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Implications of Timing of Maternal Depressive Symptoms for Early Cognitive and Language Development

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Statistically, women, particularly pregnant women and new mothers, are at heightened risk for depression. The present review describes the current state of the research linking maternal depressed mood and children's cognitive and language development. Exposure to maternal depressive symptoms, whether during the prenatal period, postpartum period, or chronically, has been found to increase children's risk for later cognitive and language difficulties. The present review considers both the timing of maternal depression and the chronicity of mothers' depression on children's risk for cognitive and language delays. Infancy is frequently identified as a sensitive period in which environmental stimulation has the potential to substantially influence children's cognitive and language development. However, children's exposure to chronic maternal depression seems to be associated with more problematic outcomes for children, perhaps because depression interferes with mothers' ability to respond sensitively and consistently over time. Consistent with this expectation, interventions targeting parenting practices of depressed mothers have been found to increase children's cognitive competence during early childhood. The current review provides a synthesis of the current state of the field regarding the association between maternal depression and children's cognitive and language development during early childhood.

KEY WORDS: maternal depression; cognitive development; language; early childhood; responsive parenting; prevention.

Despite cultural representations of motherhood as a joyous experience, pregnancy and childbirth are increasingly identified as risk factors for depression and depressive symptoms. Such findings are alarming given that clinically significant episodes of depression have been linked to increased risk for experiencing subsequent depressive episodes (Philipps & O'Hara, 1991) and children of depressed mothers' are at increased risk for internalizing or externalizing problems (e.g., Downey & Coyne, 1990; Goodman & Gotlib, 1999). Comparatively, little empirical research has specifically focused on examining the implications of mothers' depression for children's emerging cognitive and language competencies during early childhood.

Current theory and research concerning the impact of the timing of maternal depression (i.e., prenatal, postpartum, vs. chronic depression) on children's cognitive and language development during the infant and toddler years will be reviewed. The early years of life are selected because these years are most frequently identified as a point of entry on a pathway of increasing risk for later cognitive and language difficulties. The review first discusses the different ways depression has been operationalized. Next, the review will clarify differences in implications of maternal depression on the basis of the timing of the depressive symptoms (i.e., prenatal, postpartum, and chronic depression). Next, key mediators and moderators needing greater empirical attention

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will be discussed. Finally, progress in prevention and intervention for depressed mothers and their young children as well as implications for future research will be described.

PRENATAL, POSTPARTUM, AND CHRONIC DEPRESSION: OPERATIONAL DISTINCTIONS

Depressed mood has been defined as feelings of sadness, hopelessness, and/or discouragement (American Psychiatric Association, 2000). Both categorical and continuous approaches to the measurement of depression are used in empirical research. Categorical approaches often specifically assess the presence of major depressive disorder (MDD) in mothers, requiring the presence of at least one major depressive episode occurring in the absence of psychotic symptoms and/or a history of manic symptoms (American Psychiatric Association, 2000). During adulthood, MDD is almost twice as prevalent in women as men (Kessler et al., 1994). One quarter to one third of women are expected to experience an episode of major depression at some point in their lives (Kendler & Prescott, 1999). Major depression may appear at any age, but on average, first depressive episodes occur during the mid-20s (American Psychiatric Association, 2000), making the diagnosis particularly likely during childbearing years.

In contrast, continuous approaches consider variations in subclinical levels of symptoms of depression occurring during a specified period of time. Subclinical depressive symptomology, in contrast to MDD, includes depressive symptoms that do not meet criteria for a clinical diagnosis. Despite lack of diagnosis, elevated depressive symptoms on their own carry functional significance because subclinical levels of depressive symptoms have been linked to considerable social impairment (West & Newman, 2003) and increased risk for major depressive disorder and other mental diagnoses (Kessler, Zhao, Blazer, & Swartz, 1997). Even when depressive symptoms are below threshold for a clinical diagnosis, women are at greater risk than men for experiencing them (Kessler et al., 1997).

As both clinical and subclinical levels of depressive symptomology are associated with social impairment, studies using both categorical and continuous approaches are included in this review. Both clinical and subclinical depressed mood may adversely affect pregnant women's and new mothers' physical health and behavior, which creates the potential for contributing to cognitive and language deficits in the offspring via a wide array of physiological and environmental mechanisms. The form and severity of child cognitive/language deficits may vary depending on whether depressive symptoms appear during pregnancy, after pregnancy, or throughout early childhood. The subsequent sections will consider the consequences of mothers' experiences of depression during the prenatal and postpartum periods as well as chronically on children's emerging cognitive and language development.

PRENATAL DEPRESSION AND CHILDREN'S COGNITIVE AND LANGUAGE DEVELOPMENT

Recent empirical evidence suggests that approximately 20% of pregnant women experience clinically significant symptoms of depression (Marcus, Flynn, Blow, & Barry, 2003). Although prenatal depressive symptoms may occur during any trimester, increases in depressive symptoms seem to be most likely between 18 and 32 weeks of pregnancy, or during mothers' second trimester (Evans, Heron, Francomb, Oke, & Golding, 2001). Interestingly, women early their pregnancy (median gestational week 15 or less) experience rates of clinically significant depressive symptoms similar to those in the general public ($\sim$8%; Rubertsson, Waldenström, & Wickberg, 2003). For many women, then, pregnancy is not a period filled with excited anticipation of the coming child.

The lack of joy surrounding pregnancy need not be surprising given that approximately 50% of births in the United States are unplanned (Henshaw, 1998). Moreover, not all expectant mothers have adequate social support and financial resources necessary to carry and raise a child. Depressive symptoms during pregnancy are particularly likely in women who are African American or Hispanic, teenagers, or unmarried (Halbreich, 2004). Even women for whom the pregnancy was intentional and who have sufficient support and resources may become overwhelmed emotionally by the physical changes brought on by pregnancy. For instance, women experiencing morning sickness during the first trimester have been found to report greater levels of depressed mood (Abraham, Taylor, & Conti, 2001; Chou, Lin,

Cooney, Walker, & Riggs, 2003). Concerns about eating and weight gain are common among pregnant women (Abraham et al., 2001) and women who express more anxiety about changes to their bodies seem to be at greater risk for depressive symptoms (Walker, Timmerman, Kim, & Sterling, 2002). Experiencing depressive symptoms during pregnancy may indirectly affect cognitive and language development during childhood by affecting fetal development.

