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An Epidemiological Study of Maternal Depression: Findings From the National Institute
of Child Health and Human Development Study of Early Child Care and Youth
Development

A thesis
presented to
the faculty of Department of Public Health
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Master of Public Health

by
Liang Wang
August 2008

Dr. Tiejian Wu, Committee Chair
Dr. James Anderson, Committee Member
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Key Words: Longitudinal Study, Maternal Depression, Risk Factor

ABSTRACT

An Epidemiological Study of Maternal Depression: Findings From the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development

by

Liang Wang

This study examined maternal depression status from month 1 to 36 after birth using data from the NICHD Study of Early Child Care and Youth Development. Maternal depression was assessed with the Center of Epidemiological Studies Depression Scale. The prevalence of maternal depression was highest at 1 month, decreased at 6 months, and then kept fairly stable to 36 months. The prevalence was higher in blacks than other races, in 18-24 than 25-46 years old, and in single mothers than non-single mothers. Mothers with better physical health, social support, or employed had a lower prevalence than their counterparts. Mothers in poverty, receiving public assistance, or who had more parental stress had a higher prevalence. Social support and parental stress had a statistically significant relationship with maternal depression even after adjusting for other variables. In conclusion, this longitudinal study found that several maternal, child, and family factors were associated with maternal depression.

DEDICATION

I dedicate this thesis to my family for their constant support and love.

ACKNOWLEDGEMENTS

For all the days that I have been lonely, for all the times that I have felt blue, for all the times I needed...A shoulder to lean on. Thanks for being here as a student so true!

I would like to thank Dr. Tiejian Wu, my advisor, for his constant help and encouragement, without him this thesis would not have been finished. He is a great professor always building my confidence and arousing my interest for epidemiological research as well as an amazing friend sharing my happiness and anxiety. I also would like to thank Dr. James Anderson, who taught me classes of epidemiology, for helping me gradually understand the epidemiological methods. His serious and friendly attitudes of teaching benefit me a lot with solid knowledge and high spirit. I also would like to thank Dr. James Florence for his valuable suggestions during my graduate study and particularly the smile and welcome when I arrived ETSU 2 years ago, a shining start for me to pursue my dream. Last but not least; I really appreciate the eternal support from my beloved wife Shaoqing Gong, aunts Yu Du and Fang Wang, uncle Jingping Gao, and Mrs. Jing Liu.

CONTENTS

	Page
ABSTRACT	2
DEDICATION	3
ACKNOWLEDEMENTS	4
LIST OF TABLES	8
LIST OF FIGURES	9
 Chapter	
1. INTRODUCTION	10
2. LITERATURE REVIEW	14
Definition and Prevalence.....	14
Definition and Symptoms of Postpartum Depression.....	17
Etiology and Risk Factors.....	20
Biological Factors	22
Society Factors	24
Effect on Child.....	27
Summary.....	28
3. DESIGN AND METHODS	30
Data Source	30
Study Sample	31
Study Variables	31
Outcome Variables.....	32
Maternal Depression and CES-D scores.....	32
Exposure Variable.....	33
Maternal Age and Ethnicity	33

Poverty and Family Income	34
Family Structure and Marital Status	35
Social Support.....	35
Maternal Employment	36
Maternal Education.....	37
Maternal Health Status.....	37
Child Birth Outcome and Health Status.....	38
Stressful Events.....	40
Covariates	41
Plan for Data Analysis	42
Data Preparation.....	42
Analysis of the CES-D Scores and Prevalence of Maternal Depression	42
Descriptive and Bivariate Analysis.....	43
Multivariable Models.....	43
4. RESULTS	45
Characteristics of the Participants: Information Attained at 1 Month After Birth ..	45
Descriptive Statistics of CES-D and Prevalence of Maternal Depression at Five	
Periods.....	48
Bi-Variate Analysis	49
Correlations of the CES-D at Different Months After Birth	49
Correlations between Potential Risk Factors at First Month and CES-D at	
Different Months After Birth	51
Prevalence of Maternal Depression at Different Months After Birth by	
Demographic Characteristics	51
Prevalence of Depression at Different Times After Birth by Social Characteristics.	55
Prevalence of Depression at Different Times After Birth by Family Income and	
Poverty	57

Prevalence of Depression at Different Months After Birth by Maternal Education..	58
Multivariate Analysis.....	59
Logistic Regression Analysis.....	60
Risks for Maternal Depression at 1 Month After Birth: Logistic Regression	60
Risks for Maternal Depression at 6 Months After Birth: Logistic Regression....	63
Risks for Maternal Depression at 15 Months After Birth: Logistic Regression..	66
Risks for Maternal Depression at 24 Months After Birth: Logistic Regression..	69
Risks for Maternal Depression at 36 Months After Birth: Logistic Regression..	72
Linear Regression Analysis	75
Multiple Regression Analysis for CES-D at 1 Month After Birth.....	75
Multiple Regression Analysis for CES-D at 6 Months After Birth.....	77
Multiple Regression Analysis for CES-D at 15 Months After Birth.....	79
Multiple Regression Analysis for CES-D at 24 Months After Birth.....	81
Multiple Regression Analysis for CES-D at 36 Months After Birth.....	83
5. DISCUSSION	86
Summary of Findings	86
Limitations of the Study	89
Strengths of the Study.....	90
REFERENCES	91
APPENDICES	105
Appendix: Variables Pooled from NICHD Database	105
VITA	106

LIST OF TABLES

Tables	Page
1. Study Variables.....	32
2. Definitions of Child Birth Outcome Terms	39
3. Characteristics of the Participants: Information Attained at 1 Month After Birth	46
4. Descriptive Statistics of CES-D and Prevalence of Maternal Depression at Five Periods	49
5. Pearson’s Correlation Coefficients of the CES-D at Different Months After Birth	50
6. Pearson’s Correlation Coefficients between Potential Risk Factors at First Month and CES-D at Different Months After Birth	51
7. Prevalence of Maternal Depression at Different Months of Child Age by Demographic Characteristics.....	52
8. Prevalence of Depression at Different Times After Birth by Social Characteristic	56
9. Prevalence of Depression at Different Times After Birth by Family Income/Poverty..	57
10. Prevalence of Depression at Different Months After Birth by Maternal Education	59
11. Risks for Maternal Depression at 1 Month After Birth: Logistic Regression	61
12. Risks for Maternal Depression at 6 Months After Birth: Logistic Regression.....	64
13. Risks for Maternal Depression at 15 Months After Birth: Logistic Regression	66
14. Risks for Maternal Depression at 24 Months After Birth: Logistic Regression.....	70
15. Risks for Maternal Depression at 36 Months After Birth: Logistic Regression	73
16. Multiple Regression Analysis for CES-D at 1 Month After Birth.....	76
17. Multiple Regression Analysis for CES-D at 6 Months After Birth	78
18. Multiple Regression Analysis for CES-D at 15 Months After Birth	80
19. Multiple Regression Analysis for CES-D at 24 Months After Birth	82
20. Multiple Regression Analysis for CES-D at 36 Months After Birth	84

