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Links between early baseline cortisol, attachment classification, and problem behaviors: A test of differential susceptibility versus diathesis-stress

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ABSTRACT

The purpose of the current study was to predict concurrent levels of problem behaviors from young children's baseline cortisol and attachment classification, a proxy for the quality of caregiving experienced. In a sample of 58 children living at or below the federal poverty threshold, children's baseline cortisol levels, attachment classification, and problem behaviors were assessed at 17 months of age. We hypothesized that an interaction between baseline cortisol and attachment classification would predict problem behaviors above and beyond any main effects of baseline cortisol and attachment. However, based on limited prior research, we did not predict whether or not this interaction would be more consistent with diathesis-stress or differential susceptibility models. Consistent with diathesis-stress theory, the results indicated no significant differences in problem behavior levels among children with high baseline cortisol. In contrast, children with low baseline cortisol had the highest level of problem behaviors in the context of a disorganized attachment relationship. However, in the context of a secure attachment relationship, children with low baseline cortisol looked no different, with respect to problem behavior levels, then children with high cortisol levels. These findings have substantive implications for the socioemotional development of children reared in poverty.

1. Introduction

In 2015, an estimated 13.5% of all U.S. citizens, including over one in five children, were living below the federal poverty threshold (U.S. Census Bureau, 2016). Children growing up in conditions of poverty are at increased risk for impaired socioemotional functioning compared to their counterparts living above the poverty threshold (Duncan and Brooks-Gunn, 2000). Parents with low socioeconomic status, compared to parents with high socioeconomic status, tend to report more withdrawal, inattentiveness, and aggression in their children (Brooks-Gunn & Duncan, 1997; Meins, Centifanti, Fernyhough, & Fishburn, 2013; van Oort, van der Ende, Wadsworth, Verhulst, & Achenbach, 2011). These problems tend to persist and also place children on trajectories to experience disadvantages throughout the life course (McLeod & Fettes, 2007; Turney, 2012).

Although the specific pathways linking poverty to problem behaviors are still coming into focus, researchers have suggested biological mechanisms for this prospective relation. The biological embedding framework suggests that the early

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chronic stress associated with poverty may get "under the skin" and become "embedded" in biological systems, leading to individual differences in physiology, development, and health (Evans, Chen, Miller, & Seeman, 2012; McEwen & Stellar, 1993; Propper, 2012). Compelling evidence from animal and human studies support this framework and indicate that early stress exposure can indeed have lasting effects on multiple stress response systems (Alkon, Wolff, & Boyce, 2012; Evans et al., 2012; Levine, 2005; Lupien, King, Meaney, & McEwen, 2000). These alterations in biological processes are hypothesized to influence physical and mental health early in life and across the lifespan (Hertzman, 2012). As such, contextually mediated alterations in children's stress physiology may be one mechanism through which poverty influences socioemotional development (Engle & Black, 2008; Mills-Koonce & Towe-Goodman, 2012; Obradović, Bush, & Boyce, 2011).

One principal psychobiological stress system that has been the focus of such research is the hypothalamic-pituitary-adrenocortical (HPA) axis. Cortisol, a marker of HPA output, contributes to the modulation of numerous systems, including cardiovascular and immune system functioning (Sapolsky, Romero, & Munck, 2000; Takahashi et al., 2004). Researchers have frequently linked low baseline cortisol levels to higher rates of externalizing behaviors, including oppositional and aggressive behavior (Shirtcliff, Granger, Booth, & Johnson, 2005; van Goozen, Matthys, Cohen-Kettenis, Buitelaar, & Van Engeland, 2000). High baseline cortisol, on the other hand, may also be problematic and has been regularly associated with internalizing behaviors (Granger, Stansbury, & Henker, 1994; Granger, Weisz, McCracken, Ikeda, & Douglas, 1996) and less effective executive functioning (Blair et al., 2011). However, there are conflicting findings on the links between baseline cortisol levels and childhood problem behaviors, with some researchers finding non-significant, or opposite relations (Alink et al., 2008; Dahl et al., 1989). As such, it is not entirely clear how baseline cortisol might act as a risk factor for problem behaviors among children reared in poverty.

