Published in final edited form as:

Child Youth Serv Rev. 2016 December ; 71: 184–190. doi:10.1016/j.chilgyouth.2016.11.008.

Children's Executive Function in a CPS-Involved Sample: Effects of Cumulative Adversity and Specific Types of Adversity

Leslie E. Roos^a, Hyoun K. Kim^{b,c}, Simone Schnabler^a, and Philip A. Fisher^a

^aUniversity of Oregon, Department of Psychology

^bOregon Social Learning Center

^cYonsei University, Seoul, Korea

Abstract

Prior research has identified the presence of executive function (EF) deficits in child protective service (CPS) involved (versus non-involved) children but minimal work has examined predictors that might explain individual differences *within* these CPS-involved children. Here, we sought to characterize EF in a large sample (N=694) of CPS-involved children and examine how specific adversities (physical abuse, neglect, caregiver domestic violence, and caregiver substance dependence) and cumulative adversity (at ages 0–3 and 3–6 years) predict EF (at approximately 5–6 years). It was expected that the sample would exhibit low EF overall based on previous research in maltreated children. Specific adversity and cumulative adversity analyses were largely exploratory given the limited previous work in this area. Results indicated poor EF overall, with 43.5% of children performing worse than chance. Amongst children who performed greater than chance, higher cumulative adversity, physical abuse, and caregiver substance use (at ages 3–6 years) predicted better EF. These findings join literature documenting that, within CPS-involved children, the presence of certain adversities predicts variable cognitive function. Findings highlight the potential relevance of evolutionary psychology to understanding how alterations in behavior linked to harsh and unpredictable early environments may cue accelerated brain development underlying relative cognitive advantages, within at-risk, low performing samples. Longitudinal studies are critical to determine if the relative EF advantages linked to higher adversity persist over time or result in lower EF later on, reflecting a more rapid, but overall limited, trajectory of cognitive development.

Keywords

executive function; cumulative adversity; life history; individual differences; maltreatment; cognitive skills

Corresponding Author: Leslie E. Roos, Department of Psychology, 1227 University of Oregon, Eugene, OR, 97402, lroos@uoregon.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Children involved with child protective services (CPS) are at risk for a host of negative outcomes across socioemotional, academic, health, and risk-taking domains (Gramkowski et al., 2009; Leslie et al., 2005; Pears, Fisher, Bruce, Kim, & Yoeger, 2010). Although the types of outcomes associated with CPS involvement vary widely, executive function (EF), defined as effortful cognitive process necessary for goal-directed behavior, appears to be a core capacity underlying negative outcomes for CPS-involved children. A growing body of research has demonstrated that individuals exposed to a range of adversities common to CPS-involved children (e.g., trauma, neglect, homelessness) tend to exhibit poor EF, compared with children without such experience (DePrince, Weinzierl, & Combs, 2009; Hostinar, Stellern, Schaefer, Carlson, & Gunnar, 2012; Pechtel & Pizzagalli, 2011). Furthermore, EF has frequently been shown to be a mediator between early adversity and later life outcomes, which underscores the importance of understanding factors associated with EF performance among high-risk samples (Masten et al., 2012; Pears et al., 2010).

Although research that has compared children exposed to adversity (versus those not exposed) has been key for documenting that the presence (versus absence) of adversities is, on average, associated with lower EF, for the most part it has failed to draw consistent conclusions about the influence of specific aspects of rearing environments. Given that adversities (e.g., caregiver transitions, parental substance use, maltreatment, domestic violence) often co-occur in the CPS population at rates of 80%–98%, additional precision regarding the relevance of certain experiences, while controlling for others, is needed (Dong et al., 2004; Pears, Kim, & Fisher, 2008). Children referred to CPS are a particularly important group in which to characterize how different experiences contribute to individual differences in EF given that these children often exhibit EF deficits and associated negative outcomes such as academic and socioemotional difficulties (Lewis, Dozier, Ackerman, & Sepulveda-Kozakowski 2007; Pears & Fisher, 2005).

In an effort to understand individual differences *within* CPS-involved samples, who exhibit poor EF as a whole, researchers have begun to investigate how specific experiences may differentially predict performance in EF-related tasks. There is a tendency to assume that higher levels of adversity should be associated with worse outcomes (Evans, Li, & Whipple, 2013). However, the nature of the association appears to be nuanced. Although research generally shows that, compared with community controls, maltreated and/or CPS-involved children show diminished EF performance (e.g. Fishbein et al., 2009; DePrince, Weinzierl & Combs, 2009; Kirke-Smith, Henry, & Messer, 2014), higher cumulative adversity (i.e. number of types of maltreatment or caregiver risks) does not necessarily predict worse EF *within* at-risk samples. In fact, multiple studies have reported that cumulative adversity is either unrelated to EF performance or predictive of relatively higher cognitive function (Mothes et al., 2015; Revington, Martin & Seedat, 2011; Pears & Fisher, 2005). These findings may seem counterintuitive, but they are not inconsistent with “life history” theories that suggest when children are exposed to early life stress, particularly harsh and unpredictable types, biology (and brain function) can be directed toward a fast life history strategy that may accelerate development toward an early-to-mature, adult-like profile (Belsky, Schlomer, & Ellis, 2012). This earlier adaptation is theorized to have costs further down the line (e.g., less-complex total brain development), yet overall benefits for survival

and reproduction, given environmental circumstances (Del Giudice, Gangestad, & Kaplan, 2015).

Other research has sought to examine the links between specific types of adversity and EF function to understand if certain experiences can explain within-group variability, but results have been limited because of the typically small size of CPS-involved samples. One study investigating profiles of maltreatment in a foster care sample found that a typology characterized by sexual abuse predicted relatively higher cognitive performance, compared with typologies without sexual abuse (Pears et al., 2008). Other research has found that the presence of severe neglect predicts EF deficits, with longer duration of neglect predicting incremental differences in performance (Hostinar et al., 2012; Pears & Fisher, 2005). Notably, however, the findings regarding neglect were drawn from small samples with a history of severe neglect (e.g., institutionalized care settings), and CPS-involved samples may not consistently experience thresholds of neglect severe enough to cause widespread cognitive impairment.

To better understand how exposure to specific adversities is linked to individual differences in EF, we conducted a systematic assessment of maltreatment and caregiver risk in a large sample ($N = 694$) of CPS-involved children. First, we examined the link between EF performance (at approximately 5–6 years) and sociodemographic and CPS-related covariates (e.g., maternal education, household income, child age, child sex, child out-of-home placements) to determine the extent to which covariates were predictive of EF performance in CPS-involved children. Next, we assessed how cumulative exposure to maltreatment (physical abuse, neglect) and caregiver risk (domestic violence, substance abuse), as assessed via caregiver self-report survey, predicted subsequent EF performance, to build on previous work with CPS-involved samples that linked cumulative adversity to higher EF performance (Pears & Fisher, 2005). Finally, we assessed the specific contributions of each maltreatment and caregiver adversity experience to EF performance.