LIST OF FIGURES

Figures	Page
1. An Association of Work Hours, Poverty, Welfare Receipt, Income, and Relationship Unhappiness with the Outcome of Maternal Depressive Symptoms.....	16
2. An Association of Parent Education, Work Hours and Related Factors with the Outcome of Maternal Depressive Symptoms	17
3. Framework of Relationships of Maternal, Child, and Family Factors Influencing Maternal Depression	41
4. Means of CES-D at Different Months After Birth.....	49
5. Percent of Depressed Mothers at Different Months After Birth by Race	55
6. Prevalence of Depression at Different Times After Birth by Total Family Income Level.....	58

CHAPTER 1

INTRODUCTION

Depression is the leading cause of disease-related disability among women (Kessler, 2003). Women of childbearing age are at high risk for major depression (Burke, Burke, Rae, & Regier, 1991; Depression Guideline Panel, 1993; Robins & Regier, 1991). Maternal depression is a nonspecific term that refers to depression in mothers of young children. "Postpartum depression" is used to describe a continuum of depressive symptoms and diagnoses that occur in the weeks to months after childbirth. The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Text Revision uses a time frame for onset of symptoms within 4 weeks of childbirth and restricts the use of the postpartum specific to major depression, bipolar disorder, and brief psychotic disorder (American Psychiatric Association, 2000). Researchers and mental health clinicians often use a more extensive time frame for the onset of depression, such as within the first 3 months (Kendell, Chalmers, & Platz, 1987) or even up to 1 year after childbirth (Beeghly et al., 2002).

Maternal depression in the U.S. and worldwide has become a major public health concern. The lifetime risk for depression for women is estimated at 10%-25% and peaks during their childbearing years (Desai & Jann, 2000; Wisner, Gelenberg, Leonard, Zarin, & Frank, 1999). Because there is a mild or serious disorder as an adverse consequence of maternal depression, it negatively affects the social, emotional, and cognitive development of children. The development of young children can be affected significantly by maternal depression. Infants and young children of depressed mothers can experience a range of problems including lower activity levels, fussiness, problems with social interactions, and difficulty achieving age-appropriate developmental and

cognitive milestones (Weinberg & Tronick, 1998). Children of depressed parents have high rates of anxiety, disruptive, and depressive disorders that begin early, often continue into adulthood, and are impairing (Mulhern, Fairclough, Smith, & Douglas, 1992). Approximately 10% to 20% percent of women experience depression either during pregnancy or in the first 12 months after delivery (Gaynes et al. 2005; Glascoe, 2006). Among mothers with young children, between 12% and 47% experience the condition (Olson et al., 2002). Maternal depression can have serious and lasting consequences on a child's development. The consequences of maternal depression are not restricted to infancy but can also extend into toddlerhood, preschool age, and even school age children. Children of depressed mothers are at risk for developmental and behavioral problems and may be predisposed to developing depressive disorders themselves. Early recognition of depression is important because early intervention can prevent or reduce the negative impacts of maternal depression on the child and the family.

Although maternal depression has become a significant public health problem, longitudinal studies based on a national sample are rare. As a result, the dynamic of maternal depression over the different periods of child-rearing and its risk factors are largely understudied. Therefore, epidemiological investigation of maternal depression will provide useful data and has important public health implications.

There are two main objectives of this study: 1) to describe the prevalence of maternal depression and 2) to examine the risk factors for maternal depression. We examined the prevalence of maternal depression in different groups stratified by gender, race and ethnicity, age, education, and income levels. We also investigated possible risk

factors including family income, maternal age, maternal education, stressful events, social support, maternal employment, family structure, child health status, and so on.

The following hypotheses are tested in this study:

1. Mothers with a low family income are at a higher risk for maternal depression than mothers with a high family income.

2. Mothers who have low levels of education are at a higher risk for maternal depression than mothers who have high levels of education.

3. Mothers who receive less social support are at a higher risk for maternal depression.

4. Mothers who have a child with health problems are at a higher risk for maternal depression than mothers who have a healthy child.

5. Mothers who are in poor or fair health status are at a higher risk for maternal depression than mothers who are in good or excellent health status.

6. Mothers who are single or divorced are at a higher risk for maternal depression than mothers who are married.

7. Mothers exposed to high stress events are at a higher risk for maternal depression than mothers exposed to low stress events.

8. Mothers who are not employed are at a higher risk for maternal depression than mothers who are employed.

Healthy People 2010 identified depression as 1 of the 10 leading public health concerns in the United States (US Department of Health and Human Services, 2002). Pediatricians have become increasingly concerned about maternal depression (Heneghan, Silver, Bauman, & Stein, 2000; Kemper & Babonis, 1992; Zuckerman & Beardslee, 1987) because of the high rates experienced by women throughout their childbearing years

(Cooper, Campbell, Day, Kennerley, & Bond, 1988; Cyranowski, Frank, Young, & Shear, 2000; O'Hara, Neunaber, & Zekoski, 1984; Gotlib, Whiffen, Mount, Milne, & Cordy, 1989; Evans, Heron, Francomb, Oke, & Golding, 2001) and the associated negative effects on mothers, infants, and children.

The prevalence of maternal depression has recently begun to increase in the United States (O'Hara et al., 1984). Unfortunately, due to the limited number of sources and studies on the causes and risk factors of maternal depression, the problem remains largely unaddressed. The larger sample size and the rich data of NICHD provide the foundation for a comprehensive analysis. The study focused on maternal depression from the time of birth until the child is 36 months old. The study results would be very helpful in establishing the characteristics of maternal depression and the risk factors in the US population.

CHAPTER 2

LITERATURE REVIEW

Definition and Prevalence

The term depression has been used to refer to either a depressive mood or to a diagnosis of depression. A depressive mood consists of feelings of sadness, helplessness, and gloom. Sadness is a common human experience, but the mood disturbance called depression is more than just sadness; it involves a loss of interest or pleasure, an emotional emptiness, and a feeling of “flatness” (Hamilton, 1982).

The prevalence of depression differs among studies because of different populations studied, secular changes over time, different assessment tools used, and different definitions of depression (Zuckerman & Beardslee, 1987). Depression is a common, debilitating condition affecting increasing numbers of Americans. A national study of individuals aged 15–54 years reported a lifetime prevalence of 17.1% and found that depression was more common in females, young adults, and those with less education (Bebbington et al., 2003; Blazer, Kessler, McGonagle, & Swartz, 1994; Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993; NIH, 2006; Kessler, McGonagle, Nelson, et al., 1994; Kessler, McGonagle, Zhao, et al., 1994). Depression is expected to replace cancer as the second leading cause of morbidity within the next decade and, according to the Global Burden of Disease Study, ranks number one in contributing to the loss of disability-adjusted life years for females ≥ 5 years worldwide (Blehar & Oren, 1997; Murray & Lopez, 1996). Further, depression in the workplace has been linked to increased absenteeism and productivity loss, and these depression-related workplace costs are equal to those of diabetes and hypertension and nearly equal to the direct costs of depression treatment (Druss, Rosenheck, & Sledge, 2000; Kessler et al., 1999;

Marlowe, 2002). Depression in younger women is a particularly important problem because it has the potential to affect not only women but also their children (Carter, Garrity-Rokous, Chazan-Cohen, Little, & Briggs-Gowan, 2001; Downey & Coyne, 1990; Goodman & Gotlib, 1999; Guttman, Dick, & To, 2004; Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Teti, Gelfand, & Messinger, 1995).

