



Understanding cortisol reactivity across the day at child care: The potential buffering role of secure attachments to caregivers[☆]

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ABSTRACT

Full-day center-based child care has been repeatedly associated with rising cortisol across the child care day. This study addressed the potential buffering role of attachment to mothers and lead teachers in 110 preschoolers while at child care. Using multi-level modeling and controlling for a number of child, family, and child care factors, children with more secure attachments to teachers were more likely to show falling cortisol across the child care day. Attachment to mothers interacted with child care quality, with buffering effects found for children with secure attachments attending higher quality child care. Implications for early childhood educators are discussed.

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Previous work has shown that full-day, center-based child care is associated with increased reactivity of the hypothalamic-pituitary-adrenal (HPA) axis for many young children in the US (e.g., Tout, de Haan, Campbell, & Gunnar, 1998; Watamura, Donzella, Alwin, & Gunnar, 2003; Watamura, Sebanc, & Gunnar, 2002). Specifically, increasing cortisol from morning to afternoon at full-day child care, in contrast with decreasing cortisol across the day for these same children at home, has been repeatedly demonstrated for toddlers and preschoolers (Dettling, Gunnar, & Donzella, 1999; Dettling, Parker, Lane, Sebanc, & Gunnar, 2000; Watamura et al., 2003; Watamura, Kryzer, & Robertson, 2009). Although a focus on stress reactivity at child care is relatively new, efforts to understand this phenomenon have demonstrated that caregiving quality is important (Dettling et al., 2000; Sims, Guilfoyle, & Parry, 2006; Tout et al., 1998; Watamura et al., 2009). It is less clear whether particular child characteristics and relationship characteristics might be important for predicting which children are protected from responding to the challenge of child care with HPA reactivity. In particular, the theoretically important construct of attachment to both mothers and teachers as a potential buffering factor remains relatively understudied.

Human and non-human animals have an interconnected set of complex physiological systems for managing physical, cogni-

tive, and socio-emotional challenges. One of these systems is the hypothalamic-pituitary-adrenal axis. In humans, the primary product of this system is the steroid hormone cortisol (Hennessy & Levine, 1979). The HPA axis is particularly sensitive to situations that involve novelty, uncontrollability, or threats to the social self (Dickerson & Kemeny, 2004; Gruenewald, Kemeny, Aziz, & Fahey, 2004).

As part of the body's normal regulatory functions, cortisol follows a circadian rhythm, with adults and children demonstrating the highest values at waking, followed by a steady decline across the day, returning to its lowest levels at approximately midnight (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999; Watamura, Donzella, Kertes, & Gunnar, 2004). When assessed at home under baseline conditions, the mature adult rhythm is clearly evident by 36 months for children experiencing low-stress environments (Badanes & Watamura, 2008), suggesting that the increasing profile seen across the mid-section of the day in many children at child care may indicate context-dependent activation in the face of challenge.

Although it remains unclear what consequences (if any) this context-dependent activation may have, recent work has demonstrated that children who attend full-day child care *and* who show elevated cortisol levels may have lower antibody production. This work suggests the rising pattern may have consequences for physical health (Watamura, Coe, Laudenslager, & Robertson, 2010). Further, a recent analysis of the NICHD data set demonstrates that maternal insensitivity and longer child-care hours during the first three years of life (i.e., the factors that are putatively associated with concurrent elevated cortisol levels) are subsequently associated with lower awakening cortisol levels at age 15, suggesting possible long-term effects (Roisman et al., 2009).

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With as many as 63% of American children under five experiencing some form of nonparental child care (U.S. Census Bureau, 2005), there has been an effort to understand the significance of child care experiences for children's stress-system development. In order to explain afternoon elevations in cortisol at child care, early work explored whether factors other than stress or challenge, such as changes associated with age, might elucidate the rising pattern at child care. Both Dettling et al. (1999) and Watamura et al. (2003) demonstrated a curvilinear developmental course for the rising pattern such that infants in child care and school-aged children older than five years of age were less likely to show the reversed pattern as compared to two-, three-, four-, and five-year-old child care attendees.

In addition to age, several studies have demonstrated that global classroom quality is an important index for predicting children's HPA reactivity at child care. For example, Gunnar, Kryzer, Van Ryzin, and Phillips (2010) recently reported that child care quality as indexed by caregiver behavior (e.g., intrusive and overcontrolling care) was related to the rise in cortisol at child care. In an early study, Tout et al. (1998) found that 73% of the children studied showed a rising cortisol pattern across the day in centers scoring higher on the Early Childhood Environment Rating Scale (ECERS) (Harms & Clifford, 1980) as compared to 96% of children in the lower quality centers. In addition, Watamura et al. (2009) showed that better classroom interpersonal climates were related to reduced differences between home and child care cortisol levels. Similarly, in a home-based child care setting, Dettling et al. (2000) found that children's cortisol patterning across the day was related to the amount of focused attention and stimulation the child received from their teacher. These studies suggest that responsive, sensitive, and developmentally appropriate caregiving environments at child care may provide coping resources to the child facing stress and challenge. What is less clear at this point is whether HPA reactivity to child care is influenced by individual or dyadic factors such as teacher-child relationships, the child's home experiences, or the child's temperament. Work on these questions is much more limited and results have been inconsistent.

