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Maternal depression symptoms in early childhood and children's

cognitive performance at school entry: The role of maternal guidance


par

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Abstract

The mediating role of quality of guidance at 48 months was examined in the relationship between maternal depressive symptoms at 5, 17 and 42 months and children's receptive vocabulary, school readiness and short-term memory at 60 months. Participants consisted of 165 mother-child dyads from the Montreal area (Canada) recruited from a larger longitudinal study (n=572). Maternal depression symptoms were examined by the use of certain items from the *Center for Epidemiological Studies-Depression (CES-D)* screening scale (Radloff, 1977; Santé Québec, 1997). Maternal guidance was examined by the use of a 5-*point Quality of Guidance Scale* (Caron, Parent, Normandeau, Séguin & Tremblay, 2008; Parent & Caron, 2000) during two cognitive tasks: the dot-to-dot drawing task and the Mystero game (Lyons & Lyons, 1999). Children's receptive vocabulary was measured by the *Peabody Picture Vocabulary Test-Revised (PPVT-R)* (Dunn, Thériault-Whalen & Dunn, 1993), school readiness by the *Lollipop Test* (Chew & Morris, 1989; Venet, Normandeau, Letarte & Bigras, 2003) and short –term memory by the *Visually Cued Recall task (VCR)* (Zelazo, Jacques, Burack & Frye, 2002). Multiple linear regressions as well as the Sobel test were used. Results indicated that quality of guidance at 48 months fully mediated the relationship between maternal depression symptoms at 5 months and children's PPVT-R and Lollipop results at 60 months. The mediation hypothesis was rejected for the VCR measure. This study indicates that mothers experiencing early depression symptoms provide less guidance to their children and this in turn is related to less optimal receptive vocabulary and school readiness. Experimental interventions that focus on maternal guidance for these at risk children are proposed to test a causal model.

**Key words: Maternal depression, child cognition, quality of guidance, receptive vocabulary, school readiness, short-term memory**

Résumé

La présente étude examine la relation entre la dépression maternelle à 5, 17 et 42 mois et le vocabulaire réceptif, la préparation scolaire et la mémoire à court terme de l'enfant à 60 mois. De plus, le rôle médiateur de la qualité d'orientation à 48 mois est examiné. L'échantillon tiré d'une étude longitudinale plus vaste (n=572), comprend 165 dyades mères-enfants de la région urbaine de Montréal (Canada). Les symptômes de la dépression maternelle sont mesurés par une échelle de dépistage du *Center for Epidemiological Studies-Depression (CES-D)* (Radloff, 1977; Santé Québec, 1997). La qualité d'orientation est mesurée par des observateurs à l'aide d'une échelle en 5 points (Caron, Parent, Normandeau, Séguin & Tremblay, 2008; Parent & Caron, 2000) lors de deux activités: les jeux de dessins à numéros et Mystero (Lyons & Lyons, 1999). *LÉchèlle de Vocabulaire en Images Peabody (ÉVIP)* (Dunn, Thériault-Whalen & Dunn, 1993), le *Test Lollipop* (Chew & Morris, 1989; Venet, Normandeau, Letarte & Bigras, 2003) et le *Visually Cued Recall Task (VCR)* (Zelazo, Jacques, Burack & Frye, 2002) sont administrés à 60 mois pour mesurer trois dimensions du fonctionnement cognitif de l'enfant: le vocabulaire réceptif, la préparation scolaire et la mémoire à court terme. Des régressions linéaires multiples et le test de Sobel sont utilisés. Les résultats indiquent que la dépression maternelle à 5 mois prédit les résultats de l'enfant à l'ÉVIP, au Lollipop et au VCR. La qualité d'orientation joue un rôle médiateur dans cette relation pour le PPVT-R et le Lollipop à 60 mois. Finalement, l'hypothèse de médiation est rejetée pour l'association entre la dépression maternelle et le VCR. Cette étude indique que les mères souffrant de symptômes de dépression offrent une qualité moindre d'orientation à leurs enfants et que cette lacune est associée à un vocabulaire réceptif et à une préparation scolaire moins

optimale. Des interventions expérimentales portant sur l'amélioration de l'orientation maternelle sont proposées pour valider un modèle causal.

**Mots clés: dépression maternelle, cognition de l'enfant, qualité d'orientation, vocabulaire récéptif, préparation à l'école, mémoire à court terme**

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## Abbreviations

CES-D: Center for Epidemiological Studies-Depression

DSM: Diagnostic and Statistical Manual of Mental Disorders

PPVT-R: Picture Peabody Vocabulary Test Revised

VCR: Visually Cued Recall Task

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# GENERAL INTRODUCTION

Clinical depression is expected to become the second leading cause of disability worldwide (after heart disease) by the year 2020, according to the World Health Organization (Murray & Lopez, 1997). Depression is a serious, troublesome and sometimes incapacitating condition that has been associated with aberrations in biological, cognitive, socioemotional and representational developmental areas. These individuals often experience a dysphoric affect, helplessness, hopelessness and irritability (APA, 2000). Up to 20% of persons in the general population are expected to experience a major depression at least once in their life- time, with twice as many women as men. Depression is a highly recurrent condition with over 80% of cases experiencing more than one depressive episode (Belsher & Costello, 1988). Individuals with three or more previous depressive episodes have a relapse rate as high as 40% within 12–15 weeks after recovery (Keller et al., 1992) and rarely ever return to complete functioning without any symptoms (Duggan, Sham, Minne, Lee & Murray, 1998). Furthermore, the definition of depression has long been debated by both categorical and dimensional approaches. It is suggested that although the categorical system has certain advantages, viewing depression as dimensional, permits the detection of individual differences that occur within developmental periods.

*Defining Depression: A Categorical Approach*

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM) is a categorical classification system which defines depression. This "top-down" process of formulating categories and criteria was negotiated among several responsible committees of the DSM. The manual includes a clear description of depression which is beneficial for communication, morbidity statistics, treatment decision-making and health policy (Angst & Merikangas, 2001). Consequently, individuals are often labeled as either having or not

having a major depression and clinical cut points are identical across genders, ages and informants (Achenbach, 2000). Moreover, this approach recognizes that psychiatric disorders may not be discrete.

According to the DSM-IV, a major depressive episode is characterized by five (or more) of the following symptoms, which have been present during the same two-week period and represent a change from previous functioning. At least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure (Criteria A). The other symptoms firstly include depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful). Secondly, a markedly diminished interest or pleasure in all or almost all, activities most of the day and nearly everyday. Thirdly, significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. Fourthly, insomnia or hypersomnia nearly every day. Fifthly, psychomotor agitation or retardation nearly every day. Sixthly, fatigue or loss of energy nearly every day. Seventhly, feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day. Eighthly, diminished ability to think or concentrate, or indecisiveness, nearly every day. Ninthly, recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide (American Psychiatric Association, 2000).

Major depressive symptoms must not meet criteria for a Mixed Episode (Criteria B). The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning (Criteria C) and they are not due to the direct physiological effects of a substance (e.g., a drug abuse, a medication) or a general

medical condition (Criteria D). Moreover, the symptoms are not accounted for by Bereavement (Criteria E).

Several critics have argued against a categorical definition of depression. For example, Angst and Merikangas (2001) explain that there is a lack of empirical evidence for the specific thresholds within each of the major criteria for depression (e.g., number of symptoms, duration, impairment) and there is little evidence regarding which specific criteria are necessary to the diagnosis. This categorical classification of depression has led to the development of arbitrary thresholds in the dimensions which may underlie clinical syndromes (Angst & Merikangas, 2001). Thus, a significant amount of individuals experiencing depressive symptoms and distress or impairment do not exceed the diagnostic threshold for depression and may be left unnoticed. Finally, although key symptoms should be included in the classification of depression it is argued that so should duration, frequency, subjective distress or impairment.

*Defining Depression: A Dimensional Approach*

As opposed to a categorical approach, the dimensional approach is an "empirically based-paradigm" which works from "bottom-up" by beginning with data obtained on specific problems in large samples of individuals and deriving taxonomic constructs from this data. Achenbach (2000) explains that the word syndrome is used to explain co-occurring problems and to serve as building blocks for creating taxonomic constructs. Syndromes are derived from problem scores of specific developmental phases. This approach does not view problems as present or absent, but instead scores individuals on the degree to which they manifest certain difficulties by considering their intensity or

frequency. By using this quantifying approach, measurement error is more easily accounted for, patterns of problems can be quantified and items can be assigned to syndromes.

This approach incorporates clinical cut-points and norms, which vary by gender, age and informant. It also includes parent, teacher and self-report forms which are standardized procedures for obtaining information. For example, the *Center for Epidemiological Studies-Depression* (CES-D) is a short self-report scale designed to measure depressive symptomology in the general population. The items of the scale are symptoms associated with depression which have been used in previously validated longer scales. Problems are measured on simple scales: 1= Rarely or none of the time (<1 day), 2= Some or a little of the time (1-2 days), 3= Occasionally or a moderate amount of the time (3-4 days), 4= Most or all of the time (5-7 days). In doing so, it becomes possible to distinguish strong problems (score of 4), from weak problems (score of 2). In addition, in between problems (score of 3) are also acknowledged. As opposed to the DSM-IV-R which yields yes-or-no decisions about being depressed, this approach reveals many variations in profile patterns which provide an individualized picture of the problems. The dimensional approach recognizes additional syndromes that do not have clear roles in the DSM and specific problems are assessed and aggregated into syndromes (Achenbach, 2000). Overall, there are evident advantages of quantifying depression and viewing this disorder along a continuum of symptoms.

*Maternal Depression and Children's Cognitive Development*

Approximately 13% of women experience depression sometime during their first year after delivery (O'Hara & Swain, 1996). These women encounter cognitive difficulties

such as negative self-cognitions, concentration and memory impairments and delayed information processing abilities. In addition to the personal sufferings of these mothers, depression symptoms can have negative consequences for their children as early as infancy through preschool. At 9 months, the infants of postnatally depressed mothers showed poor performance on Piaget's object permanence task (Murray, 1992). One-year-old toddlers of depressed mothers demonstrated lower mental and motor development scores (Lyons-Ruth, Zoll, Connell & Grunebaum, 1986). In addition, a meta-analysis examining nine studies found that postpartum depression had a small but significant adverse effect on the cognitive development of children older than 1 year of age (r= 0.18 to 0.22) (Beck, 1998). At 15 months, chronic maternal depression, which lasted throughout the first 12 months postpartum and beyond, was associated with lower motor and cognitive performance in infants (Cornish et al., 2005). At 18 months, these infants performed poorly on object concept tasks, but not on the Bayley Scales of Infant Mental development, a general measure of infant cognitive development nor Reynell Scales, a measure of language comprehension (Murray, 1992). In addition, one and two year old toddlers of depressed mothers demonstrated lower task competency and persistence at challenging tasks (Redding, Harmon & Morgan, 1990). At 2 years of age these children showed less pleasure in tasks. Moreover, five-year-old children of depressed women had social problem-solving deficits (Hay, Zahn-Waxler, Cummings & Iannotti, 1992). Overall, these studies have found a general association between maternal depression and child's inferior cognitive development.

Some studies point out that children's cognitive outcomes are specifically impaired when mothers experience depression in the first year of their child's life. For example, a study found that 3 year old boys of postnatally depressed mothers in the first year had a

mean score of one standard deviation lower on a measure of general cognitive functioning (verbal, perceptual-performance and quantitative scales). The presence of maternal depression in the first year of life was pivotal to these findings, since maternal depression later in the child's life did not affect outcomes (Sharp et al., 1995). Similarly, Hay, Pawlby and Sharp (2001) found that 11 year old children of mothers who were depressed at 3 months and then recovered, continued to show low IQ scores, attention problems, difficulties in mathematical reasoning and were more likely than other children to have special educational needs. In addition, boys were found to be more impaired than girls, especially on performance IQ. Overall, maternal depression, especially experienced during the first year post-partum has been related to children's less optimal cognitive development.

