



Parenting predicts Strange Situation cortisol reactivity among children adopted internationally



Carrie E. DePasquale^{a,*}, K. Lee Raby^{b,1}, Julie Hoye^{c,1}, Mary Dozier^{c,1}

^a Institute of Child Development, University of Minnesota – Twin Cities, 51 E. River Road, Minneapolis, MN 55455, United States

^b Department of Psychology, 380 S 1530 E BEH S 502, Salt Lake City, UT 84112, United States

^c Department of Psychological and Brain Sciences, University of Delaware, 105 The Green, Newark, DE 19716, United States

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ABSTRACT

The functioning of the hypothalamic pituitary adrenal (HPA) axis can be altered by adverse early experiences. Recent studies indicate that children who were adopted internationally after experiencing early institutional rearing and unstable caregiving exhibit blunted HPA reactivity to stressful situations. The present study examined whether caregiving experiences post-adoption further modulate children's HPA responses to stress. Parental sensitivity during naturalistic parent-child play interactions was assessed for 66 children (M age = 17.3 months, $SD = 4.6$) within a year of being adopted internationally. Approximately 8 months later, children's salivary cortisol levels were measured immediately before as well as 15 and 30 min after a series of brief separations from the mother in an unfamiliar laboratory setting. Latent growth curve modeling indicated that experiencing more parental sensitivity predicted increased cortisol reactivity to the stressor. Although half the families received an intervention designed to improve parental sensitivity, the intervention did not significantly alter children's cortisol outcomes. These findings suggest that post-adoption parental sensitivity may help normalize the HPA response to stress among children adopted internationally.

1. Parenting predicts Strange Situation cortisol reactivity among children adopted internationally

Since 1999, families in the United States have adopted over 250,000 children from other countries, and many were adopted before the age of 3 (United States Department of State, 2015). Prior to adoption, many internationally adopted (IA) children experience a combination of institutional care, which is characterized by rotating shifts of a large number of caregivers, and foster care, which often involves frequent changes in caregivers (Dozier et al., 2012; Gunnar et al., 2000). Because of these early adversities, IA children are at increased risk for problematic adaptation in a number of domains, including physiological stress responses (for a review, see Juffer et al., 2011). Adoption leads to a dramatic improvement in caregiving environment, which has the potential to promote recovery in development following early social deprivation (Gunnar et al., 2000). The present study examined the role of IA children's post-adoption caregiving experiences in the recovery of their HPA axis regulation.

1.1. Early social regulation of the HPA axis

The HPA axis is one of the body's main stress response systems. Its primary hormonal end-product, the glucocorticoid cortisol, has wide ranging impacts on the body and brain, including regulation of the circadian rhythm and mobilization of the body's metabolic resources in response to real or imagined threat (Gunnar et al., 2015). In normative-risk populations, exposure to a stressor results in a moderate increase in circulating cortisol produced by the adrenal cortex (Gunnar and Quevedo, 2007). Negative feedback mechanisms serve to suppress the production of cortisol, which efficiently returns the system back to basal levels.

There are two main types of glucocorticoid receptors in the brain. Mineralocorticoid receptors (MRs) have a higher affinity for glucocorticoids, and cortisol typically is bound to a portion of these receptors in the absence of stress. Glucocorticoid receptors (GRs) have a lower affinity for glucocorticoids and mostly bind when there are high levels of circulating cortisol (for example, in response to stress). When the ratio of bound MR/GR receptors is high (i.e., there is cortisol bound to a

* Corresponding author.

E-mail address: depas010@umn.edu (C.E. DePasquale).

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high number of MR receptors and a low number of GR receptors), learning and memory are enhanced (Finsterwald and Alberini, 2014; see also Schilling et al., 2013). Thus, a moderate increase in cortisol to a stressor or stimulus, which facilitates MR binding with little GR binding, is likely conducive to healthy HPA stress response activation and termination.

During early development, the HPA axis is especially plastic and is regulated by children's experiences with caregivers (Gunnar and Cheatham, 2003). Caregivers typically function to buffer children's cortisol reactivity, meaning that the presence of an emotionally supportive caregiver prevents excessive activation of the HPA axis in response to stressful situations; conversely, in the absence of caregiver support, children tend to exhibit elevated HPA activity in response to stressors (Hostinar et al., 2014). When children experience chronic stress, such as the absence of typical early caregiving relationships, the HPA axis reorganizes and downregulates its cortisol production, resulting in blunted cortisol responses to stress (Doom et al., 2014; Fisher et al., 2011; Fries et al., 2005; McLaughlin et al., 2015). Decreased reactivity of the HPA axis may be the result of altered MR/GR ratios, particularly through excessive expression of GR (Strüber et al., 2014). Although this is presumed to be an adaptive response to avoid dangerously high elevations of cortisol, exhibiting little to no HPA response to stressors may also have long-term consequences for behavioral adaptation and physical health, including increased risk for externalizing behaviors (Alink et al., 2008; Conradt et al., 2014; Koss et al., 2016; Ruttle et al., 2011), reduced executive function abilities (Blair et al., 2005), problems with peer relations (Pitula et al., 2017), and increased risk for PTSD (Fries et al., 2005).