Women experiencing increases in depressive symptoms during pregnancy have been found to seek less prenatal care (Miller, 1992), gain less weight (Walker, Cooney, & Riggs, 1999), use more drugs and alcohol, smoke more cigarettes, and feel more stressed (Zuckerman, Amaro, Bauchner, & Cabral, 1989) than mothers experiencing little to no depression during pregnancy. Increased substance use and stress has been found to increase risk for premature birth and low birth weight (Orr & Miller, 1995; Singer et al., 1999). In addition to affecting mothers' health-related behaviors during pregnancy, variations in hormonal production associated with maternal stress and depression may increase children's risk for cognitive and language delays by impacting fetal growth rates and fetal development of biological systems related to attention.

Specifically, both the experiences of depression and stress during pregnancy have been shown to affect the quantity of maternal cortisol released in the bloodstream (Diego et al., 2004; Harris et al., 2000). Cortisol production increases during times of stress (Nelson, 1995) and elevated cortisol also is common among depressed individuals (Carroll, 1980; Ktiouet, 1984). Elevated maternal cortisol levels during pregnancy are concerning in that higher levels of cortisol have been linked to slower fetal growth (Gitau, Cameron, Fisk, & Glover, 1998; Trainer, 2002) and premature birth (de Weerth, van Hees, & Buitelaar, 2003). Birth weight has been positively associated with a variety of later cognitive and language test scores (Jelliffe-Pawlowski & Hansen, 2004; Lawlor, Bor, O'Callaghan, Williams, & Najman, 2005; Shenkin, Starr, & Deary, 2004), with children of low birth weight experiencing more cognitive and language delays.

Perhaps more alarming, the level of maternal cortisol to which fetuses are exposed during pregnancy may affect the development of the hypothalamic–pituitary–adrenal (HPA) axis, or the system responsible for modulating cortisol. Maternal cortisol levels have been positively correlated with fetal and infant cortisol levels (Field et al., 2004; Gitau et al., 1998; Lundy et al., 1999), suggesting effects on HPA axis functioning. The HPA axis serves a critical function of mobilizing an individual's resources to prepare for impending challenges. Once challenges are met, the HPA axis downregulates cortisol via a negative feedback loop (Nelson, 1995; de Kloet, Oitzl, & Joels, 1999; Erickson, Drevets, & Schulkin, 2003). Increases in cortisol, then, are not necessarily maladaptive; however, elevated cortisol levels that do not match the stress needs of a given situation reflects maladaptive HPA functioning.

Scientists have argued that maternal stress, depression, and/or anxiety during pregnancy may result in programming effects on the HPA axis (O'Connor, Heron, Golding, Glover, & the ALSPAC Study Team, 2003). In other words, depression during pregnancy may program the developing fetal HPA axis to be more reactive to stress, resulting in children becoming more easily over-aroused across a variety of nonthreatening situations, including learning situations. Chronic and more frequent HPA activation may interfere with children's development of learning and memory consolidation as well as executive functioning by interfering with the critical synaptic process of long-term potentiation (Blair, Granger, & Peters Razza, 2005). In addition, frequent HPA activation may interfere with children's attempts to retrieve previously encoded information to effectively exhibit learning (Quas, Bauer, & Boyce, 2004).

To summarize, mothers' physical and emotional health during pregnancy may indirectly affect children's risk for later cognitive difficulties by affecting the fetus's physiological development. Specifically, sustained feelings of stress and depression during pregnancy not only undermine mothers' physical health care behavior but also may compromise the developing HPA axis by making the axis more sensitive to environmental stressors. An over reactive HPA axis interferes with children's emerging cognitive skills by making children more reactive to stressful situations, less able to focus and sustain attention, and less able to perform complex cognitive tasks (e.g., executive functioning deficits). A reactive and demanding infant may pose challenges that continue to exceed mothers' capabilities. Mothers who do not experience prenatal depression may have children with a less sensitive HPA axis; however, postpartum depression may introduce a unique set of factors which affect children's cognitive growth.

POSTPARTUM DEPRESSION: IMPLICATIONS FOR INFANTS' EMERGING COGNITIVE AND LANGUAGE SKILLS

A number of mothers either continue to experience depressive symptoms following childbirth or experience their first bout of depression during the postpartum period. The postpartum mood syndromes currently recognized by professionals, but not appearing in official classification schemes, include postpartum blues, postpartum depression, and postpartum psychosis. *Postpartum blues* involves a mild emotional disturbance appearing in the first week following childbirth. This syndrome lasts from a few hours to 10 days and typically includes crying, confusion, mood lability, anxiety, and depressed mood (Kennerley & Gath, 1989a; O'Hara, Schlecte, Lewis, & Wright, 1991; Payne, 2003). Postpartum blues have been reported to occur in 20–80% of new mothers (O'Hara, Zekoski, Philipps, & Wright, 1990; Payne, 2003; Stein, Marsh, & Morton, 1981), making postpartum blues the most common and least severe postnatal depressive syndrome. Postpartum blues may be rooted in biological factors unique to the childbirth experience, especially the abrupt drop in levels of circulating hormones following delivery (Payne, 2003).

Women across various economic and cultural backgrounds seem to be equally affected by postpartum blues (Seyfried & Marcus, 2003). Women experiencing postpartum blues seem to be somewhat more likely to have poor family or marital relations and to have experienced mood disturbances before or during pregnancy (Ballinger, Kay, Naylor, & Smith, 1982; Cutrona, 1983; Handley, Dunn, Waldron, & Baker, 1980; Kennerley & Gath, 1989b; Nott, Franklin, Armitage, & Gelder, 1976). Currently, no available evidence links postpartum blues to adverse effects on children and the condition on its own will not be discussed further.[4]

Women who experience postpartum blues may be at increased risk for developing a more serious condition of postpartum depression. As many as 20% of women with postpartum blues develop the more serious condition of postpartum depression (Campbell & Cohn, 1991; Josefsson, Berg, Nordin, & Sydsjo, 2001; O'Hara et al., 1991; Robinson & Stewart, 1986). *Postpartum depression* reflects a nonpsychotic depressive episode beginning in or lasting into the postnatal period (O'Hara, Neunaber, & Zekoski, 1984; Cox, Murray, & Chapman, 1993). The symptoms of postpartum depression match those of a major depressive episode and include sadness, loss of interest in previously pleasurable activities, sleep disturbance, loss of energy, weight changes, concentration problems, agitation, feelings of worthlessness or guilt, or thoughts of suicide (Clay & Seehusen, 2004). Like postpartum blues, postpartum depression seems to be related to the hormonal changes associated with childbirth (Payne, 2003). In contrast to postpartum blues, however, women experiencing postpartum depression may be at greater risk for later episodes of depression (Philipps & O'Hara, 1991). That is, women at greatest risk for postpartum depression tend to have a history of psychiatric problems, are more likely to have experienced depressed mood during pregnancy and marital discord, and have fewer sources of social support (Da Costa, Larouche, Dritsa, & Brender, 2000; Honey, Bennett, & Morgan, 2003; Seyfried & Marcus, 2003).