*An Integrative Model*

Models attempting to explain the association between maternal depression and children's impaired cognitive outcomes are scarce. Goodman and Gotlib (1999) presented an integrative developmental model of four mechanisms involved in the transmission of influences from maternal depression to child adjustment problems (See Figure 1). Firstly, they propose that the children of depressed mothers are vulnerable to depression or to personality traits, cognitive or interpersonal styles or environmental experiences which place them at risk. Secondly, the children of depressed mothers may be born with dysfunctional neuroregulatory mechanisms which are the effects of abnormal fetus development. Examples include neuroendocrine abnormalities, reduced blood flow to the fetus, poor health behaviors and the use of antidepressant medications. Thirdly, the children's exposure to negative maternal cognitions, behaviors and affect may place them at an elevated risk for becoming depressed. Fourthly, the stressors often present in the lives

of the children of depressed mothers may contribute to their impairments. Stressors may include marital conflicts or discord, stressful life events or poverty. Moreover, they suggest the following three factors may moderate the association between maternal depression ad child psychopathology: 1) the father's health and involvement with the child, 2) the course and timing of the mother's depression and 3) characteristics of the child.
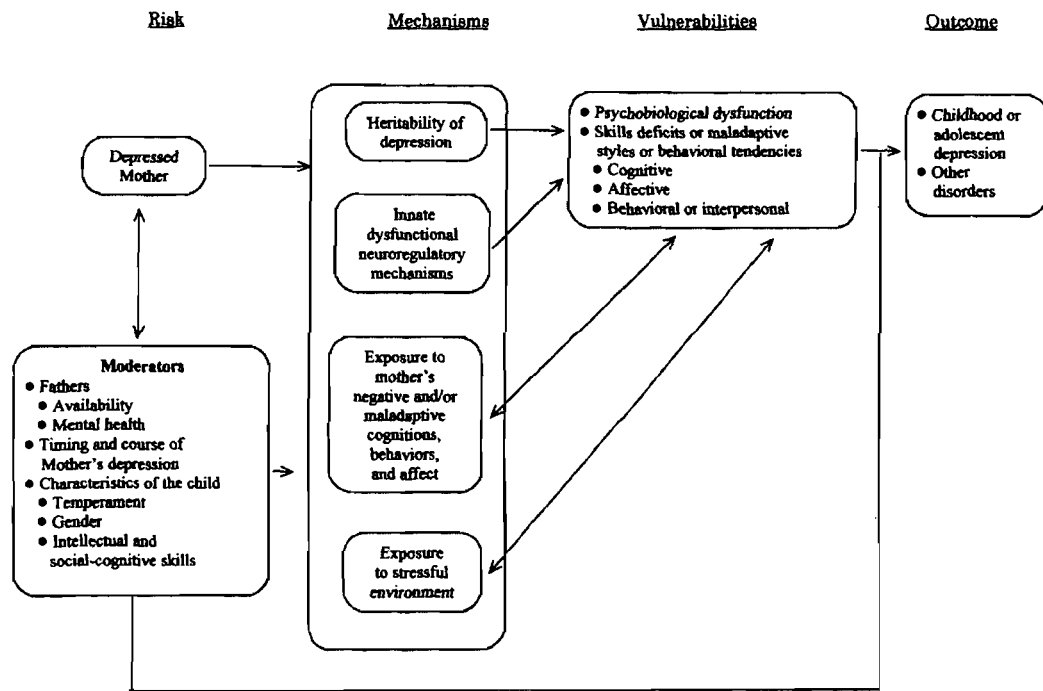


*Figure 1.* Goodman and Gotlib's (1999) integrative model for the transmission of risk to children of depressed mothers.

Conversely, Elgar, McGrath, Waschbusch, Stewart and Curtis (2004) mention that this model does not give enough attention to the transactional influences between each mechanism. Moreover, this model was created in order to explain the relationship between maternal depression and its association with psychopathology in children. To our knowledge, no specific model aimed at explaining the relationship between maternal depression and children's impaired cognitive outcomes yet exists. Nevertheless, over the years, different variables have been suggested in order to explain this association. The

following section will review the scarce amount of empirical support for different psychosocial and biological variables which may possibly mediate this relationship.

*Biological-Genetic Explanations*

Several biological and genetic mechanisms have been suggested in order to account for the association between maternal depression and child impaired cognitive results, such as: Brain differences, hormonal levels, child's gender, infant low birth weight and breast-feeding. The following section will review the few studies which support the role of these variables as potential mediators.

*Brain functions.*

Adverse conditions, such as living with a depressed mother may influence brain development. Infants of depressed mothers have shown a reduced left frontal brain activity on EEG recordings at 13 to 15 months (Dawson, et al., 1999). This reduced brain activity may explain children's less optimal cognitive development (Hay et al., 2001). When the children of chronically depressed mothers were 3.5 years old, Dawson and colleagues (2003) found a reduced atypical brain electrical activity from all scalp regions (right and left, frontal and parietal cortex). In addition, the children with lower levels of frontal activation demonstrated higher levels of internalizing and behavioral problems. Although lower brain activity mediated the relationship between maternal depression and variations in children's behavior, researchers explain that the results are modest suggesting that brain activity is only one of the many factors which can explain children's less optimal results. In addition, no study has yet examined the effect of these brain differences on children's cognitive outcomes.

*Hormonal factors.*

Children's cortisol levels have been found to be significantly associated with their mother's depressive symptoms (Ashman, Dawson, Panahiotides, Yamada & Wilkinson, 2002; Lupien, King, Meaney & McEwen, 2000). Similarly, Field (1998) reports that infants of depressed mothers have a profile of dysregulation at the neonatal period. These infants have elevated stress hormones, norepinephrime and cortisol levels. Moreover, stress has been associated to impaired brain functioning (De Bellis, 2005; Sharp et al., 1995). For example, stress causes glucocorticoids secretion by the adrenal steroids which has been associated to damages of the hippocampus (Sapolsky, 1993). Since maternal depression is associated with increased cortisol levels in children, their hippocampus may be impaired. Several studies have hypothesized that the children of depressed mothers may have damaged hippocampus functioning, which in turn is associated with impaired memory abilities (Hay et al., 2001).

*Heritability of parent's intelligence.*

Although studies are indeterminate, it has been suggested that the association between maternal depression and child's lower cognitive abilities may be explained by parent's lower intelligence. It has been established that maternal IQ is predictive of child IQ (Longstreth et al., 1981; Scarr & Weinberg, 1978; Yeates, MacPhee, Campbell & Ramey, 1983). In addition, less intellectually able mothers might be more vulnerable to depression and have children with lower intellectual capacities. Since mother's IQ has been associated with both child IQ and maternal depression, studies have examined this variable as a possible mediator. For example, a study revealed that depressed mothers' own IQ or father's IQ reliably predicted child cognitive outcomes however they did not remove the

significant influence of maternal depression on child outcomes (Sharp et al., 1995). Similarly, some studies have found that postnatal maternal depression continued to predict lower child IQ, even when mother's lower IQ was taken into consideration (Hay et al., 2001; Lyons-Ruth, Zoll, Connell & Grunebaum, 1986). Taken together, these results suggest that postnatal depression's influence on child's outcomes cannot be fully explained by heritable factors such as parental IQ and other explanations should be examined.

*Gender differences.*

Several studies have found that cognitive outcomes of boys of depressed mothers are more affected that those of girls (Hay et al., 2001; Kurstjens & Wolke, 2001; Milgrom, Westley & Gemmill, 2004; Murray, Hipwell, Hooper, Stein & Cooper, 1996; Murray, Kempton, Woolgar & Hooper, 1993; Sharp, et al., 1995) while others have found no differences between genders (Cogill, Caplan, Alexandra, Robson & Kumar, 1986; Hay & Kumar, 1994; NICHD, 1999). Different arguments have been proposed to explain these findings. It is possible that the maturational advantage of infant girls in the population as a whole may protect them from the negative social experiences associated with having a depressed mother. Also, it has been suggested that depressed mothers treat sons and daughters differently. For example, mothers with depressive symptoms are more likely to show intrusive behavior to sons compared to daughters (Hart, Field, Del Valle & Pelaez-Nogueras, 1998) and less likely to focus their speech on sons than daughters (Murray et al., 1993). Also, in comparison to girls, boy infants seem to need more support from their mothers in order to regulate their emotions (Weinberg & Tronick, 1998). Finally, boy and girl infants of depressed mothers show distinct patterns of brain activity in comparison to non-depressed mothers, which may indicate different neurodevelopmental response to

mother's illness (Dawson, Frey, Panagiotides, Osterling & Hessl, 1997). Overall, although some studies have found no gender effects, it is not yet clear why other studies have found that boys of depressed mother's are more vulnerable to impaired cognitive outcomes in comparison to girls.

*Infant low birth weight.*

It has been suggested that low birth weight or prenatal complications may increase the likelihood of postnatal depression since infant's characteristics make them difficult to care for. A study found that the sons of mothers who were depressed in the first year had been slightly lighter than infants of mothers who were not depressed (Sharp et al., 1995). In addition, low birth weight has also been associated with children's inferior intellectual development (e.g., Breslau et al., 1994). A study which attempted to test the possibility of this mediating variable, found that low birth weight appeared to potentate the effects of postnatal illness on intellectual attainment at four years old (Hay & Kumar, 1994). However, when low birth weight babies were removed from the sample, the association between maternal depression and children's cognitive outcomes remained significant. Overall, although low birth weight has been suggested as a possible mediator, no study yet confirms its significance.

*Breast-feeding.*

Depressed mothers who are irritable and often self-preoccupied may have difficulties in establishing and maintaining breast-feeding. For example, maternal depressive symptoms at 7 weeks postpartum predicted a reduced preference for breast-feeding at current and later infant ages. On the other hand, feeding practices did not predict

maternal moods at later ages (Galler, Harrison, Biggs, Ramsey & Forde, 1999). In addition, the relationship between breast-feeding and child cognitive development has been well established in research. A meta-analysis revealed that children who were breast-fed had significantly higher levels of cognitive function at 6 to 23 months in comparison to children who were formula-fed (Anderson, Johnstone & Remley, 1999). Moreover, this study found that as the duration of breast-feeding increased from 8 to 11 weeks and up to more than 28 weeks, there were gradual increments in children's cognitive development. Breast-feeding has also been associated with higher receptive vocabulary scores on the Peabody Picture Vocabulary Test Revised (PPVT-R) at 5 years old (Quinn, O'Callaghan, Williams, Najman, Andersen & Bor, 2001). Moreover, breast-feeding predicted significant increases in intelligence quotient at 8 and 9 years old and increased reading comprehension, mathematical and scholastic ability at 10 to 13 years old (Horwood & Fergusson, 1998).

However, the mediating role of breast-feeding in the relationship between maternal depression and child's cognitive outcomes is unclear. Sharp and colleagues (1995) found that depressed mothers tended not to breast-feed their infants and explain that breast-feeding may serve as a protective factor for children's cognitive outcomes. Galler and Harrison (2000) found no independent effects of infant feeding practices, including the quantity and quality of breast-feeding, on cognitive development during the first 6 months of life. However, the combination of diminished infant feeding intensity and maternal depression interacted in predicting delays in infant social development. Hay et al. (2001) found that breast-feeding was a strong predictor of children's later cognitive outcomes, especially verbal intelligence, even when considering other child-rearing practices. Although breast- feeding did not mediate the relationship between postnatal depression and boys IQ, it partly mediated the association between maternal depression and problems in

mathematical reasoning of 11 year old boys. Hay et al. (2001) explain that although breast-feeding has an important effect on children's cognitive outcomes, it is not the sole mediator and other dimensions of mother-child interactions should be examined. Since only a few studies support the possible mediating role of breast-feeding, this biological variable requires more attention.

*Psychosocial –Environmental Explanations*

The social context of children of depressed mother's provides important information on the mechanisms by which these mothers may adversely affect their children. The following psychosocial and environmental explanations have been suggested by studies as possibly mediating the relationship between maternal depression and child impaired cognitive results: Marital conflicts, parental substance abuse and mother-child interactions. Although studies are scarce, the following section will review the existing evidence for the mediating role of these variables.

*Marital conflicts.*

A study found that maternal depression was associated with increased marital conflicts. Also, these marital and social difficulties were an important determinant of unsatisfactory mother-child interactions (Stein et al., 1991). Moreover, marital conflicts have also been linked to child adjustment difficulties (Zimet & Jacob, 2004). Consequently, divorce or marital conflicts may possibly explain the relationship between maternal depression symptoms and child's lower cognitive results. A study found that low marital satisfaction and high family conflict mediated the association between maternal depression and child behavior outcomes (Ashman, 2004). On the other hand, another study found that

marital conflict did not have a significant effect on child's cognitive scores and did not significantly interact with mothers' depression (Hay & Kumar, 1994). It is possible that maternal depression symptoms predict a higher likelihood of marital conflicts, which are associated with impaired mother-child interaction and result in impaired child cognition. However, no study has examined the possibility of two mediators and more research is needed in order to clarify the role of marital conflicts.

*Parental substance abuse.*

Maternal depression has been associated with drug and alcohol abuse (Mezzich, Ahn, Fabrega & Pilkonis, 1990; Miller, Klamen, Hoffmann & Flaherty, 1996). It has been suggested that there are multiple pathways for association between maternal depression and drug and alcohol abuse which may be acting simultaneously (Swendsena & Merikangas, 2000). In addition, several studies have found that parental drug and alcohol abuse predicts child's lowered IQ. For example, infants of heroin addicts or methadone-maintained mothers perform more poorly on intelligence tests (Johnson & Leff, 1999; Sowder & Burt, 1980). Similarly, some researchers have suggested that the children of alcoholic mothers demonstrated inferior intellectual functioning (Aronson, Kyllerman & Sabel, 1985; Steinhausen, Gobel & Nestler, 1984). A study reveals that mothers' experiencing depression symptoms during pregnancy were more likely than non-depressed mothers to use cigarettes, alcohol and cocaine. These health behaviors have been associated with negative effects on infant outcome (Zuckerman, Amaro, Bauchner & Cabral, 1989). Overall, maternal substance abuse may possibly explain the relationship between maternal depression and child inferior cognitive outcomes, since depressed mothers are often drug

and alcohol abusers and this misuse has been linked with low child IQ. However, no study has specifically examined this variable as a potential mediator.

*Mother-child interactions.*

Postpartum maternal depression interferes with mother's emotional availability and sensitivity to the child's needs which disturbs the development of secure attachment between mother and child (Cicchetti, Rogosch & Toth, 1998). Infants of depressed mothers show significantly reduced likelihood of secure attachment and a raised likelihood of avoidant and disorganized attachment (Martins & Gaffan, 2000). In addition, irregularities of depressed mothers speech have been found to contribute to the lack of synchrony between mother and child (Zlochower & Cohn, 1996). A study by Weinberg and Tronick (1998) revealed that mothers experiencing depressive symptoms were significantly more disengaged when interacting with their infants and this disengagement extended to communicative domains of face, voice and touch. In turn, the infants of these mothers reacted with more anger, sadness, fussiness and less interest in episodes of face-to-face play, where mothers are asked to look at their infants but not to touch, smile or talk to them. Weinberg and Tronick (1998) suggest that mothers and infants regulate interactions together by responding to each other's affective states. Unresponsive mothers dysregulate children's affect which in turn inhibits their object exploration and compromises their sense of mastery. Infant distress and avoidance during mother-child interactions has been associated with impairments in recall (Fagen, Ohr, Fleckenstein & Ribner, 1985). Both the non-contingent, self-preoccupied behavior of depressed mothers and child distress may adversely influence child's attention regulation and learning.

