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Foster Care Promotes Adaptive Functioning in Early Adolescence Among Children Who Experienced Severe, Early Deprivation

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Abstract

Background: Experiences in early life lay the foundation for later development and functioning. Severe psychosocial deprivation, as experienced by children in early institutional care, constitutes an adverse experience with long-term negative consequences. The Bucharest Early Intervention Project sought to examine the effects of foster care as an alternative to institutional care for abandoned infants in Romanian institutions.

Methods: At a mean age of 22 months, institutionalized children were randomized to foster care or care as usual. At age 12 years, we followed-up with 98 of these children (50 randomized to foster care), as well as assessed 49 never institutionalized comparison children. Adaptive functioning was assessed across seven domains—mental health, physical health, substance use, risk-taking behavior, family relations, peer relations, and academic performance. Children at or above the threshold for adaptive functioning in at least 6 of 7 domains were classified as having overall adaptive functioning in early adolescence.

Results: Among all children who had experienced severe early deprivation, 40% exhibited adaptive functioning. Children randomized to foster care were significantly more likely to exhibit adaptive functioning at age 12 years than children in the care as usual condition (56% vs. 23%). In support of external validity, children who met the threshold for adaptive functioning at age 12 years had higher IQs and were more physiologically responsive to stress. Among children

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randomized to foster care, children placed prior to age 20 months were more likely to meet the threshold for adaptive functioning than those placed after this age (79% vs. 46%).

Conclusions: This study provides causal evidence that placing children into families following severe deprivation increases the likelihood of adaptive functioning in early adolescence.

Keywords

institutional care; foster care; adaptive functioning; resilience

Children adopted from institutions often experience have long-term developmental challenges across domains (Fisher, Ames, Chisholm, & Savoie, 1997; Gunnar, 2001; Loman, Wiik, Frenn, Pollak, & Gunnar, 2009). However, heterogeneity in these outcomes is common. A subset of previously institutionalized children appear to exhibit adaptive functioning following exposure to institutionalization in early childhood (Kreppner et al., 2007; Vorria, Ntouma, & Rutter, 2015). To date, however, most research on previously-institutionalized children has focused on negative developmental outcomes, including increases in psychopathology, cognitive deficits, and problems in social functioning (Almas et al., 2017; Almas, Degnan, Nelson, Zeanah, & Fox, 2016; Gunnar, Bruce, & Grotevant, 2000; Rutter, Sonuga-Barke, Beckett, et al., 2010; Zeanah et al., 2009).

Here, we investigate the degree to which children exhibit adaptive functioning following an extreme form of psychosocial deprivation, using a threshold approach to make determinations regarding functioning across several domains. A focus on positive outcomes following adversity, rather than solely on negative outcomes, is an important step for identifying and promoting targets for intervention. Two prior studies have examined adaptive functioning, using binary determinations, in children who experienced severe psychosocial deprivation due to institutional care. Vorria and colleagues (Vorria et al., 2015) examined functioning in 52 adolescents at age 13 years from the Metera Babies Center in Athens, Greece, and found that 38% of children adopted out of institutional care were classified as having “good” outcomes. Within the English and Romanian Adoptees Study (ERAS; Rutter, Sonuga-Barke, & Castle, 2010), among Romanian children who were previously institutionalized and adopted by families in the United Kingdom by age 6 months, 92% were identified as meeting the threshold for adaptive functioning (using a cutoff based on functioning in at least 6 of 7 domains) at age 11 years; whereas only 50% were determined to meet the threshold for adaptive functioning among those adopted after age 6 months (Kreppner et al., 2007). While these studies are informative, the nature of traditional adoption and placement decisions makes it difficult to draw conclusive links about the role of placement in families and subsequent likelihood of exhibiting adaptive functioning following early deprivation; it could be that high-functioning youth were selected for adoption by future parents or institution staff.

In the present study, we focused on children who were abandoned at or shortly after birth and placed in institutional care in Bucharest, Romania. We evaluated adaptive functioning primarily based on whether children with early institutional rearing demonstrated adaptive functioning across several domains, as compared to children who had never been institutionalized. The participants were from the Bucharest Early Intervention Project (BEIP;

Zeanah et al., 2003), the only randomized controlled trial (RCT) for foster care as an alternative to institutional care. The foster-care intervention was designed to be affordable, replicable, and grounded in developmental research on caregiving quality (Nelson, Fox, & Zeanah, 2014; Smyke, Zeanah, Fox, & Nelson, 2009). After a baseline assessment occurring at a mean age of 22 months, institutionalized children from six Bucharest institutions were randomized into either high-quality foster care or to the care as usual condition. At age 54 months, the clinical trial ended, and at age 12 years, all participants, as well as community comparison children who were never institutionalized, were invited to participate in a comprehensive follow-up assessment, in which multiple domains of functioning were assessed.

In order to examine adaptive functioning in participants of the BEIP, we created a composite based on functioning across seven domains (i.e., family relations, peer relations, academic performance, physical health, mental health, substance use, risk-taking behavior) according to self or caregiver report. Each child received a score reflecting the sum on this composite, with scores of at least 6 of 7 indicating that a child reached the threshold for classification as having adaptive functioning in early adolescence.

