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Household chaos as a context for intergenerational transmission of executive functioning

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ABSTRACT

Executive functioning (EF) may be transmitted across generations such that strengths or deficiencies in parent EF are similarly manifested in the child. The present study examined the contributions of parent EF and impulsivity on adolescent EF, and investigated whether household chaos is an environmental moderator that alters these transmission processes. American adolescents (N = 167, 47% female, 13–14 years old at Time 1) completed behavioral measures of EF and reported household chaos at Time 1 and one year later at Time 2. Parents completed behavioral measures of EF and self-reported impulsivity at Time 1. Results indicated that lower parent EF at Time 1 predicted lower adolescent EF at Time 2 (controlling for adolescent EF and IQ at Time 1), but only in the context of high household chaos. Findings suggest that household chaos may be a risk factor that compounds influences of poor parent EF and compromises adolescent EF development.

Executive functioning (EF) is best understood as a set of higher-order cognitive abilities and self-regulatory processes that includes three distinct but correlated factors: inhibitory control, working memory, and cognitive flexibility (Miyake et al., 2000). These functions work together to guide goal-directed behaviors and are predictive of a number of social (Holmes, Kim-Spoon, & Deater-Deckard, 2016), academic (Becker, Miao, Duncan, & McClelland, 2014), and psychological (Letkiewicz et al., 2014) outcomes. Research has demonstrated that individual differences in EF emerge throughout childhood and adolescence as a function of genetic and environmental conditions, and that EF is transmitted across generations such that strengths or deficiencies in parent EF are similarly manifested in the child (Deater-Deckard, 2014). However, it remains unclear how specific environmental contexts may influence the strength of these effects. It is especially important to understand these processes in adolescence, as EF begins to stabilize during this developmental period (Friedman et al., 2016). In addition to EF, parents' impulsivity may contribute to adolescents' self-regulation development. Behavioral impulsivity is closely related to EF abilities, and impulsive parents may engage in maladaptive parenting styles (Chen & Johnston, 2007) that

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can further impact adolescent EF outcomes. Thus, the current study sought to understand the contributions of parent indicators of EF and impulsivity to adolescent EF development, and the role of household chaos as an environmental context that may moderate parental influences on EF.

Intergenerational transmission of executive functioning

Previous research demonstrates that EF similarity between parent and child may manifest as early as 24 months of age, suggesting that transmission of EF is initiated in early childhood (Cuevas, Deater-Deckard, Kim-Spoon, Wang, et al., 2014). As children transition through early and middle childhood, familial similarity in EF increases (Deater-Deckard & Wang, 2012). Once children enter adolescence, EF begins to stabilize; however, there remains little research on *transmission* of EF in adolescence. One exception is a study by Jester et al. (2009), which found moderate to high effect sizes of EF transmission in adolescence ($b^* = 0.34$ for fathers and 0.51 for mothers), similar to what has been found in early childhood (Cuevas, Deater-Deckard, Kim-Spoon, Wang, et al., 2014). This finding offers preliminary evidence that intergenerational similarity in EF persists into adolescence.

Previous research lends support to the genetic basis of EF abilities. Specifically, moderate heritability has been demonstrated for performance on individual EF tasks (Lee et al., 2012; Vasilopoulos et al., 2012). These individual tasks represent separate EF domains (set-shifting, working memory, and inhibitory control) which are correlated (Miyake et al., 2000), although performance-based indicators of these domains often demonstrate weak intercorrelations (Willoughby, Holochwost, Blanton, & Blair, 2014). Nonetheless, latent variables of the common EF factor based on the three EF domains demonstrate high heritability, and individual differences in EF are attributable to these genetic influences (Friedman et al., 2016). Importantly, research also demonstrates the importance of the gene and environment interplay which *together* confer individual differences in EF (for a review, see Deater-Deckard, 2014). Thus, in order to fully understand the nature of intergenerational transmission of EF, it is important to consider the different environmental contexts that may affect EF development.

Environmental context

Familial environmental factors such as socioeconomic status (Hackman, Gallop, Evans, & Farah, 2015) and parent caregiving (Cuevas, Deater-Deckard, Kim-Spoon, Watson, et al., 2014) influence EF outcomes. However, existing research primarily focuses on how environmental factors are directly related to EF ability. Further research is required to understand environmental contexts of transmission that may promote or reduce familial similarity. Furthermore, mechanisms of transmission are increasingly complicated during adolescence since it is a time of dramatic social, neural, and environmental changes (Nelson, Leibenluft, McClure, & Pine, 2005) which may affect the interactions that facilitate intergenerational transmission. Therefore, it is particularly important to consider environmental contexts that may influence the intergenerational transmission of EF in adolescence.

Household chaos is a particular environmental context that may compromise individuals' EF development. Homes that are highly chaotic are characterized by constant noise, activity, and a lack of structure or routine (Wachs & Evans, 2010). Though they are related, household chaos is a distinct construct from socioeconomic status (SES), and has been shown to affect cognitive functioning independently of SES (Hart, Petrill, Deater-Deckard, & Thompson, 2007). Household chaos is directly and indirectly predictive of a host of self-regulation and adjustment outcomes. For example, Vernon-Faegans, Willoughby, and Garrett-Peters (2016) found that household chaos worked through EF to predict behavior regulation problems in early childhood. Similarly, another study utilizing growth mixture modeling found that higher household chaos in middle childhood predicted membership in groups with lower growth in self-control trajectories across middle-to-late childhood above and beyond SES which, in turn, predicted greater risk-taking in adolescence (Holmes, Deater-Deckard, & Kim-Spoon, 2017). It seems that the stressful and distracting qualities of such an unpredictable environment may underlie these deficits in cognitive functioning (Boksem, Meijman, & Lorist, 2006). Previous research has demonstrated the association between household chaos and lower parental self-regulation and EF (Bridgett, Burt, Laake, & Oddi, 2013; Deater–Deckard, Chen, Wang, & Bell, 2012). It follows that household chaos may serve as a common environmental risk factor that has the potential to compromise self-regulatory abilities for the family as a whole, augmenting familial similarity in EF.

Preliminary evidence suggests that the level of chaos in a home may modulate parental influences on child outcomes. For example, household chaos has been shown to moderate the association between parenting and child behavior, such that the association between negative parenting and child behavior problems is stronger for families in a highly chaotic home environment (Asbury, Dunn, Pike, & Plomin, 2003; Coldwell, Pike, & Dunn, 2006). Thus, it seems that higher levels of chaos may exacerbate the detrimental effects of negative parenting. However, it has yet to be examined how other parental risk factors, such as poor EF or impulsivity, may influence child outcomes in the context of household chaos.

Parent impulsivity

The theoretical perspective on the intergenerational transmission of EF proposed by Deater-Deckard (2014) explains that EF is transmitted across generations within parent-child relationships that provide powerful socialization and further emphasizes how parental reactivity (e.g., impulsivity) and regulation (e.g., EF) interface with each other to influence their