*Conclusion*

Whether depression is viewed as a taxonomic, DSM category or as a group of syndromes which lie on a continuum, studies have revealed that the children of mothers living with this disorder have impaired cognitive outcomes during infancy, preschool and even later on in life. Research has attempted to determine the mechanisms which can explain this association. Several biological explanations have been suggested such as: brain differences, hormonal levels, child's gender, infant low birth weight and breast-feeding. Although some researchers have studied and found evidence for the mediating role of hormonal levels, child's gender and breast-feeding, there are other explanations in the child's environment, which must not be ignored. Consequently, research has revealed that certain psychosocial variables may influence children of depressed mother's cognitive outcomes, such as: marital conflicts, substance abuse and impaired mother-child interactions. The following section will examine mother-child interactions; a psychosocial variable which has been supported and acknowledged as a potential mediator.

**ARTICLE:**

**Maternal depression symptoms in early childhood and children's cognitive**

**performance at school entry: The role of maternal guidance**

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Literature Review

Depression is frequent among women of childbearing age, affecting 8% to 10% of women between 25 and 44 years of age (Kessler et al., 1996). The reported rates of problems in children that result from having a mentally ill parent ranges from 8% to 74% in offspring of parents with unipolar depression and from 23% to 92% in those of bipolar parents (Radke-Yarrow, Nottelman, Martinez, Fox & Belmont, 1992). In particular, maternal depression has been found to have a negative association with children's cognitive outcomes but some studies report that this relationship only occurs in the context of low socioeconomic status or for boys (e.g., Beck 1998; Field, 1992; Gelfand & Teti, 1990; Murray, Hipwell, Hooper, Stein & Cooper, 1996; Milgrom, Westley & Gemmill, 2004). The underlying mechanisms which may explain the relationship between maternal depression and children's cognitive development remain unclear. However, it has been found that depression in mothers, but not fathers, was significantly related to children's difficulties (Keller et al., 1986). This difference could be explained by the fact that mothers are the infant's primary social contact and they mediate the child's experience with the non-social world. According to Vygotsky's sociocultural theory (1978), children's cognitive growth evolves from social interactions with their parents. Interestingly, depressed mothers have been described as having distinctive interaction styles (Cohn, Matias, Tronick, Lyons-Ruth & Connell, 1986; Field, Healy, Goldstein & Guthertz, 1990) and these styles may in turn perturb children's cognitive outcomes. Rather than producing a specific deficit, past research has suggested that maternal depression affects children's "g", their general intelligence (Hay, Pawlby & Sharp, 2001). Similarly, a review of 13 studies examining the relationship between maternal depression and child development found that the strongest

effects of postpartum depression appear to be on child cognitive development such as language and intelligence (IQ) (Grace, Evindar & Stewart, 2003).

The goal of this study is to investigate the relationship between maternal depression symptoms and children's cognitive outcomes at five years. In addition, we will examine mother-child interactions, particularly maternal guidance, as a possible mediator or explanatory mechanism of this relationship. We have chosen three dimensions which are often used as rough indicators of general intelligence and contribute to forecasting school success: Receptive vocabulary (Dunn & Dunn, 1981), school readiness (Chew, 1981) and short-term memory (Zelazo, Jacques, Burack & Frye, 2002). Receptive vocabulary is also known to predict children's later verbal IQ and reading abilities (Fewell & Deutscher, 2002).

Studies have revealed that a relationship exists between maternal depression and children's vocabulary as well as school readiness. A study by Breznitz and Sherman (1987) found that mothers with a major depression spoke less to their children and were slower to respond to them. In return, these children spoke less then the offspring of healthy mothers during a lunchtime period. A more recent study by Pan, Rowe, Singer and Snow (2005) found a relationship between maternal depression and the growth of child vocabulary production. They examined a group of low-income families and amongst other findings, discovered that 24-month-old children of mothers who scored in the 90th percentile on the Center for Epidemiological Studies-Depression (CES-D) scale produced approximately 4 fewer word types then children whose mothers scored in the 10th percentile. By 36 months, this difference had grown to 20 fewer word types. Another longitudinal study by a group of authors from the NICHD Early Child Care Research Network (1999) used the Reynell Developmental Language scale (Reynell, 1991) to assess children of depressed mother's

verbal comprehension and the Bracken Basic Concept Scale (Bracken, 1984) to examine children's school readiness. They found that children of mothers who reported feeling depressed chronically or sometimes at 36 months had significantly, albeit modestly, lower verbal comprehension scores and school readiness scores than did children whose mothers never reported feeling depressed. Generally, research has determined a moderate relationship between maternal depression and children's vocabulary as well as school readiness, however almost no research has examined children's short-term memory in relation to maternal depression symptoms. The current study examines all three of these cognitive dimensions at 60 months in their relationship with maternal depression symptoms at 5, 17 and 42 months. If these links were to be found for five-year-old children in the current study, the question that arises next is what underlying mechanisms may explain these relationships?

*Mediators*

Different mediators have been suggested and examined in order to explain the relationship between maternal depression symptoms and children's poorer cognitive outcomes. Children of depressed mothers have shown increased cortisol levels associated with stress (Ashman, Dawson, Panahiotides, Yamada & Wilkinson, 2002; Lupien, King, Meaney & McEwen, 2000). In turn, stress has been shown to affect brain functions (De Bellis, 2005; Sharp et al., 1995). In addition, some studies have found that in comparison to girls, boys of depressed mothers shown inferior cognitive outcomes (Hay et al., 2001; Kurstjens & Wolke, 2001; Milgrom et al., 2004; Murray et al., 1996; Murray, Kempton, Woolgar & Hooper, 1993; Sharp et al., 1995). Also, depressed mother's difficulties with breast-feeding have been associated with children's cognitive outcomes (Galler & Harrison,

2000; Hay et al., 2001; Sharp et al., 1995). Although these biological/ genetic mechanisms may explain the link between maternal depression and problematic toddler development, proximal mechanisms such as mother-child interactions are also important factors that must be considered and further examined (NICHD, 1999).

*Quality of Guidance: A Potential Mediator*

Vygotsky's theory (1978) posits that all learning takes place in the child's "Zone of Proximal Development" (ZPD), a cognitive space where children are not yet able to perform independently but are able to function with the support of more expert adults. According to Vygotsky, a child can only benefit from joint cognitive activity when the activity is geared towards the child's zone of proximal development (Conner & Cross, 2003). In an effort to study this joint activity, the concept of "scaffolding" was created to examine the transactional processes by which parents intervene in such a way that the child learns to succeed at the task and gradually learns the skills to complete the task independently (Conner & Cross, 2003). One important aspect of a scaffolding style is maternal guidance (or maternal support), which is defined as the degree to which mothers encourage child autonomy or behave in a controlling or disengaged manner during mother-child interactions. Quality of guidance includes a mother's ability to: 1) adopt a situational definition which permits a partnership with her child, 2) adapt her interventions in relation to her child's successes and failures when executing a task, 3) progressively transfer responsibilities related to the task to her child and 4) be receptive to the introduction of novelty from her child (Parent & Moss, 1995). Since maternal depression's association with maternal guidance has not been studied, we will review studies which have examined

the relationship between maternal depression and a broader concept: mother-child interactions.

Maternal depression has been associated to a poor quality of mother-child interactions. Studies have shown that mothers who experience depressive symptoms interact inadequately with their children. These mothers are frequently described either as overstimulating/ intrusive or as understimulating/ withdrawn. A study by Field and colleagues (1990) recorded and then coded mother-child interactions (at 3 months) during a play period. They revealed that 29% of depressed mothers were disengaged, 17% were intrusive, 25% were provokers, 21% were mixed and only 8% had positive engagements. Another study found that depressed mothers were less effective than non-depressed mothers at setting limits on their toddlers and made fewer compromises in their solution to conflicts (Kochanska, Kuczynski, Radke-Yarrow & Darby-Welsh, 1987). Moreover, past findings disclose that the chronicity of depressive symptoms may influence mother-child interactions. Women with chronic depression symptoms are less positive, sensitive and engaged with their infants than women whose symptoms are intermittent or short-lived. For example, Campbell, Cohn and Meyers (1995) found that women who were chronically depressed were less affectively positive and engaged with their babies than women whose depression was transient. More specifically, mothers who were depressed from the postpartum period through 6 months were less positive with their infants during face-to-face interactions at 2, 4 and 6 months and less sensitive and engaged during feeding and toy play at 4 months than women whose postpartum depression had remitted by 6 months. Overall, these studies suggest a potential link between maternal depression symptoms and the type of support or guidance provided to children.

In the general population, inadequate interactions between mothers and their children have been associated to lower child cognitive development. Several studies have determined an association between maternal adjustments to children competencies and children's cognitive development (Conner & Cross, 2003; Mattanah, Pratt, Cowan & Cowan, 2005; Parent & Moss, 1995). Tamis-LeMonda, Bornstein and Baumwell (2001) found that maternal responsiveness to infants during play at 9 months and at 13 months of age predicted the timing of children's achievement of language milestones over and above the actual activities of the children. Another study examined outcomes from four early intervention evaluation studies which were based either on child-focused or relationship-focused models. The study revealed that regardless of the interventions provided, only the level of responsiveness of the mothers was positively associated with children's developmental outcomes (Mahoney, Boyce, Fewell, Spiker & Wheeden, 1998). More recently, Parent, Normandeau, St-Laurent and Caron (2005) found a moderate correlation between mother's quality of guidance at 48 months and children's receptive vocabulary ($r=$ 0.309) and short-term memory ($r=$ 0.155) at 42 months of age. In addition, this study found that quality of guidance provided by mothers at 48 months were predictive of child later number knowledge at 60 months. Taken together, all of these studies suggest that the quality of mother-child interactions may provide an explanation for the expected association between maternal depression and children's weaker receptive vocabulary, school readiness and short-term memory.

However, few studies have examined the mediating role of specific mother-child interactions in relation to maternal depression and children's cognitive outcomes. Breznitz and Sherman (1987) were among the first to hypothesize depressed mothers failures in responding to their children's initiatives in routine interactions was associated to their

child's reduced language productivity. In support of this mediational model, Murray and colleagues (1993) reported that the speech of depressed mothers was less focused on infant experience and instead made reference to the mother's own agenda or to events and objects beyond the mother-infant contact. These mothers were found to be more negative; they expressed more criticism and hostility towards their children. Moreover, they found that having a depressed mother with low-focus communication at 8 to 11 weeks was related to children's lower Bayley Scales outcomes at 9 and 18 months old. A further study (NICHD, 1999) revealed that maternal sensitivity partly mediated the relationship between maternal depression and children's verbal comprehension and school readiness at 36 months. More specifically, lower levels of maternal sensitivity manifested by depressed mothers at 6, 15, 24 and 36 months were directly related to their children's lower school readiness and verbal comprehension scores at 36 months. Finally, a recent study by Milgrom and colleagues (2004) found that maternal responsiveness measured at 6 months (defined as the mothers' sensitivity in responding to infant cues) did not mediate the association between maternal depression and children's language but did mediate the association between maternal depression and children's full-scale IQ scores at 42 months. Overall, these studies reveal that depressed mothers demonstrate impaired sensitivity when interacting with their children and this in turn, possibly influences their offspring's cognitive performance. However, no study has yet examined the mediating role of these interactions on children's cognitive performance later than 42 months of age. In an attempt to address this issue, we will examine if the previously observed relationship also exists later on in a child's life. Also, by confirming this mediational hypothesis, we hope to contribute to the growing literature on early prevention and intervention programs (Murray, Cooper, Wilson &

Romaniuk, 2003) aimed at improving depressed mothers interactions with their children in order to minimize adverse child outcomes.

*Research Questions and Hypotheses*

Because previous studies have shown that a relationship exists between maternal symptoms of depression and children's cognitive outcomes, our goal will be to replicate these findings at a later age and to examine the extent to which mother-child interactions account for this association. Using longitudinal data, we will investigate whether mother-child interactions continue to mediate the relationship between maternal depression symptoms and children's cognitive performance at 60 months. Moreover, previous studies have measured maternal sensitivity during a short interval play period (Milgrom et al., 2004; Murray et al., 2003; NICHD, 1999). In order to increase the reliability of our results, we will observe mother-child interactions during two structured cognitive tasks for an extended period of time.

Thus, the central research question addressed in this study concerns the possible mediating role of quality of guidance in mother-child interactions in the association between maternal depression symptoms and children's receptive vocabulary, school readiness and short-term memory. More precisely, we examine mother's depression symptoms at 5, 17 and 42 months, children's receptive vocabulary, school readiness and short-term memory at 60 months and the mediating role of quality of guidance at 48 months during number related activities. In accordance with Vygotsky's theory and past findings, we expect maternal guidance to mediate the relationship between the independent and dependent variables. We will use Baron and Kenny's (1986) guidelines to examine if quality of guidance will mediate the relationship between maternal depression and

children's cognitive outcomes. The mediating effect of maternal guidance in the relationship between maternal depression symptoms and children's cognitive outcomes is expected to hold even when controlling for family household revenue, mother's level of education, child's gender and maternal anxiety symptoms (See Figure 2).