Estimates of depression in women with children (maternal depression) range from 10% to 42%, with few of these women either identified or treated (Chaudron, Szilagyi, Kitzman, Wadkins, & Conwell, 2004; Heneghan, Silver, Bauman, Westbrook, & Stein, 1998; Wells, Sturm, & Sherbourne, 1996). The majority of information on the prevalence of maternal depression comes from postpartum studies rather than studies of mothers with young children (McLennan, Kotelchuck, & Cho, 2001), although there are data to suggest that mothers may develop depression throughout the early years of children's development (Davies, Howells, & Jenkins, 2003). Correlates of depression in women with children point to a common constellation of factors. Women who are younger, socially disadvantaged (measured by low education, unemployment, low income, or being single), have more than one child, report a high number of stressful life events, and have low social support are more likely to be depressed compared with women without these characteristics (Bolton, Hughes, Turton, & Sedgwick, 1998; Brown & Moran, 1997; Murray, Cox, Chapman, & Jones, 1995; O'Hara, Zekoski, Philipps, & Wright, 1990).

Although pregnancy always leads to obvious physiological changes, mental problems can also arise. People still underestimate the impact of mental problems, though the risks of diseases have been reduced due to development of medicine and treatment. The etiology of maternal depression is not well understood, and the definition and discussion of therapy is inadequate. Maternal depression begins at the time of childbirth

and leads to periods of short mental or emotional instability. People often neglect the diagnosis of depression, and consequently do not get the immediate treatment that is essential for postpartum psychosis.

Figure 1 and Figure 2 demonstrate the result of some previous findings that show an association of work hours, poverty, welfare receipt, income, and related factors with the outcome of maternal depressive symptoms.

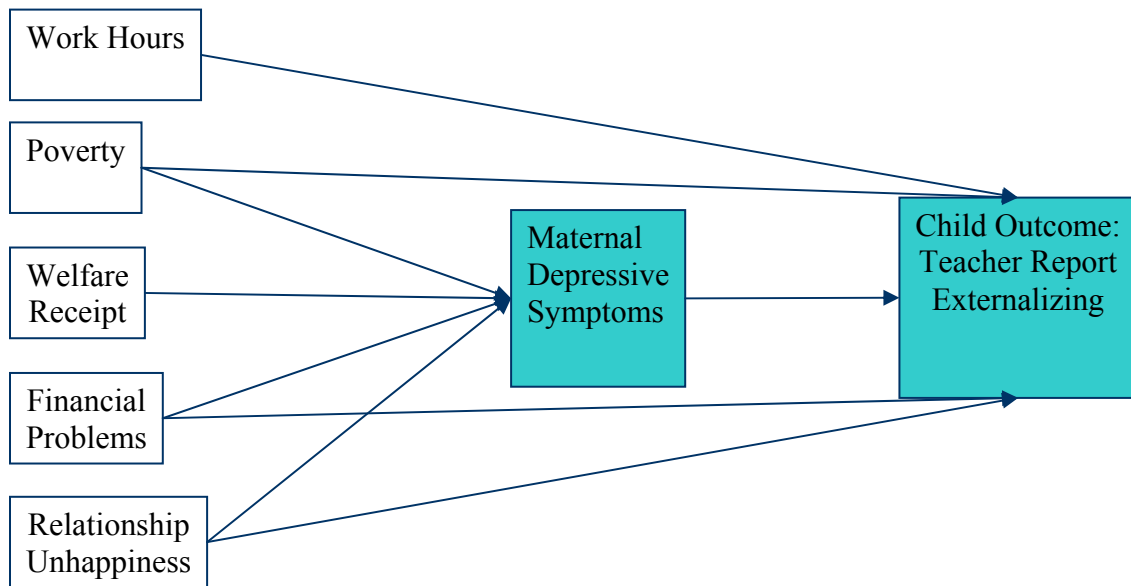


Figure 1 An Association of Work Hours, Poverty, Welfare Receipt, Income, and

Relationship Unhappiness with the Outcome of Maternal Depressive Symptoms

Source: Hair, E.C., McPhee, C.B., Milot, A.S., Halle, T., & Moore, K.A. (2001). Early Return to Work, Long Work Hours, and Maternal Depression: Lessons from the Early Childhood Longitudinal Study, Birth Cohort. Retrieved March 7, 2008, from [Http://www.childtrends.org/Files/Child_Trends-2006_11_02_SP_maternaldepression.ppt](http://www.childtrends.org/Files/Child_Trends-2006_11_02_SP_maternaldepression.ppt)

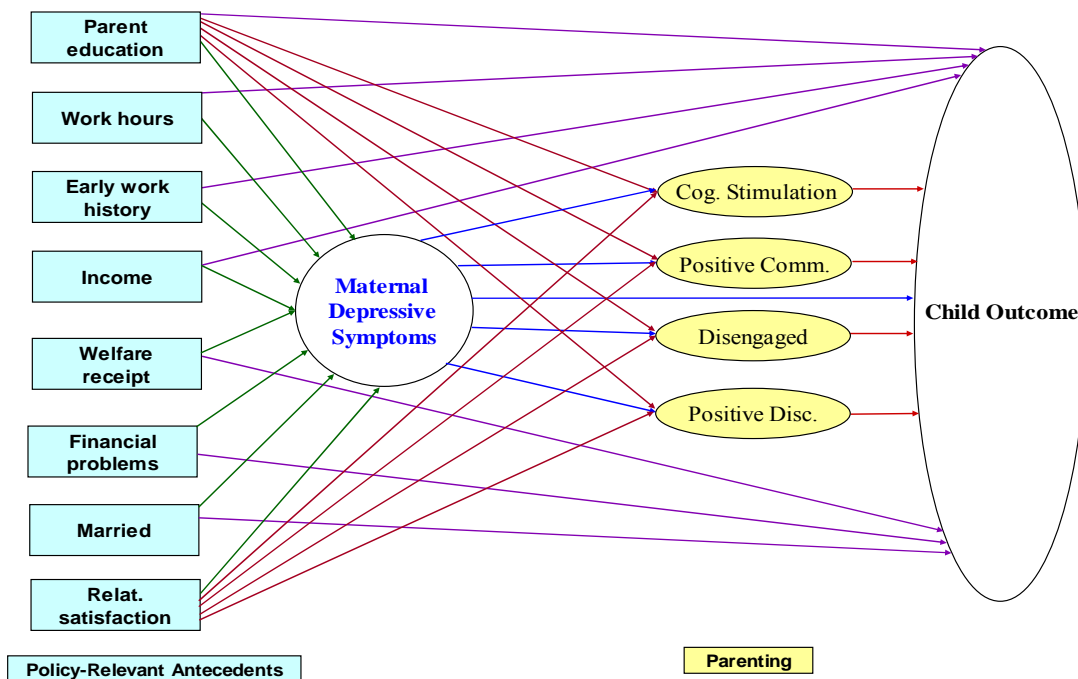


Figure 2 An Association of Parent Education, Work Hours, and Related Factors with the Outcome of Maternal Depressive Symptoms

