus, the institutions, including BHs, still exist, and they have a substantial number of preterms among children with special needs.

Generally, children exposed to the psychosocial deprivation of institutional care display deficiencies in development (van IJzendoorn et al., 2011). Interventions in institutions have produced developmental improvements in physical and developmental domains for children (Groark et al., 2013; The St. Petersburg-USA Orphanage Research Team, 2008). Despite the presence of preterm children in orphanages, this group has never been studied specifically. The purpose of the current study was to estimate the effectiveness of a social-emotional intervention for preterm infants in one BH compared to those from a typical orphanage and also compared to institutionalized full-term children.

Preterm infants are delayed in several domains, such as general behavioral development and, more specifically psychomotor (Eickmann, Malkes, & Lima, 2012), adaptive (Dusing, Thacker, & Galloway, 2016), behavioral, cognitive, and social-emotional development (Clark, Woodward, Horwood, & Moor, 2008; Evrard et al., 2011; Langerock et al., 2013). These deficits may be the result of caregivers having difficulties reading preterm children's signals during interactions (Crawford, 1982; Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983; Harel, Gordon, Geva, & Feldman, 2011; Poehlmann et al., 2011).

Interventions for non-institutionalized preterm children

There are many different interventions known to decrease the probability of adverse development in preterms. While some of them take place in hospitals (Als, 2009; Melnyk et al., 2001), others are conducted after hospital discharge and include 6 to 10 home visits by a specialist (Borghini et al., 2014; Koldewijn et al., 2009; Landry et al., 2006). The intervention programs that take place after hospital discharge focus on the child's home environment and caregiver-child interaction. Such programs are based on the importance of

early social-emotional experiences and the opportunity to have a stable, warm, and sensitive caregiver (Ainsworth et al., 1978; Bowlby, 1969; Stern, 1985). The interventions used trained professionals, adapted aspects of the home environment to the infant's specific needs, and taught parents to regulate support during their interaction with their infants (Koldewijn et al., 2009, 2010; Verkerk et al., 2012). The specialists taught parents to be more sensitive and responsive to their infant's physiological, behavioral and social cues to help the infant reach a more regulated and accessible state for interactions (Achenbach, Howell, Aoki, & Rauh, 1993), to assist parents to reduce the infants' stress (Milgrom et al., 2010; Newnham, Milgrom, & Skouteris, 2009), and to improve the quality of parent-infant interactions (Borghini et al., 2014).

Generally, the intervention programs demonstrated that responsive parenting promoted a broad range of preterm infants' skills. Specifically, the interventions improved infants' social, communicative, and emotional skills; enhanced a positive child mood and greater cooperative behavior; developed the resources necessary to cope with stressful situations; and promoted infant behavioral organization (Borghini et al., 2014; Koldewijn et al., 2009; Landry et al., 2006; Newnham et al., 2009; Ravn, Smith, Smeby, et al., 2011). The preterm infants demonstrated higher levels of visual attention to objects and other persons, and more time in joint attention (Ravn, Smith, Lindemann, et al., 2011; Ravn, Smith, Smeby, et al., 2011). One intervention had positive effects on infants' cognitive and motor development (Koldewijn et al., 2009). Furthermore, the results of the early intervention were associated with improved cerebral white matter micro-structural development in preterm infants (Milgrom et al., 2010), which means that the intervention's outcomes are observed not only for socioemotional, behavioral, cognitive, and motor development, but also for early brain development.

Most of the intervention programs have focused on extremely or very preterm infants (<32 weeks of gestation; Borghini et al., 2014; Flierman et al., 2016; Koldewijn et al., 2009; Milgrom et al., 2010; White-Traut et al., 2013). Moderate-to-late preterm infants (32–36 weeks of gestation) are physiologically immature (Engle, Tomashek, & Wallman, 2007; Kinney, 2006) and also at risk for poor developmental outcomes (Hodel, Brumbaugh, Morris, & Thomas, 2016; Nepomnyaschy, Hegyi, Ostfeld, & Reichman, 2012; Shah et al., 2016; Talge et al., 2012). However, this group is frequently less involved in the early intervention programs. Studies consistently have shown the positive effect on development of post-hospital discharge interventions for extremely and very preterm infants (Flierman et al., 2016; Koldewijn et al., 2009), but the intervention for moderate and late preterms improved social and communication skills and the quality of child-caregiver interaction (Ravn, Smith, Lindemann, et al., 2011; Ravn, Smith, Smeby, et al., 2011) but not the children's cognitive, motor, and behavioral development (Kynø et al., 2012).