Mother's:
Depression Symptoms
5, 17, 42 months

Child's:
Receptive Vocabulary
School Readiness
Short-Term Memory
60 months

*Control Variables:*
*Family revenue*
*Mother's Education*
*Child Gender*
*Mother's Anxiety*

Quality of Guidance
48 months
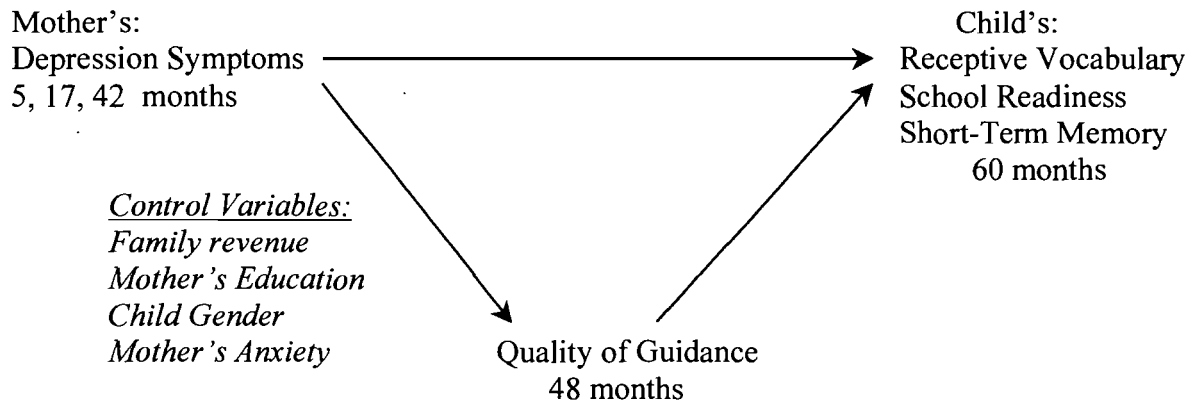
*Figure 2.* Illustration of mediational hypothesis.

Third variables such as family revenue, mother's education, child gender and mother's anxiety will be controlled for since they have been associated with maternal depression, impaired mother-child interactions and adverse child cognitive outcomes. Low socio-economic status may place women at risk for depressive symptoms (e.g., Kessler et al., 1994), impaired mother-child interactions and influence children's cognitive development (Hay et al., 2001). More specifically, a study found that chronically depressed women with higher financial resources were more sensitive during mother-child interactions in comparison to chronically depressed women with little resources (NICHD, 1999). In addition, lower educated mothers are at risk for depression (e.g., Patel, Araya, Lima, Ludermir & Todd, 1999) and in turn, they interact less adequately with their children (e.g., Schiffman, Omar & McKelvey, 2003). Mother's higher education has also been

associated with children's elevated language production scores (e.g., Dollaghan et al., 1999). Moreover, several studies have found that boys of depressed mothers seem to be more cognitively impaired than girls (e.g., Milgrom et al., 2004; Sharp et al., 1995). The quality of these interactions may differ according to gender since in comparison to their daughters, depressed mothers were found to be more intrusive during interactions with their sons (Hart, Field, Del Valle & Pelaez-Nogueras, 1998). Also, these mothers were less likely to focus their speech on their sons then on their daughters (Murray et al., 1993). Lastly, depression and anxiety are strongly and consistently associated with each other, but t the prevalence of anxiety alone is consistently greater than that for depression alone (Murphy et al., 2004). Anxious mothers have been found to interact in less positive ways with their children (Farber, Vaughn, & Egeland, 1981) and their anxiety levels have been associated with child impaired mental developmental scores (Brouwers, Baar & Pop, 2001). In consequence of the above evidence, we will control for these variables.

## Method

*Participants*

The mother-child dyads examined participated in a larger longitudinal study of child development (ÉLDEQ- Santé Québec, 1997). The primary goal of this study is to better understand the link between children's development and their adaptation to school. The sample consists of 5-month-old babies who lived within one hour away from the cities of Quebec and Montreal, Canada (Santé Quebec, 1997). A list of 1000 babies was obtained from the Quebec Master Birth Registry of the Ministry of Health and Social Services in 1996. An invitation to participate in the study was sent to families. Among the families that did not participate in the first assessment: 71 had moved, 70 could not be traced from the addresses and phone numbers given by the Ministry, 15 participated in another study, 221

declined to participate, 45 declined due to illness and 6 reported death or illness in the family. Thus, the total sample included five hundred and seventy-two (572) mothers and their 5-month-old babies. Only the evaluations relevant to the current study are presented.

When children reached 48 months, a subgroup of these families were invited to participate in a series of laboratory tasks. Two hundred and eighty-three (283) French-speaking families from the Montreal area were targeted for this laboratory visit and 194 mother-child dyads participated (8 families could not be found, 11 families refused to participate to any evaluation, 65 refused to participate to this lab visit, 4 families had moved out of the area and 1 family spoke Spanish during the tasks and had to be removed from analyses). Therefore, the 48-month sample included 194 mother-child dyads. Due to missing data at 42 or 60 months for predictor or dependent variables, the remaining sample of this present study consisted of 165 mother-child dyads. The characteristics of the sample are demonstrated in Table 1.

Chi squared tests and t- tests revealed that our sample was not significantly different from the original sample on maternal depression symptoms ($p = 0.36$), family revenue ($p = 0.06$), mother's education ($p = 0.77$) and child gender ($p = 0.56$), measured at 5 months. Maternal depression at 5 months (t (549) = $0.92$; $p \geq .05$), family revenue (t (570) = $-1.87$; $p \geq 0.05$) and mother's education (t (550) = $-0.29$; $p \geq 0.05$) did not significantly differ from the original sample (n= 572). Child gender (df = 1) = $0.34$; $p \geq 0.05$) was also not significantly different from the larger longitudinal sample.

Table 1
Characteristics of sample

| Characteristics | Child age | Categories | N | Our sample |
|---|---|---|---|---|
| Child gender | 5 months | Male | 72 | 44% |
| | | Female | 93 | 56% |
| Mother's education | 5 months | No high school diploma | 14 | 8.6% |
| | | High school diploma | 14 | 8.6% |
| | | Post-secondary studies | 36 | 22.2% |
| | | Professional diploma | 19 | 11.7% |
| | | College diploma | 17 | 10.5% |
| | | University studies | 9 | 5.6% |
| | | University diploma | 53 | 32.7% |
| Revenue | 5 months | Under 10 000 $ | 2 | 0.3% |
| | | 10 000 $ to 14 999 $ | 6 | 1.0% |
| | | 15 000 $ to 19 999 $ | 9 | 1.6% |
| | | 20,000 $ to 29 999 $ | 16 | 2.8% |
| | | 30,000 $ to 39 999 $ | 29 | 5.1% |
| | | 40 000 $ to 59 999 $ | 45 | 7.9% |
| | | 60 000 $ to 79 999 $ | 26 | 4.5% |
| | | 80 000 $ and more | 26 | 4.5% |
| Maternal anxiety symptoms | 30 months | Mean (s.d) | 134 | 12.9 (10.4) |

Measures

*Maternal Depression Symptoms: Center for Epidemiological Studies- Depression Scale, (CES-D)*

The CES-D self-report scale was designed to measure depression symptoms including depressed mood, feelings of guilt, worthlessness, hopelessness, loss of energy and sleep and appetite disturbances (Radloff & Teri, 1986). The CES-D is an ordinal measure that asks subjects to rate a series of symptoms on a 4-point scale, reflecting the frequency with which they experienced each symptom during the previous week. Due to the fact that the CES-D is concerned with the present state of the parents, it allows us to specify the impact of parental depression on the parent-child relationship. A study of 675 middle aged women provided evidence for strong reliability and construct validity for the full-scale score of the CES-D (Knight, Williams, McGee & Olaman, 1997). The alpha for the full scale was above 0.90 for all occasions administered. Another study using the CES-D found Cronbach alphas were high at each assessment (range= 0.88 to 0.91) and depression scores were moderately correlated over time (range= 0.41 to 0.58) (NICHD, 1999). The validity of this measure has been acceptable across a variety of demographic characteristics including age, education, geographic area, racial and language groups (Radloff & Teri, 1986).

Maternal depression symptoms were measured when infants were 5, 17 and 42 months old. At 5 and 17 months, an interviewer and her assistant administered 12 questions from a French version of the CES-D (Radloff, 1977; Santé Québec, 1997; see Appendix A). The French version of the twelve-item questionnaire had Cronbach alphas of 0.79 at 5 months and 0.80 at 17 months. At 42 months mothers completed the six most reliable items from the twelve items depression scale. The retained items at 42 months are noted in

Appendix A. At 42 months, the six-item questionnaire had an alpha of 0.81. Means and standard deviations are presented in Table 2.

Table 2
Means and standard deviations for mother's depression symptoms, quality of guidance, children's receptive vocabulary, school readiness and short-term memory

| Variables[a] | N | Mean | (s.d.) |
|---|---|---|---|
| CES-D (5 months): 12 items | 162 | 17.86 | (5.1) |
| CES-D (17 months): 12 items | 159 | 17.15 | (4.8) |
| CES-D (42 months): 6 items | 160 | 8.45 | (3.1) |
| Quality of Guidance (48 months) | 165 | 3.93 | (0.95) |
| PPVT–R standardized score (60 months) | 165 | 0.02 | (1.04) |
| Lollipop standardized score (60 months) | 165 | 0.04 | (0.96) |
| VCR standardized score (60 months) | 162 | 0.09 | (0.93) |

[a]CES-D: Center for Epidemiological Studies-Depression; PPVT-R: Picture Peabody Vocabulary Test Revised; VCR: Visually Cued Recall Task.

*Maternal Guidance: Quality of Guidance Scale*

At 48 months, mothers and their children took part in a laboratory visit. They were given different cognitive tasks, which included a numbered dot-to-dot drawing task and the Mystero task (Lyons & Lyons, 1999) The dot-to-dot task involves a series of 20 to 25 points that are numbered and must be connected to create a drawing. This game requires that a child recognizes numbers and locates their position in a sequence of different numbers. It also relies on visual-motor capacities, which permit a child to trace a line and connect points using a pencil. Three dot-to-dot drawings of similar difficulty were presented to the children. The children then chose their favorite drawing to complete.

The Mystero game makes associations between numbers and images. Mystero requires counting skills, cardinality skills and the ability to recognize written numbers. Two problem boards, each containing a 3 x 3 array of nine squares, were presented to children and their mothers. Each square on the board presented an image, which made reference to a number from 1 through 9. These images included 1) socio-cultural representations of numbers, 2) objects which must be counted, 3) numeric symbols in different calligraphies and 4) ambiguous hints which required negotiation between partners. The dyad's task was to place a numbered chip (1 through 9) on the corresponding image. The goal of the game was to discover the mystery number denoted by a question mark in the middle of the board, that is, the number from 1 to 9 that is left over after the other eight images have been paired with their corresponding chips. Upon administration, the experimenter provided the dyads with instructions as well as an example for each board.

Each of the previous tasks took approximately 20 to 25 minutes to complete. All mother-child dyads were filmed while they interacted together to complete the cognitive tasks. These activities were too difficult for most 48-month-olds to complete by themselves. The mother was told to help her child as she normally would at home. Each task was administered separately and order of administration was counterbalanced with other evaluations occurring during the 2-hour lab visit. A 9-point Quality of Guidance Scale was used to assess mother-child interactions (Caron, Parent, Normandeau, Séguin & Tremblay, 2008; Parent & Caron, 2000). This scale assessed the degree to which the level of maternal support provided to the child (scaffolding) was optimal, given observable child competence and task goal. This measure has been adapted from the work of Oppenheim, Nir, Warren and Emde (1997). Inter-rater reliability was calculated several times during the coding process for a random set of videos in order to insure consistency of the results.

Inter-rater agreement (intra-class correlations) computed on 35 tapes (18%) ranged from 0.85 to 1.00 for the quality of guidance measure (Racine, 2004).

For the purpose of our analyses, this 9-point scale was transformed into a 5-point ordinal scale, where 5 indicates optimal quality of guidance and 1 indicates an inadequate quality of guidance (See Appendix B). Both scores on dot-to-dot and Mystero tasks were transformed into this 5-point scale. Maternal guidance scores on the dot-to-dot and Mystero tasks were strongly correlated (r =0.67). In consequence, the means of maternal guidance scores on Mystero and dot-to-dot activities were combined in order to create a global, continuous variable, which measures quality of guidance at 48 months on both tasks (See Table 2).

*Child Receptive Vocabulary: Peabody Picture Vocabulary Test–Revised (PPVT-R)*

When children reached 60 months, their receptive vocabulary was evaluated at home using the French validated version of the Peabody Picture Vocabulary Test–Revised (PPVT-R; Dunn, Thériault-Whalen & Dunn, 1993). The PPVT-R was designed to measure children's receptive vocabulary and to provide a quick estimate of their scholastic aptitude. It is an age-normed test that requires no verbal response from the child and consists of five demonstration items and a total of 170 items of increasing level of difficulty. Each item is represented on a card, which contains four drawings in black and white. The subject's task is to select the picture that illustrates best the meaning of a stimulus word presented orally by the examiner. Children are required to express their understanding of a spoken vocabulary word by pointing to one of four drawings that best represented the meaning of the word. Administration of this test requires 8 to 10 minutes. Each subject answers only 25 to 50 items that are at an age appropriate level of difficulty. For example, a 5-year-old child

starts the test at item 30. When six mistakes out of eight consecutive items are noted, the task is terminated.