1. Attachment

Attachment theory proposes that differences in the organization of the child's early attachment relationships will emerge as a result of differences in the nature and quality of the patterns of interactions with a caregiver over the first few years of life (Ainsworth & Wittig, 1969; Bowlby, 1969/1982, 1973, 1980). These differences support the construction of distinct working models of attachment relationships and the self that carry forward to subsequent relationships (Cassidy, Kirsch, Scolton, & Parke, 1996; Sroufe, 1985).

Children's attachments to their caregivers have been broadly characterized along the dimension of security versus insecurity. More secure attachment is associated with higher levels of maternal sensitivity and responsiveness, and securely attached children are expected to develop working models of caregivers as trusting and supportive, and to therefore seek out caregivers for help and support in times of need and use them as a secure base from which to explore (Bretherton & Munholland, 1999). In contrast, insecure children may be unwilling or unable to use caregivers as a secure base from which to explore (Sroufe, Egeland, & Carlson, 1999).

Although parents typically serve as the primary attachment figure for the toddler or preschooler, several studies suggest that young children in families that use out-of-home child care also form attachment relationships with their teachers (Howes & Hamilton, 1992; Pianta, Nimetz, & Bennett, 1997). Through their daily interactions of supervision and instruction, teachers and young children develop close relationships characterized by proximity seeking,

reassurance, and other secure-base behaviors (Barnas & Cummings, 1994; Howes & Ritchie, 1999). Goossens and van IJzendoorn (1990) rated teachers in one-on-one free play sessions and found them to be more sensitive than the mothers of the same one-year olds. However, this sensitivity appeared to decrease significantly in whole group child care settings where the caregivers' attention is divided (Goossens & Melhuish, 1996). Other variables associated with higher-quality teacher-child relationships include more hours spent at child care (Goossens & van IJzendoorn, 1990), teacher experience (Stuhlman & Pianta, 2002), female child gender (Birch & Ladd, 1997), non-minority children (Hamre & Pianta, 2001), and higher family resources (Ladd, Birch, & Buhs, 1999).

The availability of coping resources and effective coping behavior plays an important role in determining whether potentially threatening events stimulate elevations in cortisol (see Stansbury & Gunnar, 1995). Attachment security reflects one potential coping resource. Through their contingent and sensitive interactions with their caregivers, secure children may develop regulatory capacities that allow them to modulate stress reactions more effectively. Children who are securely attached may be better equipped to deal with the stressors associated with child care because they are better able to manage their emotional arousal within a social interaction (Parker & Gottman, 1989), have more positive interactions with their peers (Cohn, 1990), are more behaviorally and emotionally empathetic (Kestenbaum, Farber, & Sroufe, 1989), and are rated by teachers as having higher levels of social skills (Sroufe, 1983). However, because young children do not yet cope with impending threat very well on their own, of particular importance in coping with a potential threat is whether a responsive caregiver is present (Bowlby, 1973; Gunnar & Brodersen, 1992). For example, infants receiving their wellness inoculations were more likely to demonstrate cortisol elevations in response to the injection when they were insecurely attached to the parent bringing them to the appointment (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996).

Much of the previous work demonstrating associations between attachment security and HPA-axis activation has been conducted with infants using Ainsworth's Strange Situation paradigm with their primary caregiver (Ainsworth & Wittig, 1969; e.g., Ahnert, Gunnar, Lamb, & Barthel, 2004; Hertsgaard, Gunnar, Erickson, & Nachmias, 1995). We know much less, however, about the associations between attachment security and cortisol responses to child care providers after prolonged or repeated separations from parents in preschoolers. Only one study published to date has assessed attachment security and cortisol levels after daily separations from a parent, and this was with infants and toddlers. In this work (Ahnert et al., 2004), salivary cortisol was assessed in the morning on days 1, 5, 9, and 5 months after child care entry (mean age = 14.9 months old) and dyads were coded for secure-base behaviors. Compared with insecure infants and toddlers, secure young children had lower cortisol levels during the adaptation phase to child care when the mother was present. However, young children from both attachment types demonstrated increased cortisol levels during the separation phase as compared to the adaptation phase.

Of course, infants and toddlers are not always in the presence of their primary caregiver during a stressful situation. In a laboratory study that allowed for the manipulation of supportive caregiving behaviors, infants who received individualized care from a babysitter that was less friendly, playful, and responsive during half-hour separations from their mothers demonstrated cortisol elevations, whereas the infants cared for by a more interactive and responsive babysitter showed no cortisol elevations (Gunnar, Larson, Hertsgaard, Harris, & Brodersen, 1992). Dettling et al. (2000) also demonstrated that children's cortisol patterns across the day at family child care were lower when they received more focused attention and stimulation from their caregivers, behaviors that

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