Source: Hair, E.C., McPhee, C.B., Milot, A.S., Halle, T., & Moore, K.A. (2001). *Early Return to Work, Long Work Hours, and Maternal Depression: Lessons from the Early Childhood Longitudinal Study, Birth Cohort*. Retrieved March 7, 2008, from [Http://www.childtrends.org/Files/Child_Trends-2006_11_02_SP_maternaldepression.ppt](http://www.childtrends.org/Files/Child_Trends-2006_11_02_SP_maternaldepression.ppt)

Definition and Symptoms of Postpartum Depression

The epidemiology of postpartum depression is considered separately because it is of special interest in the study of the effects of maternal depression on children. Postpartum depression (PPD) is a serious medical condition that can develop some time in the first few months after childbirth. Without treatment, PPD can be prolonged and disabling. Postpartum depression is very common, affecting 1 in 8 women during the first months after childbirth (Wisner, Parry, & Piontek, 2002). It can also strike after

miscarriage, stillbirth, and adoption. Researchers have identified three types of postpartum depression: baby blues, postpartum depression and postpartum psychosis.

The "baby blues" is the most minor form of Postpartum Depression. It usually starts 1 to 3 days after delivery and is characterized by weeping, irritability, lack of sleep, mood changes, and a feeling of vulnerability. These "blues" can last several weeks. It is estimated that between 50% and 80% of mothers experience the "baby blues" (Conway & Kennedy, 2004).

Postpartum Depression is more debilitating than the "blues." Women with this condition suffer despondency, tearfulness, feelings of inadequacy, guilt, anxiety, irritability, and fatigue. Physical symptoms include headaches, numbness, chest pain, and hyperventilation. A woman with Postpartum Depression may regard her child with ambivalence, negativity, or disinterest, thus causing a strain in the bond between mother and newborn. Postpartum Depression is still poorly defined and under studied; it tends to be under reported with estimates of its occurrence ranging from 3% to 20% of births. The depression can begin at any time between delivery and 6 months post-birth and may last up to several months or even a year.

Postpartum Psychosis is a relatively rare disorder. The symptoms include extreme confusion, fatigue, agitation, alterations in mood, feelings of hopelessness and shame, hallucinations, and rapid speech or mania. Studies indicate that it affects only one in 1,000 births (Conway & Kennedy, 2004).

A woman with PPD may have feelings similar to the baby blues-- sadness, despair, anxiety, irritability -- but she feels them much more strongly. PPD often keeps her from doing the things she needs to do every day. When a woman's ability to function is affected, this is a sure sign that she needs treatment. If a woman does not get treatment

for PPD, it can get worse and last for as long as a year. While PPD is a serious condition, it can be effectively treated with antidepressant medications and counseling. Just like diabetes or heart disease, it can be treated with therapy, support networks, and medicines such as antidepressants. The symptoms of postpartum depression include:

- Feeling sad or down often
- Frequent crying or tearfulness
- Feeling restless, irritable, or anxious
- Loss of interest or pleasure in life
- Loss of appetite
- Less energy and motivation to do things
- Difficulty sleeping, including trouble falling asleep, trouble staying asleep, or sleeping more than usual
- Feeling worthless, hopeless, or guilty
- Unexplained weight loss or gain
- Feeling like life isn't worth living
- Showing little interest in the baby

Although many women get depressed right after childbirth, some women don't begin to feel depressed until several weeks or months later. Depression that occurs within 6 months of childbirth may be postpartum depression. In rare cases, a woman may develop postpartum psychosis. This is a very serious disease and includes all the symptoms of postpartum depression and thoughts of hurting yourself or hurting the baby (Familydoctor.org editorial staff, 2008).

Etiology and Risk Factors

Postpartum depression seems to be triggered by the sudden hormone changes that occur after childbirth. These hormonal changes most commonly lead to postpartum depression when paired with risk factors such as previous depression (including bipolar disorder), poor support from partner, friends, and family, or a high level of stress (Wisner et al., 2002). The hormone changes and grief following miscarriage and stillbirth also trigger PPD in many women (Miller, 2002).

The following factors have been linked to maternal depression:

- Poor social support, meaning you have no one you can rely on for assistance or to share intimate thoughts and feelings with.
- Multiple or serious stressful life events such as difficulty in family relationships or at work, a recent move, a new job or other major change, the death of a loved one, severe financial problems, or the like.
- Previous history of severe PMS, menstrual disorders, and difficulty becoming pregnant (signs of hormone imbalance).
- History of childhood abuse, including emotional, physical, or sexual abuse.
- Thyroid problems or family history of thyroid problems.
- Chronic or frequent vaginal yeast infections or frequent antibiotic or steroid use, causing yeast overgrowth in the bowels.
- Low-fat, low-protein diet or other poor nutrient diet or severe morning sickness, which increases malnutrition.
- Poor relationship with your mother.
- A mother who had PPD.
- Oral-contraceptive use or receiving the Depo-Provera shot soon after delivery.

- Stopping breastfeeding soon after delivery, either by choice or because of lack of adequate milk.
- High weight gain during pregnancy and poor weight loss after pregnancy.
- A traumatic birth experience, including unexpected cesarean section or the delivery of a preterm infant.
- Early discharge from the hospital (less than 24 to 40 hours).
- Marital discord.
- Unwanted pregnancy.
- Women having their first baby after the age of 30 (Anonymous).

It has been noted in many studies that some children with depressed caregivers do not display behavioral dysfunctions and that some factors may exacerbate or moderate the effects of parental depression (Cicchetti & Toth, 1998). Among contextual risk factors, marital conflict (Downey & Coyne, 1990), stressful life events (Cicchetti & Toth, 1998), limited social support (O'Hara, 1997), poverty (Lyons-Ruth, Connell, Grunebaum, & Botein, 1990), lower social class (Murray, 1992), and lower maternal education (Hay & Kumar, 1995) are factors that may exacerbate parental depression and maladaptive parenting.