Interventions in institutions

The risk for poor developmental outcomes of preterm infants is considerably higher if they are placed in a low-quality social environment. Studies have established that the early socioemotional environment plays a greater role in preterms' development than birth status and medical circumstances (Bradley & Casey, 2008; Brumberg & Shah, 2015; Crnic et al.,

1983; Miceli et al., 2000; Sameroff & Chandler, 1975). Research has shown that children in general who were reared in institutions have higher rates of developmental problems in physical, general behavioral, socio-emotional, neurophysiological and neuroendocrine functioning, and in attachment (Dobrova-Krol, van IJzendoorn, Bakermans-Kranenburg, Cyr, & Juffer, 2008; Groark, McCall, & Fish, 2011; Johnson & Gunnar, 2011; Marshall, Fox, & the BEIP Core Group, 2004; The St. Petersburg-USA Orphanage Research Team, 2008; van IJzendoorn et al., 2011; Vorria et al., 2003; Zeanah, Smyke, Koga, Carlson, & the BEIP Core Group, 2005). Thus, the development of preterm children is poorer when they are left without parental care and raised in an institutional environment, which is characterized by a lack of sensitive, warm, and responsive interactions with a few consistent caregivers.

Several interventions were aimed at improving the quality of care and development of institutionalized children (Berument, Sönmez, & Eyüpo lu, 2012; Groark et al., 2013; Hakimi-Manesh, Mojdehi, & Tashakkori, 1984; Kim, Shin, & White-Traut, 2003; Sparling, Dragomir, Ramey, & Florescu, 2005; Taneja et al., 2002; The St. Petersburg-USA Orphanage Research Team, 2008). Some of them consisted only of tactile stimulation (Brossard & Decarie, 1971; Hakimi-Manesh et al., 1984; Kim et al., 2003; Sayegh & Dennis, 1965) or social interaction (Rheingold & Bayley, 1959; Taneja, Aggarwal, Beri, & Puliyl, 2005), which increased children's physical and mental development. However, the effects of the intervention tended to fade after the intervention terminated. Others focused on child-caregiver interaction with some structural changes in the institution (Smyke, Dumitrescu, & Zeanah, 2002; Sparling et al., 2005). These also improved general development, but they were not implemented in the usual work of the institution over a long period of time.

The most comprehensive intervention was conducted in one of the St. Petersburg (RF) Baby Homes (The St. Petersburg-USA Orphanage Research Team, 2008). Russian orphanages are characterized by socioemotional deprivation but with an acceptable quality of medical care, sanitation, and nutrition (The St. Petersburg-USA Orphanage Research Team, 2005). The intervention program focused on improving caregiver-child interactions and relationships with stable, sensitive, and responsive caregivers. One of the Baby Homes (BHs) implemented both a training and structural changes intervention (T+SC), in which training of caregivers promoted warm and responsive caregiving, and structural alterations reduced the group size, mixed children of different ages and disability status, designated two primary caregivers in each group, and terminated transitions of children to new wards. These changes increased the consistency of fewer caregivers in children's lives. Children involved in the T +SC intervention improved their physical characteristics (i.e., height, weight and chest circumference); socioemotional, adaptive, cognitive, and motor development; and attachment to their caregiver compared to children from the no intervention BH (NoI).

This intervention promoted the development of both typically developing children and children with disabilities, which includes those with minor and major impairments. Preterm children were included in both groups and not examined as a separate condition. Similarly, other studies have not examined preterm children separately.