Mothers who experience postpartum depression may influence infants' emerging cognitive and language skills. Physiological and social factors seem to distinguish infants of mothers suffering from postpartum depression. Physiologically, infants of depressed mothers have been found to exhibit lower vagal tone (Field, 1995) and less left frontal electrical brain activation (Dawson et al., 2003). Socially, depressed mothers seem to be more irritable and less responsive to their developing infants' needs (e.g., NICHD Early Child Care Research Network, 1999). The role of physiological and social risk factors associated with postpartum depression on emerging cognitive and language competence will be subsequently described.

Infant Physiological Correlates of Postpartum Maternal Depression

Newborn infants of depressed mothers seem to have distinct biological response patterns. Characteristically, newborn infants of depressed mothers have been observed to exhibit lower cardiac vagal tone than newborns of comparison mothers (Field, 1995). Infants typically exhibit an increase in vagal tone between 3 and 6 months, a pattern not observed in

[4]Postpartum psychosis is a syndrome that involves delusions, hallucinations, and gross functional impairment (Brockington et al., 1981) and symptoms are often consistent with a bipolar disorder (Benvenuti et al., 1992; Kendell, Chalmers, & Platz, 1987). Postpartum psychosis rarely occurs (1–2 cases per 1000 births; Kendell et al., 1987; Kumar, 1994) and the duration tends to be temporary.

infants of depressed mothers (Field, 1995). In addition to maintaining slowed heart rate, the vagus nerve activates facial expressions and vocalization. Six-month-old infants with reduced vagal tone have been found to be less facially and vocally expressive (Field, 1995, 2002), a situation that may interfere with mothers' abilities to accurately interpret and respond to their infants' needs. Relevant to cognitive and language development, vagal regulation has been shown to support infant information processing (Bornstein & Suess, 2000) and to predict toddlers' language scores (Suess & Bornstein, 2000). Physiological self-regulation in the form of vagal tone may facilitate infants' abilities to manage internal arousal in order to adequately attend to and extract environmental information (Bornstein & Suess, 2000). Although more research is needed in this area, vagal tone deficits found in infants of depressed mothers may partially contribute to impaired maternal responsiveness and indirectly affect children's developing cognitive and language abilities.

Maternal depression also may affect infants' electrical brain activity as measured using the electroencephalogram (EEG). Recent EEG research has linked electrical frontal brain activity in the right and left hemispheres to meaningful behavioral and emotional patterns. Left frontal electrical activity is generally associated with approach and positive emotionality, whereas activity in the right frontal hemisphere appears related to withdrawal and negative emotionality (Field, Fox, Pickens, & Nawrocki, 1995; Jones, Field, & Davalos, 2000). Typically, infants exhibit greater left than right frontal brain activity (Dawson et al., 1999). Infants and toddlers of depressed mothers have been found to exhibit less left frontal electrical brain activation and more right frontal activation than children of nondepressed mothers (Dawson et al., 2003; Dawson, Frey, Panagiotides, Osterling, & Hessl, 1997; Dawson et al., 1999; Dawson, Panagiotides, Grofer Klinger, & Hill, 1992; Field et al., 1995; Jones, Field, Fox, Lundy, & Davalos, 1997). These EEG asymmetries suggest a tendency to favor withdrawal over approach behaviors and negative affect over positive emotions. Tendencies towards withdrawal and negative affect are significant for cognitive and language development because negative emotional states likely disrupt infants' readiness to process and respond to external stimuli (Dawson et al., 1992). In other words, infants of depressed mothers may be less likely to approach and process novel objects and situations and, thus, benefit less from early learning opportunities.

Taken together, the vagal tone and electrical brain activity of newborn infants of depressed mothers suggest a reduced ability to learn from and act on their environment. These physiological differences also are associated with reduced self-regulation, emotional expression, and approach behaviors as well as more unpredictable and unpleasant infant behavior that may interfere with early mother–infant interactions. Irritable and taxing behaviors displayed by infants of depressed mothers may serve to intensify or maintain maternal depressed mood and interfere with the emergence of coordinated parent–infant interaction.

Social Correlates of Postpartum Depression

Recent empirical research points to the importance of the quality of early social interactions on children's long-term cognitive development (e.g., Kurstjens & Wolke, 2001; Murray, Hipwell, & Hooper, 1996). The negative affect, irritability, and social withdrawal associated with maternal depression may interfere with depressed mothers' ability to sensitively respond to the needs of their infants (Kurstjens & Wolke, 2001; NICHD Early Child Care Research Network, 1999). Characteristically, mothers suffering from postpartum depression are less contingent, less positive, and more negative during interactions with their infants and have been found to use too little or overly excessive levels of stimulation (Campbell, Cohn, & Meyers, 1995; Cohn, Campbell, Matias, & Hopkins, 1990; Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Cohn & Tronick, 1989; Field, Healy, Goldstein, & Guthertz, 1990; Field et al., 1988). Such parenting behaviors may interfere with children's emerging cognitive skill in that mothers fail to teach children logical consequences to behavior. In contrast, warm, responsive, and contingent maternal behavior has been positively associated with children's emerging cognitive and language competence (Bornstein & Tamis-LeMonda, 1989; Hart & Risley, 1995; Landry, Smith, Miller-Loncar, & Swank, 1997; Landry, Smith, Swank, Assel, & Vellet, 2001; Murray & Hornbaker, 1997).