The reasons for occurrence of postpartum depression are extensive and probably associated with many risk factors such as genetics, society, psychology adjustment of internal environment after pregnancy, rearrangement of the proportions of sex hormones, family relationships, and environment, etc. The details on the following factors are provided below:

Biological Factors

Obstetric factors—such as operative birth, long and difficult labor, and negative experience of the birth—have all shown quite inconsistent findings (Astbury, Brown, Lumley, & Small, 1994; Green, 1990; Murray & Cartwright, 1993; Paykel, Emms, Fletcher, & Rassaby, 1980; Warner, Appleby, Whitton, & Fargher, 1996). Brown points out that as individual hospital samples are common, it is likely that local factors—social differences, variations in operative delivery rates, and possibly differences in women’s satisfaction with care—play a role in this (Brown, 1998).

Hormonal factors have been studied, but very little evidence of association with maternal depression has been found (George & Sandler, 1988; Kendall, 1985; O’Hara, Schlechte, Lewis, & Wright, 1991). A considerable degree of interest in the role of breastfeeding has been part of the search for hormonal factors in maternal depression, but as has been pointed out, no study has yet demonstrated any evidence of a positive association between breastfeeding and maternal depression despite widespread misinterpretation of the findings of two influential studies (Astbury et al., 1994). Indeed, there is consistent evidence that breastfeeding is negatively associated with maternal depression (Astbury et al., 1994; Currie, Thompson, Elwood, & Roberts, 1999; Forman, Videbech, Hedegaard, Dalby, & Secher, 2000).

Endocrine control system changes a lot during the process of pregnancy, especially within 24 hours after delivery. The sudden change of hormones is the main biological reason of postpartum depression. New mothers feel happiness when the release of placenta steroids increases to a maximum level. As the levels of placenta steroids decrease, mothers begin to feel the onset of depression. The first day after birth, the level of dissociate trihydroxyestrin drops more sharply than before, but it remains at a higher

level for depressed compared to non-depressed mothers during the following 2 days, while levels of estradiol do not show obvious changes.

Genetics: The incidence of postpartum depression is higher in mothers who have a family history of mental problems, especially depression issues. This demonstrates that heredity may influence the susceptibility and personality of women to depression.

Psychological factors: Maternal depression always occurs in the mothers with the following characteristics: ego, immaturity, easily irritated personality, instability of emotion, traditional gender role, lack of sociality, stubbornness, introversion, etc.

Pregnancy experiences occurring in a difficult psychosocial context constitute stressful life events capable of provoking an onset of depression. In this respect the experiences are comparable to negative life events from a variety of domains that can trigger the onset of depressive episodes in women (Brown & Harris, 1978).

Gestation: The more negative events that occur, the higher the chance of maternal depression. Adverse events include unemployment, illness, threatened abortion, etc, and these are important inducements to depression. Some studies say the probability of maternal depression is increased in women who are nervous before childbirth and have experienced premenstrual tension syndrome in the past. Motherhood is undoubtedly a crucial part of many women's lives. Although it brings numerous pleasures, it can also carry its load of stressors of which negative pregnancy experiences are among the most frequent (Lee & Slade, 1996; Osofsky & Osofsky, 1972). Numerous studies have shown the detrimental impact of such negative pregnancies on women's mental health. It is now widely recognized that negative pregnancy experiences are life events that can potentially trigger the onset of psychological disturbances in women, especially depression. While most studies have focused on the short-term impact for depression, there is reason to

believe that such pregnancies can act as an additional risk or vulnerability factor for depression later in life (Bernazzani & Bifulco, 2003).

Stage of childbirth or childbearing age: Inadequate knowledge of the process of delivery leads to new mothers' anxiety about the pain associated with childbirth. A nervous mind will result in a series of changes including nerve and endocrine disorders (eg, noradrenalin decrease) and decreased immunity. A number of studies have demonstrated that pregnancy in teenage years experienced outside a cohabiting relationship is associated with an increased risk of psychiatric morbidity in adulthood, including major depression (Harris, Brown, & Bifulco, 1987; Harris, Brown, & Bifulco, 1990; Maughan & Lindelow, 1997). In addition, it has been shown that teenage pregnancy is associated with well-established childhood and adulthood risk factors for depression (Harris et al., 1987; Maughan & Lindelow). Teen mothers are more likely to have experienced childhood adversity (Kessler et al., 1997) and to be exposed to difficult social circumstances in adulthood such as marital breakdown, unemployment, and financial and housing difficulties (Furstenberg, Brooks-Gunn, & Chase-Lansdale, 1989; Kiernan, 1980; Maughan & Lindelow). Consequently, teen pregnancy has been proposed as a key mediator between childhood adversity and later psychiatric morbidity (Harris et al., 1990; Radestad, Steineck, Nordin, & Sjögren, 1996) with some authors arguing that a prior depressive episode is a further mediator (Kessler et al., 1997).

Society Factors

Childbirth Outcome: Pregnant women worry about different delivery methods (e.g. Caesarean birth or natural delivery). The Caesarean birth impacts more on mothers due to fear of surgical pain. Some adverse outcomes including miscarriage, stillbirth,

birth defects, and antipathy to baby gender are risk factors to maternal depression. In China, families are fond of boys and the birth of girls is often viewed as unwelcome.

Traditional Habit: Some mothers prefer to rest at home for at least 1 month after delivery, during which they do not watch TV, read newspaper, go outside for a walk, or even get out of bed. In this case, the mothers become introverted and can not communicate well with others. Their regular lives have changed. These mothers always exhibit symptoms of sadness, despair, anxiety, and irritability, which increase the incidence of depression.

Support Power: Lack of family and society support particularly husband and parents' help might increase the risk of occurrence of postpartum depression. Many patients have common reasons: discordance with husband, inadequate care of family after delivery, chaotic home environment, and so on. The role of fathers and paternal distress in child development are understudied, meanwhile, primary emphasis continues to be placed on mothers, possibly because the main caregiver for the young infant is usually the mother. However, in their study of 3- to 6-month-old infants, Hossain et al. (1994) showed that infants of depressed mothers interacted better with their nondepressed fathers who could 'buffer' the effects of the mother's depression on infant interaction behavior. In addition, a cross-sectional study (Goodman, Brogan, Lynch, & Fielding, 1993) of 96 families with children between the ages of 5 and 10 years showed that in families in which the mother was depressed, children showed lower social and emotional competence if the father also had a psychiatric disorder. The role of fathers has been studied indirectly in the context of marital discord. According to a review by Downey and Coyne (1990), marital distress contributes directly to children externalizing problems, and increases their risk for clinical depression by inducing and maintaining parental

depression. It seems reasonable to suggest that satisfying relationships within the family unit would be associated with fewer depressive symptoms in mothers (Shore, Austin, Huster, & Dunn, 2002).

Other Factors: Unemployment and lower socioeconomic status are risk factors of maternal depression. Those women are often easily irritated, self-contemptuous, anxious, and unsure about how to plan the development of child. Low-income women are even more susceptible to depression, and there is evidence that those on welfare suffer greater depression than other low-income women (e.g., Lennon, Blone, & English 2001). Yet, current economic research completely overlooks the role that maternal depression plays in infant health (Conway & Kennedy, 2004). Financial resources are needed for the management of family life. Lack of adequate income has been shown to be associated with poorer parental coping (Peterson & Hawley, 1998). Lower socioeconomic status has been related to lower family cohesion, empathy, and the ability to reverse roles within the family. Higher family income provides the family with more options in regard to health care, recreation, and other commodities. Further, low income and worry about how to make ends meet can be a significant stressor for mothers (Peterson & Hawley).