Current Study

The main aim of the present study was to examine the effect of the social-emotional intervention on the general behavioral development of preterm children raised in an institution for children without parental care. Behavioral development was assessed in five domains including Personal-Social, Communicative, Adaptive, Motor, and Cognitive Development from 3 to 24 months of age in preterm and full-term children. In addition, children came from two St. Petersburg institutions for children from birth to 4 years of age (called Baby Homes, BH) with different caregiving environments. One BH was a traditional Russian BH (i.e., typical no intervention Baby Home – NoI BH) and the other was a BH in which a training and structural changes (T+SC BH) intervention was implemented.

The first research question was whether the intervention effected to the general development throughout the first two years for institutionalized preterm children. On the basis on the results of the intervention in the main study (The St. Petersburg-USA Orphanage Research Team, 2008), which showed the positive effect of the intervention for typically developing children and those with disabilities, we hypothesized that the intervention would improve the general behavioral development of preterm children across their first two years of life while they are in the intervention BH. Additionally, we expected that the T+SC intervention for preterm children would produce higher levels of development in comparison to preterms from the NoI BH.

The second research question was whether the intervention effect would be different for preterm and full-term children. We hypothesized that, if the preterm children have lower developmental levels at the beginning compared to full-term children and if the dose of the social-emotional intervention is the same, the intervention would produce the same amount of change in preterm children's development as for full-term children but at lower levels during their first two years of life. This hypothesis is based on previous studies of preterm children that have shown lower levels of development in different domains at different stages of infancy and early childhood (Clark et al., 2008; Dusing et al., 2016; Eickmann et al., 2012; Harel et al., 2011; Langerock et al., 2013).

Method

This study uses a subset of data from a comprehensive intervention conducted in St. Petersburg, Russian Federation (The St. Petersburg-USA Orphanage Research Team, 2008), the report of which provides extensive methodological details that will not be repeated here.

Participants

We selected from the original database all those preterm and full-term children who met the following criteria: The presence of BH records on birth information including gestational age, no diagnoses of pathological symptoms of the central nervous system, no severe hereditary and somatic diseases, and the availability of behavioral assessments. We decided not to include preterm children with severe diagnoses because it could mask the intervention effect specifically for preterms. The birth and medical information including gestational age was obtained from BH records. The original database contains notes of 502 children from

birth to 48 months of age. Of these, 51 children did not have information about gestational age and were excluded from analyses, 140 children were preterm with gestational ages of 24–36 weeks, and 276 children were full-term with gestational ages 37–42 weeks. According to the inclusion criteria, the total group of 149 children included *pre-term children* (PCh, $N = 56$) with gestational ages of 30–36 weeks and *full-term children* (FCh, $N = 93$) with gestational ages of 37–42 weeks. Most of the PCh were moderate and late preterms (32–36 weeks of gestation, 88%). The birth weights of preterm children were appropriate for their gestational ages. Therefore, four groups of children were analyzed: Preterm children from the T+SC BH (PCh T+SC, $N = 22$), full-term children from the T+SC BH (FCh T+SC, $N = 48$), preterm children from the NoI BH (PCh NoI, $N = 35$), and full-term children from the NoI BH (FCh NoI, $N = 45$).

Table 1 presents the sample characteristics (means, standard deviations, and range). Group characteristics of preterm and full-term children were significantly different based on Gestation (Pre- versus Full-Term)×Intervention Condition (T+SC, NoI) analyses of variance. There were no effects for Intervention Condition (T+SC, NoI) on group characteristics of PCh and FCh. The age of entering either BH for FCh was older than for PCh (see Table 1), but this difference was not significant. The BHs' records indicated that the reason for the difference in age of entering for PCh and FCh might be that PCh frequently spend more time in hospital before placement into the BH, whereas FCh spend more time with their biological parents before entering the BH.