Infant feeding situations provide mothers with opportunities for high levels of mutual mother and infant engagement. Breastfeeding, in particular, seems to be linked to better social and cognitive outcomes for infants. Compared to nondepressed mothers, depressed mothers have been found to

breastfeed their infants significantly less frequently (Campbell & Cohn, 1997; Field, 2002). Higher levels of maternal depression during the days following childbirth have been associated with lower quantities of breast milk and a longer time to initiate breastfeeding (Feldman & Eidelman, 2003). Breastfeeding has been found to enhance children's cognitive development, perhaps because of nutritional benefits associated with breast milk or increased opportunities for mother–infant interaction (Feldman & Eidelman, 2003; Hay et al., 2001). Despite potential concerns that the biochemistry of depressed mothers' breast milk may be altered by their negative mood state (Hart et al., 2004) the benefits of breastfeeding appear to outweigh the risks. That is, Hay and colleagues (2001) found that breastfeeding during infancy was associated with greater cognitive competence as late as age 11, independent of maternal depression.

Interestingly, low birth weight infants may benefit from breastfeeding more than normal birth weight infants (Andersen, Johnstone, & Remley, 1999). As discussed previously, prenatal maternal depression has been found to elevate risk for low birth weight. Depression continuing from pregnancy to the postpartum period, then, may decrease the likelihood of infant breastfeeding to the very infants who may benefit most.

In summary, postpartum maternal depression may adversely affect children's cognitive and language development in a number of ways. The most consistent theme emerging from current literature is that mothers experiencing postpartum depression are less able to meet their infants' emotional and physical needs. Less responsive parenting during infancy may affect neurological development and/or fail to shape the environment so as to optimize learning opportunities. Despite these compelling notions, the literature on the link between postpartum depression and children's cognitive development over time has been inconsistent, with some studies reporting significant associations up to age 11 (e.g., Hay et al., 2001) and others reporting no association between postpartum depression and later cognitive competence by age 5 (e.g., Murray, Hipwell, Hooper, Stein, & Cooper, 1996). Importantly, effects sizes appear to be small for postpartum depression and children's cognitive development (Grace, Evindar, & Stewart, 2003). Furthermore, postpartum depression per se does not appear to predict children's cognitive performance in many studies, yet chronicity and severity of maternal depression appear to exert considerable influence (Grace et al., 2003). This is not surprising given that recent evidence indicates that responsive parenting across the early childhood period enhances children's cognitive and language development (Cicchetti, Rogosch, & Toth, 2000; Landry et al., 2001). Consequently, children most at risk for cognitive and language deficits are likely those of mothers exhibiting depressed mood throughout their early childhood years.

CHRONIC MATERNAL DEPRESSION: CONSEQUENCES FOR CHILDREN'S COGNITIVE AND LANGUAGE COMPETENCE

The effects of depressed mood on parenting may be particularly pronounced when mothers experience chronic depression (NICHD Early Child Care Research Network, 1999; Petterson & Albers, 2001). Chronic maternal depression, for the purposes of this review, includes depression that persists beyond the postpartum period. In the Campbell et al. (1995) sample of 66 mothers depressed 2 months postpartum, 20 still exhibited clinically significant depression at a 6-month follow-up, 27 showed subclinical symptoms, and 19 of the mothers' depression had remitted. Given that the majority of these women experienced some degree of depressive symptomology 6 months after giving birth, attention to the risk factors for and potential consequences of chronic maternal depression on mother–child interactions is warranted.

Risk for chronic maternal depression seems to be associated with specific postpregnancy factors. Postpartum depression has been found to persist longer among women whose hormone levels are slower to return to prepregnancy levels (Wisner, Perel, Peindl, & Hanusa, 2004). Adverse childbirth experiences, including young maternal age at delivery, health complications for mother or baby, single parent status, poor social support, and accompanying marital, social, financial or health problems have been shown to increase risk for lifetime depression (Bernazzani & Bifulco, 2003). The hormonal variations in chronically depressed mothers suggest that the experiences of mothers experiencing postpartum depression likely apply to chronically depressed mothers. Additionally, the lack of social, financial, and practical support may interfere with mothers' ability to parent in a sensitive and responsive

manner. Consequently, mothers experiencing longer lasting and re-occurring depressive experiences are expected to experience substantially more difficulties parenting than mothers with brief experiences with depression.

Chronically depressed mothers may experience a greater depletion of energy to cope with the everyday demands of parenting than mothers experiencing a single depressive episode (NICHD Early Child Care Research Network, 1999). For example, prospective longitudinal studies have noted the lowest initial and overall levels of maternal sensitivity among women reporting chronic depression (Campbell et al., 1995; Frankel & Harmon, 1996; NICHD Early Child Care Research Network, 1999). Importantly, mothers whose depression had remitted by a 6-month follow-up appear to interact with their children in a manner comparable in sensitivity to nondepressed mothers (Campbell et al., 1995), suggesting that the depression per se may interfere with mothers' ability to respond sensitively to their infants. Chronically depressed mothers also seem to exhibit a drop in observed sensitivity from the time their children are 15 months to 24 months of age, indicating the potential for cumulative effects of depression on parenting (NICHD Early Child Care Research Network, 1999). A lack of maternal sensitivity during the infancy and toddler periods is concerning. Maternal sensitivity has been shown to account for differences in school readiness and verbal comprehension among children of never depressed, sometime depressed, or chronically depressed mothers, and appears to moderate group differences in expressive language (NICHD Early Child Care Research Network, 1999).

In addition to general patterns of sensitive parenting (e.g., global ratings of sensitivity), recent evidence suggests that interactions between chronically depressed mothers and infants and toddlers differ qualitatively from interactions between nondepressed mothers and their infants and toddlers. The pattern of less sensitive and responsive parenting, characteristic of chronically depressed mothers, may represent a point of entry on to developmental pathways of risk for cognitive and language problems, particularly when such parenting emerges during infancy. The following sections will review the developmental significance of specific parenting styles for children's emerging cognitive and language development during early childhood and beginning in infancy.

NEWBORN PERIOD: BIRTH TO 3 MONTHS

Mothers' ability to respond positively to their newborns' bouts of distress and to engage in reciprocal interactions may stimulate cognitive development by motivating infants to learn to communicate. For instance, the work of Feldman and colleagues suggests that children's cognitive and language development during the newborn period is affected by mothers' use of (a) positive affect, (b) infant-directed speech, and (c) affectionate touch (Feldman & Eidelman, 2003; Feldman, Eidelman, & Rotenberg, 2004; Feldman, Eidelman, Sirota, & Weller, 2002). Depressed and nondepressed mothers' interactions seem to vary qualitatively across these domains, variations that may systematically influence children's interest in communication and learning about their environments.