In studies of welfare reform, there is a growing recognition of the role depression plays in preventing women from getting off welfare and finding and keeping employment. For instance, Lennon et al. (2001) provide an extensive survey of the prevalence of depression among low-income women and the consequences it has for them. They also discuss and evaluate different kinds of welfare and unemployment programs that incorporate treating mental illness. The results suggest that perhaps the Medicaid program and, more generally, the health care providers who treat pregnant women also need to recognize the important role that maternal depression plays in infant

health. Negative ratings of parenting competence, low perceived social support, and presence of health-related activity restrictions can be useful markers of likely depression among inner-city mothers of young children (Silver, Heneghan, Bauman, & Stein, 2006).

Having a baby can be one of the biggest and happiest events in a woman's life. While life with a new baby can be thrilling and rewarding, it can also be hard and stressful at times. Many physical and emotional changes can happen to a woman when she is pregnant and after she gives birth. These changes can leave new mothers feeling sad, anxious, afraid, or confused. For many women, these feelings (called the baby blues) go away quickly. But when these feelings do not go away or get worse, a woman may have postpartum depression (The National Women's Health Information Center US Department of Health and Human Services, 2002).

Effect on Child

Studies demonstrate an association between a mother's depression and adverse outcomes for a child, including low birth weight, behavior problems, somatic complaints, learning difficulties, poor growth, accidents, and affective illness (Zuckerman & Beardslee, 1987). Epidemiological research has shown that infants of depressed mothers show signs of poorer health (Abrams, Field, Scafidi, & Prodromidis, 1995; Dawson, Frey, Panagiotides, Osterling, & Hessel, 1997a; Dawson, Panagiotides, Klinger, & Spieker, 1997b; Field & Tiffany, 1995; Field & Tiffany, 1998; Jones, Field, Fox, Lundy, & Davalos, 1997; Locke et al., 1997) and are more likely to be depressed compared with women without these characteristics (Orr & Miller, 1995; Orr, James, & Blackmore, 2002). UK research has suggested depression during pregnancy and after birth can increase the risk of sudden infant death syndrome (SIDS) (Anonymous, 2007). When a mother's depression remits, her child's clinical state also improves, and children of

mothers who remain depressed are likely to deteriorate. When a mother's depression remits, her child's clinical state also improves, and children of mothers who remain depressed are likely to deteriorate. Maternal depression is one of the most consistent risk factors for childhood anxiety, depression, and disruptive behavior disorders (Moon, 2006). The following methodological improvements are found in more recent studies: (1) the use of nonclinical community samples of mothers and children; (2) in-depth observational assessment of the behavior of young children of depression mothers; and (3) the use of standardized diagnostic criteria for assessing both mother and child. These studies are highlighted (Zuckerman & Beardslee, 1987).

Summary

Maternal depression is a major public health problem that requires more resources to investigate. It affects not only the mother but also the father, other children in the family, and, most importantly, the newborn. Knowing the risks of maternal depression, we must recognize our responsibility to address this illness through improved research and greater access to care and services. Given the paucity of longitudinal studies following women with young children, little is known about the persistence of depression or of elevated depressive symptoms in these women or about the predictors of persistence or new onset. It still leaves some important questions unaddressed, particularly, the role of psychosocial variables and the characterization of women who newly develop symptoms and quality of marriage indicators in women with partners are important issues to investigate.

Therefore, advancing understanding of maternal depression will require further epidemiologic research that will focus on the onset of maternal depression and associated long-term changes. In addition, identifying key risk factors for maternal depression is the

basis for effective interventions. Using a national sample, this study performed a comprehensive analysis of the pattern of maternal depression over a period of child-rearing and provided new insights on the issue.

CHAPTER 3

DESIGN AND METHODS

Data Source

The NICHD Study of Early Child Care (SECC) is one of the most comprehensive longitudinal studies of children initiated by the National Institute of Child Health and Human Development (NICHD) in 1989. Participants in the NICHD SECCYD were recruited from hospitals at 10 research sites that were located in 10 different states. A conditionally random sample of 3,015 was selected from the eligible list to assure representation of at least 10% of single-parent households, mothers with less than a high school education, and ethnic minority mothers. Additional screening was conducted at the 2-week phone call to exclude families planning to move within the next 3 years and infants who had stayed in the hospital for more than 1 week after birth. A total of 1,526 mothers were eligible and agreed to interview at 1 month after birth; 1,384 of these mothers completed the 1-month interview and were enrolled in the study. The resulting sample was diverse, including 24% ethnic minority children, 10% mothers without a high school education, 14% single mothers, and 34% poor or near poor families (income-to-needs ratio < 2).

The children were enrolled and followed by measuring their development at frequent intervals from birth through adolescence. In 1991, 1,364 children were enrolled in the study. Phase I of the study was conducted from 1991-1994, following the children from birth to age 3 years. Phase II of the study was conducted between 1995 and 2000 to follow the 1,226 children continuing to participate from age 3 through their second year in school. Phase III of the study was conducted between 2000 and 2005 to follow over

1,100 of the children through their seventh year in school. Phase IV, which is currently being conducted, will follow over 1,000 of the original children through age 15.

Study Sample

The participants for the study were recruited from designated hospitals at the 10 data collection sites. Recruitment began in January 1991 and was completed in November 1991. A total of 1,364 families were enrolled. Participants were selected in accordance with a conditionally random sampling plan, which was designed to ensure that the recruited families (a) included mothers who planned to work or to go to school full time (60%) or part time (20%) in the child's first year, as well as some who planned to stay at home with the child (20%), and (b) reflected the demographic diversity (economic, educational, and ethnic) of the sites. Both two-parent and single-parent families were included. The major exclusionary criteria used were (a) mothers younger than 18 years of age at the time of the child's birth, (b) families who did not anticipate remaining in the catchment area for at least 3 years, (c) children with obvious disabilities at birth or who remained in the hospital more than 7 days postpartum, and (d) mothers not sufficiently conversant in English.

Beginning with the time of enrollment (the 1-month home visit), families were scheduled for extensive periodic data collections. Over the 36-month period of Phase I of the study, each child was visited from the sites including his or her home, in child care (if used), and in a laboratory playroom. The study population of the NICHD SECCYD is large, diverse, and chosen so as to be probability based for the United States population.

Study Variables

Table 1 below described the variables in this study, including

1. Maternal depression and CES-D scores

2. Potential risk factors of interests

- Family income or poor status
- maternal education
- family structure
- parental relationship
- maternal and child health status

3. Covariates: Race, child age, maternal age.

Table 1

Study Variables

Study Variables			
Outcome variables	Exposure variables	Other variables	Demographic variables
CES-D scores	Family income and poor status	Child health status	Age
Maternal depression	Maternal education Family structure Social support Maternal employment	Stressful events	Gender Ethnicity

Outcome Variables

Maternal Depression and CES-D Scores

Depression status will be defined according to Wisner et al. (2002). The CES-D is a self-report scale intended to measure symptoms of depression in nonclinical populations. Respondents rate the frequency during the past week of 20 symptoms.