Good psychometric properties of the PPVT-R have been reported. The reliability coefficients of the PPVT-R for various age groups ranged from 0.54 to 0.90 and its internal consistency ranged from 0.71 to 0.81 (Dunn & Dunn, 1981). The PPVT-R French version (Échelle de Vocabulaire en Images de Peabody; ÉVIP) has also been demonstrated to be a reliable measure. The Spearman-Brown correlation coefficient of the ÉVIP is between 0.68 and 0.88. The median test–retest correlation of the ÉVIP was found to be 0.72. Using the Clarapède index, the ÉVIP demonstrated adequate internal validity; the measure was sensitive to age differences up to 13 or 14 years old.

Many studies have demonstrated that the PPVT-R has high criterion-related validity; its correlation with other vocabulary tests (Stanford-Binet vocabulary, WISC vocabulary, WAIS vocabulary etc.) averaged 0.71. Since vocabulary is a central component of IQ, the PPVT-R also correlates well with the full scale Stanford–Binet ($r = 0.62$) and the full–scale WISC ($r = 0.64$). In addition, the PPVT-R correlates positively with measures of intelligence (from 0.23 to 0.78: Dunn & Dunn, 1997) and achievement (range from 0.33 to 0.80; Williams & Wang, 1997). More generally, the PPVT-R has been validated as an adequate measure of receptive vocabulary and is sometimes used as a proxy for general intelligence and achievement.

Because the norms for this test were obtained on a French Canadian sample (including children from outside Quebec) more than 10 years before it was administered in this study, the standardized scores were not used. For the purpose of this analysis, the total raw scores of global PPVT-R results at 60 months were used and examined as a continuous measure. A total of 162 children's scores on PPVT-R at 60 months were examined.

*Child School Readiness: The Lollipop Test*

The Lollipop is a diagnostic screening test of school readiness (Chew, 1981) that is consistently found to be entertaining for children. Its French version (Venet, Normandeau, Letarte & Bigras, 2003) was individually administered to children at 60 months during home visits. This test consists of 52 items divided in the following four subtests: 1) Identification of colors and shapes and copying shapes (14 questions), 2) picture description, position and spatial recognition (10 questions), 3) identification of numbers and counting (14 questions) and, 4) identification of letters and writing (14 questions). The test items were administered individually and orally and each item was scored between 1 and 5 points, with a maximum of 69 points. The Lollipop required 15 minutes for administration and scoring.

The total KR-20 reliability estimate of the Lollipop test was 0.93 for a standardized sample (Chew, 1981). The Lollipop test has been shown to be relatively independent of socio-economic variables (Chew & Morris, 1984). This test has demonstrated concurrent validity since its score at 5 years were significantly correlated with all six sub-tests of the Metropolitan Readiness Test, an instrument frequently used to measure school readiness in the first grade (Chew & Morris, 1984). As for its predictive validity, a study revealed that the Lollipop test administered in kindergarten predicted children's reading and mathematics in fourth grade (Chew & Morris, 1989). Like its original version, the French version of the Lollipop test has been reported as a reliable and valid measure. The overall Cronbach alphas for the French version of the Lollipop were between 0.84 and 0.89 (Venet et al., 2003). Moreover, the test-retest correlation between the beginning of preschool and the end of preschool was 0.86 and the correlation between the beginning of kindergarten and the end of kindergarten was 0.70. In addition, it was demonstrated that over time, the Lollipop

test scores significantly increased in a linear fashion. The French version of the Lollipop

test also demonstrated convergent and discriminant validity. It was positively correlated

with the WPSSI-R (0.69 and 0.61) and the ÉVIP (0.43 and 0.53). Furthermore, it was

negatively correlated with specific sub-tests of the PSA (Social and Affective Profile)

(aggressiveness –0.24 and anxiety –0.21) (Lemelin et al., 2007; Venet et al., 2003).

*Child Short-Term Memory: Visually Cued Recall Task (VCR)*

During the 60 months home visits, children's short-term memory was assessed

using the Visually Cued Recall Task (VCR; Zelazo et al., 2002). The VCR was created to

assess basic memory span in very young children and individuals whose memory abilities

may be underestimated on conventional tests (e.g., digit span tasks). Young children may

have difficulties on conventional tests for reasons other than memory limitations. They may

have difficulty remembering material that is not familiar to them (e.g., numbers), they may

have difficulty with instructions geared towards older children and adults, or they may

simply be unable to respond verbally because their language skills are not fully developed.

The VCR task was specifically constructed so as to minimize any other potential cognitive

or linguistic requirements aside from requiring children to remember a specific number of

items. This makes the VCR task particularly useful for assessing basic memory abilities in

very young children (Zelazo et al., 2002). On the VCR task, children are provided with

verbal, spatial and perceptual information about the items that they must remember. That is,

when indicating each item that the child has to remember, the experimenter names (verbal)

the object and points (spatial) to a particular spatial location where a picture (perceptual)

depicting the object is located.

In order to administrate the VCR, an experimenter explains that a puppet will point to pictures that it likes and then it will be the child's turn to point to the pictures identified by the puppet. On the first poster, the puppet points only to one picture. The number of pictures then increases with each successive poster, until the child makes errors on two consecutive posters. The series of posters each contain 12 pictures. There are two types of error: 1) the child points to one or several images that were not pointed out by the assistant (commission error) and, 2) the child does not point to one or several images that were pointed out by the assistant (omission error).

A previous study examined differences between bilingual and monolingual children, using the PPVT and VCR as measures of intelligence (Bialystok, 1999). It was found that over time, 3-year-old children and 6-year-old children showed improvement on both tasks. For example, the VCR scores for the monolingual children were 16.2 at 3 years and 21.2 at six years. This was an indication that the VCR demonstrated appropriate change over time and had a similar change to that of the PPVT (Bialystok, 1999). A study has demonstrated that performance on the VCR task correlates well with verbal IQ ($r = 0.75$) and the central memory component of the central-incidental memory task ($r = 0.69$) in higher functioning individuals with autism (Zelazo et al., 2002).

Global scores on the Visually Cued Recall Task at 60 months were used in our analysis. A total of 162 children's scores on the VCR were examined. Scores were considered as a continuous variable (See Table 2).

*Control Variables*

The following variables were controlled for in this study: household revenue, mother's education, child's gender and mother's anxiety symptoms.

Household revenue was obtained when children were 5, 30, 42 and 60 months old. Information was collected by phone interviews or questionnaires. Mothers were asked to indicate on an 8-point ordinal scale the overall family income before taxes. The following choices were given: less than $10 000, between $10 000 and $14 999, between $15 000 and $19 999, between $20 000 and $29 999, between $30 000 and $39 999, between $40 000 and $59 999, between $60 000 and $79 999 and $80 000 or above.

Mother's education was assessed during a 5-month home interview, mothers answered questionnaires related to their current education level. The following ordinal scale was created: 1) no high school degree, 2) high school degree, 3) post-secondary degree, 4) professional degree, 5) college degree, 6) university studies and, 7) university degree.

Child gender was coded in the following way: Males were given a score of 0 and females, a score of 1. The sample consisted of 73 males and 96 females.

Mothers' anxiety symptoms were measured using a 10-item questionnaire representing key features of DSM-IV-R (American Psychiatric Association, 2000) anxiety disorder (i.e., social phobia, specific phobias, agoraphobia, panic attacks, generalized anxiety-somatic, generalized anxiety-cognitive, obsessions, compulsions, hypochondriasis and post-traumatic stress disorder). Each item was rated on a scale from 0, being never, to 8, being constantly. The questionnaire was administered to mothers over the telephone when children reached 30 months. A reliability analysis revealed that this measure has an alpha of 0.86. In our analyses, the ten items were summed in order to create a total anxiety score. One hundred and thirty five mothers were examined, 34 were missing (See Table 1).

Data Analysis

Firstly, preliminary analyses were conducted in order to create scores necessary to test the hypothesis. Secondly, we examined Pearson correlations of maternal depression symptoms at 5, 17 and 42 months and quality of guidance at 48 months with children's cognitive performance at 60 months (PPVT-R scores, Lollipop scores and VCR scores). Thirdly, multiple linear regressions were used in order to test for the hypotheses, while considering the control variables effects on children's cognitive outcomes. Baron and Kenny's (1986) recommendations were followed to test the mediating role of quality of guidance. In order to establish mediation, the following criteria are necessary: 1) Variations in maternal symptoms of depression symptoms will account for variations in children's receptive vocabulary, school readiness and short-term memory, 2) variations in maternal symptoms of depression will significantly account for variations in mother's quality of guidance, 3) variations in the mother's quality of guidance will significantly account for variations in children's receptive vocabulary, school readiness and short-term memory outcomes and lastly, 4) when mother's quality of guidance is added to the model, the previously significant relationship between maternal depression symptoms and children's receptive vocabulary, school readiness and short-term memory will no longer be significant. Finally, we used the Sobel significance test (Sobel, 1982) in order to examine the strength of the mediation. Sobel's test verifies the significance of the indirect link between the predictor and the criterion through the mediator. This test was used to confirm whether the mediator carries the influence of the independent variable to the dependent variable.

Results

*Preliminary Analysis*

In order to create necessary scores for our analysis, preliminary analysis were conducted. Firstly, trajectories for household revenue were created. Secondly, Pearson correlations were examined between 12 and 6 items of the CES-D and dependent variables. Thirdly, an estimated score of maternal depression was created by a stepwise, backward regression method. Lastly, Pearson correlations were used in order to examine the association between this estimated score of maternal depression and control variables, mediator and dependent variables.

*Household Revenue.*

Trajectories were created in order to take into account change or stability of revenue over the four assessment points (Nagin, 2005; Nagin & Tremblay, 2001). Rather than to assume that all families follow the same growth function, this methodology identifies different groups of individuals who tend to follow similar patterns over time. For example, some families may never show variations in income over time (intercept model or zero order polynomial) and other families may increase or decrease over time (e.g., linear – 1st, quadratic – 2nd, or cubic – 3rd order polynomials). The methodology can also be adapted to accommodate various data distributions (i.e., binary, censored normal, zero-inflated Poisson and count data). The trajectory methodology uses all available data points and assigns families to trajectories on the basis of a posterior probability rule. Resulting groups are meant to represent approximations of an underlying continuous process. In order to identify the model that best represents variations of income levels during a given time frame, models with a varying number of trajectories are estimated. Model selection is

dependent on a combination of statistical and investigator-guided concerns. Besides a need to determine the best model for the data distribution, the shapes of trajectories, key decisions are also based on Bayesian fit indices for model selection in accordance to procedures described by Nagin (2005), e.g., the Bayesian Information Criterion (BIC). The optimal model is thus also determined by adding trajectories to the model until the BIC ceases to improve. The investigator would then have enough information to determine the best model. A key output of model estimation is the posterior probability of group membership. For each trajectory group this probability measures the likelihood of an individual of belonging to that trajectory group based on observations across assessments. In other words, 100% accuracy in classification is not assumed nor required.

Models with between 2 to 6 trajectories and varied shapes for each trajectory were compared using BIC. Five ordered trajectories using a censored normal (CNORM) distribution and following linear growth trends were identified (See Appendix C). The first trajectory (6.1% of the sample) described a stable low revenue trajectory and the fifth (8.6% of the sample) described a stable high revenue trajectory and trajectories 2 (15.4%), 3 (36.8%) and 4 (33.1%) described intermediate situations. The 95% confidence interval for the posterior probability for the assigned trajectory group ranged between 0.80551 and 0.83370 which indicates low entropy (or a good classification). Families were then assigned to one of the five trajectories as a function of their highest probability.

*Depression Measure: Six or Twelve Items.*

Bivariate Pearson correlations were used in order to verify the strength and direction of the relations between maternal depression symptoms, quality of guidance and children's cognitive outcomes. We have examined the correlations between the 12- item

CES-D scale at 5 and 17 months, the 6-item CES-D at 42 months and other variables. Table 3 shows that maternal depression symptoms at 5 months were significantly negatively correlated to mother's quality of guidance and child PPVT-R scores but not to Lollipop or VCR scores. At 17 months, maternal depression symptoms were significantly negatively associated to PPVT-R but not to quality of guidance, Lollipop or VCR scores. At 42 months, maternal depression symptoms were significantly negatively associated to Lollipop scores and not to quality of guidance, PPVT-R or VCR scores. In turn, quality of guidance at 48 months was significantly associated to age 60 months PPVT-R, Lollipop and VCR scores (r = 0.27, r = 0.30, r = 0.17, respectively).

Table 3
Pearson correlation coefficients among study variables.

| Variables[a] | CES-D: 5 | CES-D: 17 | CES-D: 42 |
|---|---|---|---|
| Guidance: 48 | -0.17* | -0.08 | -0.08 |
| PPVT-R: 60 | -0.27** | -0.17* | -0.15 |
| Lollipop: 60 | -0.14 | -0.12 | -0.21** |
| VCR: 60 | 0.04 | -0.03 | -0.04 |

[a] CES-D: Center for Epidemiological Studies-Depression (non estimated scores); Guidance: Quality of guidance; PPVT-R: Picture Peabody Vocabulary Test Revised; VCR: Visually Cued- Recall Task. $**p \leq 0.01$, $*p \leq 0.05$. All two tailed.

