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Maternal depressive symptoms and child temperament: Longitudinal associations with executive functioning

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ABSTRACT

The present study investigated the contributions of maternal depressive symptoms and child temperament to youths' executive functioning (EF) across an 18-year longitudinal study. The primary hypothesis proposed that the association between youths' exposure to early maternal depressive symptoms (ages 3 & 5) and their EF (age 18) would be moderated by temperament in middle childhood (ages 8 & 10). Temperament was a significant moderator of the association between early maternal depressive symptoms and youth EF. Positive child temperament (high effortful control, EC, and low negative affectivity, NA) was associated with higher EF when maternal depressive symptoms during early childhood were low. In contrast, elevated maternal depressive symptoms overrode any associations between child temperament and later EF. Parallel analyses examining the interaction between child temperament and maternal depressive symptoms during middle childhood (controlling for earlier maternal depressive symptoms) revealed a different pattern of results. Clinical implications for prevention/intervention work on EF are discussed.

Maternal depression creates a caregiving environment that is often marked by failure to reach the minimal standards of appropriate and apt parenting. Relative to mothers without depression, mothers with depression have more inappropriate feelings and sentiments towards their children as well as more inappropriate interactions with their children (Downey & Coyne, 1990; Hammen, 2009). Moreover, several adverse child outcomes have been associated with maternal depression. Children of depressed mothers compared with children of nondepressed mothers form more insecure attachments (Martins & Gaffan, 2000), develop less social and emotional competence (Hammen, 2009), suffer from increased psychopathological and adjustment problems (Gotlib & Goodman, 1999), and struggle more academically (Wright, George, Burke, Gelfand, & Teti, 2000). Considerably little research, however, has investigated the effects of maternal depression on children's neurocognitive processes. The present study aimed to fill this gap in the literature by examining the relation between maternal depressive symptoms and children's executive functioning specifically within a sample of adolescent mothers and their children.

Despite steady declines across the past few decades, rates of adolescent pregnancy and births in the United States remain strikingly high when compared to rates of other developed or industrialized countries (Klein, 2005). Unsurprisingly, in contrast to parenting in adulthood, adolescent parenting presents a unique context often marked by amplified adversities and challenges for the teen mothers themselves as well as their children. Adolescent mothers are forced to simultaneously negotiate new parenting demands with the characteristically challenging developmental tasks presented in adolescence (e.g., further attainment of independence and enhanced cognitive and socioemotional development as well as increased stability in identity; Trad, 1995). In fact, when compared to adult mothers, adolescent mothers are often much less cognitively prepared to parent, tend to be less vocal and stimulating in interactions with their children (Miller, Miceli, Whitman, & Borkowski, 1996), and experience elevated depressive symptomatology (Deal & Holt, 1998; Figueiredo, Pacheco, & Costa, 2007). Consequently, children of adolescent mothers are at increased risk for behavioral, psychosocial, and developmental difficulties. In fact, when compared to children of adult mothers, children of adolescent mothers possess lower achievement levels in language and other academic areas as well as heightened levels of internalizing and externalizing behaviors (Levine, Pollack, & Comfort, 2001). As such, increased understanding of potential associations between maternal depressive symptoms and children's neurocognitive functioning is especially relevant within the context of adolescent parenting.

Additionally, the present study sought to evaluate individual child characteristics, namely temperament, which may contribute to the relation of maternal depressive symptoms to children's executive functioning. Temperament, defined as inherent individual differences in self-regulation or in attentional, emotional, and motor reactivity

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(Rothbart & Bates, 2006), is commonly labeled as a potential buffering or exacerbating agent to child developmental outcomes given unfavorable contexts. In particular, research suggests that easy temperamental qualities, such as positivity, adaptability, and predictability in response and behavior, may contribute to resiliency in children (Thomas, Chess, Birch, Hertzig, & Korn, 1963) when faced with unfavorable caregiving environments. In contrast, children with difficult temperament, or those who are unpredictable, nonadaptive, and have heightened negative responses and behaviors (Thomas et al., 1963), possess a detrimental vulnerability to similar environments (Cummings & Davies, 1994). Therefore, negative temperament may exacerbate the negative association between maternal depressive symptoms and children's neurocognitive functioning.

Executive functioning and maternal depressive symptomatology

Executive functioning (EF), a major neurocognitive functioning system, encompasses a number of related yet distinct components, which united classify higher-order cognitive functioning abilities and more purposeful, goal-directed behaviors (Anderson, 2002). Among EF's separable elements, inhibition, shifting, updating/working memory, planning, and cognitive flexibility are most frequently noted as the fundamental components comprising EF (Anderson, 2002; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Evidence for both a unitary framework of EF and also a separable three-factor component view of EF has been presented in the literature (Miyake et al., 2000). Factor analysis suggests that these three central EF factors of inhibition, shifting, and updating are separable yet moderately correlated, thus substantiating both unity and diversity of EF components (Miyake et al., 2000). In addition, most EF tasks, especially the more complex EF tasks, are not considered as pure measures of any individual component of EF, and instead utilize multiple EF components (Miyake et al., 2000). Thus, for the purposes of this study, EF was considered as a unitary construct consisting of various related EF elements tested in a number of administered EF tasks.