Following the creation of this binary adaptive functioning determination at age 12 years, we had five aims. First, we examined whether those with and without any history of institutional care differed in adaptive functioning. We predicted that never institutionalized children would be significantly more likely to be classified as having adaptive functioning than those who were ever institutionalized. Second, within those with a history of institutional care, we examined the external validity of the classification for adaptive functioning, using non-self or caregiver report measures of functioning (i.e., cognitive ability; objectively measured markers of stress response). We predicted that, within those ever institutionalized, those determined to meet the threshold for adaptive functioning would have higher IQ scores and demonstrate more typical physiological responsivity to stress (i.e., increased reactivity), compared to those not meeting the threshold for adaptive functioning. Third, using an intent-to-treat (ITT) approach, we examined whether the adaptive functioning of children assigned to the intervention differed in from that of children assigned to the care as usual condition. We predicted that those children randomized to foster care would be significantly more likely to exhibit adaptive functioning than children randomized to care as usual. Fourth, we examined whether sex was associated with adaptive functioning overall and by group. We predicted that girls would be more likely than boys to exhibit adaptive functioning following adversity, based on prior research (Rutter, 1987). Fifth, among those ever institutionalized, we examined whether institutional care exposure (i.e., age placed into family care and time spent in institutional care) was associated with likelihood of meeting the determination of adaptive functioning. We predicted that being placed in foster care earlier in life, as well as reduced time in institutional care, would be associated with greater likelihood of exhibiting adaptive functioning.

Methods

Participants

Participants were drawn from an RCT of abandoned children from all six institutions for young children in Bucharest, Romania (age range 6–31 months, mean age 22 months [SD=7]) in which children were randomized to foster care (foster care group; FCG) or to care as usual (care as usual group; CAUG). The trial concluded when the children were 54 months of age, at which point the foster care network was turned over to local governmental authorities in Bucharest and the investigators continued to simply follow the sample. Original trial participants were invited to complete a comprehensive follow-up assessment at age 12 years old. Details about the original sample are available elsewhere (Zeanah et al., 2003). Figure 1 presents a CONSORT diagram which displays the initial and 12-year status of the children. By age 12 years, 22 of the original 136 children had ceased participation in the study (see CONSORT for attrition by follow-up wave). At age 12 years, only those with complete data for all seven domains of adaptive functioning were included (i.e., 48 CAUG and 50 FCG). Participants who did and did not participate at age 12 years and those with and without complete data at age 12 years did not significantly differ (*ps*>.10) in gestational age at birth, birth weight, APGAR score (if known), age when placed into the institution, or the percent time in institutional care at baseline. In addition to the two randomized groups, a third group of Romanian children who had never been placed in an institution were recruited from pediatric clinics and schools in Bucharest were matched on age and gender to the randomized children. They served as a typically developing comparison group (never institutionalized group, NIG). Of the 49 NIG children, 27 had been followed since baseline and 22 were newly recruited through local elementary schools (and initiated participation at the age 8 years follow-up). Original and new NIG participants did not significantly differ ($\chi^2(1)=2.11$, $p=.146$) in adaptive functioning (described in detail below). Please see Table 1 for descriptive statistics of the 147 total participants by group.

Ethical Considerations

After approval by the institutional review boards of the three principal investigators (CAN, NAF, and CHZ), and by the local Commissions on Child Protection in Bucharest, the study started in collaboration with the Institute of Maternal and Child Health of the Romanian Ministry of Health. At the age 12 year follow-up, each child's legal guardian signed consent for participation as per Romanian law, and written assent from each child for each procedure was obtained (unless the child had intellectual disabilities, in which case they gave verbal assent). Studies of vulnerable populations require careful attention to ethical issues. These have been discussed in detail elsewhere (Miller, 2009; Millum & Emanuel, 2007; Nelson et al., 2014; Rid, 2012; Zeanah, Fox, & Nelson, 2012).

At age 12 years, children from the original randomized groups, and their current caregivers, were reassessed. Throughout the study and follow-ups, we have maintained a policy of noninterference with decisions about placement, which are in the purview of local governmental authorities. Many children changed living situations over the course of the study.

Randomization and Masking

In the original trial (Zeanah et al., 2003), after baseline assessment, children were randomly assigned to the CAUG or FCG. The children in the two groups did not significantly differ in terms of age, gender, ethnicity, birth weight, developmental quotient, observed caregiving environment, caregiver ratings of behavior problems and competence at baseline (Smyke et al., 2007). Masking group assignments to children, their caregivers, or study investigators was not possible, although IQ assessments at age 12 were administered by a research assistant unfamiliar with the study sample.

Procedures

At 12 years of age, children and their primary caregivers were assessed with interviews and questionnaires in-person in our laboratory. Given participant burden, the measures were divided up into multiple sessions. Age is reported for when the MacArthur Health and Behavior Questionnaire was obtained (M age=12.54, SD=0.55; range 11.43–14.62) given that the greatest number of domains were assessed using this measure. Eighty-three percent of children completed all measures included in the composite sessions within 2 months. In addition, the children were administered IQ tests and physiological responses to stress, described below.