Affect

Depressed and nondepressed mothers vary in their levels of expressed negative affect. Specifically, depressed mothers have been found to exhibit negative affect more frequently than nondepressed mothers do (Campbell, Cohn, Flanagan, Popper, & Meyers, 1992; Hay, 1997; Field, 1995; Murray, Fiori-Cowley, Hooper, & Cooper, 1996; Murray, Kempton, Woolgar, & Hooper, 1993; Radke-Yarrow, Nottelmann, Belmont, & Welsh, 1993). Negative maternal affect seems to diminish infants' motivation and interest in communicating and increase infants' distress and arousal (Field, 1995; Gauvain, 2001). Moreover, frequent bouts of infant distress seem to interfere with infants' ability to process information (Bugental, Blue, Cortez, Fleck, & Rodriguez, 1992; Hay, 1997) and increase infants likelihood of forgetting recent information (Fagen, Ohr, Fleckenstein, & Ribner, 1985; Hay, 1997; Singer & Fagen, 1992). Thus, infants of chronically depressed mothers may be more vulnerable to learning difficulties in part because the high levels of negative maternal affect increases infants' arousal to levels that interfere with infants' early learning efforts.

Verbal Communication

Depressed mothers seem to use infant-directed speech less effectively than nondepressed mothers. During interactions with infants, chronically depressed mothers seem to be less facially and

vocally expressive, to be more likely to speak with a "flat" tone of voice (Breznitz, 2001; Field, 1995; Martinez et al., 1996; Puckering, 1989), and to use less infant-directed speech (Bettes, 1988). Infant-directed speech, often called "motherese" or "parentese," differs from adult-directed speech in that parents use a greatly exaggerated prosody (Kaplan, Bachorowski, Smoski, & Hudenko, 2002). Infant-directed speech is more effective in eliciting infant attention (Cooper & Aslin, 1990). The combination of flat affect, less animation, and a lack of infant-directed speech have been linked to less associative learning among infants of depressed mothers (Kaplan et al., 2002).

Although infants of depressed mothers may experience less associative learning, they do not lack the capacity to learn associatively. Specifically, Kaplan and colleagues (2002) found that infants of depressed mothers demonstrated more associative learning when paired with a nondepressed mother, but not when paired with their own or another depressed mother. Importantly, the quality of mothers' speech directly affected learning. When the pitch and tone of a depressed mother's voice lacks a sense of urgency or attentional focusing, the influence of speech on learning is limited (Kaplan, Bachorowski, Smoski, & Zinser, 2001; Kaplan, Bachorowski, & Zarlengo-Strouse, 1999; Kaplan et al., 2002). Infants of chronically depressed mothers may experience learning difficulties in part because of they are less exposed to the facilitative components of infant-directed speech.

Physical Touch

Early touch has been shown to exert lasting effects on cognitive development (Caulfield, 2000), possibly because maternal touch stimulates cortical growth and synaptic proliferation (Weiss, Wilson, & Morrison, 2004). The newborn period is associated with vast neural development. Although partially affected by genetic factors, neural development is shaped by environmental stimulation (Nelson, 2000; Nelson & Bosquet, 2000; Weiss et al., 2004). Animal studies demonstrate that more early tactile stimulation is associated with larger cortical size and more diffused patterns of neural connections (Greenough, 1990; Nudo, Milliken, Jenkins, & Merzenich, 1996). Stimulating touch also may have the immediate consequence of facilitating attention and readiness for environmental engagement (Weiss et al., 2004), potentially pulling infants into a state in which they are particularly primed to learn.

The benefits of early tactile stimulation for human infants have been investigated mainly for preterm infants. Preterm infants receiving regular massage in the neonatal intensive care unit are more alert and responsive, and exhibit better motor maturation (Scafidi & Field, 1996; Wheeden et al., 1993). One year later, infants massaged as newborns also display higher motor and cognitive test scores (Field, Scafidi, & Schanberg, 1987). In contrast, depressed mothers have been found to touch their infants significantly less than nondepressed mothers; when depressed mothers do touch their babies, this touch tends to be less pleasant and more jarring or harsh (Field, 1997). Thus, chronically depressed mothers' pattern of physical touch may indirectly affect children's later cognitive development by affecting infants' neural development and/or readiness for learning.

MIDDLE INFANCY: 3 MONTHS TO 6 MONTHS

During their next 3 months of life, infants become increasingly capable of sustained face-to-face interactions. Infants' cognitive skills are enhanced when mothers use face-to-face exchanges to model the give-and-take of social exchanges (Feldman et al., 2004; Feldman & Greenbaum, 1997; Feldman, Greenbaum, Yirmiya, & Mayes, 1996). Importantly, mothers facilitate cognitive and language advances by adapting and responding to infants' cues and inputs.

According to Vygotsky (1978), mothers (and other experienced interaction partners) support infants' budding skills and help them to extend skills into higher degrees of competence. For instance, during this early infant period, infants lack the ability to associate two events if the two events occur too far apart from each other; infants learn associations when mothers create contingent interactions (Finkelstein & Ramey, 1977). Such early mother–infant interactions teach infants to expect predictable responses from others, or begin to teach infants about the rhythms and routines of human social interaction (Hay, 1997). Inconsistent maternal responding, in contrast, fails to provide infants with opportunities to perceive order and predictability in their environment. Uncoordinated, unresponsive, and noncontingent maternal responses to infants' cues tend to characterize the interactional patterns between depressed mothers and their infants (Hay, 1997).

In addition to teaching children about the reciprocal nature of interactions, coordinated and synchronized parent–infant interactions seem to encourage symbolic and representational thought. That is, children's ability to perceive order from seemingly disordered, unrelated events is enhanced by repetitive exposure to similar experiences (Feldman & Greenbaum, 1997; Vygotsky, 1978). The noncontingent interactional style observed in depressed mothers may impede their infants' development of symbolic thought.

LATE INFANCY: 6 MONTHS TO 12 MONTHS

Dramatic changes in children's ability to communicate occur during the second half of infants' first year of life. During this developmental period, infants begin looking toward the locations attended to by adults, mimic adult actions with objects, and begin to active direct adult attention to objects (Carpenter, Nagell, & Tomasello, 1998; Gauvain, 2001). Infants' nascent abilities for sharing attention and social referencing allow their exploration of novel objects to become interactive exercises. When mothers engage in joint manipulation of objects with their infants, mothers support exploratory skills and enhance cognitive development (Feldman, et al., 2004; Feldman, Weller, Sirota, & Eidelman, 2002; Kopp & Vaughn, 1982).