*Depression Measure: Estimated Scores.*

Since the number of items on the CES-D were not the same at 5, 17 and 42 months, it was difficult to interpret why quality of guidance was associated to maternal depression symptoms at 5 months but not at later times (17 and 42 months), (i.e., differences related to the developmental processes or differences related to specific items included, or both). A

backward regression entering separate item scores was used in order to identify those items which most strongly predict quality of guidance.

Each of the 12 item scores of the CES-D at 5 months were entered and regressed on quality of guidance scores at 48 months. Using a linear regression analysis, the twelve items of the CES-D were regressed on quality of guidance, using the stepwise, backward regression method. This method starts off with all 12 items of the CES-D and items are deleted one at a time if they do not significantly contribute to the regression. Tabachnick and Fidell (2007) explain that this procedure is typically used to develop a subset of independent variables that are useful in predicting the dependent variable. The independent variables that do not provide additional prediction to the independent variables already in the equation are eliminated. When the 12 items of the CES-D scale were entered in a backward regression as the independent variables and quality of guidance, as the dependent variable, the model retained six significant items associated with quality of guidance (See Table 4).

Table 4

Results of the backwards regression on the 12 items of the CES-D[a] at 5 months with quality of guidance at 48 months

| Items of CES-D[a] | $\beta$ | $t$ | Sig. |
|---|---|---|---|
| A: I did not feel like eating; my appetite was poor | -0.164 | -2.06 | 0.04 |
| B: I felt that I could not shake off the blues even with help from my family or friends | -0.308 | -2.68 | 0.01 |
| D: I felt depressed | 0.189 | 1.84 | 0.07 |
| F: I felt hopeful about the future | 0.172 | 2.01 | 0.05 |
| H: I was happy | -0.202 | -1.86 | 0.07 |
| L: I felt that people disliked me | -0.175 | -2.18 | 0.03 |

[a] CES-D: Center for Epidemiological Studies-Depression.

In order to account for the fact that the items differed in the strength of their relationship with maternal guidance, we have used the unstandardized predicted scores of the regression in our analysis as a weighted index of maternal depression symptoms. This estimated score maximizes the relationship with quality of guidance. As expected, this measure was somewhat positively skewed. Pearson correlations disclose that maternal depression symptoms measured by estimated scores at 5 months were significantly correlated with age 60 months PPVT-R scores ($r = -0.23$), Lollipop test scores ($r = -0.21$) and VCR scores ($r = -0.20$), as well as quality of guidance age 48 months ($r= -0.35$). Moreover, family revenue, mother's education and mother's anxiety symptoms were significantly associated to estimated maternal depression symptoms at 5 months ($r = -0.33$, $r = -0.28$, $r = -0.19$, respectively).

The same procedure was used for maternal depression symptoms at 17 months. Items were regressed on quality of guidance using a backward regression method (See Table 5). In comparison to the 12- item measure of maternal depression which was not associated to quality of guidance ($r = -0.08$), the weighted index of maternal depression symptoms was significantly correlated to quality of guidance ($r = -0.27$). In addition, family revenue, mother's education and mother's anxiety symptoms were significantly associated to maternal depression symptoms at 17 months ($r = -0.28$, $r = -0.24$, $r = -0.19$, respectively). However, because the estimated score of maternal depression symptoms at 17 months was no longer significantly associated to PPVT-R scores ($r = -0.15$) and continued to be unrelated to Lollipop and VCR scores, this variable was dropped from further analysis. Moreover, since no item was significantly associated with maternal guidance at 42 months; these results were excluded.

Table 5

Results of the backwards regression on the 12 items of the CES-D at 17 months with quality of guidance at 48 months

| Items of CES-D[a] | $\beta$ | $t$ | Sig. |
|---|---|---|---|
| B: I felt that I could not shake off the blues even with help from my family or friends | 0.181 | 1.96 | 0.05 |
| H: I was happy | -0.194 | -2.19 | 0.03 |
| K: I had crying spells | -0.219 | -2.70 | 0.01 |

[a] CES-D: Center for Epidemiological Studies-Depression.

In order to further understand the relationship between the independent variable, the mediator and the dependent variables, control variables were examined with Pearson correlations in Table 6. Maternal estimated depression at 5 months was significantly associated with family revenue, mother's education and mother's anxiety symptoms. Maternal guidance was significantly correlated with family revenue, mother's education and child's gender. Finally, PPVT-R was significantly associated with family revenue and mother's education, whereas mother's anxiety symptoms and child's gender were not. Furthermore, Lollipop scores were significantly correlated with household revenue and child's gender. The VCR was not associated to any control variable.

Control variables were retained for our analysis only if they were associated to all of the following variables: the independent variable, the mediator and the dependent variable. For analyses related to the PPVT-R, household revenue and mother's education met these criteria. For analyses related to the Lollipop test, only household revenue met these criteria. No control variable met these criteria for the VCR.

Table 6
Pearson correlation coefficients among study variables

| Variables[a] | CES-D 5 | CES-D 17 | Guidance 48 | PPVT-R 60 | Lollipop 60 | VCR 60 | Rev. | Mother ed. | Gender | Anx. |
|---|---|---|---|---|---|---|---|---|---|---|
| CES-D 5 | | | | | | | | | | |
| CES-D 17 | 0.30** | | | | | | | | | |
| Guidance 48 | -0.35** | -0.27** | | | | | | | | |
| PPVT-R 60 | -0.23* | -0.15 | 0.27** | | | | | | | |
| Lollipop 60 | -0.21* | -0.15 | 0.30** | 0.44** | | | | | | |
| VCR 60 | -0.20* | -0.04 | 0.17* | 0.17* | 0.28** | | | | | |
| Revenue | -0.33** | -0.28** | -0.21** | 0.24** | 0.23** | 0.13 | | | | |
| Mother ed. | -0.28** | -0.24** | 0.25** | 0.23** | 0.15 | 0.05 | 0.41** | | | |
| Gender | -0.05 | -0.06 | 0.17* | -0.07 | 0.21** | 0.08 | 0.05 | 0.03 | | |
| Anx. | 0.19* | 0.19* | -0.11 | -0.01 | -0.08 | 0.01 | -0.17* | -0.19* | .02 | |
| Mean (SD) | 3.9 (0.3) | 3.9 (0.3) | 3.9 (0.9) | 0.0 (1.0) | 0.0 (0.1) | 0.1 (0.9) | 3.3 (0.1) | 4.5 (2.4) | 0.6 (0.5) | 12.9 (10.4) |

[a] CES-D: Center for Epidemiological Studies-Depression (estimated scores); Guidance: Quality of guidance; PPVT-R: Picture Peabody Vocabulary Test-Revised; VCR: Visually Cued- Recall Task; Revenue: Household revenue; Mother ed: Mother's level of education; Anx: Mother's anxiety symptoms.
**$p \leq 0.01$, *$p \leq 0.05$. All two tailed.

*Main analysis*

The following section verifies, by the use of multiple linear regressions, the mediating role of maternal guidance in its association between maternal depression and child's receptive vocabulary, school readiness and short- term memory.

*Maternal Depression Symptoms and Receptive Vocabulary.*

Overall, the control variables significantly predicted child PPVT-R outcomes ($R^2$ = 0.09, $F$ (2,159) = 7.44; $p \leq 0.001$). Specifically, household revenue significantly predicted child PPVT-R outcomes ($t$ (2,159) = 2.32; $p \leq 0.01$) and mother's education was almost significantly predictive of child PPVT-R outcome ($t$ (2,159) = 1.86; $p$ = 0.06). When control variables and maternal depression symptoms were included, the model significantly predicted child PPVT-R outcomes ($R^2$ = 0.010, $F$ (3,158) = 6.11; $p \leq 0.001$). However, Table 7 shows that the unique contribution of maternal depression symptoms at 5 months was nearly significant ($t$ (3,158) = 1.80; $p$ = 0.07). The higher the depression symptoms at 5 months, the lower children's PPVT-R scores at 60 months. Because mother's education did not clearly contribute to the model given its shared variance with family revenue and maternal depression, it was removed from the model for exploratory purposes. The unique contribution of maternal depression symptoms at 5 months became clearly significant ($t$ (2,159) = 2.07; $p \leq 0.04$). Thus, the first criteria necessary to establish mediation was confirmed, because the independent variable was significantly associated with the dependent variable, although this contribution seems to be partly confounded with maternal education.

Table 7

Mediation regression predicting PPVT-R as mediated by quality of guidance

| Variables [a] | Dependent variable(s) | Predictor variable(s) | $R^2$ | $\Delta R^2$ | $\beta$ |
|---|---|---|---|---|---|
| Regression 1 a<br>*Controlling for*<br>*revenue and education* | PPVT-R | CES-D | 0.10 | | 0.146 *ns* |
| Regression 1 b<br>*Controlling for*<br>*revenue* | PPVT-R | CES-D | 0.09 | | 0.166* |
| Regression 2 | Guidance | CES-D | 0.15 | | 0.293*** |
| Regression 3 | PPVT-R<br>(Controlling for<br>CES-D) | Guidance | 0.14 | 0.04 | 0.208** |
| | PPVT-R<br>(Controlling for<br>Guidance) | CES-D | 0.14 | | 0.100 *ns* |

[a] CES-D: Center for Epidemiological Studies-Depression; Mediator: Quality of guidance; PPVT-R: Peabody Picture Vocabulary Test-Revised.

***$p \leq 0.001$, **$p \leq 0.01$, *$p \leq 0.05$, *ns:* $p \geq 0.05$.

*Maternal Depression Symptoms and Maternal Guidance.* Mother's education significantly predicted quality of guidance scores, where higher education was associated with higher quality of guidance ($\beta$= 0.21, $t$ (2,159) = 2.45; $p \leq 0.01$). Family revenue did not significantly influence quality of guidance scores ($\beta$= 0.12, $t$ (2,159) = 1.41; $p \geq 0.05$). The second regression analysis shown in Table 7 discloses that quality of guidance at 48 months was significantly predicted by maternal depression symptoms at 5 months. Higher maternal depression symptoms at 5 months were associated with lower quality of guidance during mother-child interactions at 48 months. Once maternal depression was included in the model, the association between mother's education and quality of guidance became

weaker ($\beta$= 0.16, $t$ (3,158) = 1.91; $p$ = 0.06). Overall, this regression confirmed the second criteria necessary to establish mediation; the independent variable was significantly associated with the mediator.

*Maternal Depression, Maternal Guidance and Receptive Vocabulary.* When quality of guidance was added to the model which controlled for maternal depression symptoms, it significantly predicted children's PPVT-R outcomes ($t$ (4,157) = 2.62; $p \leq 0.01$). This finding confirmed the third criteria necessary to establish mediation; the mediator was associated with the dependent variable after controlling for the independent variable.

Finally, the relationship between maternal depression symptoms and PPVT-R scores was reduced to non-significance when quality of guidance was considered in the model ($t$ (4,157) = 1.21; $p$= 0.228). The $\beta$ weights for the relationship between CES-D and PPVT-R scores reduced from 0.166 to 0.100 when including quality of guidance as a mediator. These findings confirm the fourth criteria necessary to establish mediation, when quality of guidance (mediator) is added to the model, the previously significant relationship between maternal depression symptoms and children's PPVT-R outcomes is no longer present (See Regression 3 in Table 7).

Finally, the Sobel significance test (Sobel, 1982) revealed that quality of guidance significantly mediated the relationship between maternal depression symptoms and PPVT-R scores (Sobel $z$ = 2.02, $p$ = 0.04).

*Maternal Depression Symptoms and School Readiness.*

Household revenue significantly predicted child Lollipop scores ($t$ (1,160) = 3.08; $p \leq 0.01$). Results indicated that when revenue and maternal depression symptoms were included, the model significantly predicted Lollipop outcomes, ($R^2$ = 0.075, $F$ (2,159) =

6.43; $p \leq 0.01$). Specifically, maternal depression symptoms at 5 months were close to significance level in their prediction of child Lollipop scores when family revenue was controlled for ($t$ (2,159) = 1.81; $p = 0.07$). Thus, the first criterion necessary to establish mediation was partly confirmed, because the independent variable was almost significantly associated with the dependent variable (Regression 1 in Table 8).

Table 8

Mediation regression predicting lollipop as mediated by quality of guidance

| Variables [a] | Dependent variable(s) | Predictor variable(s) | $R^2$ | $\Delta R^2$ | $\beta$ |
|---|---|---|---|---|---|
| Regression 1 Controlling for revenue | Lollipop | CES-D | 0.075 | | 0.146 ns |
| Regression 2 | Guidance | CES-D | 0.130 | | 0.317*** |
| Regression 3 | Lollipop (Controlling for CES-D) | Guidance | 0.125 | 0.05 | 0.241** |
| | Lollipop (Controlling for Guidance) | CES-D | 0.125 | | 0.070 ns |

[a] CES-D: Center for Epidemiological Studies-Depression; Mediator: Quality of guidance.
***$p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, ns: $p \geq 0.05$.

*Maternal Depression, Maternal Guidance, School Readiness.* Household revenue, maternal depression symptoms and maternal guidance scores were regressed on Lollipop scores. When quality of guidance was added to the model which controlled for maternal depression symptoms, it significantly predicted children's Lollipop outcomes ($t$ (3,158) = 3.02; $p \leq 0.01$) (See Regression 3 in Table 8). This finding confirmed the third criteria

necessary to establish mediation; the mediator was associated with the dependent variable after controlling for the independent variable.