Previous research has emphasized the importance of timing of environmental experiences for EF function and the overall development. This includes research from the executive function domain noting the changing parental support needs of children in the toddler versus preschool years (see Carlson, 2009 for a review). Evolutionary psychology research has identified the early childhood years, broadly, as being highly relevant to life-history strategies with potential mechanisms including more generalized pathways in infancy/toddlerhood (e.g. attachment, chemical-signalling in breast milk) and more specific pathways in the preschool period (e.g. harsh, unpredictable punishment; Simpson, Griskevicius, Kuo, Sung, & Collins, 2012; Hinde et al., 2014; Sund et al., 2016). Based on these theories, we examined two developmental time periods (0–3 and 3–6 years) in order to determine the impacts of adversity exposure during each time period on cognitive performance. Such a separate consideration is also useful given the differential nature of intervention strategies in the infancy/toddlerhood versus preschool years (e.g. Ramey & Ramey, 1998; Pears et al., 2013).

This research was conducted using data drawn from a nationally representative survey of all children with an open CPS case. As a whole, the group was expected to exhibit lower levels

of performance than have been reported in previous research among community children. We also expected there would be significant variability in EF performance predicted by different types of adversity, but the directionality of associations was largely exploratory, because of the limited previous research in this area. In regard to cumulative adversity, we expected that higher cumulative adversity would predict relatively better EF performance in this at-risk sample, consistent with previous findings and life-history theory (e.g., Pears & Fisher, 2005). We also anticipated stronger links between EF and adversity at ages 3–6 years given that the preschool years have been identified as a critical period for EF development (Carlson, 2009; Cicchetti & Toth, 1992; Garon, Bryson, & Smith, 2000). Insight gained from this research on individual differences in EF performance may be particularly meaningful in that contact with CPS can offer a critical opportunity for early EF intervention and prevention of negative long-term outcomes.

Materials and Methods

Participants

Secondary data analysis was conducted on data from the National Survey of Child and Adolescent Well-Being I (NSCAW I), a longitudinal study designed to evaluate outcomes for children involved in the child welfare system who were referred to CPS between 1999 and 2000 (Dowd et al., 2002). NSCAW data were collected from multiple sources, including children, caregivers, and CPS administrative statistics. The Wave 1 interview occurred within 6 months of the initial CPS investigation, followed by the Wave 2 interview at 12 months post-baseline, Wave 3 at 18 months post-baseline, Wave 4 at 36 months post-baseline, and Wave 5 at 59–97 months post-baseline. Our study excluded Wave 2 data because maltreatment, caregiver risk, and covariates of interest were not assessed at that time point.

Although the entire NSCAW sample is nationally representative of all children with an open CPS case during the study recruitment months (selected from 92 primary sampling units in 97 counties across the nation), our study focused on a subset of the children who completed the flanker task (described in later sections of this article; Webb, Dowd, Karden, Landsverk, & Testa, 2009). All children who were infants (age < 1 year; $N = 1,186$) at initial CPA investigation were eligible to participate in the flanker task at Wave 5; 694 children completed at least 2 of the 3 flanker task blocks, (out of 790 children who participated). Because this subset of 694 children who completed the flanker task was not sampled in a nationally representative manner, weights and stratification variables are not included in our analyses.

Sociodemographic Covariates

Sociodemographic covariates (see Table 1.) examined include Wave 5 child age ($M = 5.27$, $SD = .45$ years), gender (50.1% male), and race/ethnicity (40.6% Black/non-Hispanic, 34.4% White/non-Hispanic, 18.1% Hispanic; 6.9% other). Caregiver education level (23.5% < high school equivalent; 46.9% high school equivalent; 22.5% vocational certificate, diploma, or associates degree; 7.0% bachelor's degree or higher) and annual household

income (median = \$20,000–\$24,999) were also examined. This information was obtained from in-person interviews with primary caregivers.

Child Protective Service Covariates

Additional variables relevant to CPS involvement were derived from interviews with primary caregivers. They included the total number of out-of-home living arrangements by Wave 5 (46.9% = 0, 14.4% = 1, 13.7% = 2, 25.0% = 3+) and substantiated initial CPS report (66.8%, yes). Living with a permanent caregiver (defined as biological or adoptive parents) was also assessed for Waves 1–3 (19.7%, no; 21.8%, one wave; 58.5%, both waves) and Waves 4–5 (1.4%, no; 14.0%, one wave; 84.6%, both waves).

Executive Function

Children completed the color flanker task (in Wave 5 at approximately 5–6 years), as a measure of attention and inhibitory control (McDermott, Perez-Edgar, & Fox, 2007). This task involved the presentation of horizontal rows of five blue or red circles on a computer screen for 700 milliseconds, with a 500-millisecond warning cue preceding each trial (described in NSCAW, 2009). Rows of five blue or five red circles represented selective attention trials, whereas a central blue circle flanked by two red circles or a central red circle flanked by two blue circles represented inhibitory control trials. Children were instructed to press a button corresponding with the color of the central circle while ignoring the color of the flanking circles. A total of 180 trials were split equally between inhibitory control and selective attention trials, divided into three blocks of 60 trials each. Children were asked to respond as quickly as possible, with an allowable response window of 1,300 milliseconds and intertrial intervals of 0–500 milliseconds.

Of the 694 children who completed at least 2 of 3 the task blocks, average errors of omission were 26.3%, and errors of commission were 21.9%. A “passing” level of accuracy, defined by performance greater than chance (> 50%), was achieved by 392 (56.5%) participants. Preliminary analyses (amongst individuals with passing scores) indicated a high degree of overlap between inhibitory control and sustained attention accuracy ($r = .80, p < .001$) and reaction time ($r = .94, p < .001$) indicators. Because of the overlap between constructs, performance on inhibitory control and selective attention trials was averaged to create percent accuracy ($M = 66.4\%$, $SD = 10.1\%$; range = 50.6%–95%) and reaction time scores ($M = 699.45$ ms, $SD = 118.44$ ms; range = 399.20–998.77), reflecting general EF performance. Four children had outlier reaction time scores (> 2.5 standard deviations below the mean) and were Winsorized.