Individually and collectively, the EF components are recognized as essential to daily functioning across various contexts and settings (Anderson, 2002). Moreover, research has found that EF is related to core achievement tasks including, but not limited to, academic achievement (Biederman et al., 2004), communication proficiencies (Clark, Prior, & Kinsella, 2002), social competence (Kochanska, Murray, & Harlan, 2000), and emotion regulation (Simonds, Kieras, Rueda, & Rothbart, 2007). Because EF is critically linked to childhood and adult outcomes, identification of environmental and individual trait antecedents of EF is important.

Depression is consistently documented in the literature as negatively linked to neurocognitive performance, such as in EF. In fact, both adults and children presenting with depression often experience poorer neuropsychological functioning compared to those without depressive symptoms (Austin, Mitchell, & Goodwin, 2001; Smith, Muir, & Blackwood, 2006). Moreover, meta-analytic research confirms increased risk for the development of depressive symptomatology among children of parents with depression, and a handful of studies have documented attentional and neuropsychological deficits among these children of depressed parents (Klimes-Dougan, Ronsaville, Wiggs, & Martinez, 2006). Researchers postulate that this link between parental depression and child neuropsychological outcomes stems from the inappropriate interactions children often experience with their depressed parents. In particular, deficits in parental cognitive guidance (i.e., scaffolding behaviors for problem-solving techniques) displayed by parents with depressive symptoms may produce elevated rates of behavioral problems and lower self-regulation among their children, specifically in early childhood (Gartstein & Fagot, 2003). In addition, the stressful environment created by and associated with parental depressive symptoms may press children's attentional resources, increasing susceptibility for weakened self-regulation skills that are critical for EF (Pérez-Edgar, Fox, Cohn, & Kovacs, 2006).

Furthermore, maternal depressive symptoms experienced during early childhood, particularly within the preschool years (ages 3 to 5), may be especially detrimental to children's developing EF skills. Whereas the development of core components of EF skills has documented beginnings in infancy, EF undergoes rapid development through toddlerhood and the preschool period. The early childhood period plays a particularly critical role in the development of EF, forming the foundation for future development of higher-order cognitive processes into adolescence and adulthood (Garon, Bryson, & Smith, 2008). Underscoring the importance of this age period to EF, preschool-age brain lesions or injuries to the prefrontal cortex, synonymously linked to EF, have more significant impact to EF than brain lesions or injuries incurred later in life (Jacobs, Harvey, & Anderson, 2007). Additionally, EF interventions specific to the preschool years have yielded significant improvements in EF, as well as behavioral and academic functioning (Diamond, Barnett, Thomas, & Munro, 2007). As such, further research aimed at better understanding the antecedents of EF in early childhood continues to have critical implications for early detection and intervention programs. Little research, however, has directly investigated the association between exposure to maternal depressive symptoms during early childhood and later EF development, especially longitudinally (Klimes-Dougan et al., 2006), and it continues to remain uncertain what maternal, environmental, and individual factors (or specific timing of these factors) may specifically contribute to poor neuropsychological functioning among children of depressed parents.

Executive functioning and temperament

Aside from the considerable overlap in definition and theory (Wolfe & Bell, 2007), strong functional similarities between temperament and EF are also evident given that these constructs are often measured by analogous cognitive performance tasks targeting children's attentional and behavioral regulation behaviors (Zhou, Chen, & Main, 2012). Temperament is typically divided into the three broad dimensions of effortful control (EC), negative affectivity, and surgency (Rothbart & Bates, 2006), of which EC is especially illustrative of the professed link between EF and temperament (Posner & Rothbart, 2007). EC, a regulatory-type temperament construct, signifies a child's capacity to strategically select and implement appropriate and efficient steps in completing a presented conflicting task or future endeavor, as well as the ability to detect potential errors and effectively minimize them (Rothbart & Bates, 2006). Inhibitory control, the capacity to manage impulsive or improper actions and responses, and attentional control, the ability to direct and appropriately shift one's attention, are two key elements of EC that closely parallel EF (Putnam, Ellis, & Rothbart, 2002). Accordingly, it is often presumed that these constructs exist in a mutually facilitative fashion in which higher EC levels would facilitate greater EF and vice versa (Rothbart & Bates, 2006). To date, however, most research has focused only on EC or EF alone, not both together, despite their similarities and the need to better delineate their relation, as both are central to adaptive functioning and may prove to be critical targets for intervention (Zhou et al., 2012).

Apart from EC specifically, direct associations have been identified between neurocognitive functioning and other components of temperament, especially that of negative affectivity (NA), a construct which reflects children's disposition and expression of anger, frustration, sadness, and fear, or even general mood. Extant research examining the link between NA and EF has focused narrowly on the EF component of inhibition, finding that greater inhibition reduces the expression of negative emotions (Carlson & Wang, 2007; Zelazo & Cunningham, 2007). Considerably more literature has focused on the effects of positive affect on neurocognition, finding in fact that positive affect impacts a broad scope of cognitive processes (Ashby, Isen, & Turken, 1999). Specifically, research indicates that positive affect enhances both cognitive flexibility and verbal fluency (Phillips, Bull, Adams, & Fraser, 2002), and reduces rigidity in problem solving (Greene & Noice, 1988). Research, however, has focused primarily on main effects, rather