Intervention

One BH implemented an intervention with two main components - training for caregivers and structural changes. The training encouraged warm, sensitive and responsive interactions with children during routine caregiving activities (feeding, bathing, changing) and free play. In addition, the training covered developmental milestones in young children, caregiver-child relationships, developmentally appropriate play, handling, positioning, and interaction. The structural changes included (a) the reduction in group size from 12–14 children to 5–6; (b) the assignment of primary caregivers to each group, where one primary caregiver was present for most of the children's waking hours 7 days a week; (c) groups that were heterogeneous for age and disability status of children; (d) termination of periodic transitions of children to new wards when they reached a certain age; (e) family hour twice a day when visitors were not allowed and children were to be with their caregivers only; (f) the creation of an in-house monitoring and supervisory system; and (g) a train-the-trainer strategy in which the training personnel were continually available to prepare new caregivers. The intervention improved the quality of caregiver-child interactions and relationships and created a more family-like environment in the BH. The intervention was successfully implemented into the routine life of the institution and maintained after the main project ended (McCall et al., 2013). The main maintenance activities were (a) to preserve structural changes in the routine life of the BH, (b) to use a train-the-trainer strategy so new staff could be trained and refresher sessions could be offered, (c) a supervision system was implemented in which specialists monitored the caregivers and encouraged their work on the wards, and (d) having the director of the BH thoroughly committed to supporting the intervention. Six years after the intervention project ended, T+SC caregivers

still had higher HOME scores and children had better developmental scores than in NoI (McCall et al., 2013). The second BH had no intervention and conducted business as usual. Each ward contained 12–14 children segregated according to their age and disability status. Each ward had its own staff, consisting mostly of assistant teachers, medical nurses, and nurses (i.e., aides). A group of 12 children had about nine caretakers per week, because caregivers worked 24-hour shifts, one every four days. When children reached a certain age (about 6, 12, 18 months), they transferred from one ward to another with new caregivers and peers. The caregivers concentrated on routine caregiving tasks without social and emotional interactions with children. The NoI BH was characterized by unstable and inconsistent, business-like interactions with many caregivers.

Assessment and Procedure

The Battelle Development Inventory (BDI; LINC Associates, 1988) was used to assess developmental skills of children. The BDI was selected because the items tended to involve more activities that might occur in a BH, and it was more accommodating to children with disabilities. The BDI includes a Total Score based on subscales for Personal–Social, Motor, Adaptive, Communication, and Cognition. BDI Total Raw Scores were converted to developmental quotients (DQs).

The BDI was administered in a separate quiet room in each BH by independent assessors with psychological training. The child was accompanied by the caregiver who knew the child best or had the best relationship with the child (see The St. Petersburg-USA Orphanage Research Team, 2008). In the larger project, children were assessed periodically at 3, 6, 9, 12, 18, 24, 36 and 48 months. Children tend to leave BHs for families, so there were too few children available at 36 and 48 months of age so the current study used the information for ages 3, 6, 9, 12, 18, and 24 months of assessments. Assessments began at 3 months of age, and at that time the children had been at the BHs for about 1–3 months. The chronological age was used for all children.

Data Analysis

In the present study, both HLM and ANOVA analyses were used to examine the effect of the intervention (T+SC vs. NoI) on preterm vs. full-term children's general behavioral development over time. The HLM examined possible differences in linear developmental slope across the entire age range available, whereas the ANOVAs (SPSS 22.0) indicated group mean differences separately at each age in the event that group differences were not linear across age. For the HLM, we conducted a multilevel analysis in Stata version 14 using the mixed commands (StataCorp, 2015) with BDI Total Score DQs at each time point nested within groups of children. To understand the degree of nesting in the data, we calculated the intraclass correlation coefficient (ICC) using an unconditional model analyzed in Stata. The ICC indicated that 48.58% of the total variance in the BDI Total DQs was attributable to between-children differences (level 2), and suggested that the scores at each time point for each child were not independent of each other. Therefore, multilevel models were needed for these analyses.

Age of entering—Children entered the BHs at different ages. Research indicates that the earlier a child is placed in the institutions and the more time a child spends there, the more effect the institutional environment could have on his or her developmental level, depending on the quality of the institution (Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011). Consequently, we included age of entering the BH in our analyses, although its relation to BDI Total DQs was not always statistically significant.