Measures

All measures were translated into Romanian, then back translated into English, and assessed for meaning at each step by bilingual research staff. For children living with biological parents or foster parents, the mother reported on the child's behavior. For children living in institutions, an institutional caregiver who worked with the child regularly and knew the child well reported on the child's status and behavior.

MacArthur Health and Behavior Questionnaire (HBQ; Essex et al., 2002).

The HBQ is a well-validated assessment of children ranging from 4 to 18 years, and has been previously used to assess emotional and behavioral adjustment in institutionally reared children (Wiik et al., 2011). For the purposes of the present study, we obtained caregiver report of the following domains from the HBQ: peer relations, academic performance, physical health, mental health).

Social Skills Rating System (SSRS; Gresham & Elliott, 1990).

The SSRS is a 55-item questionnaire assessing various social and problem behavior in children. It has been shown to have good reliability and validity (Gresham, Elliott, Vance, & Cook, 2011). In this study, the family relations domain was derived from caregiver report of the SSRS.

CDC Youth Risk Behavior Survey (YRBS; Centers for Disease Control, 2001).

The YRBS is a measure developed by the Center for Disease Control that monitors health-risk behavior among youth and young adults. We used a modified version of the 2001 YRBS Middle School Questionnaire, with prompts orienting participants to answer questions using the time frame of the past year. This version was further modified by the Romanian research

staff to include culturally relevant items (e.g., “provokes undomesticated dogs”). Children reported on their own substance use and risk-taking behavior from items on the YRBS.

Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV; Wechsler, 2004).

The WISC-IV is a widely used, individually administered instrument for assessing the cognitive abilities of children. For the present study, the overall composite score, or Full Scale IQ (IQ), was used as an external, examiner assessed marker of adaptive functioning with which to compare with the group determinations.

Stress Response.

Described in detail elsewhere (McLaughlin et al., 2015), participant physiological stress response was obtained during a single laboratory-based session as part of the age 12 year follow-up (mean age = 12.9 years), and was typically the final session for the age 12 year follow-up. Briefly, approximately 30 minutes after arrival to the laboratory, participants provided a baseline saliva sample and physiological monitoring equipment was set up. After a 5-minute resting period, participants completed three laboratory-based procedures (a peer-evaluation task, an evaluated social performance task [Trier social stress test (TSST); which included preparation, speech, and math portions], and a nonsocial task designed to elicit frustration). Each task was followed by a baseline recovery period. Diastolic blood pressure (DBP) reactivity, heart rate (HR) reactivity, pre-ejection period (PEP) reactivity, and cortisol reactivity to the TSST were selected as physiological markers of adaptive functioning with which to examine external validity to adaptive functioning determinations.

Domain Details

Family Relations.—Eight items related to family interactions on the Social Skills scale of the SSRS comprise the Family Relations scale. Caregivers rated the frequency of the behavior for each item on a scale of 0 (“never”), 1 (“sometimes”), or 2 (“very often”). The reliability for the scale was good (α=.77). A summary score was created and having a score within 1 SD of the mean (or higher) of the NIG was used as the threshold for adaptive functioning in this domain. See Table 2 for details of the domain scores descriptive statistics and cutoffs.

Peer Relations.—Eight items from the Prosocial subscale of the HBQ comprise the Peer Relations scale. Caregivers rated the frequency of behavior on a scale of 0 (“rarely applies”) to 2 (“certainly applies). The reliability for the scale was good (α=.81). A score within 1 SD of the mean (or higher) of the NIG was used as the threshold for adaptive functioning in this domain.

Academic Performance.—To devise the scale assessing academic functioning, we first examined demographic data about whether the youth involved in the study were in a typical or “regular” Romanian school or an alternative or “special” school for youth who are not able to function academically in a regular school. Youth enrolled in a special school were coded as not exhibiting adaptive functioning in this domain (n=18). For all other participants (n=129), we used three items from the HBQ to devise the Academic Performance scale. These items asked caregivers to rate the youth’s performance in 1) Language Arts/Reading,

2) Math, and 3) overall academic performance on a 5-point scale ranging from 1 (“poor”) to 5 (“excellent”). The reliability for this scale was very good (α=.91). For those youth enrolled in a regular school, meeting adaptive functioning criterion was defined as having a score within 1 SD of the mean (or higher) of the NIG, with 69% of the 129 meeting this threshold, resulting in a total of 61% identified as adaptively functioning in this domain (i.e., 89 of the 129 in regular school and 0 of 18 in special school).

Physical Health.—To assess this domain, we examined impairment in functioning. Thus, physical health was assessed using a single item from the HBQ: “To what extent does health limit your child in any way, keeping him or her from activities he or she wants to do?” Caregivers provided responses using a 4-point scale, ranging from 0 (“none”) to 3 (“a great deal”). If any score other than “0” was provided, adolescents were characterized as not functioning well in physical health. Seventy-six percent of the children were adaptive functioning in this domain.

Mental Health.—We selected eight items from the HBQ assessing impairment in functioning due to mental health symptoms. The scores ranged from 0 (“none”) to 2 (“a lot”) regarding the level of impairment the caregiver reported for each item. The reliability for the scale was good (α=.87). Scores falling within 1 SD of the mean (or lower) of the NIG were used as the threshold for adaptive functioning in this domain.