Blunted cortisol reactivity is distinct from social buffering. Sensitive caregivers – caregivers that respond contingently and flexibly to their child's cues – tend to reduce children's HPA response to stress. Children who have not experienced chronic stress and are in the presence of a supportive caregiver display a moderate, though not excessive, HPA stress response (Gunnar and Quevedo, 2007). Among children from normative-risk backgrounds, more supportive parent-child relationships are associated with a dampened HPA response to stress (for a review, see Hunter et al., 2011). This allows the body to activate the HPA axis and other systems in order to respond to the stimulus or stressor effectively, but not so much that it becomes overwhelming (Hostinar et al., 2014). This pattern of HPA functioning is not associated with changes in MR/GR expression or behavioral problems (Chrousos, 2009). Thus, there seems to be an inverted U-shaped curve association between HPA axis reactivity and developmental adaptation, such that both too much and too little cortisol production can have damaging effects on well-being (Gunnar et al., 2015; Gunnar and Vazquez, 2001)

1.2. HPA axis functioning for children adopted internationally

Researchers have examined the HPA responses of IA children as a way of better understanding whether early adversity results in dysregulation of children's neurobiological stress response system. An initial study of only 18 IA children suggested that these children showed increased cortisol reactivity relative to non-adopted children (Fries et al., 2008). However, more recent studies with larger samples indicate that IA children exhibited a more blunted pattern of cortisol reactivity than non-adopted children. Specifically, Koss et al. (2016) examined the cortisol responses to laboratory stress for over 100 IA children and reported that IA children exhibited an attenuated HPA response. Similarly, children raised in Romanian orphanages exhibited more blunted cortisol reactivity during early adolescence than children randomly assigned to receive a foster care intervention (McLaughlin et al., 2015). Similar patterns have also been found for children in foster care who have experienced maltreatment (Fisher et al., 2012). Thus, the preponderance of the evidence suggests that disturbances in early caregiving relationships typically experienced by internationally adopted

children are associated with hypocortisolism.

To our knowledge, no studies have examined the significance of IA children's post-adoptive caregiving experiences for their cortisol stress responses. As a result, the consequences of IA children's experiences with their adoptive parents for their neurobiological development are still unknown. However, there is growing evidence indicating that sensitive caregiving promotes healthier behavioral outcomes among IA children (e.g., Garvin et al., 2012; Stams et al., 2002). Thus, sensitive caregiving appears to facilitate the recovery of IA children's developmental outcomes following earlier experiences of deprivation.

1.3. The current study

The purpose of the current study was to examine the role of IA children's post-adoptive caregiving experiences for their HPA responses. Data for this study were drawn from a randomized controlled trial assessing the effectiveness of an attachment-based intervention for IA children's biobehavioral development. However, the current study focuses on the predictive significance of IA parents' sensitive caregiving, which was observed prior to receiving the intervention (see the Supplemental Materials for more information about the intervention). Approximately 8 months later children's cortisol responses to the Strange Situation Procedure (Ainsworth et al., 1978) were collected. The Strange Situation is one of the most common tasks for assessing cortisol reactivity among young children (for a review, see Gunnar et al., 2009). Based on the previous evidence that IA children are at risk for blunted cortisol reactivity to stress (e.g., Koss et al., 2016; McLaughlin et al., 2015), we hypothesized that experiencing higher post-adoption parental sensitivity would be associated with normalization of the stress response, and thus increased cortisol reactivity compared to those with less sensitive adoptive parents.

2. Methods

2.1. Participants

Participants included 66 children (33 female) who were adopted from orphanages or foster care systems in several countries, including China (38%), Russia (21%), Ethiopia (18%), South Korea (18%), Kazakhstan (3%), and Armenia (2%) into the Mid-Atlantic region of the United States. Participants were recruited through partnerships with local international adoption agencies, an international adoption clinic at a local children's hospital, and international adoption support groups. Families were asked to participate if they had recently adopted a child internationally. Children were excluded if they lacked mobility or if they had severe physical or mental disabilities. Children involved in the study came into the primary care of their adoptive parents between 4 and 28 months of age ($M = 13.9$, $SD = 4.8$). Based on adoptive parents' reports, 80% percent of the children had experienced institutional care prior to adoption. Those children who had experienced institutional care spent on average 82% of their pre-adoptive lives in institutions (range = 2 to 23 months, $M = 11.6$). Ninety-five percent of the adoptive parents who participated in the study were female, and 95% were White/non-Hispanic (2% were African-American, 2% were Asian-American, and one did not provide information). Ninety-two percent of the adoptive parents were married, and the remaining 8% were single. Eighty-two percent had at least a college degree, and the others had at least a high school degree or GED. Sixty-four percent of the families had an annual income of \$100,000 or more; approximately 32% had an annual income of \$60,000-\$99,000, and approximately 5% had an annual income of \$40,000-\$59,000. There were two pairs of adoptive siblings in the sample. The results did not differ with the random exclusion of one sibling from each pair, so siblings were retained in the results presented below. This study was approved by the Institutional Review Board of the University of Delaware. Informed consent was obtained from the child's primary caregiver prior to

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