Results

Preliminary analyses

Children's individual developmental trajectories were examined across the duration of the study, using empirical growth records that produced intercepts, slopes, and R^2 's for each trajectory (Singer & Willett, 2003). These results showed variability in initial developmental quotients ($M = 12.83$, $SD = 25.91$) and rates of growth over time ($M = 9.82$, $SD = 3.01$). Estimated initial development scores were significantly and negatively correlated with rate of growth over time ($r = -.70$, $p < .001$), indicating that children with the lowest initial scores developed at a faster rate than their peers.

Some data were missing over time due to normal movement in and out of the BHs. The percentage of missing data ranged from 38% at 6 months to 77% at 24 months. Based on logistics regressions on the extent of missing data at each time point, total developmental quotient missing data were not significantly related to the type of institution, being preterm or full-term, child gender, child developmental quotient score, or age at entering the institution. This lack of statistical significance suggested that the data were missing at random with respect to these variables. In the following multilevel analyses, we used maximum likelihood estimation (MLS) to appropriately deal with missing data and decrease bias in standard errors.

The BDI Total Score DQ means for each group are plotted across age in Figure 1. Table 2 presents the results of HLM analysis. Preliminary HLM analyses failed to reveal a significant interaction between intervention and gestational age, so this term was omitted from subsequent HLM analyses. At the same time, the lack of the interaction in the HLM and in the analyses of variance indicates that the Pre- vs Full-Term differences were essentially the same within both intervention conditions. The lack of an interaction indicates that the intervention influenced the general linear behavioral development in the same way for preterm and full-term children.

Main analyses

The means, standard deviations, change from age to age, and numbers of assessments at each age are presented in Table 3. A graph of the means across age is given in Figure 1, and the results of the HLM analysis are presented in Table 2. The HLM tests on the intercept (i.e., estimated mean at birth) indicated a significant difference for pre- vs. full-term children (preterms had lower scores) as expected, but not for the intervention groups when controlling for age at entrance to the BHs, which indicated that these groups did not display any differences in sampling in this regard.

When looking at development over age (i.e., slope), however, both being born preterm and being in an intervention institution were significantly related to the linear rates of growth. Specifically, multilevel model estimates indicated that preterm children began this study, on average, over 20 points (about 2 SD in initial developmental quotient) behind their full-term peers in development, and over time developed at a rate of 0.55 points every 3 months, faster than the full-term children. Further, being in the T+SC intervention was related to developing at a rate of 2.25 points every 3 months (almost 1 SD of the fitted slope) faster than the children in the NoI institution.

The general HLM intervention result was examined separately within each age. The results of Intervention Conditions (T+SC, NoI)×Gestation (PCh, FCh) analyses of variance with age of entering as a covariate at each age are presented in Table 4. Simple effects tests were also conducted to test the difference between specific groups of children at each age. These analyses indicated the intervention difference was not significant at 3 months but was significant at 6 months and thereafter and with substantial effect sizes. Moreover, simple effects tests revealed that preterms from T+SC BH had consistently higher developmental levels than preterms from NoI at ages 6 months, $F(1, 29) = 5.32, p = .028, \eta^2 = .16$; 9 months, $F(1, 28) = 7.51, p = .011, \eta^2 = .21$; 12 months, $F(1, 14) = 5.19, p = .039, \eta^2 = .27$; 18 months, $F(1, 14) = 6.40, p = .024, \eta^2 = .31$; and 24 months, $F(1, 13) = 4.12, p = .053, \eta^2 = .24$.

The general HLM developmental difference for gestational age was quite consistent across ages. The age-specific analyses of variance showed the full-term infants scored better at each age. More specifically, the BDI Total Score DQ for the FCh T+SC group approached 100 at the ages 12–24 months, which corresponds approximately to the developmental level of USA children from biological families. The FCh NoI group displays an increase only at 12 to 18 months, which could be explained by the fact that 50% of children assessed at these ages lived in their biological families during their first year of life.

