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Full length article

## Moderating effects of maternal emotional availability on language and cognitive development in toddlers of mothers exposed to a natural disaster in pregnancy: The QF2011 Queensland Flood Study



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### ABSTRACT

**Background:** Prenatal maternal stress exposure has been linked to sub-optimal developmental outcomes in toddlers, while maternal emotional availability is associated with better cognitive and language abilities. It is less clear whether early care-giving relationships can moderate the impact of prenatal stress on child development. The current study investigates the impact of stress during pregnancy resulting from the Queensland Floods in 2011 on toddlers' cognitive and language development, and examines how maternal emotional availability is associated with these outcomes.

**Methods:** Data were available from 131 families. Measures of prenatal stress (objective hardship, cognitive appraisal, and three measures of maternal subjective stress) were collected within one year of the 2011 Queensland floods. Maternal emotional availability was rated from video-taped mother-child play sessions at 16 months: sensitivity (e.g., affective connection, responsiveness to signals) and structuring (e.g., scaffolding, guidance, limit-setting). The toddlers' cognitive and language development was assessed at 30 months. Interactions were tested to determine whether maternal emotional availability moderated the relationship between prenatal maternal stress and toddler cognitive and language functioning.

**Results:** Prenatal stress was not correlated with toddlers' cognitive and language development at 30 months. Overall, the higher the maternal structuring and sensitivity, the better the toddlers' cognitive outcomes. However, significant interactions showed that the effects of maternal structuring on toddler language abilities depended on the degree of prenatal maternal subjective stress: when maternal subjective stress was above fairly low levels, the greater the maternal structuring, the higher the child vocabulary level.

**Conclusion:** The current study highlights the importance of maternal emotional availability, especially structuring, for cognitive and language development in young children. Findings

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suggest that toddlers exposed to higher levels of prenatal maternal stress in utero may benefit from high maternal structuring for their language development.

## 1. Introduction

### 1.1. Prenatal maternal stress (PNMS) & offspring cognitive outcomes

There is growing evidence that fetal exposure to maternal stress during pregnancy can negatively impact the developmental outcomes of toddlers, including delayed language development and lower intellectual functioning (King & Laplante, 2015; Kingston, McDonald, Austin, & Tough, 2015; Kingston, Tough, & Whitfield, 2012; O'Donnell, O'Connor, & Glover, 2009; Talge, Neal, & Glover, 2007).

A variety of stressors in the prenatal period have been implicated in offspring cognitive development, including prenatal maternal anxiety (Brouwers, van Baar, & Pop, 2001; DiPietro, Novak, Costigan, Atella, & Reusing, 2006; Grant, McMahon, Reilly, & Austin, 2010), prenatal depression (Koutra et al., 2013; Lydsdottir et al., 2014), and objective degree of exposure to hardship (Laplante et al., 2004; Laplante, Brunet, Schmitz, Ciampi, & King, 2008; Segre, O'Hara, Arndt, & Beck, 2010; Zhu et al., 2014). Studies have also shown that high levels of maternal cortisol in pregnancy are associated with lower cognitive abilities at age 7 years (LeWinn et al., 2009). However, little is known about the effects of these types of pregnancy stressors on toddlers' language development.

### 1.2. Key challenges for prenatal maternal stress research

Some of the biggest challenges for research into PNMS and its effects on offspring cognitive and language development are the variability of maternal stressors utilized in the literature, including depression, anxiety, life events, daily hassles (King & Laplante, 2015; Tarabulsky et al., 2014). One approach to better control for variability in exposure to stress in pregnancy is to use a sudden-onset paradigm – such as a natural disaster – allowing for more objective quantification of the maternal hardship experienced (e.g., loss of home or income) as well as timely assessments of the woman's subjective reactions (e.g., post-traumatic-like symptoms) to the event. This approach also allows for a quasi-randomized methodology in which the objective degree of hardship is distributed within the population without respect to sociodemographic characteristics, nor to individuals' personalities or propensities to experience stressful life events. A landmark longitudinal study that used this method to investigate PNMS is "Project Ice Storm" (King & Laplante, 2005), which followed women who were either pregnant during, or became pregnant within three months of, a severe ice storm in Canada. The study found that in utero exposure to high levels of objective PNMS were associated with poorer general intellectual and language outcomes, as well as poorer play abilities, at ages 2 and 5½ years (Laplante et al., 2004; Laplante et al., 2008; Laplante, Zelazo, Brunet, & King, 2007) but maternal subjective distress (severity of post-traumatic stress-like symptoms) was not related to child cognitive development.

### 1.3. Possible moderating effect of maternal behaviors on exposure to PNMS and offspring outcomes

Another key consideration is the relationship between maternal parenting behaviors, such as high maternal sensitivity, and children's cognitive and language development, particularly during the first four years of life (Leigh, Nievar, & Nathans, 2011; Pearson et al., 2011). Maternal sensitivity is defined as the mother's timely and appropriate response to her child's signals (Ainsworth, Bell, & Stayton, 1974; Biringen, Derscheid, Vliegen, Closson, & Easterbrooks, 2014; Bornstein, 1989; de Wolff & van Ijzendoorn, 1997; Landry, Smith, Swank, Assel, & Vellet, 2001; Pederson, Gleason, Moran, & Bento, 1998). In particular, maternal sensitivity in the first year has been found to be predictive of expressive language development in the second and third year (Leigh et al., 2011).

Scaffolding, which refers to the mother's ability to offer support that guides the child in solving cognitive problems (Wood, Bruner, & Ross, 1976), is also positively associated with children's cognitive development, particularly executive functioning (Bernier, Carlson, & Whipple, 2010), and expressive vocabulary (Matte-Gagné & Bernier, 2011).

A system that examines these maternal supportive behaviors within the mother-child dyad is that of Emotional Availability (EA) (Biringen et al., 2014). This is a multidimensional construct consisting of maternal sensitivity, structuring (similar to scaffolding), non-intrusiveness, and non-hostility, as well as the child's responsiveness towards, and involvement with, the mother or caregiver. The association between maternal EA and child cognitive and language development has been investigated in one study, which found that higher maternal EA at 15 months predicted higher levels of children's language and cognitive development at age 2 years (Moreno, Klute, & Robinson, 2008).

While there is a significant relationship between maternal EA and offspring cognitive outcomes, it is unclear whether maternal sensitivity and structuring may buffer (or moderate) against the adverse impacts of prenatal maternal stress on the toddler's cognitive and language development. Animal studies provide some evidence for a moderating effect of maternal behaviors. For example, rodent studies have shown that maternal nurturing behaviors (such as licking and grooming) can partially mitigate, or even reverse, adverse cognitive outcomes in pups that were exposed to prenatal stress (Bredy, Humpartzoomian, Cain, & Meaney, 2003; Del Cerro et al., 2010). Similar findings are emerging in human studies, showing that secure attachment in infants moderates the negative impact of

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