Joint attention, or mothers' abilities to coordinate perspectives and actions with children (Bruner, 1975), seems to enhance children's language development (Baldwin, 1995; Carpenter et al., 1998; Goldsmith & Rogoff, 1997; Mundy, Fox, & Card, 2003). Depressed mothers experience more difficulty establishing and maintaining joint attention and providing contingent responses to their children's behaviors (Goldsmith & Rogoff, 1997; Henderson & Jennings, 2003; Jameson, Gelfand, Kulcsar, & Teti, 1997). Characteristically, depressed mothers engage in less coordinated joint attention and maintain less awareness of their children while a competing focus of attention is present than nondepressed mothers (Goldsmith & Rogoff, 1997; Henderson & Jennings, 2003). As a result, less feedback or reinforcement is provided for infants' behaviors, like exploration and manipulation of objects as well as eventual attempts at speaking. When depression is chronic in duration, the lack of coordinated, synchronized mother–child interactions results in a number of missed opportunities for mothers to shape and promote child learning.

TODDLERHOOD: THE SECOND AND THIRD YEARS

The beginning of children's second year of life is associated with increases in symbolic thought via words, gestures, and early symbolic or pretend play (Feldman et al., 2004). Children's increased ability to communicate encourages a new repertoire of mother–child interactional activities, like pretend play and shared book reading. Both pretend play and shared book reading provide mothers with opportunities to stretch children's cognitive abilities. Mothers' own depression may interfere with their ability to use play and reading opportunities to extend children's cognitive and language skills.

Play Practices

Important developmental changes in infants' play activities occur during their second year of life. During this period, young children shift from relying heavily on functional play to simple symbolic play (Feldman et al., 2004; Fenson & Ramsay, 1980; McCune, 1995). Symbolic play allows young children to think abstractly or "as if" (Bretherton, 1984; Tingley, 1994). Although some have argued that toddlers' capacity for symbolic play rests more in their own maturing cognitive abilities than social interaction (e.g., Piaget, 1952), mothers seem to facilitate toddlers' use of symbolic play (Dunn, 1986; Dunn & Dale, 1984; Dunn & Wooding, 1977; Nelson & Seidman, 1984). By playing with their toddlers, mothers encourage cognitive and language competency by stretching children's level of play. That is, children's play with their mothers tends to involve more complex, varied, and sustained activity than solitary play (Dunn & Wooding, 1977; Tamis-LeMonda, Užgiris, & Bornstein, 2002). In other words, children are challenged more by playing with mothers than by playing alone.

Depressed mothers, particularly those with more severe and chronic symptoms, are less able to engage in symbolic play with their young children (Tingley, 1994). In addition, toddlers of chronically depressed mothers exhibit lasting deficits in their own capacity to engage in symbolic play (Tingley, 1994). Chronically depressed mothers may frequently leave their children to play by themselves or only half-heartedly play with them when prompted. Thus, children of depressed mothers

may miss important opportunities to learn abstract thought or to advance language skills.

Reading Practices

During the early toddler period, mothers begin to read more frequently to their children and, as such, reading provides new contexts for mother–child interactions. Empirical evidence indicates tremendous benefits of early reading on children's cognitive and language development; mothers who read more frequently to their children have children with more sophisticated language abilities (Bus, van IJzendoorn, & Pelligrini, 1995; Karrass & Braungart-Rieker, 2005; Scarborough & Dobrich, 1994) and who demonstrate greater reading ability upon entry into school (Bus, 1995; Bus & van Ijzendoorn, 1988; Stevenson & Fredman, 1980). Early shared book reading encourages joint attention, exposes children to complex language that varies from everyday spoken language, provides opportunities for vocabulary instruction, and/or establishes regular reading habits (Karrass & Braungart-Rieker, 2005).

Depressed mothers of 1–3-year-old children have been found to read significantly less frequently to their children than nondepressed mothers (Bigatti, Cronan, & Anaya, 2001). Moreover, Bigatti and colleagues (2001) found that when depressed mothers did read to their children, depressed mothers read for shorter periods of time and asked their children fewer questions about the story. Similarly, Reissland, Shepherd, and Herrera (2003) found that depressed mothers differed from nondepressed mothers in the quality of their book reading. Although depressed mothers read more words per page, nondepressed mothers' reading included more pauses to ask children questions about the story. Depressed mothers also failed to adjust their speech based on the age of the child, perhaps reflecting a less child-centered approach towards reading (Reissland et al., 2003). Taken together, children of chronically depressed mothers may enter preschool and/or elementary school with less exposure to books and reading and less understanding of language than their same-aged peers.

To summarize, exposure to maternal depression, whether prenatally, postnatally, or chronically, places children at increased risk for experiencing cognitive and language delays. The consequences of exposure to maternal depression are likely additive, with unique risks associated with each developmental period. The frequency, severity, and duration of chronic depression may result in more profound cognitive and language impairments for children, however, empirical research has not evaluated the consequences of timing of exposure to depression and children's cognitive and language development. That is, taken together, the data presented suggests a troubling picture for children of depressed mothers and identify specific links between characteristics of depressed mothers and children's learning. However, comprehensive, longitudinal studies evaluating the consequences of maternal depression during the prenatal, postnatal, and/or chronically have not been undertaken. Such studies are clearly needed to better understand the additive, interactive, and cumulative effects of exposure to maternal depression during the infancy period on emerging cognitive and language skill.

Although direct and indirect effects of maternal depression on children's cognitive and language development have been supported, risk and protective factors may exacerbate or minimize such associations. The following section provides a brief overview of characteristics that may mediate or moderate the associations between depression and cognition.

POTENTIAL MEDIATORS AND MODERATORS OF MATERNAL DEPRESSION AND CHILDREN'S COGNITIVE AND LANGUAGE DEVELOPMENT

Although the preceding sections provide some support that maternal depression and associated physiological factors and parenting styles interfere with cognitive and language development during early childhood, the association between maternal depression and children's cognitive adjustment is likely not direct or linear. Quite possibly genetic factors, mothers' education, children's gender, families' economic status, and the involvement of other adults affect the association between mothers' depressed mood and children's cognitive growth. The possibility that each of these factors may affect the magnitude of the association between depression and cognition will be considered.