Adversity (Child Maltreatment and Caregiver Risk)

Children’s maltreatment history and caregivers’ risk factors were taken from primary caregivers’ reports assessed via Audio Computer-Assisted Self-Interview. In assessing the presence (versus absence) of maltreatment and caregiver risk variables, if information were missing at one of the two waves (e.g., missing at Wave 4, complete at Wave 5), the presence of a given adversity at the completed wave resulted in the participant being included in analyses, while the absence of adversity at the completed wave resulted in the participant being considered missing.

Although this approach selectively excludes lower-risk children (e.g. children with no adversity present at one wave and missing data at the other), individuals with this profile reflected < 1% of children across adversity types so biasing the sample is of minimal concern.

Child Maltreatment

The maltreatment categories examined in our analyses included physical abuse and neglect. Permanent caregivers responded to items measuring the frequency of specific acts of abuse and neglect by using an 8-point scale (*1 time; 2 times; 3 to 5 times; 6 to 10 times; 11 to 20 times; more than 20 times; not in the past 12 months; never*). As defined by the Parent-Child Conflict Tactics Scale (CTSPC), physical abuse entails spanking and other forms of corporal punishment, as well as more-severe indicators of maltreatment, such as punching or kicking a child (Straus, Hamby, Finkelhor, Moore, & Runyan, 1998). Neglect is present when a child's developmental needs are unfulfilled (e.g., failure to provide adequate food or supervision; Straus et al., 1998). The following items were included in assessing child neglect: (a) leaving child home alone when you shouldn't, (b) not showing or telling child you love him/her, (c) unable to ensure child got needed food, (d) unable to get child to doctor as needed, and (e) couldn't take care of child because you were drunk or high. Sexual abuse was not included in our study because of a low incidence (< 1%) of reported sexual abuse in this young sample. Similarly, it was not statistically appropriate to examine emotional abuse, because, according to CTSPC definitions, emotional abuse was present for almost all (> 90%) of the sample. In the NSCAW sample, internal consistency for the CTSPC subscales was moderate to high for caregiver report, with Cronbach's alphas in the NSCAW sample for CTSPC subscales (e.g. severe physical abuse, neglect) ranging from (.66 to .95).

We used caregiver reports of the child *ever* experiencing physical abuse or neglect at Wave 3 to determine physical abuse or neglect occurring between ages 0 and 3 years and *past year* or new *ever* reports of violence at Waves 4 and 5 to determine physical abuse or neglect between ages 3 and 6 years. Prevalence rates of physical abuse were 6.3% (Waves 1–3) and 15.1% (Waves 4–5). Prevalence rates of neglect were 19.6% (Waves 1–3) and 32.3% (Waves 4–5) in our study sample.

Caregiver Risk

In our study, caregiver risk experiences included substance dependence and domestic violence. The Composite International Diagnostic Interview–Short Form (CIDI-SF) is designed to assess the presence of substance dependence when the criteria established in the *Diagnostic and Statistical Manual of Mental Disorders III–Revised* for alcohol dependence or drug dependence are met (American Psychiatric Association, 1987; Kessler, Andrews, Mroczek, Üstün, & Wittchen, 1998). The items used in establishing alcohol or drug dependence symptom criteria included endorsing three or more of the following symptoms during the previous 12 months: (a) drinking/drug use interfering with work, school, or home; (b) any time using alcohol/drugs where you could get hurt; (c) any emotional or psychological problems from alcohol/drugs; (d) unable to control the urge or desire to drink/use drugs; (e) drinking or recovering from the effects of alcohol/drugs for 1 month or

more; (f) drinking/using drugs more or longer than intended; (g) having to drink/use drugs more than before to get the same effect. The strong reliability and validity of the CIDI have been widely reported across studies (Wittchen, 1994). Cronbach's alpha ranged from .78 to .80 for the alcohol dependency module and from .84 to .90 for the drug dependence module across time.

Caregivers' experience of domestic violence was indexed using the Reduced Conflict Tactics Scales 2 Physical Assault scale (Straus, Hamby, Boney-McCoy, & Sugarman, 1996). Items measuring minor domestic violence included (a) throwing something at other parent; (b) pushed, grabbed, or shoved other parent; (c) slapped other parent. Severe domestic violence was measured by the following items: (a) kicked, bit, or hit other parent with a fist; (b) hit or tried to hit other parent with something; (c) beat up other parent; (d) choked other parent; (e) threatened other parent with knife or gun; (f) used knife or gun on other parent. Participants were asked to respond if the experiences occurred at frequencies from 0 (*never*) to 6 (*more than 20 times*). The report of at least one act of violence was categorized as indicative of the presence of domestic violence experience. Cronbach's alpha suggests moderate to high reliability of the physical violence scale, with NSCAW sample scores from .74 to .85 across time periods.

To assess domestic violence exposure between ages 0 and 3 years, we combined reports of domestic violence in the *past year* at Wave 1 and *past year* or new *ever* reports of violence at Wave 3. Exposure to domestic violence between ages 3 and 6 years was determined by combining reports in the *past year* or new *ever* cases at Waves 4 and 5. Finally, current alcohol or drug dependence at Waves 1 and 3 was used to establish substance use among caregivers of children ages 0–3 years, and current alcohol or drug dependence at Waves 4 and 5 was used to establish substance use among caregivers of children ages 3–6 years. Prevalence rates of caregiver domestic violence were 50.1% (Waves 1–3) and 24.4% (Waves 4–5). Prevalence rates of caregiver alcohol or drug dependence were 12.7% (Waves 1–3) and 4.2% (Waves 4–5).

Cumulative Adversity

Cumulative adversity at Waves 1–3 and 4–5 was assessed by assessing the presence of the four adversity variables (physical abuse, neglect, caregiver domestic violence, caregiver substance dependence) and counting the total number of adversity types. The average risk for children at Waves 1–3 was .85 ($SD = .89$). The average risk for children at Waves 4–5 was .72 ($SD = .90$).

Missing Analyses

For covariates of child age, child gender, caregiver education, household income, and out-of-home placements, < 5% of data were missing for all children. For child maltreatment, caregiver risk, and Wave 1 substantiated maltreatment variables, 18.7%–50.7% of children had missing data (due to non-permanent caregiver status or caregiver failure to complete the relevant questionnaires). Chi-square tests were conducted with the entire sample ($N = 694$) to assess if missing status was significantly related to children's ability to obtain passing scores on the flanker task. Independent sample *t*-tests were conducted amongst children with

passing scores ($N = 392$) to assess if missing status was predictive of accuracy or reaction time. These analyses indicated that missing status was not significantly related (all $ps > .05$) to any flanker task performance variables. Full information maximum likelihood was used in Mplus v.7 to accommodate missing data (Muthén & Muthén, 2012).

