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Child diurnal cortisol rhythms, parenting quality, and externalizing behaviors in preadolescence

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Summary This study examined a neurobiologically informed model of the emergence of child externalizing behaviors in an ethnically diverse community sample of 232 9—12 year old children. Replicating extensive prior research, our analyses revealed that parents' inconsistent discipline and poor quality monitoring were predictive of child externalizing behavior. In addition, poor parental monitoring, but not inconsistent discipline, was associated with children having a significantly flatter morning-to-evening cortisol slope, which was in turn, related to higher levels of externalizing behaviors. An indirect effect of parental monitoring on externalizing behaviors, through child diurnal cortisol rhythms, was also supported. These findings highlight the role of the hypothalamic-pituitary-adrenal (HPA) axis and its hormonal end product, cortisol, in the relationship between the caregiving environment and the development of externalizing behaviors.

1. Introduction

Externalizing behaviors, characterized by aggression and defiance are associated with poor academic performance, substance abuse, and criminal activities (Brook et al., 2011; Moilanen et al., 2010). Parenting practices such as inconsistent discipline and poor monitoring are recognized as robust predictors of child externalizing behaviors (Capaldi et al., 1997; Lahey et al., 2008). The hypothalamic-pituitary-adrenal axis (HPA)—a neurobiological system involved in stress reactivity and regulation—is postulated to play a role in the association between parenting and the development of externalizing behaviors (Susman, 2006; van Goozen et al., 2007). Although pathways between parenting practices, the HPA axis, and child externalizing behaviors have been individually tested and supported (Lahey et al., 2008; Pendry and

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Adam, 2007; Ruttle et al., 2011), they have not been tested in a model simultaneously. The current study sought to fill this gap by examining the role of diurnal cortisol slope in linking parenting practices to externalizing behaviors.

1.1. HPA axis and cortisol

The HPA axis is a critical component of the body's stress reactivity and regulation system and is involved in maintaining homeostasis in the face of dynamic environmental change. It responds to physical and psychological stressors via a cascade of neuroendocrine hormones, ending with cortisol, and activates systems involved in modulating immune function, learning, memory, and emotion and behavior regulation (Sapolsky et al., 2000; McEwen, 2008). In addition to its role in the stress response system, cortisol exhibits a diurnal pattern of activity in humans, with levels typically peaking 30—45 min after waking and declining gradually throughout the remainder of the day (Stone et al., 2001). Dysregulated diurnal cortisol patterns (e.g., lower morning and higher evening cortisol levels, resulting in a flatter diurnal cortisol slope, or rhythm, across the day) are associated with decreased physical and psychological health (Chrousos, 2009; Heim et al., 2000). Flatter diurnal cortisol rhythms have been observed among children, adults, and nonhuman primates exposed to chronic stress (Bruce et al., 2009; Heim et al., 2000; Fries et al., 2005; Gunnar and Vazquez, 2001; Sánchez et al., 2005).

1.2. Behavioral and neurobiological consequences of poor quality parenting

Inconsistent discipline and poor parental monitoring are two salient parenting practices associated with the development of externalizing behaviors, especially during preadolescence (Capaldi et al., 1997; Lahey et al., 2008). Coercion Theory (Patterson, 1982) explicates a pattern of interactions in which aggressive behaviors lead to desired outcomes within the parent—child dynamic, resulting in mutual escalation of inconsistent discipline and aversive child behavior. Parental monitoring, which involves attending to and tracking the child's whereabouts and activities, also becomes particularly important during preadolescence, as youth begin to spend more time away from home (Beyers et al., 2003).

Research on the neurobiological effects of childhood adversity has also supported the relationship between parenting practices and dysregulation of the HPA axis (see Lucas-Thompson and Goldberg, 2011 for a review). Lower maternal parenting quality, responsiveness, and scaffolding and greater negativity have been significantly related to flatter diurnal cortisol rhythms in young children (Pendry and Adam, 2007; Zalewski et al., 2012). Notably, parental responsiveness, monitoring, and consistency have been found to mitigate the negative neurobiological effects of being raised in stressful environments (Evans et al., 2007; Fisher et al., 2007). These results suggest that poor quality parenting negatively impacts HPA axis activity.

1.3. Diurnal cortisol rhythms and externalizing behaviors

In addition to the link between parenting quality and externalizing behaviors, low morning cortisol levels and flatter morning-to-evening diurnal cortisol rhythms have been associated with child externalizing behaviors (Shirtcliff et al., 2005; Poustka et al., 2010; Ruttle et al., 2011). Flatter diurnal cortisol rhythms in middle childhood have been shown to predict more severe externalizing behaviors in adolescence (Shoal et al., 2003; Shirtcliff and Essex, 2008). However, the findings examining this association are not entirely consistent. In their meta-analysis, Alink et al. (2008) found that the association between diurnal cortisol levels and externalizing disorders was moderated by age, with a positive relation for preschool-aged children and a negative relation for school-aged children. Other studies have found higher evening cortisol levels associated with externalizing behaviors (Marsman et al., 2008; Sondeijker et al., 2007). However, these studies examined morning and evening values individually. Thus, it is unclear whether the evening cortisol levels in these studies contributed to flatter morning-to-evening cortisol slopes associated with externalizing behaviors.

Cortisol has been theorized as an important link in the association between poor quality caregiving and externalizing behaviors in youth (Susman, 2006; van Goozen et al., 2007). Exposure to chronic low quality caregiving, and in particular inconsistent and unresponsive parenting, appears to contribute to the down-regulation of the HPA axis and flatter diurnal cortisol rhythms, which subsequently contribute to later child externalizing behaviors (Gunnar and Vazquez, 2006; Pendry and Adam, 2007). Thus, it is plausible that diurnal cortisol rhythms may partially explain the association between poor parenting practices and child externalizing behaviors.

The aim of the current study was to empirically examine a neurobiological model of externalizing behaviors in 9—12 year old children (Fig. 1). We hypothesized that poor quality parenting would be associated with increased externalizing behaviors and that effects of poor quality parenting practices on externalizing behaviors would be partially explained by

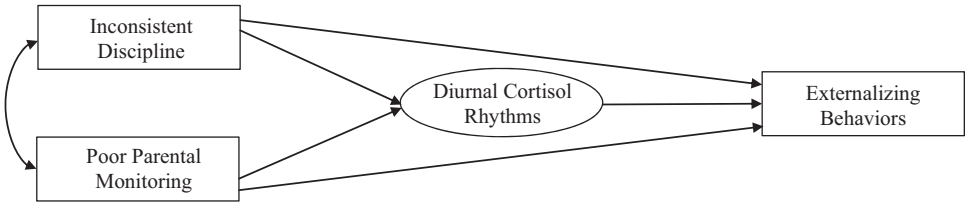

Figure 1 Conceptual model of the associations between parenting practices and child diurnal cortisol slope and externalizing behaviors in late childhood.