Discussion

We examined the effect of a social-emotional intervention implemented in one St. Petersburg (RF) Baby Home for children birth to 4 years of age on the general behavioral development of preterm vs. full-term children during their first two years of life. The intervention consisted of training caregivers in warm, sensitive, responsive, and child-directed interactions plus implementing a variety of structural changes that reduced group sizes, assigned primary caregivers, eliminated periodic graduations to wards, integrated groups by age and disability status, and promoted more consistent relationships with fewer caregivers. The results showed that the intervention positively influenced the general behavioral development of preterm children throughout their first two years of life. Our findings also suggest the intervention effect was developmentally similar for preterm and for full-term children, but preterm children consistently scored lower than full-term children.

Consistent with our first hypothesis, the intervention in the BH significantly improved the general behavioral development of institutionalized preterm children. The effect of the intervention was observed in a steeper developmental slope for preterm children from T+SC

BH in comparison with those from NoI BH. This result is consistent with the main study's results that clearly demonstrated an increase of the general developmental level of children who experienced the intervention conditions of the T+SC BH for more than 3 months (The St. Petersburg-USA Orphanage Research Team, 2008). Notably, the current study documents the benefits of the intervention specifically for preterm children who were not studied as a specific group in the main study (The St. Petersburg-USA Orphanage Research Team, 2008) and also in other intervention studies of institutionalized children (Sparling et al., 2005; Groark et al., 2013). Additionally, the intervention effect was observed in a higher level of preterm children's BDI Total DQs from T+SC BH at each assessed age 6, 9, 12, 18 and 24 months compared with preterm children from NoI BH. These improved outcomes are in line with the effectiveness of interventions for non-institutionalized preterm children from biological families (Koldewijn et al., 2009; Koldewijn et al., 2010; Verkerk et al., 2012). Notably, our research investigated the intervention effect specifically for preterms left without parental care who lived in BHs during infancy.

The result highlights the importance of a family-like environment in institutional care for young children. Although family care for orphan children is the most ideal and acceptable alternative, usually it takes time to find a family for each child, and BHs are still the alternatives as a temporary place for children. A special resolution of the Russian government (issued 24/05/2014) mandated the creation of a more family-like environment in Baby Homes, including the elimination of periodic transitions of children to new wards and the establishment of primary caregivers (The Resolution of the Government of the Russian Federation No481, 2014). Unfortunately, the Resolution provides only for structural changes in institutions; however, despite the fact that in this study we do not investigate the impact of different intervention components, based on previous research results (The St. Petersburg-USA Orphanage Research Team, 2008) the training and supervision system for caregivers are also important and should be included in the intervention.

It is important to note that most preterm children (80%) from both T+SC and NoI BHs were moderate and late preterms without diagnoses of pathological symptoms of the central nervous system and no severe hereditary diseases. Such a specific group of higher gestational age preterm children (32–36 weeks of gestation), who were left without parental care and experienced institutional care in the early ages, reflected the positive effect of the T+SC intervention. Interestingly, other studies of interventions for moderate and late preterm non-institutionalized children from biological families reported improvements of the quality of child-caregiver interaction and enhanced communication skills, but they had no effect on mental and psychomotor development of preterms (Kynø et al., 2012; Ravn, Smith, Smeby, et al., 2011). Perhaps, only the comprehensive intervention that provided fewer and more consistent caregivers and training for caregivers that increased their sensitivity and responsiveness could produce improvements in general behavioral development for moderate and late preterms. Additionally, the duration of the intervention in those studies was 90 days, and perhaps it was not enough for later improvements in children's development. In the current study, the caregivers were trained not only at the beginning of the intervention but also were involved in a supervision system and regularly got feedback. The results of the main project and follow-up research showed that such a system prevented the intervention from fading during the later stages (McCall et al., 2013; The St. Petersburg-

USA Orphanage Research Team, 2008). We observed the higher developmental level of preterm children from T+SC BH at each assessed age compared to preterms from NoI BH.