Substance Use.—Two items from the YRBS were used to create the Tobacco and Alcohol Use scale. Adolescents reported whether or not they had ever used alcohol or cigarettes. Children who had used both substances were considered as not meeting criteria for adaptive functioning in this domain.

Risk-taking Behavior.—Six items from the YRBS were used to create the risk-taking behavior scale (i.e., dog provocation, reckless street crossing, riding in a vehicle with drinking driver, physical fighting, initiating physical fights, gambling). Because different response options were provided for the different items, each item was first transformed into binary options (0 or 1) so that the total weight was consistent across items. The reliability was fair (α=.64). Scores within 1 SD of the mean (or lower) of the NIG were designated as adaptive functioning in this domain.

Data Analysis

Chi-square analyses were used to examine group differences for each individual domain and adaptive functioning classification, which included differences based on institutional care history (Aim 1) and ITT group (Aim 3). For ITT analyses, all participants were analyzed according to original group assignment, regardless of subsequent or current placements. In order to examine the external validity of the adaptive functioning determination (Aim 2), we tested whether individuals with a score of at least 6 out of 7 on the composite, versus those with a score of 5 or fewer, differed in IQ, and reactivity in DBP, PEP, and HR. For IQ, an analysis of variance was conducted. Mixed effects modeling with restricted maximum likelihood estimation was used to examine DBP, PEP, and HR reactivity in response to two stressors (reactivity to speech and reactivity to math from the TSST) treated as repeated

measurements within individuals, with adaptive functioning classification as a fixed predictor. In order to examine cortisol reactivity, the log transformed value following the TSST was examined using an analysis of covariance, covarying for log transformed cortisol levels obtained at baseline. Chi-square analyses, followed by binary logistic regression analyses, were conducted to examine differences in adaptive functioning within group by sex, sex differences based on institutional care history, and potential sex by group interactions (Aim 4). In order to examine institutional care history (Aim 5), odds ratios (OR) were calculated to examine age of placement into foster care (before and after age 20 and 24 months) and likelihood of meeting the classification of adaptive functioning. Lastly, binary logistic regression was used to examine time spent in institutional care as a predictor of adaptive functioning.

As noted above, participants who discontinued study participation, as well as participants without complete data across all 7 domains assessed for adaptive functioning, were excluded from these analyses. Using the last observation carried forward was not an option as no previous assessment of adaptive functioning in this sample had been assessed, and participants providing incomplete information regarding functioning across domains could not be reliably determined to meet the threshold for adaptive functioning criteria.

This trial is registered with ClinicalTrials.gov, number NCT00747396.

Results

Determining the Composite

Our approach of considering multiple domains allows for adaptive functioning to be determined by more than one specific outcome (e.g., mental health, academic performance). We took cues from prior research (Baumrind, 1991; Kreppner et al., 2007; McGloin & Widom, 2001) to select face-valid domains in which adaptive functioning can be meaningfully assessed, rather than identifying domains in which the assessment was previously found to be associated with gains, and treated each domain with equal weight. We attempted to include many aspects of functioning provided by available data, including two measures of health (physical and mental), two measures of relationship functioning (peer and family), two measures of behavioral dysregulation (substance use and risk-taking behavior), as well as academic performance. We selected a relatively strict threshold for domains in which an individual was determined to be competent in order to exhibit adaptive functioning (i.e., 6 of 7 domains), in order to ensure that only individuals who were functioning well in many areas were classified as such. A correlation matrix of the overall adaptive functioning and domain specific adaptive functioning classifications is in Table 2, and overall classification of adaptive functioning and domain specific adaptive functioning based on group is in Table 3.

Adaptive Functioning by Institutional Care History

Forty percent of ever institutionalized (EIG) children (i.e., CAUG and FCG) were identified as having adaptive functioning (i.e., at least 6 of 7 domains), which was less than

half of the NIG group's percentage (82%) (see Table 3 for percentages and statistical significance of group comparisons).

External Validity with Adaptive Functioning

Within the EIG, we sought to identify whether objective individual difference variables (not self or caregiver report [i.e., IQ and stress response system metrics]) were associated with the overall adaptive functioning classification (Table 4). Providing support of external validity, children who were determined to exhibit adaptive functioning had significantly higher IQ scores, greater DBP reactivity, and greater PEP reactivity compared to those who did not. For HR reactivity, there was a trend for greater reactivity among classified as exhibiting adaptive functioning compared to those who did not. Adaptive functioning was not significantly associated with cortisol reactivity during the laboratory-based stressor.

Adaptive Functioning by Randomized Controlled Trial Group

To examine ITT effects, chi-square tests were conducted on adaptive functioning among the CAUG vs. FCG (Table 3). Tests revealed that adaptive functioning significantly differed in only two domains (i.e., academic performance and peer relations). Nevertheless, as is clear from the percent determined to exhibit overall adaptive functioning (i.e., at least 6 of 7 domains), there was a significant ITT effect, such that the FCG were more likely to exhibit adaptive functioning than the CAUG (OR=4.28 [1.79, 10.27]).