When quality of guidance was introduced in the model, maternal depression symptoms no longer predicted child Lollipop scores ($t$ (3,158) = 0.841; $p$ = 0.40). When quality of guidance was considered, the $\beta$ weights for the relationship between CES-D and Lollipop scores reduced from -0.146 to -0.070. These findings confirmed the fourth criteria necessary to establish mediation, when mother's quality of guidance (mediator) was added to the model; the previously significant relationship between maternal depression symptoms and children's school readiness scores was no longer present (See Table 8).

The Sobel test (1982) demonstrated a significant mediation effect. Quality of guidance significantly mediated the relationship between maternal depression symptoms and Lollipop scores (Sobel $z$ = 2.65, $p$ = 0.007).

*Maternal Depression Symptoms and Short-Term Memory.*

Results indicated that maternal depression symptoms at 5 months significantly predicted child VCR outcomes, ($R^2$ = 0.04, $F$ (1,157) = 6.29; $p \leq 0.01$). Higher maternal depression symptoms at 5 months predicted lower child VCR outcomes at 60 months (See Table 9).

Table 9

Mediation regression predicting VCR as mediated by quality of guidance

| Variables[a] | Dependent variable(s) | Predictor variable(s) | $R^2$ | $\Delta R^2$ | $\beta$ |
|---|---|---|---|---|---|
| Regression 1 | VCR | CES-D | 0.04 | | 0.196** |
| Regression 2 | ·Guidance | CES-D | 0.12 | | 0.349*** |
| Regression 3 | VCR (Controlling for CES-D) | Guidance | 0.05 | | 0.119 *ns* |
| | VCR (Controlling for Guidance) | CES-D | 0.05 | 0.01 | 0.154 *ns* |

[a]CES-D: Center for Epidemiological Studies-Depression; Mediator: Quality of guidance; VCR: Visually Cued Recall Task.
***$p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, *ns: $p \geq 0.05$*.

*Maternal Depression, Maternal Guidance and Short-Term Memory.* The betas for

the relationship between CES-D and VCR changed from 0.196 to 0.154 when quality of

guidance was introduced in the model, but remained close to significance (*t* $(2,156) =$

1.842; $p = 0.07$). Results indicate that quality of guidance did not significantly predict

children's VCR outcomes when controlling for maternal depression ($R^2 = 0.05$, *t* $(2,156) =$

1.424; $p = 0.156$, $\beta = 0.119$). Thus, although the relationship between the independent and

dependent variables was significant, quality of guidance did not mediate this association.

This finding did not confirm the third criteria necessary to establish mediation since the

mediator was not associated with the dependent variable after controlling for the

independent variable (See Table 9).

Discussion

Using a longitudinal design from 5 to 60 months, the goal of this study was to examine the mediating role of mothers' quality of guidance at 48 months in the relationship between maternal depression symptoms at 5, 17 and 42 months and children's receptive vocabulary, school readiness and short-term memory at 60 months. When maternal depression symptoms were examined by the use of 12 and 6 items questionnaires, symptoms at 5 months were associated with impaired maternal guidance, whereas symptoms at 17 and 42 months were not. When using estimated scores, maternal depression symptoms at 5 and 17 were significantly associated with quality of guidance. However, only maternal depression symptoms at 5 months were significantly associated to receptive vocabulary, school readiness and short-term memory. These results point to the postpartum period as an important determinant in quality of interaction between mother and child and child cognitive outcomes. These findings are consistent with studies which have identified the first year of life as a "sensitive period" for children of depressed mothers' performance on cognitive development scales (Sharp et al., 1995; Hay et al., 2001). Undeniably, the mother-infant relationship constitutes the major social environment of early life for most children. As posited by Tronick and Cohn (1989), with increasing age, usually beginning at 9 months, the child becomes more active in initiating a topic or object of attention. Children older than 1 year of age of mothers experiencing depressive symptoms may depend less on interactions with their mothers, since they more actively seek their engagement and focus on external stimuli. By 17 months, once children had become more active, maternal depression resulted in less impaired interactions and cognitive outcomes. An alternative explanation would be that interaction patterns stabilize once constructed in the first year and become somewhat resistant to either negative or

positive changes past this period. Finally, our results indicate that depression symptoms assessed once during the first year of life have a significant influence three and a half years later on maternal scaffolding and child's later cognitive functioning. As observed by Campbell and colleagues (1995) the chronicity of these maternal symptoms during the first year may prove to be an even more important contributor to children's outcomes. Thus, monitoring mothers' depressive symptoms at different time points during the first year may disclose interesting results.

*Differentiating Depression Symptoms*

Using an estimated score of maternal depression symptoms was a particular strength of our study. By identifying those items of the CES-D which most powerfully predicted quality of guidance scores, we can examine developmental differences in depressed mother's symptoms which influence their quality of guidance. It seems that over time some maternal depression symptoms become more important in predicting quality of guidance whereas other symptoms become less important. For example, some CES-D items which strongly related to quality of guidance at 5 months were no longer related with quality of guidance at 17 months such as: "I did not feel like eating; my appetite was poor", " I felt depressed", " I felt hopeful about the future", " I felt that people disliked me". In addition, at 17 months the item "I had crying spells" was identified as a powerful predictor of quality of guidance, whereas this item was not significant at 5 months. It is possible that at an earlier age, depressive symptoms and cognitions predicted mother's quality of guidance, whereas at a later age, depressed mood such as crying spells become more pertinent in predicting less adequate maternal guidance. Depressed cognitions include a marked lowering of self-esteem and self-confidence with increased thoughts of pessimism,

hopelessness and helplessness. Depressed mood includes feeling sad or empty and being tearful. Thus, when examining mothers experiencing "baby blues", a common temporary psychological state right after childbirth, or "postpartum depression" which onsets within 4 weeks of childbirth, the specific symptoms identified in our analysis should receive careful attention. The presence of these particular symptoms, as opposed to others, is associated with a greater risk for impaired mother- child interactions. Future studies should explore the developmental meaning of these particular symptoms of maternal depression which predict child's cognitive development problems.

*Maternal Depression and Child Cognitive Outcomes*

Our study reveals that maternal depression symptoms at 5 months are predictive of children's receptive vocabulary scores, school readiness and short-term memory scores at 60 months. However, the strength and robustness of these relationships varied according to age. For example, at 42 months maternal depression symptoms correlated more strongly with school readiness. Overall, children of mothers experiencing depressive symptoms were less proficient at selecting pictures which best illustrated the meaning of a stimulus word. They experienced difficulty identifying colors and shapes, describing pictures, identifying numbers and letters. In addition, it was difficult for them to remember verbal, spatial and perceptual information of items. In line with past studies which have found a relationship between maternal depression and a general measure of cognitive outcomes (Beck, 1998; Hay, Zahn-Waxler, Cummings & Iannotti, 1992; Murray, 1992; NICHD, 1999), this study pinpoints to impairments in specific cognitive dimensions. To our knowledge, no other study has examined child short- term memory in its relationship to maternal depression.

*Maternal Depression, Quality of Guidance and Child Cognitive Outcomes*

In this study, mothers experiencing depression symptoms at 5 months were impaired in the scaffolding provided to their children during two different number-related activities at 48 months, even when variables such as maternal education and family revenue were controlled for. These mothers were more likely to be intrusive, controlling or disengaged during the activities with their children. Similarly, other studies have found that depressed mothers have distinctive interaction styles (Cohn et al., 1986; Field et al., 1990). For example, Albright and Tamis-LeMonda (2002) found that mother-child interactions suffered dramatically in the context of maternal depression symptoms measured by the CES-D at 18 to 30 months in low-income mothers. More specifically, depressive symptoms were associated with less sensitivity, engagement, flexibility and positive affection in mothers and with less mutuality, reciprocity and enjoyment in dyads.

In turn, our results suggest that higher quality of guidance during mother- child interactions at 48 months is predictive of higher receptive vocabulary, school readiness and short-term memory in children at 60 months. This association suggests that children in our study were more likely to benefit from joint cognitive activities when maternal support was geared towards their zone of proximal development (Conner & Cross, 2003). These findings extend prior results which have found an association between impairments in the dyads' quality of interactions and child cognitive outcomes, such as academic competence (Mattanah et al., 2005), developmental abilities (Mahoney et al., 1998) and language development (Tamis-LeMonda et al., 2001). It is possible that children with higher cognitive outcomes may have provided their mothers with more opportunities for positive feedback, facilitating the creation of a good quality of scaffolding in their interactions. Since our measure of quality of guidance was only at 48 months it may prove interesting to

follow the developmental sequence of these interactions in order to examine how these relations evolve and influence cognitive outcomes for children of both depressed and non-depressed mothers.

*Maternal Guidance: A Mediator Effect*

Our most significant finding is that maternal guidance at 48 months fully mediated the relationship between maternal depression symptoms at 5 months and children's receptive vocabulary at 60 months. Since maternal sensitivity has been found to mediate the relationship between maternal depression and child verbal comprehension at 42 months (NICHD, 1999), this study extends findings to the school entry period, (60 months). In addition, our second hypothesis stipulating that maternal guidance mediates the relationship between maternal depression symptoms and child's school readiness is confirmed. Maternal depression symptoms at 5 months less clearly predicted Lollipop scores (p=0.07). When quality of guidance was included in the model, maternal depression symptoms no longer predicted Lollipop scores, indicating the mediating role of quality of guidance, further confirmed by a significant Sobel test. These findings are in line with Vygotsky's zone of proximal development theory (1978) in which children's cognitive growth evolves from social interactions with their parents. Overall, quality of guidance seems to play an important role in explaining the relationship between maternal depression and child cognitive outcomes. As Heckman (2006) explains, environments that do not stimulate the young and fail to cultivate skills at early ages place children at an early disadvantage. This disadvantage emerges more from lack of cognitive and noncognitive stimulation given to children than simply from the lack of financial resources.

Our third hypothesis stipulating that quality of guidance at 48 months may explain the relationship between maternal depression symptoms at 5 months and VCR scores at 60 month is rejected. When maternal depression symptoms are regressed on VCR scores and quality of guidance is controlled for, neither maternal depression nor quality of guidance significantly predict child VCR scores. Although there is an existing relationship between maternal depression symptoms and child's short- term memory, it seems that quality of guidance does not explain this relation.

In contrast to measures such as PPVT-R and the Lollipop test, the VCR may be more susceptible to other influences. Let us examine a few possibilities. Mother-child interactions measured before 48 months may differently influence VCR scores. Child short-term memory could be influenced by quality of guidance or sensitivity provided by these mothers at earlier time points, such as in the first year of life. Alternatively, in the last decade, evidence has continued to accumulate about the strong association between childhood maltreatment and social, emotional, behavioral and cognitive adaptational failure in later childhood and adulthood (Glaser, 2000). It has been shown that early severe stress produces many neurobiological events that have the potential to cause enduring changes in brain development. Moradi, Doost, Taghavi, Yule and Dalgleish (1999) found that children with post-traumatic stress disorder showed poorer overall memory performance compared with controls. Interestingly, stress hormones, both cortisol and noradrenalin, have been found to be elevated in depressed mothers and infants (Field, 1998). Infants of depressed mothers also show less distress when separated from them. Sapolsky (1996) has found a significant correlation between sustained stress, excess cortisol and damage to the hippocampus in humans. The hippocampus, part of the temporal lobe of the brain, is integrally concerned with memory. Thus, this stress may possibly explain the relationship

between maternal depression symptoms and child impaired short-term memory. On the other hand, brain functioning differences may also explain the existing relationship between maternal depression symptoms and child short- term memory. For example, Jones, Field, Davalos and Pickens (1997) found that a significant number of children of depressed mothers demonstrated right frontal EEG asymmetry during 3 to 6 month visit and continued to show the same pattern at 3 years of age.

*Conclusion*

In line with several studies, we have found that maternal depression symptoms predict child cognitive impairments in receptive vocabulary, school readiness and short-term memory. In support of research stipulating that the child's first year of life is a "sensitive period", we have found that mother's depression symptoms at 5 months influences child's cognitive outcomes. Increased depressive symptoms in mothers were associated with lower quality of guidance during mother-child interactions. These mothers tended to be more intrusive, controlling or disengaged in interactions with their children. We have identified certain depression symptoms which are more likely to negatively influence the quality of mother child interactions and which may place children at a greater risk. As previously confirmed by other studies, increased quality of guidance provided by mothers was associated with children's higher receptive vocabulary, school readiness and short-term memory outcomes. Finally, we have found that the relationship between maternal depression at 5 months and child's receptive vocabulary and school readiness is significantly mediated by quality of guidance at 48 months. However, quality of guidance during mother-child interactions did not explain the association between maternal depression symptoms and child's impaired short-term memory. Nevertheless, our study

endorses the relevance and the need of continued longitudinal studies in order to determine the complex developmental mechanisms through which maternal depression exerts lasting effects on the child.

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# GENERAL DISCUSSION AND CONCLUSION

Maternal depression has been shown to predict impaired cognitive outcomes in children. Studies have revealed that these children have lower cognitive outcomes at 9 months, 18 months (Murray, 1992), 1 year old (Lyons-Ruth et al., 1986; Beck, 1998), 2 years old (Redding et al., 1990) and 3 years old (Cornish et al., 2005). Moreover, many studies have found that it is especially maternal depression symptoms experienced in the first year of a child's life that impair later child cognitive development (Cornish et al., 2005; Sharp et al., 1995; Hay et al., 2001). Similarly, we have found that maternal depression symptoms, particularly in the child's first year were significantly predictive of child's later receptive vocabulary, school readiness and short-term memory at 60 months.