Response categories are "rarely or none of the time (less than 1 day)", "some or a little of the time (1-2 days)", "occasionally or a moderate amount of time (3-4 days)", and "most or all of the time (5-7 days)". Eleven scales range from 0 to 60, with a score of 16 suggesting potential referral for further assessment. Factor analysis on the original standardization samples identified four factors: depressed affect, positive affect, somatic and retarded activity, and interpersonal. These factors are rarely reported in the literature; instead, a total score is calculated.

The scale scores are assessed by Center for Epidemiological Studies Depression Scale (CES-D) (My Feelings). The assessment was conducted at age 1, 6, 15, 24, & 36 months at home and 15, 24, 36 months at Child Care respectively. Maternal depressive symptoms were assessed longitudinally with the Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is a 20-item, self-report depression scale developed to identify depression in the general population (Radloff, 1977). The scale is one of the best-known survey instruments for identifying symptoms of depression and has been extensively used in large studies and norms are available (McDowell & Newell, 1996) Reported Cronbach's α s were high at each assessment (range = .88 to .91), and depression scores were moderately correlated over time (range = .41-.58) (NICHD network, 2005). In line with the work of Radloff and others (e.g., Myers & Weissman, 1980), a cutoff score of 16 or above was commonly taken as indicative of depression.

Exposure Variables

Maternal Age and Ethnicity

Maternal age and ethnicity were obtained at the child 1 month survey. Maternal age was categorized into 18-24, 25-34, and 35-46 years old. There were five categories used to define ethnicity: American Indian, Eskimo, or Aleut, Asian or Pacific Island,

Black or Afro-American, Whites, and Other. For comparison, five categories were changed into three categories: whites, blacks, and other.

Poverty and Family Income

Poverty is a multidimensional phenomenon and as a result may be conceptualized and measured in different ways. Citro and Michael (1995) describe economic poverty as the extent to which households experience a "low level of material goods and services or a low level of resources to obtain these goods and services" (p. 21). These two forms of economic poverty are conceptually quite different; one focuses on the lack of resources, most often measured in terms of income, and the second on the lack of goods and services, or deprivation. Family income level was measured as the ratio of income to needs, calculated as the total family income divided by the poverty threshold for their family size. In other studies, 100% was often used to designate poverty, many observers agreed that this index did not represent a minimally sufficient income (Citro & Michael, 1995). Financial resources are needed for the management of family life. Lack of adequate income has been shown to be associated with poorer parental coping (Peterson & Hawley, 1998). Lower socioeconomic status has been related to lower family cohesion, empathy, and the ability to reverse roles within the family. Higher family income provides the family with more options in regard to health care, recreation, and other commodities. Further, low income and worry about how to make ends meet can be a significant stressor for mothers (Peterson & Hawley). The Family Finances measure consisted of 3 items to measure financial stress, 1 item asking how many people are supported by the respondent's family income and 2 items to assess sources of income (other than earned income) and the amount of income from these sources. The measure was self-administered. In this study, total income level was categorized into below

\$20,000, \$20,000-\$40,000, and above \$40,000. Poor status was also involved. If ratio of income to needs was less than 1, the household was considered poor. If ratio of income to needs was greater than or equal to 1, then the household was not considered poor.

Family Structure and Marital Status

In families in which a child had cystic fibrosis, mothers who had supportive spouses were less likely to be depressed than mothers with nonsupportive spouses (Nagy & Ungerer, 1990). It seems reasonable to suggest that decent family structure would be associated with fewer depressive symptoms in mothers. Information about the mother and family was obtained from questionnaires and interviews with the mother at different time points. Marital status at child 1 month old was categorized as a) mother single, not married; b) mother separated or divorced; and c) mother currently married. Family structure was defined as a) one-parent household, including both single-mother and separated/divorced-mother families, and b) two-parent household. For more convenience, marriage status was categorized into single and not single.

Social Support

Social support was measured using the Medical Outcomes Study (MOS) parent questionnaire concerning social support (Sherbourne & Stewart, 1991). More specifically, two scales of this self-report measure, tangible support and emotional support, were used. The scales are composed of 12 items and have demonstrated adequate psychometric properties including a modest 1-year stability. Women who scored in the lowest quintile were categorized as low support (tangible support ≤ 3.25 ; emotional support ≤ 3.86) (Horwitz, Briggs-Gowan, Storfer-Isser, & Carter, 2007). Panzarine, Slater, and Sharps (1995) rated the frequency of emotional, tangible, and cognitive support and social reinforcement that the adolescent mothers received from people in their social

environments. They found that certain dimensions of social support were significantly associated with depressive symptom, while others were not. The frequency of social support received did not differ significantly between the adolescent mothers with depressive symptoms and those with no symptoms. Hudson et al. (2000) studied the relationship between social support, self-esteem, loneliness, and depressive symptoms at approximately 3 months postpartum in a sample of 21 adolescent mothers. The CES-DC was used to measure depression. The results revealed a negative correlation between the mother's depressive scores and social support. No significant relationship between depressive scores and self-esteem was found. However, there is a positive correlation between loneliness and depression, meaning that the adolescent mothers who reported more feelings of loneliness also were more likely to report having depressive symptoms (Reid & Meadows-Oliver, 2007). In this study, the "Relationships with Other People" questionnaire measured both general and perceived availability of social support, based on how respondents rate their relationships over the past month. This self-administered questionnaire consisted of 11 items rated on a 6-point scale with 1 = "none of the time" and 6 = "all of the time". The composite variable was formed as the imputed mean of the 11 questionnaire items. Scores could range from 1 to 6 with higher values indicating more social support.

Maternal Employment

Maternal employment refers to the labor force affiliation of mothers with children 0-18 years. Includes full (35 or more hours per week), part-time work (greater than 0, but less than 35 hours per week), contracting, and working out of the home. It is important to recognize that mother's work situation can change across her child's developing years (e.g., changing from full-time to part-time during specific years) (Lerner, 2001). These

hours included hours at work and hours in school. In this study, maternal employment status at child 1 month old was used and the variable could take on the following values: 0 (mother not employed), 1 (mother employed and at work), 2 (mother employed and on leave).

Maternal Education

Maternal education is a resource that can be used to seek, process, and organize information related to a child's chronic illness. Judge (1998) found a significant relationship between maternal education level and a family's efforts to be active and innovative and to seek new experiences. In this study, education variable was categorized by two measures. First was categorized into less high school, high school grad or GED, some college but no degree, AA degree or vocational school beyond high school, bachelor's degree from college or university, some graduate work or a master's degree, law degree (LL.B or J.D.), and more than one master's degree or a doctoral degree (M.D., Ph.D., Ed.D., etc.). There were two categories in second measure: under bachelor degree and above bachelor degree.

