



## Maternal depression and sex differences shape the infants' trajectories of cognitive development

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### ABSTRACT

The effect of maternal depression on the trajectories of cognitive development was studied in 26 infants with depressed mothers as compared to a group of 24 infants with non-depressed mothers. The infants were tested on Mullen Scales of Early Learning when they were 6, 12 and 18 months old. Mothers reported their depressive symptoms over the follow ups. The study also investigated if there were sex differences in the cognitive trajectories. Multilevel modeling analyses revealed that infants of depressed mothers had a stable lower cognitive score over the period 6–18 months of age as compared to the infants of non-depressed mothers, and that the girls tended to increase their cognitive scores as compared to the boys over the same time period. The results are discussed in light of the stability of depression symptoms over the follow up and sex differences in cognitive development.

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### 1. Introduction

The effects of maternal postnatal depression on child cognitive functioning are inconsistent. Some research shows a relation between maternal depression and reduced cognitive performance (Hay et al., 2001; Murray, 1992). Others find a relation under specific conditions such as chronic depression, or for specific groups such as male infants or low educated parents (Hay & Kumar, 1995; Murray, Kempton, Woolgar, & Hooper, 1993). In an attempt to explain the inconsistency in results, researchers have looked to the timing and duration of depression and gender interactions. Different types of studies have demonstrated that maternal depression of longer duration in infancy is contributing to poorer cognitive development in infants and older children (Cicchetti, Rogosch, & Toth, 2000; NICHD SECC, 1999a, 1999b; Petterson and Alison Burke, 2001; Sutter-Dallay et al., 2011). The impact of brief and less chronic depression on child cognitive development is less clear, but there are some studies indicating that even brief postnatal depression may have long lasting effect on cognitive development (Hay et al., 2001).

Still, it is unclear how maternal postnatal depression is related to individual change in cognitive abilities since few have done longitudinal studies with repeated measures of cognitive capacity. One exception is a study by Feldman and Eidelman (2009) who investigated if vagal tone and maternal postpartum depressive symptoms influenced premature infants' trajectory of cognitive development assessed at infant corrected ages 6, 12 and 24 months and again at 5 years. Their results showed different timing of the two factors: higher vagal tone increased the rate of cognitive development across the first years of life, whereas maternal postpartum depressive symptoms interfered with development in the preschool years.

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Unfortunately, they did not track depressive symptoms during the follow-up period, neither did they use clinical interview for depression, so it is uncertain which aspect of maternal depression, the early timing or the severity or chronicity that was influencing the change in cognitive development in the preschool years. The current study aimed to investigate if maternal clinical depression and gender are related to change in infant cognitive abilities through the first 18 months of life.

### 1.1. *Maternal depression and change in infant cognitive development*

Murray, Hipwell, Hooper, Stein, and Cooper (1996) and Murray (1992) measured object permanence tasks in a group of 9 months old infants with postnatal depressed mothers, and tested their cognitive abilities at 18 months and again at 5 years of age. At 9 months infants with depressed mothers performed less well than infants in a control group with healthy mothers on the object permanence task. At 18 months of age there were no overall effects of maternal depression, although boys and infants in families with lower socioeconomic status were affected by maternal depression. At follow-up at 5 years of age there were no relations between concurrent maternal depressions and the severity or duration of postnatal depression, also the boys and disadvantaged groups exposed to maternal postnatal depression were accomplishing as well as the non-depression group. Even though the infants of depressed mothers were initially inferior on the object permanence tasks they were gradually performing as well as the comparison group on the cognitive tests.

In another longitudinal study (Hay et al., 2001) it was shown that children exposed to maternal postnatal depression had lower cognitive abilities when assessed on WISC at 4 and 11 years of age as compared to children with non-depressed mothers. The difference persisted after control for both concurrent depression and maternal IQ. The differential results may partly be due to differential social contexts, such as the quality of education that might have influenced the children's cognitive performance (Bronfenbrenner, 1979; Murray et al., 1996).

Sutter-Dallay and colleagues (2010) assessed both maternal depressive symptoms and infant cognitive development repeatedly during the infants' two first years of life. They found a significant relation between maternal depressive symptoms at infant age 6 weeks and infant cognitive development over the two first years of life. When taking into account the mothers' subsequent depressive symptoms over the two first years of life, this relation was reduced to a statistically insignificant trend. They also found that depressive symptoms at infant age 6 weeks strongly predicted the symptoms levels in mothers at all follow up assessments. The results suggest that the effect of early maternal depression on infant cognitive development is partly mediated by subsequently elevated depressive symptoms.

In summary, the results from the previous longitudinal studies suggest that there is a change in children's cognitive abilities over time that is related to maternal postnatal depression, but it is unclear how this change is taking place. It is also unclear how early it is possible to assess a relation between maternal depression and change in children's cognitive performance. The human brain is developing structurally and functionally over a much longer time span as compared to other primates (Johnson, 2005). This implies that the developing child will be affected differentially by the environment at different phases in development.

The influence of maternal depressive symptoms on the young child's cognitive performance could vary as a function of timing in brain development and the duration of exposure to maternal depression. The very young infant's brain and perceptual system are tuned to detecting contingency between its own reactions and environmental events. Also, the young infants' immobility demands that caregivers in some way bring the social and physical environment to them. Exposure to an insensitive and depressed mother from a very early age and for a longer period may turn the infant into a state of learned helplessness (Seligman, 1975). Kaplan and colleagues (2011) showed that 1-year old infants of currently depressed mothers with prenatal depression onset, to a lesser degree took advantage of infant-directed speech produced by a non-depressed mother as compared to infants with currently exposure to maternal depression with later onset. Their results suggested that the infants had generalized their response to infant-directed speech from the depressed mothers' to the non-depressed mothers' speech. A depressed mothers' speech to her infant is less pitched (Kaplan, Bachorowski, Smoski, & Zincer, 2001) and refers less to the infants' agency (Murray et al., 1993). Infants exposed to a self-occupied mother may gradually tune out from her because there are less reinforcing activities like imitation and expansion of the infants' experience. Infants exposed to maternal depression for a longer time may generally come to expect less stimulating responses from women.

On the other hand, exposure to maternal depression may also fail to support later developing functions, such as the child's autonomy (Kochanska & Leon, 1991), verbal IQ (Cicchetti et al., 2000) and executive functions in toddlerhood and childhood (Rohrer, Cicchetti, Rogosch, Toth, & Maughan, 2011). Feldman and Eidelman (2009) found that maternal depressive symptoms measured before discharge had its strongest impact on infants' trajectories of cognitive development between 2 and 5 years of age. The researchers concluded that depressive mothers may have special difficulties in supporting functions emerging at preschool age, such as the child's independence, executive functions and peer friendships.

It is also possible that changes in the environment like recovery from depression or healthy paternal care will allow the child to catch up in development, though some treatment studies have failed to document any change in cognitive development (Grace, Evindar, & Stewart, 2003; Gunlicks & Weissman, 2008). Alternatively there might be a stable relation between maternal depression and infant cognitive ability. If postnatal maternal depression is stable throughout infancy it may be expected to exert a stable influence on infant cognitive abilities.

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