Analytic Plan

Because such a high proportion of children failed to achieve passing performance, we conducted preliminary analyses on the entire sample ($N = 694$) to assess if covariates and/or adversity experiences were predictive of reaching the 50% accuracy cut-off. This was assessed in a series of bivariate correlations and ANOVAs examining if passing performance (yes/no) was predicted by sociodemographic (Wave 5: child age, child gender, child race/ethnicity, caregiver education, household income) and CPS-related covariates (substantiated maltreatment at Wave 1, total child out-of-home living arrangements by Wave 5, and permanent caregiver status at Waves 1–3 and Waves 4–5) in addition to both specific adversity (physical abuse, physical neglect, caregiver substance use, caregiver domestic violence) and cumulative adversity variables at Waves 1–3 and 4–5.

For the primary goals of our study, we conducted a series of analyses with children ($N = 392$) who achieved passing flanker task performance. This step included bivariate correlations and ANOVAs with sociodemographic and CPS-related covariates (e.g., maternal education, household income, child age, child sex, and child out-of-home placements) to assess which covariates were predictive of flanker task performance (i.e., accuracy, reaction time). All covariates significantly associated with flanker task performance were included in subsequent multivariate structural equation model analyses.

Next, we used structural equation modeling in Mplus v.7 to assess how cumulative exposure to maltreatment (physical abuse, neglect) and caregiver risk (domestic violence, substance abuse) at Waves 1–3 and 4–5 predicted flanker task performance (accuracy and response time, assessed at Wave 5), controlling for covariates identified in preliminary analyses (Muthén & Muthén, 2012). Finally, we conducted a second structural equation model to examine how specific types of child maltreatment (physical abuse, neglect) and caregiver adversity (caregiver substance dependence, caregiver domestic violence) experiences at Waves 1–3 and 4–5 predicted flanker task performance, controlling for covariates identified in preliminary analyses.

Results

Preliminary Analyses Predicting Flanker Task Performance

Bivariate correlations analyses were conducted with the full sample ($N = 694$) to assess associations between covariates and achievement of a passing score on the flanker test (i.e., $> 50\%$ accuracy). Older child age ($r = .25, p < .001$), lower number of out-of-home living arrangements ($r = -.09, p < .05$), and living with a permanent caregiver at Waves 1–3 ($r = .08, p < .05$) were all significantly associated with achievement of a passing (versus failing) score on the flanker task.

Correlational analyses were conducted between all covariates, cumulative adversity, specific adversity, and flanker task performance (accuracy and reaction time) variables, among children who achieved passing flanker task performance ($N = 392$); see Table 2. Child age, caregiver education, household income, out-of-home placements, older child age and female gender were significantly correlated with higher flanker task accuracy. Being a girl was positively associated with reaction time. Additional ANOVA analyses with categorical variables (child race) indicated no significant group differences (all p s $> .05$) in performance.

Variables that were significantly correlated with achieving passing flanker task accuracy (i.e., total out-of-home placements, permanent caregiver status Waves 1–3) and flanker task performance (i.e., child age, child gender) were included in the multivariate model as covariates.

Cumulative Adversity Structural Equation Model Multivariate Analyses

Structural equation modeling was conducted to examine the extent to which cumulative adversity measures (from Waves 1–3 and Waves 4–5) were associated with flanker task accuracy and reaction time (Wave 5), controlling for potential effects of covariates. The model fit the data well, $\chi^2(9) = 8.13$, $p = .52$, comparative fit index (CFI) = 1.00, Tucker-Lewis Index (TLI) = 1.01, root mean square error of approximation (RMSEA) = .00. Results indicated that higher levels of cumulative adversity at Waves 4–5 (*Estimate* = 2.16, *SE* = .74, $p < .01$), as well as older child age (*Estimate* = .46, *SE* = .01, $p < .001$) and female gender (*Estimate* = 2.10, *SE* = .97, $p < .05$), were significant predictors of higher task accuracy. Female gender (*Estimate* = 69.67, *SE* = 11.35, $p < .001$) and more out-of-home placements were significant predictors of longer flanker task reaction time on correct trials ($\beta = 13.60$, *SE* = 6.20, $p < .05$). No other predictors reached the statistical significance.

Specific Adversity Structural Equation Model Multivariate Analyses

Structural equation models were also used to identify the presence of unique associations between the maltreatment (from Waves 1–3 and Waves 4–5), caregiver risk (from Waves 1–3 and Waves 4–5) and flanker task accuracy and reaction time (Wave 5), controlling for the same covariates. The model fit the data well, $\chi^2(11) = 12.15$, $p = .35$, CFI = .99, TLI = .97, RMSEA = .02. Results indicated that older child age (*Estimate* = .46, *SE* = .10, $p < .001$), more out-of-home placements (*Estimate* = 1.14, *SE* = .54, $p < .05$), as well as the presence of caregiver substance use (*Estimate* = 6.24, *SE* = 2.75, $p < .05$) and physical abuse (*Estimate* = 3.96, *SE* = 1.80, $p < .05$) at Waves 4–5, were significant predictors of higher accuracy. Female gender (*Estimate* = 68.98, *SE* = 11.51, $p < .001$), more out-of-home placements (*Estimate* = 14.14, *SE* = 6.28, $p < .05$), and absence of caregiver substance use (*Estimate* = -54.44, *SE* = 25.43, $p < .05$; Waves 1–3) were significant predictors of longer flanker task reaction time on correct trials. None of the other variables were significant in predicting task accuracy.

Discussion

An estimated 3.2 million children and families receive responses from CPS annually, highlighting the importance of understanding characteristics linked to child well-being within this large, at-risk group (U.S. Department of Health and Human Services, 2013). The purpose of this study was to understand the link between a range of adversities (experienced at child ages 0–3 and 3–6 years) and subsequent EF performance in a sample of CPS-involved children from across the United States. This is a particularly valuable sample in which to study EF, because the large sample size allowed us to both characterize EF performance in a diverse sample of CPS-involved children and to examine the contributions of specific adversities to EF performance at the school-entry age of approximately 5–6 years.

Overall, this group of CPS-involved children exhibited poor EF performance, a finding consistent with findings from previous research in smaller maltreated samples (Fishbein et al., 2009; DePrince, Weinzierl & Combs, 2009; Kirke-Smith, Henry, & Messer, 2014). Structural equation models used to examine the effects of cumulative adversity indicated that exposure to a greater number of adversity types at child ages 3–6 years, but not ages 0–3 years, predicted relatively higher EF. Specific types of adversity were also linked to individual differences in EF performance, with caregivers' substance use and physical abuse predicting higher flanker task accuracy measured at Wave 5 (approximately 5–6 years). These results join a growing body of the literature documenting that, *within* CPS-involved and/or maltreated samples, the presence of certain adversities may predict variable cognitive function in early childhood, and not always in the negative direction. To better understand these results, we discuss the findings in the larger context of early adversity and EF research. Next, we offer possible explanations for these findings and discuss key directions for future research.