The finding that the intervention effect for preterm children was observed in the same way as for full-term children matches the main study's results on the intervention for institutionalized children. That study demonstrated that the social-emotional intervention with the primary focus on the quality of child-caregiver interaction worked in the same way for typically developing children and those with disabilities (The St. Petersburg-USA Orphanage Research Team, 2008). Nevertheless, even being institutionalized and in the intervention, preterm children still had developmental deficits and exhibited lower levels of general behavioral development during their first two years of life compared to full-term children living under the same environmental conditions. These results fit with studies that observed developmental delay among preterms during infancy and early childhood (Eickmann et al., 2012; Wolf et al., 2007). The preterm institutionalized children did not catch up to the developmental level of full-term peers living under the same conditions. Also, we should take into account that at the beginning preterm children started the intervention at a lower developmental level than full-terms, and the dose of the intervention was the same for both groups. The T+SC intervention was designed for all children in the BH, including preterms and children with disabilities. Perhaps, because of the biological immaturity at birth, preterm children need to be involved in an additional or more intensive early intervention that should be created specifically for preterm children in BHs. We hypothesized that the T+SC intervention, which had the primary focus on improving socio-emotional child-caregiver relationships, would produce the most advantages for personal-social development, but at the same time an increase in talking during the interaction promoted improvements in communicative and cognitive domains. It may also have motivated children to engage in more activity and thus improve in gross and fine motor and adaptive skills. In fact, the intervention had a general effect for all developmental domains of preterm children.

In general, our results join a larger literature in support of the crucial role of warm, sensitive, and responsive interactions with a constant and emotionally available caregiver for healthy child development for both term and preterm children (Ainsworth et al., 1978; Bowlby, 1969; Stern, 1985). In addition, our research and the main study (The St. Petersburg-USA Orphanage Research Team, 2008) emphasize the importance of a sensitive and responsive environment for development of institutionalized children.

Limitations

Although the present study has important findings, there are also limitations. First, the sample size was small and did not include those with disabilities. Most children housed in orphanages in their first months of life have pathological symptoms of the central nervous system and severe hereditary and somatic diseases; a healthy group of institutionalized children is small and unusual. Including preterms with disabilities could have decreased the intervention effect, and omitting them limits the generalizations that can be made from this study to preterm children without special needs. Second, we could only present the results of the intervention for children 3 to 24 months and not older, because children tend to leave

BHs for families, so there were too few children available at 36 and 48 months of age. Nevertheless, we expect higher general developmental levels of preterm children in T+SC BH at 36 and 48 months compared with preterms from NoI BH. Third, we could not provide longitudinal data for all children, because healthy children are the most attractive for adoption and do not stay in the institution long enough to provide full longitudinal data. Despite these limitations our study is the only one that presents results of a social-emotional intervention for institutionalized preterm children.

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Figure 1.

Battelle Developmental Inventory (BDI) Total Score Developmental Quotients (DQs) as a function of intervention conditions and gestation. T + SC = Training + Structural Changes in Baby Home; NoI = No Intervention in Baby Home; PCh = Preterm Children; FCh = Full-term Children.

Table 1

Sample Characteristics

Measure	Groups				Statistics
	T+SC		NoI		
	PCh (N = 22; 11 male)	FCh (N = 48; 21 male)	PCh (N = 34; 20 male)	FCh (N = 45; 28 male)	
Gestational age, weeks					
M	34.3	39.7	34.1	39.4	$F_{\text{Intervention}}(1, 144) = 1.61, \text{ n.s.}$
SD	1.5	1.0	1.9	1.0	$F_{\text{Gestation}}(1, 144) = 502, p < .001$
Range	31–36	37 – 42	30 – 36	37 – 40	$F_{\text{Intervention} \times \text{Gestation}}(3, 144) = <1, \text{ n.s.}$
Birth weight, grams					
M	2070	3115	2140	3094	$F_{\text{Intervention}}(1, 144) = <1, \text{ n.s.}$
SD	407	455	351	355	$F_{\text{Gestation}}(1, 144) = 211, p < .001$
Range	1390 – 2850	2190 – 4260	1290–2630	2240 – 3770	$F_{\text{Intervention} \times \text{Gestation}}(3, 144) = <1, \text{ n.s.}$
Age of entering institution, days					
M	94	131	85	119	$F_{\text{Intervention}}(1, 144) = <1, \text{ n.s.}$
SD	142	181	124	189	$F_{\text{Gestation}}(1, 144) = <1.6, \text{ n.s.}$
Range	16 – 617	5 – 740	7 – 526	5 – 615	$F_{\text{Intervention} \times \text{Gestation}}(1, 144) = <1, \text{ n.s.}$