Adaptive Functioning by Sex

We also examined sex differences in adaptive functioning by group. Table 5 provides details on the number and percent within each sex and group who met the threshold for adaptive functioning. Within each sex separately there was evidence of both an ITT effect and effect of institutional care history on likelihood of exhibiting overall adaptive functioning. In addition, EIG girls were more likely than EIG boys to exhibit adaptive functioning (OR=2.50 [1.09, 5.75]), though the same effect, while larger in magnitude, did not reach statistical significance in the NIG (OR=5.25 [0.96, 28.57]). A binary logistic regression of sex by group (dummy-coded) indicated main effects of each (Wald(1)=8.17, p=.014 and Wald(2)=28.69, p<.001, respectively), and there was no significant sex by group interaction (Wald(2)=0.50, p=.781).

Additional Predictors of Adaptive Functioning

Additionally, we examined age of placement into the study sponsored foster families within the FCG only. Supplemental Figure 1 displays the age of placement for all FCG based on whether or not they exhibited adaptive functioning. In order to inform placement decisions, which are binary in nature, for analytic purposes we split the sample based on age of placement, and based on prior research selected age 20- and age 24-month cutoffs to examine potential placement effects. Those children who were placed into families by age 20 months were significantly more likely to exhibit adaptive functioning (11/14) than children placed after this age (16/35; OR=4.35 [1.03, 18.37]). A similar, although not statistically significant effect was found by using a placement age of 24 months, as those

placed prior to this age were somewhat more likely to exhibit adaptive functioning (16/24) than those placed after this age (67% vs. 44%, (11/25; OR=2.54 [0.80, 8.11]).

Further, we examined time spent in institutional care among the EIG in relation to the adaptive functioning classification, and found that increased time spent in care, assessed at the various assessment waves, was associated with reduced likelihood of exhibiting adaptive functioning: age 30 months (B=−0.03, SE=0.01, Wald $\chi^2(1)=11.29$, $p<.001$), 42 months (B=−0.04, SE=0.01, Wald $\chi^2(1)=12.97$, $p<.001$), 54 months (B=−0.04, SE=0.01, Wald $\chi^2(1)=12.83$, $p<.001$), 8 years (B=−0.05, SE=0.01, Wald $\chi^2(1)=11.53$, $p<.001$), and 12 years (B=−0.05, SE=0.02, Wald $\chi^2(1)=9.78$, $p=.002$).

Discussion

We examined adaptive functioning in 12 year old children through assessments across seven domains in children from the BEIP, all of whom experienced early psychosocial deprivation in the form of institutional care. Consistent with prior research (Kreppner et al., 2007; Vorria et al., 2015), we found significant heterogeneity in outcomes in children who were previously institutionalized, as 40% of ever institutionalized children exhibited adaptive functioning (i.e., at least 6 of 7 domains) in early adolescence. Family placements, known to be protective following adoption after early psychosocial deprivation, are considered natural experiments, in which circumstances allow for researchers to examine placement status as well as age of placement on child outcomes (Rutter, Kumsta, Schlotz, & Sonuga-Barke, 2012). The RCT design of BEIP goes one step further, as any differences found between the groups randomized to either CAUG or FCG can be causally attributed to the intervention. Thus, our unique study design allows us to provide compelling evidence that the foster care intervention promoted adaptive functioning following deprivation. In addition, we found that placement by age 20 months and reduced time in institutional care were associated with greater likelihood of exhibiting adaptive functioning.

Prolonged hazards of all types are thought to increase the risk for developmental difficulties and reduce the likelihood of resilience following adversity (Masten, 2001). Across studies following individuals who experienced different forms of adversity, the percentage of individuals who exhibit adaptive functioning depends greatly on specific features of the adversity they experienced. For example, among children who experienced maltreatment in the form of sexual abuse, a large body of work has identified that aspects of the stressor (e.g., duration, severity, age of the child) are associated with likelihood of later functioning (Spaccarelli & Kim, 1995). These findings are in concert with our own, highlighting duration of institutional care as an impediment to later adaptive functioning. Considered another way, placement into family care following institutionalization couples both “hazard” removal and “asset” building. Masten (2001) identified “assets” or resources that appear to predict resilience, these features are often variables that can be added to a child’s life (e.g., a caring mentor) to counterbalance risk factors. The notion of interventions that are “asset-building” to promote adaptive functioning following adversity can be applied to the context of the present study, as providing a family (i.e., a stable caregiver) for orphaned or abandoned children is perhaps the strongest asset for improving their well-being. For institutionalized children, evidence from the BEIP suggest that family-based care is

preferable to institutional care, and that such placements should occur as early in life as possible, and should be stable across the child's life (Humphreys, Gleason, et al., 2015; Vanderwert, Zeanah, Fox, & Nelson, 2016).