Examination of flanker task performance suggests that these CPS-involved children, on average, experienced substantial difficulty in completing the task. To begin with, 43.5% of the sample had to be excluded from analyses because of poor performance (< 50% correct, or performing at chance). This suggests that many children did not understand task instructions or refused to comply with assessor directions. Although there was no community control group to directly compare with CPS-involved children, the proportion of excluded participants is markedly higher than the number of children excluded by similar behavioral cut-offs in flanker tasks from community samples (< 10%; Röthlisberger, Neuenschwander, Cimeli, Michel, & Roebbers, 2012; Rueda et al., 2004), including tasks with nearly identical timing and response demands (e.g. McDermott, Perez-Edgar & Fox, 2009; Bruce, McDermott, Fox & Fisher, 2009). More out-of-home placements and a lack of permanent caregiver at Waves 1–3 were predictive of failure to reach passing task performance, although the maltreatment and caregiver risk variables were not. This negative effect of early instability is generally consistent with findings from previous research that has linked multiple placements, and earlier age at first placement, with lower EF performance (Lewis, Dozier, Ackerman, & Sepulveda-Kozakowski, 2007; Pears & Fisher, 2005).

Of the children who met performance cut-off criteria, the *average* accuracy remained low, at 66.4% correct. In nonclinical samples that include children from a range of socioeconomic status backgrounds, accuracy has been reported to be ~70%–90%. Reaction time performance was similar in this sample (699.45 ms) to that of community samples reported in other studies (600–1100 ms; Röthlisberger, et al., 2012; Rueda et al., 2004). Although we do not have a community control group with which we can compare our results of this exact task version, we find it important to note that, in addition to more children failing to perform ‘at chance’ (as noted above), children in this CPS-involved sample tended to exhibit substantially lower levels of performance than has been reported in prior flanker task research (McDermott, et al., 2009; Bruce, McDermott, Fox & Fisher, 2009; Röthlisberger, et al., 2012; Rueda et al., 2004). Consistent with research in normative samples, we found that older child age was predictive of higher EF. Females also exhibited higher flanker task accuracy and slower reaction time, suggesting that a more cautious performance strategy. Gender differences in EF are inconsistently documented, but when they are found, females tend to perform better and often have slower reaction times, particularly on tasks that require inhibition, such as the flanker task (Blair, Granger, and Razza, 2005; Mezzacappa, 2004; Brocki, K. C., & Bohlin, 2004).

Amongst children in the CPS-involved sample who achieved passing task accuracy, we found that children with higher cumulative adversity (assessed by number of types of adversities) at child age 3–6 years predicted higher EF performance concurrently or 1 year later (child age 5–6 years). Additional analyses investigating the impacts of specific types of adversity indicated that presence of several risk factors (physical abuse, substance use, and domestic violence) at child age 3–6 years predicted relatively better EF performance, compared with the absence of such risk. These results add to a growing body of the literature indicating that, within generally low-performing at-risk groups, the presence of cumulative adversity (or specific risk factors) may predict higher performance on EF tasks (Pears & Fisher, 2005; Pears et al., 2008). Notably, results do not suggest that exposure to cumulative adversity is in any way supportive of EF development; the overall levels of performance within this high-risk group are dramatically lower than performance levels in samples that do not include CPS-involved children. However, *within* this at-risk sample, certain types of experience may be predictive of relatively higher EF performance in early childhood.

Evolutionary psychology may help explain these findings, given the potential for the biology of children exposed to severe adversity to move toward fast life history strategies (Belsky et al., 2012; Del Giudice et al., 2015). Specifically, early exposure to caregiving that is harsh, insensitive, and unpredictable is theorized to serve as an indicator of ecological stress that may cue the body into accelerated development (Del Giudice et al., 2015). To date, early exposure to such stressors has been linked to earlier puberty, suggesting a more rapid maturation profile (Del Giudice et al., 2015). It is possible that, in the young sample assessed here, this rapid maturation profile would include more adultlike brain development and associated higher EF performance. Multiple qualities of our investigation suggest the potential relevance of life history theory for informing our findings. These include (a) the timing of stressor exposure within the important developmental window of 0–5 years for biological programming; (b) the stressors assessed (physical abuse, caregiver substance use, caregiver domestic violence) being characteristically harsh, insensitive, and unpredictable;

and (c) the assessment of EF at child age 5–6 years, shortly after the peak of brain growth speed, when a more adultlike profile (e.g., greater prefrontal cortex connectivity) may be particularly facilitative of higher EF performance, but before the long-term costs of early-to-mature life history strategies (e.g., reduced overall brain development) would be likely to emerge (Del Giudice et al., 2015). Related neuroimaging work in preadolescent children has documented that early institutionalization-related maltreatment predicted adultlike connectivity of the prefrontal cortex (critically implicated in effective EF) and emotion regulation regions (Gee et al., 2013). This connectivity was predictive of relatively better functioning within the maltreated group, even though the maltreated group as a whole exhibited worse functioning when compared with nonmaltreated community controls (Gee et al., 2013).

In future research, it would be helpful to incorporate neuroimaging work to assess the extent to which children exposed to higher adversity exhibit more adultlike prefrontal cortex development in early childhood. Longitudinal studies that can assess EF skills over time within CPS-involved samples are also critical to determine if the relative EF advantages observed in children with higher cumulative adversity persist over time or result in lower EF later on, reflecting a more rapid, but overall limited, trajectory of cognitive development. Given the relevance of higher EF performance to improved functioning in a number of domains (e.g., academic achievement), it is important to identify and understand potential EF influences so that resources may be most appropriately directed to improve outcomes for all CPS-involved children. For example, within CPS-involved children, individuals at lower risk for EF impairment may be at higher risk for other (e.g., social–emotional) problems that have a more pressing intervention need. Finally, in future research on within group differences in CPS-involved children, it would be valuable to investigate EF tasks that include the working memory domain (not assessed here) and/or specific sub-components of EF (i.e. attention shifting versus inhibition), which a growing body of the literature suggests may be differentially affected by early adversity (e.g. Kirke-Smith et al., 2014).