Table 2

Results of a Multilevel Model of Intervention for BDI DQs Total (N = 149)

Parameter	Coefficient	Standardized Coefficient	SE	t Ratio
Intercept	17.66		7.47	2.37
Age at Entering	0.03	.17	0.04	0.80
PCh vs. FCh	20.17	.47	3.40	5.93***
T+SC vs. NoI	4.68	.11	3.33	1.41
Slope	1.30	.40	0.58	2.24*
Age at Entering	-0.00	-.22	0.00	-1.02
PCh vs. FCh	-0.55	-.31	0.26	-2.13*
T+SC vs. NoI	0.75	.42	0.25	2.98**

Note. T + SC = Training + Structural Changes in Baby Home; NoI = No Intervention in Baby Home; PCh = Preterm Children; FCh = Full-term Children.

*
 $p < .05$.

**
 $p < .005$.

***
 $p < .001$.

Table 3

Battelle Total Score Developmental Quotients Means (Standard Deviations), Means Differences, and the Number of Assessments per Group

Group	3 mos	6 mos	9 mos	12 mos	18 mos	24 mos
PCh T+SC						
M (SD)	59.0 (24.2)	64.3 (17.1)	71.8 (16.1)	81.9 (16.2)	93.8 (22.1)	88.9 (9.4)
M		5.4	7.5	10.1	11.9	-4.9
N	13	14	13	6	9	9
FCh T+SC						
M (SD)	64.9 (28.3)	80.9 (13.6)	86.2 (15.2)	94.4 (9.2)	96.2 (9.9)	99.6 (7.8)
M		15.7	5.6	8.2	1.8	3.4
N	19	27	21	15	16	11
PCh NoI						
M (SD)	52.6 (16.9)	51.9 (13.9)	58.6 (11.3)	64.4 (14.0)	68.0 (18.5)	78.5 (10.3)
M		6.4	6.7	5.8	3.6	10.5
N	22	18	18	11	8	6
FCh NoI						
M (SD)	71.1 (20.9)	67.2 (9.7)	67.5 (10.5)	67.5 (12.1)	84.9 (13.0)	85.2 (4.2)
M		-3.9	0.3	0.0	17.4	0.3
N	30	33	28	19	14	9

Note. T + SC = Training + Structural Changes in Baby Home; NoI = No Intervention in Baby Home; PCh = Preterm Children; FCh = Full-term Children.

Table 4

Statistical Results for Analyses of Variance at Each Age

Age of assessment, months	Intervention conditions (T+SC, NoI)	Gestation (PCh, FCh)
3	$F(1, 79) = < 1, n.s.$	$F(1, 79) = 7.2, p = .009, \eta^2 = .08$
6	$F(1, 87) = 20.4, p < .001, \eta^2 = .19$	$F(1, 87) = 23.1, p < .001, \eta^2 = .21$
9	$F(1, 75) = 35.9, p < .001, \eta^2 = .32$	$F(1, 75) = 14.1, p < .001, \eta^2 = .16$
12	$F(1, 46) = 37.0, p < .001, \eta^2 = .45$	$F(1, 46) = 4.1, p = .05, \eta^2 = .08$
18	$F(1, 42) = 15.6, p < .001, \eta^2 = .27$	$F(1, 42) = 3.9, p = .05, \eta^2 = .08$
24	$F(1, 30) = 18.4, p < .001, \eta^2 = .38$	$F(1, 30) = 11.6, p = .002, \eta^2 = .28$

Note. T + SC = Training + Structural Changes in Baby Home; NoI = No Intervention in Baby Home; PCh = Preterm Children; FCh = Full-term Children.