Genetic Influences

Although both depression (Lesch, 2004) and cognitve competence demonstrate a high degree of heritability (Price, Dale, & Plomin, 2004; Scarr,

1992), risk for depression and level of cognition are affected by environmental influences (e.g., Scarr, 1992). Several mechanisms may explain the association between maternal depression and child cognition. First, passive gene-environment (G-E) correlation may explain associations between mothers' and children's behavior because mothers provide children's genes and environment that is likely suited to their children's genetic makeup (Reiss, 1995). Second, evocative G-E correlations may account for similarity between mothers' and children's adjustment. Regarding evocative G-E correlations, children may evoke predictable responses from their environment that match their own genetic propensities (Silberg & Rutter, 2002). Behavior genetics research examining the extent to which covariation between mothers and children's behavior is tied to gene-environment correlation is lacking. The presence of passive or evocative G-E correlation would suggest that concordance between mothers' depression and children's cognitive and language proficiency results from similarity in genetic propensities. Alternatively, gene-environment interaction may be operating (e.g., Reiss, 1995). That is, under conditions of low maternal depression, genetic factors that promote more curiosity, persistence, and attentional focusing, or processes that promote and encourage cognitive growth are activated. Adoption designs may shed important light on the processes by which environmental characteristics enhance or diminish children's cognitive and language growth.

Mothers' Education

Mothers' level of education (perhaps a proxy for genetic effects) seems to affect children's cognitive and language development during early childhood. Although maternal education appears unrelated to very early (before 9 months) cognitive status (Mayes & Bornstein, 1995), a statistically significant association between mothers' education and children's cognitive skill emerges from 9 months onward (Roberts, Bornstein, Slater, & Barrett, 1999). Interestingly, Hay and Kumar (1995) report that earlier findings linking maternal depression to poorer child cognitive development (e.g., Cogill, Caplan, Alexandra, Robson, & Kumar, 1986) were actually restricted to cases in which mothers had less education, demonstrating the necessity to include or control for maternal education when examining the association of any variable with children's cognitive adjustment.

Child Gender

The effects of maternal depression on children's cognitive and language development seems to be moderated by child gender; boys of depressed mothers have been found to be at greater risk for adverse cognitive and language outcomes than girls of depressed mothers (Hay, 1997; Kurstjens & Wolke, 2001; Murray, 1992; Sharp et al., 1995). Such findings may actually reflect inflation of normative gender differences in patterns of cognitive and language development, because girls tend to perform better than boys on cognitive and language tasks (Cornish et al., 2005; Hops, 1995). Nevertheless, child gender, if not accounted for, could influence overall patterns of results and hinder the interpretability of findings by skewing patterns of results.

Economic Status

Young children raised in poverty are repeatedly found to exhibit lower scores on measures on cognitive and language performance (Hart & Risley, 1995; Smith, Brooks-Gunn, & Klebanov, 1997). Consequently, poverty status may partially explain or attenuate the associations between maternal depression and children's cognitive and language development. Economic status moderates risk for adverse effects of maternal depression on children's cognitive and language competence, with children of depressed mothers in low SES families exhibiting lower cognitive and language scores than children of depressed mothers in higher SES families (Kurstjens & Wolke, 2001). Likewise, family affluence may protect against the negative consequences associated with exposure to maternal depression for children's cognitive and language development. Consistent with this notion, Petterson and Albers (2001) found that affluence generally protected children against the adverse effects of maternal depression, but not with severe maternal depression. More affluent families may have greater access to books, educational toys, and quality child care.

Father and Other Adult Involvement

When paired with a depressed mother, fathers' mental health and the presence of nondepressed childcare providers may protect children against the harmful effects of depression on children's

cognitive development. However, the buffering or protective effects of the quality of fathers, extended family members, and daycare workers on children's cognitive development are often neglected. An important empirical question is whether other adults in a child's daily life can compensate for suboptimal maternal functioning. Although fathers and other adult caregivers may not compensate for maternal intrauterine influences, close caring adults likely expose infants and toddlers to positive affect, infant-directed speech, affectionate or stimulating touch, contingent responding, joint attention, symbolic play, and shared book reading.

Expecting adult caregivers to protect against the harmful affects of maternal depression and children's cognitive development is not a farfetched assumption. The work of Kaplan and colleagues (2002) suggests that infants of depressed mothers learn when exposed to infant-directed speech from another adult. Similarly, increased father involvement has been found to moderate the association between maternal depression and childhood behavior problems (Jackson, 1999; Mezulis, Hyde, & Clark, 2004), however the protective affects of father involvement for children's cognitive and language development has yet to be addressed. Responsive day care instructors have been found to interact with infants who behave more positively and display greater activity levels than they do with their depressed mothers (Pelaez-Nogueras, Field, Cigales, Gonzalez, & Clasky, 1994). Grandparent and extended family contributions have been largely neglected in the literature, but similar associations could be expected particularly when grandparents and extended family members visit and interact with children regularly. Although far more research is needed in this area, increasing involvement of other caring adults in the lives of children of depressed mothers may safeguard against negative effects of maternal depression on child cognitive and language development.

MATERNAL DIAGNOSIS NEED NOT BE DESTINY: PROGRESS IN INTERVENTION AND PREVENTION

Taken together, the empirical research reviewed indicates that early exposure to maternal depression or depressive symptoms, whether prenatal, postpartum, or chronic, is associated with meaningful indirect effects on child cognitive and language development. Although the magnitude of the effects varies with the severity and duration of maternal depression, simply being carried or raised by a depressed mother does not necessarily place children on a path toward inevitable cognitive and language deficits. Recent evidence indicates that interventions targeting maternal depression and/or mother–child interactions during early childhood may minimize the negative impact of maternal depression on children's cognitive and language development (Bigatti et al., 2001; Cicchetti et al., 2000; Kaplan et al., 2001, 2002). The following sections will review the results of two promising intervention targeting cognitive and/or language development in toddlers and preschoolers of depressed mothers.

PROJECT PRIMER

Project PRIMER (Producing Infant/Mother Ethnic Readers) was a community-based literacy program targeting low-income families (Bigatti et al., 2001). The goal of Project PRIMER was to increase amount and quality of mother-child interactions and, consequently, improve children's language development among a sample of both depressed and nondepressed mothers (Bigatti et al., 2001). University student tutors were hired and trained to teach mothers literacy techniques to use while reading to their 1-, 2-, or 3-year-old children. At each visit, tutors modeled how to read to their children. Mothers were required to practice each technique in the presence of the tutor, who provided any necessary feedback. Over time, tutors taught mothers how to teach the child increasingly more complex concepts. Visits concluded by learning a new song. During each visit, tutors encouraged mothers to speak to their children frequently, read often, and ask their children slightly challenging questions. Mothers received a new children's book, copies of the materials used during the visit, and the words to the newly learned song (Bigatti et al., 2001).