The study findings should be considered in light of limitations. In regard to EF, limitations include a restricted range of variables that could be examined in our study, given the nature of secondary data analysis. Ideally, when examining EF data, we would be able to reanalyze all data at the trial-by-trial level to gain insight into additional processes, such as performance monitoring, that may be relevant to EF performance (Roos, Pears, Bruce, Kim, & Fisher, 2013). An additional limitation is the reliance on caregiver self-report data to assess children's adversity exposure. Although data were collected in a computerized, confidential manner, CPS-involved parents may be reticent to disclose that they have exposed their children to stressful environments. It was not possible to examine case-report administrative data about maltreatment and caregiver risk variables because these data were collected only for children with substantiated maltreatment and open CPS cases. Finally, limitations due to missing data were a substantial challenge given that only ~88% of children who were administered the flanker task completed 2 of 3 blocks, even before accounting for children who failed to meet passing performance standards. We suggest that this limitation is illustrative of the marked level of impairment in CPS-involved children's ability to engage with this EF task, but future research should seek to pilot task versions in which a greater proportion of target children are able to perform reasonably well, in addition

to including a community control group for performance comparison. A substantial amount of caregiver risk and maltreatment data was missing because this data was not collected from children living with non-permanent caregivers and some permanent caregivers chose not to respond. Notably, however, missing data was not predictive of EF performance. Despite these limitations, the NSCAW reflects the largest sample of CPS-involved children to date and provides a significant opportunity for researchers to characterize EF performance and examine relevant predictors.

In summary, results examining EF performance in a large sample of CPS-involved children, suggest that these children had substantial difficulties in task performance in comparison with community samples studied in previous research. Within this lower performing group, certain experiences (cumulative adversity, physical abuse, caregiver substance use, domestic violence) predicted relatively better EF performance, suggesting that variability in adversity exposure may help predict individual differences in EF in early childhood (approximately 5–6 years). These results are an important first step to help future investigations identify pathways through which CPS-involved children come to exhibit EF risk and resilience. Given the variety of challenges faced by CPS-involved children, it is critical to focus on the specific domains of functioning that may be the most relevant for any given individual in order to best allocate resources across financial, time, and energy domains. More systematic longitudinal studies could help clarify the arc of EF development and how it may be altered, in order to help us understand the potentially accelerated EF trajectories for children experiencing certain types of harsh and unpredictable experiences such as the ones described here.

Acknowledgments

The authors thank Cheryl Mikkola for editorial assistance. Leslie E. Roos received support from HHS-2014-ACF-ACYF-CA-0803. Hyoun K. Kim received support from NIH grant P50 DA035763. Philip A. Fisher received support from HHS-2014-ACF-ACYF-CA-0803 and NIH grants R01 HD075716 and P50 DA035763.

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 3. Washington, DC: Author; 1987. Rev
- Belsky J, Schlomer GL, Ellis BJ. Beyond cumulative risk: Distinguishing harshness and unpredictability as determinants of parenting and early life history strategy. *Developmental Psychology*. 2012; 48(3):662–673. DOI: 10.1037/a0024454 [PubMed: 21744948]
- Blair C, Granger D, Peters Razza R. Cortisol reactivity is positively related to executive function in preschool children attending Head Start. *Child development*. 2005; 76(3):554–567. <http://dx.doi.org/10.1111/j.1467-8624.2005.00863.x>. [PubMed: 15892778]
- Brocki KC, Bohlin G. Executive functions in children aged 6 to 13: A dimensional and developmental study. *Developmental neuropsychology*. 2004; 26(2):571–593. http://dx.doi.org/10.1207/s15326942dn2602_3. [PubMed: 15456685]
- Carlson, SM. Social origins of executive function development. In: Lewis, C., Carpendale, JLM., editors. *Social interaction and the development of executive function*. Vol. 123. *New Directions for Child and Adolescent Development*; 2009. p. 87–97.
- Cicchetti D, Toth SL. The role of developmental theory in prevention and intervention. *Development and Psychopathology*. 1992; 4(04):489–493. <http://dx.doi.org/10.1017/S0954579400004831>.

- Del Giudice, M., Gangestad, SW., Kaplan, HS. Life history theory and evolutionary psychology. In: Buss, DM., editor. The handbook of evolutionary psychology, Vol 1: Foundations. 2. New York, NY: Wiley; 2015. p. 88-114.
- DePrince AP, Weinzierl KM, Combs MD. Executive function performance and trauma exposure in a community sample of children. *Child Abuse & Neglect*. 2009; 33(6):353–361. <http://dx.doi.org/10.1016/j.chiabu.2008.08.002>. [PubMed: 19477515]
- DePrince AP, Weinzierl KM, Combs MD. Executive function performance and trauma exposure in a community sample of children. *Child abuse & neglect*. 2009; 33(6):353–361. <http://dx.doi.org/10.1016/j.chiabu.2008.08.002>. [PubMed: 19477515]
- Dong M, Anda RF, Felitti VJ, Dube SR, Williamson DF, Thompson TJ, ... Giles WH. The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse & Neglect*. 2004; 28(7):771–784. <http://dx.doi.org/10.1016/j.chiabu.2004.01.008>. [PubMed: 15261471]
- Dowd, K., Kinsey, S., Wheelless, S., Thissen, R., Richardson, J., Mierzwa, F., Biemer, P. National Survey of Child and Adolescent Well-being (NSCAW): Introduction to the wave 1 general and restricted use releases. Ithaca, NY: National Data Archive on Child Abuse and Neglect; 2002.
- Evans GW, Li D, Whipple SS. Cumulative risk and child development. *Psychological Bulletin*. 2013; 139(6):1342–1396. DOI: 10.1037/a0031808 [PubMed: 23566018]
- Fishbein D, Warner T, Krebs C, Trevarthen N, Flannery B, Hammond J. Differential relationships between personal and community stressors and children's neurocognitive functioning. *Child Maltreatment*. 2009; 14(4):299–315. <http://dx.doi.org/10.1177/1077559508326355>. [PubMed: 18971345]
- Garon N, Bryson SE, Smith IM. Executive function in preschoolers: a review using an integrative framework. *Psychological Bulletin*. 2008; 134(1):31–60. DOI: 10.1037/0033-2909.134.1.31 [PubMed: 18193994]
- Gee DG, Gabard-Durnam LJ, Flannery J, Goff B, Humphreys KL, Telzer EH, ... Tottenham N. Early developmental emergence of human amygdala–prefrontal connectivity after maternal deprivation. *Proceedings of the National Academy of Sciences*. 2013; 110(39):15638–15643. <http://dx.doi.org/10.1073/pnas.1307893110>.
- Gramkowski B, Kools S, Paul S, Boyer CB, Monasterio E, Robbins N. Health risk behavior of youth in foster care. *Journal of Child and Adolescent Psychiatric Nursing*. 2009; 22(2):77–85. <http://dx.doi.org/10.1111/j.1744-6171.2009.00176.x>. [PubMed: 19490278]
- Herbers JE, Cutuli JJ, Lافavor TL, Vrieze D, Leibel C, Obradovi J, Masten AS. Direct and indirect effects of parenting on the academic functioning of young homeless children. *Early Education & Development*. 2011; 22(1):77–104.
- Hinde, K., Skibieli, AL., Foster, AB., Del Rosso, L., Mendoza, SP., Capitano, JP. Cortisol in mother's milk across lactation reflects maternal life history and predicts infant temperament; *Behavioral Ecology*. 2014. p. 269-281. <http://dx.doi.org/10.1093/beheco/aru186>
- Hostinar CE, Stellern SA, Schaefer C, Carlson SM, Gunnar MR. Associations between early life adversity and executive function in children adopted internationally from orphanages. *Proceedings of the National Academy of Sciences*. 2012; 109(S2):17208–17212. <http://dx.doi.org/10.1073/pnas.1121246109>.
- Kessler RC, Andrews G, Mroczek D, Ustun B, Wittchen HU. The World Health Organization Composite International Diagnostic Interview-short form (CIDI-SF). *International Journal of Methods in Psychiatric Research*. 1998; 7(4):171–185. DOI: 10.1002/mp.47
- Kirke-Smith M, Henry L, Messer D. Executive functioning: Developmental consequences on adolescents with histories of maltreatment. *British journal of developmental psychology*. 2014; 32(3):305–319. <http://dx.doi.org/10.1111/bjdp.12041>. [PubMed: 24684281]
- Leslie LK, Gordon JN, Lambros K, Premji K, Peoples J, Gist K. Addressing the developmental and mental health needs of young children in foster care. *Journal of Developmental and Behavioral Pediatrics*. 2005; 26(2):140–151. <http://dx.doi.org/10.1097/00004703-200504000-00011>. [PubMed: 15827467]