In addition, the building of such assets may be greater earlier in development. Developmental periods characterized by heightened plasticity, often termed sensitive periods, allow for greater adaptation to both positive and negative environments. Increasing evidence from the BEIP and other studies indicate that sensitive periods exist in early life that are relevant to recovery from severe psychosocial deprivation (Nelson et al., 2014; Rutter, 2001; Vorria et al., 2015). The majority of sensitive period findings in BEIP suggest that sometime between 18–24 months is an important turning point in development, such that placement before that age is associated with more recovery from psychosocial deprivation (Nelson et al., 2014; Nelson, Fox, & Zeanah, 2017; Zeanah, Gunnar, McCall, Kreppner, & Fox, 2011). Researchers from the ERAS noted dramatically different outcomes at age 11 years among previously institutionalized children based on whether or not they had been placed in families by age 6 months (Kreppner et al., 2007), with nearly all children placed by 6 months demonstrating resilience to adversity. However, among children placed after 6 months, cutoffs based on additional time in care (i.e., 6–24 months vs. 24–42 months) did not significantly relate to impairment in early adolescence. This diverges from the present study's findings that greater time spent in institutional care, measured at all study assessment periods (from baseline through age 12 years), was associated with reduced likelihood of exhibiting adaptive functioning. More similar to our own findings, work from the Metera Babies Centre found that the largest predictor of early adolescent resilience was the length of time in institutional care, with those children who remained in care past age 2 years having significantly worse outcomes than those placed before that age (Vorria et al., 2015). Taken together, these results suggest the potential for a sensitive period for the impact of family placements in which later adaptive functioning may be more easily facilitated.

In addition to family-based care, being a girl is associated with increased likelihood of exhibiting adaptive functioning. Sex differences favoring girls' recovery following adversity is well established (see Rutter, 1987). McGloin and Widom's (2001) study on longitudinal outcomes following child maltreatment found a significant sex difference indicating that girls with maltreatment histories were significantly more likely to be resilient than maltreated boys. Not only were girls from our study more likely to exhibit adaptive functioning following psychosocial deprivation, there was some evidence that never institutionalized girls were more likely to exhibit adaptive functioning, indicating that sex differences were not moderated by institutional care history. Such sex differences may be due to neurodevelopmental vulnerabilities found at higher rates in males, or perhaps different expectations by caregivers for the abilities and behavior of girls and boys (Rutter, 1987).

In terms of our determination of adaptive functioning, choices made were guided by prior work but were somewhat arbitrary by necessity. Had we required adaptive functioning in all 7 domains, or merely 5 domains, the results would obviously differ, and the field has yet to reach consensus on (a) salient domains, (b) thresholds for determining adaptive functioning, and (c) how many areas in which one must meet this threshold to be considered to be

functioning adaptively following adversity (see Luthar, Cicchetti, & Becker, 2000; Masten et al., 1999). McGloin and Widom (2001) followed a large number of children with and without substantiated maltreatment cases, and defined resilience as adaptive functioning in at least 6 of 8 domains (i.e., arrest records, education, employment, homelessness, psychiatric disorder, self-reported of violence, and substance abuse).

In the ERAS, 7 domains (i.e., cognitive impairment, quasi-autistic patterns, inattention/overactivity, disinhibited attachment, conduct, emotional, and peer relationship problems) were assessed, and being at the 15th percentile was required as the cutoff for impairment (with the exception of one domain in which a clinical diagnosis was used; Kreppner et al., 2007). In the Metera Babies Centre study, Vorria et al. (2015) focused on 4 domains (i.e., quality of attachment; cognitive performance; hyperactivity; request for psychiatric services), in which scores were given from 0 to 4 for each domain. While there is overlap among these examples, each varies in important ways to each other and to our own approach.

The domains were selected *a priori* for inclusion, as we attempted to assess a wide range of functioning inspired by previous studies of resilience rather than selecting those domains in which we previously found evidence for an intervention effect. Perhaps because of this approach, several domains indicated no significant ITT effect (e.g., including mental health impairment [in contrast to recent findings of intervention effects at age 12 years based on symptom levels; Humphreys, Gleason, et al., 2015]), suggesting that the overall differences between the CAUG and FCG in overall adaptive functioning may have been cumulative across domains or driven specifically by specific domains assessed (e.g., peer relations and academic performance). Indeed, those two domains demonstrated the highest correlation with overall adaptive functioning. Notably, in the two domains in which the adolescent was the informant (i.e., substance use and risk-taking behavior), there were no significant differences between the three groups, which could indicate a true lack of differences in these domains or potential biases in self-report. The EIG have relatively low IQ levels, on average, even among those who exhibited adaptive functioning, and there are known methodological concerns regarding self-report data among individuals with intellectual disabilities (Finlay & Lyons, 2001).