Prior to the intervention, depressed mothers were less skilled than nondepressed mothers in their use of behaviors designed to promote child literacy (Bigatti et al., 2001). Promisingly, depressed mothers and their children appeared to benefit as much as nondepressed mothers and their children from Project PRIMER. Main effects for the intervention emerged such that both depressed and nondepressed groups demonstrated equivalent increases in their

literacy behaviors and their children's cognitive test scores (Bigatti et al., 2001).

Although depressed mothers participating in Project PRIMER received instruction in reading-related behaviors, they did not receive feedback or teaching regarding their affective tone or their communicational style in mother–child interactions not specifically related to reading. Cicchetti and colleagues (2000) have investigated an intervention addressing more general communication patterns often seen in depressed mothers, such as lack of positive affective expression and negative attributions of child behavior. Although Project PRIMER produced equivalent *gains* for children of both depressed and nondepressed mothers, Cicchetti and colleagues' program yielded equivalent *performance* for these two groups by the close of treatment. That is, children of depressed mothers in the following program actually matched their peers reared by nondepressed mothers in most domains on measures of cognitive performance as a result of the intervention.

TODDLER–PARENT PSYCHOTHERAPY

Cicchetti et al. (2000) examined the efficacy of Toddler–Parent Psychotherapy (TPP), an intervention designed to improve the mother–child relationship and communication patterns. On the basis of attachment theory, TPP was based on the notion that mothers act out their internal representational models of attachment relationships when interacting with their toddlers (Cicchetti et al., 2000). In other words, therapists can hypothetically surmise mothers' expectations for close relationships from the emotional quality and degree of responsiveness exhibited during interactions with their toddlers. Therapists promoted warm, positive emotional interactions between mothers and their toddlers. Mothers learned strategies designed to improve the quality of communication and interaction with their toddlers and widen their understanding of and response to child behavior and emotional communication (Cicchetti et al., 2000).

Mothers participating in TPP were provided with guidance and feedback regarding critical parenting practices. By encouraging more frequent mother–toddler interactions and teaching depressed mothers how to achieve more harmonious interactions, TPP facilitated increased opportunities for fostering toddler cognitive development (Cicchetti et al., 2000). Additionally, by helping depressed mothers create realistic expectations for their children's developmental abilities, TPP practitioners sought to increase the likelihood that subsequent mother-toddler interactions would optimize toddlers' cognitive skill level and foster self-efficacy and exploration.

In order to test the efficacy of TPP, three groups of mother-child dyads were recruited, an intervention group of depressed mothers, and two control groups, one depressed and one nondepressed. Participating children averaged 20.5 months. Mother-child dyads were followed longitudinally over an average of 57.7 weeks from the baseline assessment with an average of 45.6 intervention sessions conducted. Comparisons across the two control groups demonstrated expected findings. Although all three groups obtained equivalent cognitive test scores at baseline, by age 3, children of the depressed mothers (control group) demonstrated a decline in age expected cognitive skill whereas the children in the nondepressed control group demonstrated age expected increases.

Interestingly, by the end of the intervention, children in the depressed intervention group were nearly indistinguishable from the nondepressed control children in their cognitive functioning, although the children in the depressed intervention group did demonstrate lower verbal IQ scores than the children of the nondepressed control group (Cicchetti et al., 2000). The results of Cicchetti and colleagues' (2000) investigation suggest that cognitive deficits can be prevented by early introduction of a preventive intervention geared toward bettering the mother-child relationship.

GENERAL CONCLUSIONS

Mothers appear to be at heightened risk for depression in part because of the physical and emotional changes associated with pregnancy and parenthood. Children of depressed mothers are often identified as at risk for social and emotional difficulties; the present review illustrates how children of mothers depressed during and after pregnancy also appear at increased risk for cognitive and language problems, particularly when mothers' depression is chronic. Taken as a whole, the findings reviewed indicate that young children of depressed mothers are at risk for cognitive and language delays due to a wide variety of mechanisms, mechanisms that may operate in a additive or cumulative manner in increasing children's risk for delays. Potential mechanisms for adverse effects on cognitive and language development

include genetic risk, intrauterine environmental influences, reduced overall warmth and sensitivity, and qualitative and quantitative differences in a variety of specific maternal behaviors that shape early cognitive and language development.

Hope exists for young children of depressed mothers. Several factors likely protect against the harmful affects of exposure to maternal depression, like the involvement of nondepressed fathers or other adults in children's early lives. Furthermore, prevention and intervention in early childhood targeting parenting behaviors has been shown to bolster the cognitive and language skills of children of depressed mothers.

Because the efficacy of early prevention/intervention and protective factors appears supported, developmental scientists should further explore means for reducing risk for cognitive and language delays in children of depressed mothers. Additional research is clearly needed to more carefully delineate associations between maternal depression and children's cognitive and language development. Studies fully examining longitudinal influences of depressive symptomotology over time on children's cognitive and language development are lacking. Given the complex nature of mother-child interactions during pregnancy and beyond, studies disentangling genetic, intrauterine, and postnatal environmental influences are clearly needed. Because mothers' provide children with 50% of their genetic material and the intrauterine and postnatal environments, adoption designs may offer considerable promise. Adoption designs overcome limitations of family studies in that (1) genetic and intrauterine influences are separate from postnatal environmental influences, and (2) G-E correlations and interactions can be evaluated. An adoption study collecting substantial data regarding birth mother mood state, health, and activities during pregnancy may additionally distinguish genetic and intrauterine effects, offering hope that researchers may begin to better identify key factors at work and their overall relevance to later adjustment. Prospective studies beginning during pregnancy would be highly difficult to accomplish, but ideal for avoiding the potential bias stemming from retrospective reporting. With progress leading towards large, prospective, longitudinal genetically informed studies, researchers may begin to better integrate lines of work supporting the many ways in which maternal depression may adversely impact early cognitive and language development. Greater understanding of key mechanisms at work may have important implications for prevention and intervention efforts with pregnant women, new mothers, and their infants and toddlers.

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