- Lewis EE, Dozier M, Ackerman J, Sepulveda-Kozakowski S. The effect of placement instability on adopted children's inhibitory control abilities and oppositional behavior. *Developmental Psychology*. 2007; 43(6):1415–1427. DOI: 10.1037/0012-1649.43.6.1415 [PubMed: 18020821]
- Masten AS, Cutuli JJ, Herbers JE, Hinz E, Obradovi J, Wenzel AJ. Academic risk and resilience in the context of homelessness. *Child Development Perspectives*. 2014; 8(4):201–206. <http://dx.doi.org/10.1111/cdep.12088>.
- Masten AS, Herbers JE, Desjardins CD, Cutuli JJ, McCormick CM, Sapienza JK, ... Zelazo PD. Executive function skills and school success in young children experiencing homelessness. *Educational Researcher*. 2012; 41(9):375–384. <http://dx.doi.org/10.3102/0013189X12459883>.
- McDermott JM, Pérez-Edgar K, Fox NA. Variations of the flanker paradigm: Assessing selective attention in young children. *Behavior Research Methods*. 2007; 39(1):62–70. <http://dx.doi.org/10.3758/BF03192844>. [PubMed: 17552472]
- Mezzacappa E. Alerting, orienting, and executive attention: Developmental properties and sociodemographic correlates in an epidemiological sample of young, urban children. *Child development*. 2004; 75(5):1373–1386. <http://dx.doi.org/10.1111/j.1467-8624.2004.00746.x>. [PubMed: 15369520]
- Mothes L, Kristensen CH, Grassi-Oliveira R, Fonseca RP, Lima Argimon II, Irigaray TQ. Childhood maltreatment and executive functions in adolescents. *Child and Adolescent Mental Health*. 2015; 20(1):56–62. <http://dx.doi.org/10.1111/camh.12068>.
- Muthén, LK., Muthén, BO. Mplus Version 7 [statistical software]. Los Angeles, CA: Muthén & Muthén; 1012.
- National Survey of Child and Adolescent Well Being (NSCAW). Inhibitory Control Abilities Among Young Children in the Child Welfare System. 2009. Retrieved from: <http://www.acf.hhs.gov/programs/opre/resource/national-survey-of-child-adolescent-and-well-being-no-1-inhibitory-control>
- Pears KC, Fisher PA, Bruce J, Kim HK, Yoerger K. Early elementary school adjustment of maltreated children in foster care: The roles of inhibitory control and caregiver involvement. *Child Development*. 2010; 81(5):1550–1564. <http://dx.doi.org/10.1111/j.1467-8624.2010.01491.x>. [PubMed: 20840240]
- Pears KC, Fisher PA, Kim HK, Bruce J, Healey CV, Yoerger K. Immediate effects of a school readiness intervention for children in foster care. *Early Education & Development*. 2013; 24(6): 771–791. [PubMed: 24015056]
- Pears KC, Kim HK, Fisher PA. Psychosocial and cognitive functioning of children with specific profiles of maltreatment. *Child Abuse & Neglect*. 2008; 32(10):958–971. <http://dx.doi.org/10.1016/j.chiabu.2007.12.009>. [PubMed: 18995901]
- Pears K, Fisher PA. Developmental, cognitive, and neuropsychological functioning in preschool-aged foster children: Associations with prior maltreatment and placement history. *Journal of Developmental & Behavioral Pediatrics*. 2005; 26(2):112–122. <http://dx.doi.org/10.1097/00004703-200504000-00006>. [PubMed: 15827462]
- Pechtel P, Pizzagalli DA. Effects of early life stress on cognitive and affective function: an integrated review of human literature. *Psychopharmacology*. 2011; 214(1):55–70. <http://dx.doi.org/10.1007/s00213-010-2009-2>. [PubMed: 20865251]
- Ramey CT, Ramey SL. Prevention of intellectual disabilities: early interventions to improve cognitive development. *Preventive medicine*. 1998; 27(2):224–232. [PubMed: 9579000]
- Revington N, Martin L, Seedat S. Is There A Relationship Between The Number Of Abuse Experiences And Measures Of Neurocognition In Trauma Exposed Youth? *African Journal*. 2011; 2(2):92–107. [http://dx.doi.org/10.1186/1471-244X-2\(2\):92-107](http://dx.doi.org/10.1186/1471-244X-2(2):92-107).
- Roos LE, Pears K, Bruce J, Kim HK, Fisher PA. Impulsivity and the association between the feedback-related negativity and performance on an inhibitory control task in young at-risk children. *Psychophysiology*. 2015; 52(5):704–713. <http://dx.doi.org/10.1111/psyp.12389>. [PubMed: 25424570]
- Röthlisberger M, Neuenschwander R, Cimeli P, Michel E, Roebbers CM. Improving executive functions in 5-and 6-year-olds: Evaluation of a small group intervention in prekindergarten and kindergarten children. *Infant and Child Development*. 2012; 21(4):411–429. <http://dx.doi.org/10.1002/icd.752>.