Several mediating mechanisms have been suggested in order to account for this association. The following biological variables may possibly mediate the relationship between maternal depression and child impaired cognitive outcomes: brain function differences (Dawson et al., 2003), hormonal factors (Hay et al., 2001), heritability of intelligence (Hay et al., 2001; Sharp et al., 1995), gender differences (Murray et al., 1993; Murray et al., 1996; Sharp, et al., 1995; Milgrom et al., 2004; Hay et al., 2001; Kurstjens & Wolke, 2001), infant low birth weight (Hay & Kumar, 1994; Sharp et al., 1995) and breast-feeding ( Sharp et al., 1995; Galler & Harrison, 2000; Hay et al., 2001). Moreover, the following psychosocial variables have been suggested as influencing this relationship: marital conflicts (Hay and Kumar, 1994; Ashman, 2004), maternal substance abuse (Swendsena & Merikangas, 2000; Johnson & Leff, 1999; Sowder & Burt, 1980) and mother child interactions (Milgrom et al., 2004; NICHD, 1999). More precisely, of the variables mentioned, studies have principally examined and supported hormonal levels, breast-feeding, child gender and mother-child interactions as potential mediators in the association between maternal depression and child impaired cognitive development.

Goodman and Gotlib's integrative model (1999) proposes that exposure to mothers' negative cognitions, behaviors and affect may influence child outcomes. They explain that the behavior of the depressed caregiver with their child during interactions may have a negative influence on the child. Indeed, depressed mothers have been found to be less sensitive and emotionally available (Cicchetti et al., 1998), more disengaged (Weinberg & Tronick, 1998; Field et al., 1990), intrusive or provoking (Field et al., 1990) and less effective at setting limits on their toddlers and making compromises in their solution to conflicts (Kochanska et al., 1987). Similarly, we found that, mothers who experienced depression symptoms at 5 months were found to be more intrusive, controlling or disengaged during activities with their children at 48 months. Moreover, several studies have suggested that mothers' lack of sensitivity explains the existing relationship between depression symptoms and child outcomes (Breznitz & Sherman, 1987; Murray et al., 1993; NICHD, 1999; Milgrom et al., 2004). Our study supports these findings since we have found that impaired quality of guidance at 48 months mediated the association between maternal depression symptoms at 5 months and child outcomes, specifically child's receptive vocabulary and school readiness at 60 months. However, it now becomes necessary to understand how maternal guidance is integrated within these aberrations in order to further understand the processes underlying the development of children's cognitive outcomes.

*Clinical Implications*

The children of mothers who exhibit depressive symptoms are placed at an immediate risk and potential enduring disadvantage by their mother's lack of guidance. These children may benefit from interventions which focus on improving mother-child interactions, specifically the degree of maternal support provided to the child during

exchanges. By working on improving these interactions at an early age, it is possible that child receptive vocabulary may be improved. For example, Cicchetti, Rogosch and Toth (2000) implemented a conjoint intervention for depressed mothers and their toddlers called "Toddler-Parent Psychotherapy" which aimed to improve mother-child relationship and promote positive interactions and responsivity. Children of depressed mothers who took part in the intervention group had higher overall verbal IQ's than children of depressed mothers who were not in the intervention group. By improving mother-child communication, it may be that children begin to feel more confident and are thus more prepared to master their environments. Nonetheless, few studies have focused on interventions for difficulties in mother-child relationships with samples of mothers with depressed symptoms (Lyons-Ruth et al., 1986; Gelfland, Teti, Seiner & Jameson, 1996; Cicchetti et al., 2000) and findings remain unclear. These types of interventions, which aim at improving the quality of maternal scaffolding or maternal sensitivity remain the subject of speculation and present an inviting topic for future research.

*Limits*

Although our study has notable strengths, including a rich longitudinal database, structured and extended observation periods of mother-child interactions and refined measures of children's cognitive abilities as opposed to a global IQ measure, it involves certain limitations. The sample includes mother's experiencing depressive symptoms and not mother's clinically diagnosed with a depressive disorder. It is of interest to examine these same questions with clinically depressed mothers so as to better understand the generalizability of our findings. In addition, since research reveals that chronicity of depressive symptoms may influence mother-child interactions and child outcomes, future research should investigate this facet in more detail. For example, a study found that

mothers who were depressed from the postpartum period through 6 months were less positive with their infants during face-to-face interactions at 2, 4 and 6 months and less sensitive and engaged during feeding and toy play at 4 months than women whose postpartum depression had remitted by 6 months (Campbell, Cohn & Meyers, 1995). Another study revealed that chronic maternal depression, which lasted throughout the first 12 months postpartum and beyond, was associated with lower motor and cognitive performance in infants assessed at 15 months of age (Cornish et al., 2005). Finally, the self-report nature of maternal depression symptoms may be vulnerable to potential confounds of response bias. On a more positive note, this study includes cognitive measures of child receptive vocabulary, school readiness and short-term memory which are robust in respect to their reliability and validity.

*Conclusion*

We have found that early maternal depression symptoms predicted children's later outcomes on all three cognitive measures: receptive vocabulary, school readiness and short-term memory. Also, mothers experiencing depressive symptoms provided a lower quality of guidance during interactions with their children. In turn, this quality of maternal guidance predicted children's cognitive outcomes on all three measures. The results of this study highlight the importance of mother's quality of guidance, which provides an explanation for the association between maternal depression symptoms and child's weaker receptive vocabulary as well as school readiness outcomes. Our results imply that disadvantaged early environments are powerful predictors of later cognitive failure. Although these results are correlational, not causal, some speculation about the implication of this work for practice is appropriate. In many cases, children are often forgotten in a therapeutic process. When assessing maternal depressive symptoms, it is suggested that

clinicians observe mother-child interactions in order to better identify the children at risk for less optimal cognitive development. The quality of these interactions can be determined according to mothers' collaborative, controlling, intrusive or withdrawn behaviors. When working with families where maternal depression symptoms are present as well as impaired mother-child interactions, mental health professionals may assist mothers in using sensitive parenting skills, so that their children are given the best possibility for later vocabulary and school readiness.

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Appendix A:

CES-D Questionnaire:

Maternal Depression Symptoms

Combien de fois êtes-vous senti ou comporté de cette façon au cours de la dernière semaine:

1: Rarement ou jamais (moins d'un jour)
2: Parfois ou une toute petite partie du temps (1 à 2 jours)
3: Occasionnellement ou une partie modérée du temps (3 à 4 jours)
4: La plupart du temps ou tout le temps
-2: Ne sais pas
-1: Refus de répondre à la section
-3:Refus de répondre à la question

(Ces items sont présentés lors des ceuillettes de données à 5 et 17 mois)

a. Je n'ai pas envie de manger, j'avais peu d'appétit
b. J'ai eu le sentiment de ne pas pouvoir me débarrasser du cafard, même avec l'aide de ma famille ou de mes ami (e)s.
c. J'ai eu de la difficulté à me concentrer sur ce que je faisais
d. Je me suis senti (e) déprimé (e)
e. J'ai eu le sentiment que tout ce que je faisais me demandait un effort.
f. J'ai été plein d'espoir face à l'avenir.
g. Mon sommeil a été agité
h. J'ai été heureux (se)
i. Je me suis senti (e) seul (e)
j. J'ai joui de la vie
k. J'ai pleuré
l. J'ai eu le sentiment que les gens ne m'aimaient pas

\* À 5 et 17 mois, tout les items sont administrés, à 42 mois, seulement les items suivants sont administrés: b, d, e, h, i, j.

\*\* À 5 mois, l'analyse de regression « backward » identifie les items a, b, d, f, h, l

\*\*\*À 17 mois, l'analyse de regression « backward » identifie les items b, h, k

Appendix B:

Coding Scale used to Measure

Quality of Guidance During Mother- Child Interactions

Grille de codification: Qualité de l'orientation: autonomie/intrusion/désengagement

**(1) Orientation inadéquate: Intrusion et contrôle constants ou Non implication parentale:** Le parent ne laisse pas assez d'opportunités à l'enfant de contribuer à la tache; il organise toute l'activité de l'enfant ou le fait à sa place. Le parent contrôle constamment l'enfant. OU Le parent n'est pas impliqué dans la tache, le support qu'il apporte à l'enfant est minime. Il semble ailleurs, peu attentif à la tache. Dans l'ensemble, la tache n'est pas une bonne opportunité d'apprentissage pour l'enfant.

**(2) Orientation précaire: Minimum d'autonomie, beaucoup de contrôle ou au contraire, manqué de contrôle de la part du parent:** Le parent fournit un minimum d'opportunités à l'enfant de contribuer à la tache, tout en continuant d'en contrôler la majeure partie. Ou, au contraire, le parent laisse trop d'opportunité à l'enfant de contribuer à la tache, ou le guide parfois, mais en utilisant des directives trop vagues, générales, beaucoup trop globales. Le défi de la situation ne demeure donc pas assez grand pour l'enfant, ou est trop grand à cause du manque de support parental. On peut aussi observer beaucoup d'interruptions de la part du parent (trop contrôlant), ou encore de l'enfant, qui effectue des demandes d'aide à un parent qui ne le contrôle pas assez.

**(3) Orientation plus au moins adéquate: Autant d'insuffisance que de contrôle approprié:** Le parent fournit quelques opportunités à l'enfant de contribuer à la tache, mais on a l'impression que l'enfant n'a pas contribué autant qu'il aurait pu faire si son parent lui avait laissé plus de place. Ou au contraire, pendant au moins la moitié de la tache, le parent ne fournit pas assez de support à l'enfant, alors qu'on sent nettement que l'enfant en aurait nécessité plus. Dans ce cas, étant donné que le défi de la tache demeure en partie trop grand pour l'enfant, celui-ci peut alors sembler désintéressé ou paraissant avoir perdu sa motivation.
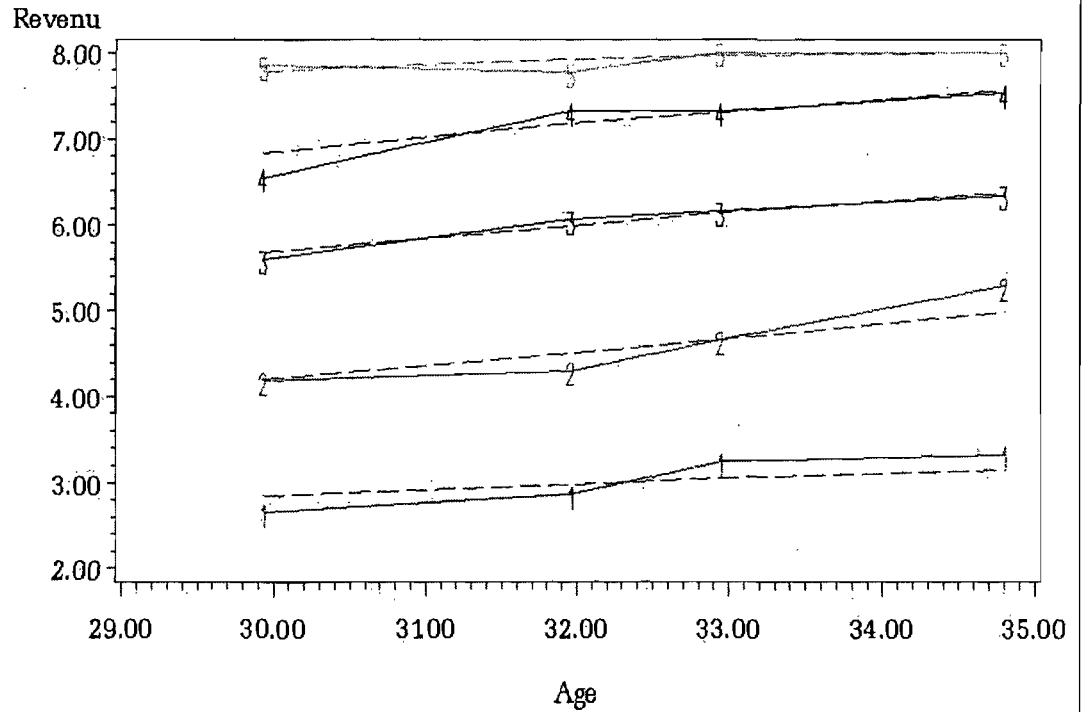
**(4) Orientation adéquate, parfois plus au moins appropriée: Il peut y avoir des épisodes de contrôle insuffisant de la part du parent:** Étant donné le niveau de développement et les habiletés de l'enfant, dans l'ensemble il y a un équilibre approprié entre l'apport du parent et de l'enfant dans la tache. Généralement, le parent est sensible aux indices de l'enfant et au degré d'orientation dont il a besoin. Mais il peut arriver qu'à quelques reprises pendant l'activité, on observe que le parent ne fournit pas assez de support à l'enfant. Alors que celui-ci en aurait nécessité plus. Le défi de certaines opérations demeure ainsi parfois trop grand pour l'Enfant. Certaines opérations sont alors trop difficiles à accomplir pour lu, et on perçoit à quelques moments qu'il se décourage ou se désintéresse de la tache.

**(5) Orientation optimale: Équilibre constant entre l'autonomie et le contrôle:** Il y a un équilibre constant et excellent (étant donné le niveau de développement et les habiletés de l'enfant) entre l'apport du parent et de l'enfant dans la tache. Le parent est hautement sensible aux indices de son enfant et au degré d'orientation dont il a besoin. On observe qu'il s'ajuste pendant la tache aux prises d'initiative de son enfant. Il est possible d'observer des interactions laissant place à de la négociation entre les partenaires.

Appendix C

Household Revenue Trajectories

# Revenu familial vs. Age

## Modele CNORM