We are unable to conclude, specifically, why each child did or did not exhibit adaptive functioning, although it is likely that there are multiple factors that play a role in predicting adaptive functioning following adversity. Individual features (e.g., positive temperament; (Moran et al., 2016) and specific genotypes may be more protected from adversity and/or sensitive to the intervention (Brett, Humphreys, et al., 2015; Brett, Sheridan, et al., 2015; Drury et al., 2010; Humphreys, Zeanah, Nelson, Fox, & Drury, 2015). Although resilience to adversity is, of course, a desired outcome, a focus on inherent traits rather than external circumstances may pathologize those children who show impaired functioning after experiencing adversity. Perhaps most important to emphasize is that adaptive functioning can be fostered by positive environments. Further, investigations into potential mechanisms by which experience can foster adaptive functioning may consider cognitive ability (Almas et al., 2016) and/or adaptive mounting of the stress response system (McLaughlin et al., 2015), given the associations between these markers and classification of adaptive

functioning within the EIG. Such an approach is consistent with a framework in which the association between risk factor and adverse outcomes can be modified, specifically noting that individual features and circumstances may promote vulnerability, whereas others may promote protection (Rutter, 1987, 1996, 1999). It is worth noting that cortisol reactivity, perhaps the most commonly studied metric of physiological stress response, did not differentiate those who did and did not exhibit adaptive functioning. Despite finding an ITT effect for cortisol reactivity to stress (McLaughlin et al., 2015), differences based on adaptive functioning group, though in the expected direction, did not reach statistical significance, indicating that this metric may be a better marker of stress exposure than adaptive functioning.

Several additional limitations should be noted. First, as noted above, the nature of the intervention meant that caregivers, children, and laboratory staff were not blind to condition. Second, participant attrition has occurred since the initial randomization. Although we attempted to examine difference between those individuals who did and did not participate in the present follow-up, we cannot rule out the possibility that those individuals not included would have altered the findings. As a related point, our ITT analyses may be overly conservative in estimating the effect of the foster care intervention, given that many children at age 12 years were no longer in the same placement as following randomization. Approximately half of children in the FCG were no longer in their original foster care placement at age 12, and many CAUG were subsequently placed in family care. While alternative metrics assessing aspects of institutional care were considered (i.e., age of placement into foster care; percent time in institutional care), these variables are correlated with ITT group.

In conclusion, findings from the present research indicates that placement into foster care following institutional care promotes adaptive functioning. Earlier placements and reduced overall time in institutional care appears to be associated with better outcomes for these children in early adolescence.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- Studies examining the sequelae of early deprivation due to institutional rearing often focus on negative outcome (i.e., a deficit model).
- Significant heterogeneity in outcomes exist, and many children demonstrate adaptive functioning despite severe experiences of early adversity.
- Outcomes from the Bucharest Early Intervention Project, a randomized controlled trial of institutional care as an alternative to institutional care, indicate a causal effect of the intervention on promoting adaptive functioning in early adolescence.
- Earlier age of placement and reduced time in institutional care are associated with increased likelihood of exhibiting adaptive functioning among those who experienced early deprivation.

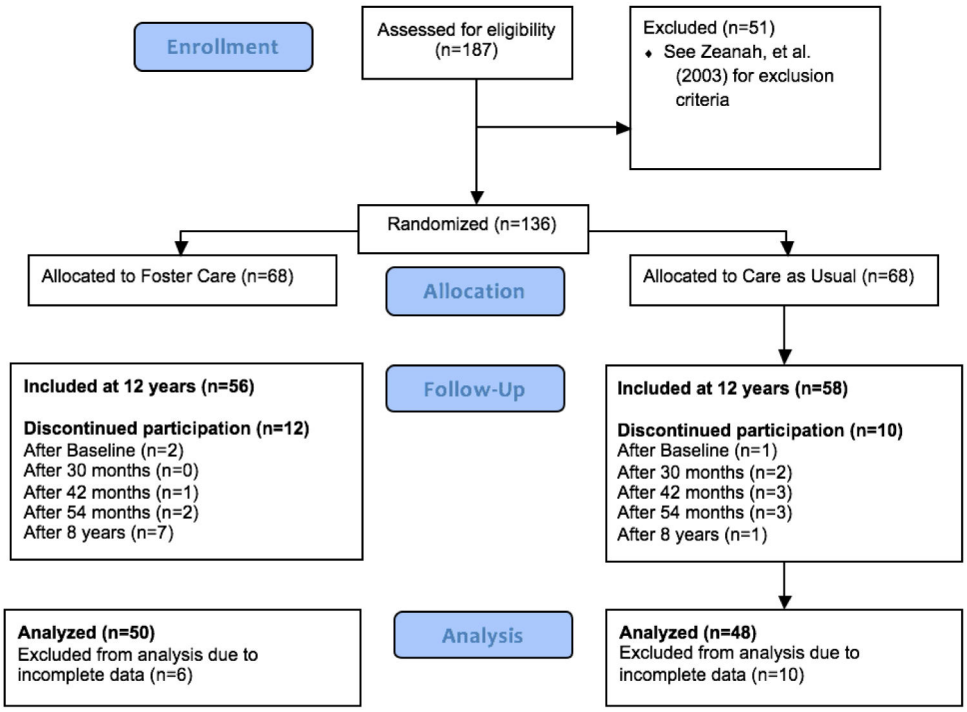

Figure 1.
CONSORT for the Randomized Controlled Trial and Adaptive Functioning at Age 12 Years

Table 1.

Sex, age, and IQ by group.