- Rueda MR, Fan J, McCandliss BD, Halparin JD, Gruber DB, Lercari LP, Posner MI. Development of attentional networks in childhood. *Neuropsychologia*. 2004; 42(8):1029–1040. <http://dx.doi.org/10.1016/j.neuropsychologia.2003.12.012>. [PubMed: 15093142]
- Simpson JA, Griskevicius V, Kuo SI, Sung S, Collins WA. Evolution, stress, and sensitive periods: the influence of unpredictability in early versus late childhood on sex and risky behavior. *Developmental psychology*. 2012; 48(3):674–686. <http://dx.doi.org/10.1037/a0027293>. [PubMed: 22329381]
- Straus MA, Hamby SL, Boney-McCoy S, Sugarman DB. The revised conflict tactics scales (CTS2): Development and preliminary psychometric data. *Journal of Family Issues*. 1996; 17(3):283–316. <http://dx.doi.org/10.1177/019251396017003001>.
- Straus MA, Hamby SL, Finkelhor D, Moore DW, Runyan D. Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: Development and psychometric data for a national sample of American parents. *Child Abuse & Neglect*. 1998; 22(4):249–270. [PubMed: 9589178]
- Sung S, Simpson JA, Griskevicius V, Sally I, Kuo C, Schlomer GL, Belsky J. Secure Infant-Mother Attachment Buffers the Effect of Early-Life Stress on Age of Menarche. *Psychological science*. 2016; 27(5):667–674. <http://dx.doi.org/10.1177/0956797616631958>. [PubMed: 26980153]
- U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, & Youth and Families. *Child Maltreatment 2012*. 2013. Retrieved from <http://www.acf.hhs.gov>
- Webb, MB, Dowd, K, Harden, BJ, Landsverk, J., Testa, M., editors. *Child welfare and child well-being: New perspectives from the national survey of child and adolescent well-being*. New York, NY: Oxford University Press; 2009.
- Wittchen HU. Reliability and validity studies of the WHO-Composite International Diagnostic Interview (CIDI): A critical review. *Journal of Psychiatric Research*. 1994; 28(1):57–84. [http://dx.doi.org/10.1016/0022-3956\(94\)90036-1](http://dx.doi.org/10.1016/0022-3956(94)90036-1). [PubMed: 8064641]

Highlights

- Executive function (EF) performance is markedly low in a large sample of young, CPS-involved children, with 43.5% of children performing worse than chance.
- Markers of early caregiving instability (i.e. more out-of-home placements and a lack of permanent caregiver) at ages 0–3 years were predictive of failure to perform better than chance.
- Among children performing better than chance, markers of exposure to harsh and unpredictable environments (i.e. cumulative risk, physical abuse, caregiver substance abuse) at ages 4–6 years were predictive of relatively higher EF.
- Findings highlight the potential relevance of evolutionary life-history theory; biological alterations related to stressful early environments may be linked to short-term behavioral advantages.
- Longitudinal studies are critical to determine if the relative EF advantages linked to higher risk persist over time or result in lower EF later on, reflecting a more rapid, but overall limited, trajectory of cognitive development.

Table 1

Variable Descriptives

	Total N(%) 694 (100.0)
Sociodemographics	
Child age; <i>M(SD)</i>	5.27 (.45)
Child gender	
Male	347 (50.1)
Female	346 (49.9)
Child race/ethnicity	
White Non-Hispanic	238 (34.4)
Black Non-Hispanic	281 (40.6)
Hispanic	125 (18.1)
Other	48 (6.9)
Caregiver education	
Less than high school	159 (23.5)
High school or equivalent	317 (46.9)
Vocational or associates	152 (22.5)
Bachelor's or higher	48 (12.8)
Annual household income; median	\$20,000 – 24,999
CPS-related covariates	
Substantiated initial report	373 (66.8)
Permanent caregiver	
Waves 1–3	
Neither wave	137 (19.7)
One wave	151 (21.8)
Both waves	406 (58.5)
Waves 4–5	
Neither wave	10 (1.4)
One wave	97 (14.0)
Both waves	586 (84.6)
Total out of home placements	
0	325 (46.9)
1	100 (14.4)
2	95 (13.7)
3+	173 (5.0)
Presence of adversities	
Neglect 0–3 years	90 (19.6)
Neglect 3–6 years	182 (32.3)
Physical abuse 0–3 years	29 (6.3)
Physical abuse 3–6 years	83 (15.1)
Domestic violence exposure 0–3 years	196 (50.1)
Domestic violence exposure 3–6 years	125 (24.4)

	Total N(%) 694 (100.0)
Caregiver substance dependence 0–3 years	47 (12.7)
Caregiver substance dependence 3–6 years	23 (4.2)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Bivariate Correlations

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Flanker task accuracy	--																
2. Flanker reaction time	.23**	--															
3. Child age	.21**	.11*	--														
4. Child gender	.11*	.30**	.06	--													
5. Caregiver's highest degree	.06	.02	.02	-.00	--												
6. Total family income	-.01	.00	-.04	-.00	.40**	--											
7. Total OOH living arrangements	.06	.09	-.03	.02	.19**	.28**	--										
8. Cumulative adversity, age 0–3	.03	-.07	.00	.03	.04	.03	-.13*	--									
9. Cumulative adversity, age 3–6	.12*	-.03	.03	.05	-.07	-.12*	-.14**	.40**	--								
10. Physical abuse, age 0–3	.04	-.11	.02	-.09	-.06	-.08	-.14*	.34**	.21**	--							
11. Physical abuse, age 3–6	.15*	-.02	-.01	.00	.05	-.05	-.07	.20**	.47**	.32**	--						
12. Physical neglect, age 0–3	.03	-.05	.04	.01	.04	-.11	-.09	.61**	.27**	.15**	.01	--					
13. Physical neglect, age 3–6	.10	.03	.08	.09	-.02	-.15*	-.05	.18**	.63**	.14**	.21**	.31**	--				
14. Domestic violence, age 0–3	.14*	.04	.09	-.02	.18**	.16*	.13	.51**	.22**	.03	.12*	.19**	.09	--			
15. Domestic violence, age 3–6	.01	-.06	.04	.03	-.08	-.04	-.15**	.28**	.62**	.15**	.10	.19**	.23**	.27**	--		
16. Substance abuse, age 0–3	.01	-.1-	-.06	.05	.05	-.06	.08	.33**	.15*	.01	.23**	.15**	.07	.13*	.06	--	
17. Substance abuse, age 3–6	.17*	-.00	.03	.07	-.02	-.02	-.10	.27**	.35**	.08	.21**	.10	.13**	.23**	.26*	.29**	--

Note. OOH = out of home