A number of researchers have argued that the quality of caregiving a child receives is a factor that likely moderates the relations between children's stress physiology and problem behaviors (Boyce and Ellis, 2005; Eisenberg et al., 2012; Luecken & Lemery, 2004). Supportive parenting encourages socioemotional competence by fostering the development of self-regulation and prosocial behaviors (Barnett, Gustafsson, Deng, Mills-Koonce, & Cox, 2012; Spinrad et al., 2007). In particular, the early development of emotion regulation is highly dependent on the responsiveness and patterns of regulation provided by attachment figures (Halligan et al., 2013). Studies have consistently demonstrated that sensitive and responsive caregiving promotes the development of secure attachment (Ainsworth, Blehar, Waters, & Wall, 1978; De Wolff & van IJzendoorn, 1997) whereas frightening/frightened, unpredictable, and extremely insensitive parenting is thought to contribute to the development of disorganized attachment (Hesse & Main, 2006). As such, secure and disorganized attachment reflect a history of caregiving extremes (Conradt, Measelle, & Ablow, 2013). Although researchers have identified caregiving quality as important determinants of children's problem behaviors, relatively few efforts have been made to study these links in relation to children's baseline cortisol levels.

Given these findings, it is likely that the interplay between caregiving experience and children's cortisol levels influences early socioemotional outcomes among children living in the context of poverty. The differential susceptibility theory offers one potential mechanism through which contextual and caregiving influences moderate the relations between children's HPA activity and socioemotional development (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; also see Boyce & Ellis, 2005). According to differential susceptibility theory, children who would be considered more vulnerable to contextual risk within a traditional diathesis-stress framework (Zuckerman, 1999), such as children with physiological hyperreactivity, may also reap the benefits of supportive environments in a "for-better-and-for-worse" fashion (Belsky & Pluess, 2009). That is, susceptibilities may predispose children to maladaptation when paired with stressful, unsupportive contexts. However, according to differential susceptibility theory, this type of susceptibility may also predispose these children to the most successful outcomes when paired with supportive and positive contexts. In other words, susceptibilities can moderate the effect of context on adaptation such that sensitive children, compared with less sensitive peers, are more negatively affected by harmful rearing environments *and* more positively affected by supportive rearing environments (Boyce & Ellis, 2005). Thus, the essential difference between diathesis-stress and differential susceptibility models is that the former emphasizes the exclusive susceptibility to negative environments for some individuals, while the latter highlights susceptibility to both negative *and* positive environments in the same individuals (Belsky & Pluess, 2012).

Several studies have provided initial evidence suggesting that physiological reactivity may act as a marker of differential susceptibility (Belsky & Pluess, 2009). For example, in a sample of 5- to 6-year old children, Obradović.Bush, Stamperdahl, Adler, and Boyce (2010) found that children with high respiratory sinus arrhythmia (RSA; a measure of parasympathetic stress response related to respiration-linked heart rate) and high cortisol reactivity had more maladaptive outcomes (e.g., more externalizing and less prosocial behavior) in the context of high adversity but better adaptation in the context of low adversity. Similarly, in a sample of mothers and infants living in poverty, Conradt et al. (2013) found that infants with high baseline RSA exhibited the highest levels of problem behavior in the context of a disorganized relationship, but the lowest levels of problem behaviors in the context of a secure attachment relationship. Together, these studies offer evidence that stress-related physiology may act as a marker of differential susceptibility. At present, physiological susceptibilities have figured prominently in the growing differential susceptibility literature. However, relatively little of this work has focused on very young children, limiting our ability to identify susceptibilities earlier in life when they may be most sensitive to initial rearing conditions and, ideally, to intervention effects.

Beyond the immediate caregiving context, children living in poverty face a broad range of ecological stressors known to compromise socioemotional development (Chang, Shelleby, Cheong, & Shaw, 2012; Shonkoff, Boyce, & McEwen, 2009). Greater risk for adverse outcomes has been linked to low maternal education and low income (Baharudin & Luster, 1998;