Domain	CAUG n=48	FCG n=50	NIG n=49	Intent-to-treat χ^2 or F	Intent-to-treat differences	Three group χ^2 or F	Three group differences
Sex (% Male)	26 (54%)	25 (50%)	23 (47%)	0.17	--	0.61	--
Age	12.59 (0.67), 11.97–14.62	12.46 (0.53), 11.43–14.04	12.57 (0.42), 12.04–13.53	1.02	--	0.73	--
IQ	69.76 (14.39), 40–104	78.76 (17.24), 45–120	98.06 (15.96), 48–129	7.57**	CAUG<FCG	39.39***	CAUG<FCG<NIG

Note. N (percent) or M (SD), range. CAUG=care as usual group. FCG=foster care group. NIG=never institutionalized group.

** $p<.01$.

*** $p<.001$.

Table 2.

Spearman's correlations between binary classifications of overall adaptive functioning and domain specific adaptive functioning thresholds and original scale descriptive information.

Domain	Overall Adaptive Functioning	Family Relations	Peer Relations	Academic Performance	Physical Health	Mental Health	Substance Use	Risk-taking Behavior
Overall Adaptive Functioning	1							
Family Relations	.47***	1						
Peer Relations	.56***	.30***	1					
Academic Performance	.65***	.30***	.46***	1				
Physical Health	.39***	.23**	.10	.25***	1			
Mental Health	.48***	.31***	.23**	.33***	.27***	1		
Substance Use	.34***	.18*	.07	.05	.21**	.05	1	
Risk-taking Behavior	.38***	.22**	.19*	.17*	.07	.01	.47***	1
Original Scale Mean (SD)	5.18 (1.72)	11.11 (3.21)	15.80 (3.58)	15.80 (3.58)	0.38 (0.76)	2. 52 (3.19)	0.69 (0.72)	1.73 (1.55)
Range	0 to 7	3 to 16	5 to 20	3 to 15	0 to 3	0 to 14	0 to 2	0 to 6
Cutoff	6 or higher	9 or higher	16 or higher	Regular school and 9 or higher	0 only	2 or lower	0 or 1	3 or lower
N (Percent) Classified as Adaptive Functioning	79 (54%)	118 (80%)	98 (67%)	89 (61%)	111 (76%)	95 (65%)	125 (85%)	125 (85%)

*Notes. $p<.05$.

**$p<.01$.

***$p<.001$.

Table 3.

Number (percent) in each group who met criteria for adaptive functioning within each domain and using the threshold of 6 out of 7 domains.

Domain	CAUG n=50	FCG n=48	NIG n=49	Intent-to-treat χ^2	Intent-to-treat differences	Three group χ^2	Three group differences
Family Relations	34 (71%)	41 (82%)	43 (88%)	1.70	--	4.53	CAUG<NIG
Peer Relations	22 (46%)	35 (70%)	41 (84%)	5.88*	CAUG<FCG	16.00***	CAUG<FCG, NIG
Academic Performance	15 (31%)	30 (60%)	44 (90%)	8.15**	CAUG<FCG	34.80***	CAUG<FCG<NIG
Physical Health	33 (69%)	36 (72%)	42 (86%)	0.12	--	4.28	CAUG<NIG
Mental Health	25 (52%)	25 (50%)	45 (92%)	0.04	--	23.85***	CAUG, FCG<NIG
Substance Use	39 (81%)	42 (84%)	44 (90%)	0.13	--	1.46	--
Risk-taking Behavior	39 (81%)	44 (88%)	42 (86%)	0.86	--	0.90	--
Adaptive Functioning in 6 or 7 Domains	11 (23%)	28 (56%)	40 (82%)	8.15**	CAUG<FCG	33.78***	CAUG<FCG<NIG

Note. N (percent). CAUG=care as usual group. FCG=foster care group. NIG=never institutionalized group.

** $p<.01$.

*** $p<.001$.

Table 4.

Among the ever institutionalized children, IQ and stress reactivity scores based on those who did and did not exhibit adaptive functioning overall.

	Exhibited adaptive functioning (n=39)	Did not exhibit adaptive functioning (n=59)	t^a
Full scale IQ	78.82 (17.54)	71.32 (15.09)	−2.23*
Diastolic Blood Pressure Reactivity	8.64 (7.61)	4.67 (8.14)	−2.45*
Pre-ejection Period Reactivity	−6.57 (5.60)	−4.05 (5.63)	2.17*
Heart Rate Reactivity	14.97 (8.72)	11.58 (8.80)	−1.88†
Cortisol Reactivity	1.90 (0.34)	1.80 (0.35)	−1.33

Note. Mean (SD).

[a]GLM was used for full-scale IQ and cortisol reactivity; mixed modeling was used for diastolic blood pressure, pre-ejection period, and heart rate reactivity.

†$p<.06$.

*$p<.05$.

Table 5.

Number (percent) exhibiting adaptive functioning by sex and group.

	CAUG n=48	FCG n=50	NIG n=49	Intent-to-treat χ^2	Intent-to-treat Differences	Three group χ^2	Three group Differences
Male (n=74)	4 (15%)	11 (44%)	16 (70%)	5.03*	CAUG<FCG	14.79***	CAUG<FCG, NIG
Female (n=73)	7 (32%)	17 (68%)	24 (92%)	6.13*	CAUG<FCG	19.45***	CAUG<FCG<NIG

Note. N (percent). CAUG=care as usual group. FCG=foster care group. NIG=never institutionalized group.

* $p<.05$.

*** $p<.001$.