Maternal Health Status

Maternal health status was assessed by asking mother to describe her health compared to other women of her age. Respondents answered on a four-point scale: 1=poor health, 2=fair health, 3=good health, and 4=excellent health. This question was asked at each time period or assessment age but information obtained at child 1 month old was used in this study. The sample size of mothers who were in poor health was too small; therefore, they were changed into three categories: 1=poor or fair health, 2=good health, and 3=excellent health.

Child Birth Outcome and Health Status

Child's birth weight was abstracted from the medical charts in NICHD SECCYD. Low birth weight is defined as birth weight < 2,500 grams. Low birth weight infants are at a greater risk of having a disability and for diseases such as cerebral palsy, visual problems, learning disabilities, and respiratory problems (Alberta Health, 1998; Robertson, Svenson, & Joffres, 1998). These morbidities are often chronic and have long-term sequelae impacting the child, family, schools, and communities. The factors that elevate the risk of low birth weight are multiple and complex. They include smoking, alcohol and drug use, as well as broad determinants of health such as maternal age, in vitro fertilization and assisted reproduction, multiple births, social support, and socioeconomic status (Health Surveillance, 1999). The incidence of preterm delivery (<37 weeks completed gestation) varies from population to population with reported estimates ranging between 6.0% and 10.0% (Creasy, 1988). These births are reported to contribute to 85% of all neonatal deaths and are of substantial social, emotional and economic impact (Merkatz, R., & Merkatz, I. 1991). The majority of preterm infants are low birth weight and this combination increases the risk of growth and development problems, visual and hearing difficulties, delayed speech, and other health conditions (Miller, Fine, & Adams-Taylor, 1989; Robertson, Sauve, & Christianson, 1994). The risk of preterm delivery is elevated by the same risk factors as for low birth weight (e.g. smoking, low socioeconomic status) as well as by maternal medical conditions such as high blood pressure or diabetes (Health Surveillance). The days of hospital stay after delivery vary depending on the method of delivery, Cesarean section or vaginal, and the medical benefits plan. Detailed definitions of terms are given in Table 2.

Similarly as the measure of maternal health status, child health status was

changed into three categories: 1=poor or fair health, 2=good health, and 3=excellent health.

Table 2

Definitions of Child Birth Outcome Terms

Outcome Terms	Definition
Birth or Live Birth (LB)	The complete expulsion or extraction from the mother, irrespective of the duration of the pregnancy, of a fetus in which, after expulsion or extraction there is breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle, whether or not the umbilical cord has been cut or the placenta attached.
Birth Weight	The first weight of the fetus or newborn obtained after birth, preferably within the first hour after birth, before the significant post-natal loss has occurred.
Gestational Age (GA)	The duration of gestation is measured from the first day of the last normal menstrual period. Gestational age is expressed in completed days or completed weeks (e.g. events occurring 280 to 286 completed days after the onset of the last normal menstrual period are considered to have occurred at 40 weeks of gestation).
Preterm	Less than 37 full weeks of gestation or less than 259 full days.
Term	37 to 42 full weeks of gestation or between 259 and 293 full days.
Postterm	More than 42 full weeks of gestation or 294 full days or more.
Low Birth Weight (LBW)	Birth weight of less than 2500 grams.

Table 2 (continued)

Outcome Terms	Definition
Very Low Birth Weight (VLBW)	Birth weight of less than 1500 grams.
Extreme Low Birth Weight (ELBW)	Birth weight of less than 1000 grams.
Multiparous	Having had two or more pregnancies that resulted in viable fetuses.
Primiparous	Bearing or having borne one child.
Small for Gestational Age (SGA)	An infant with a birth weight less than the 10th percentile for gestational age.
Stillbirth (SB)	The complete expulsion or the extraction from the mother after at least 20 weeks' pregnancy, or after attaining a weight of 500 grams or more, of a fetus in which, after the expulsion or extraction there is no breathing, beating of the heart, pulsation of the umbilical cord, or unmistakable movement of voluntary muscle.

Stressful Events

Parenting stress was measured with the parent distress and parent-child dysfunctional interaction subscales of the Parenting Stress Index Short Form (PSI/SF), 1990 (Abidin, 1990). The parent distress subscale measures distress in the parenting role (e.g., I feel trapped by my responsibilities as a parent), whereas the parent-child dysfunctional interaction subscale measures the parent's perception of her relationship with her child as reinforcing (e.g., my child makes more demands on me than most children). The PSI/SF has shown high internal consistency and good test-retest reliability. Scores of at least 36 on the parent distress scale were considered to be high, as were scores of at least 27 on the parent-child dysfunctional scale (as recommended by the author of the PSI/SF) (Horwitz, Briggs-Gowan, Storfer-Isser, & Carter, 2007). Parents

completed a 30-item, modified version of the 101-item PSI, at the 1 and 6 month home visit. The PSI was designed to identify parent-child systems that were under stress and at risk for development of dysfunctional parenting, or behavior problems in the child involved.

Covariates

Mothers answered several questions about their family sociodemographic status, including the target child's sex, age, ethnicity, income before birth. Information of these variables was obtained.

Figure 3 below shows the framework that was used in this study to describe the relationships of maternal, social, and child factors with maternal depression.

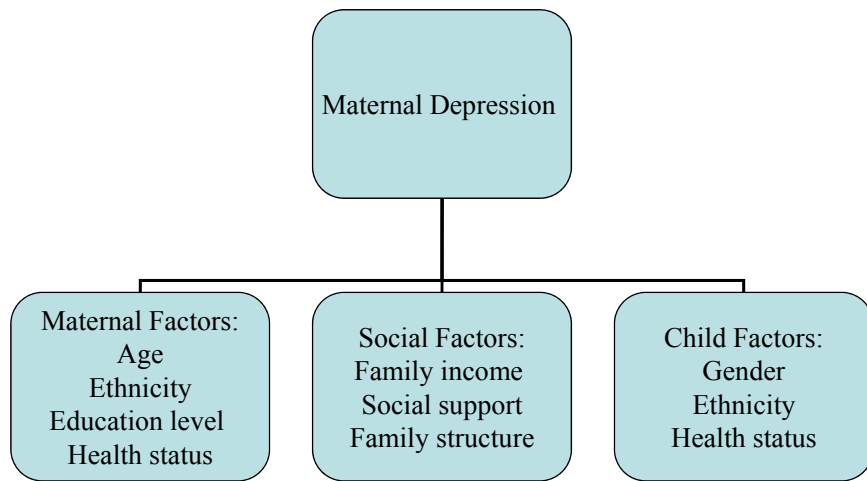


Figure 3. Framework of Relationships of Maternal, Social, and Child Factors Influencing Maternal Depression

Plan for Data Analysis

Data Preparation

Data were obtained from Phase I of the NICHD SECCYD. The documentations below were also attained: descriptions of instruments used to gather the raw data, descriptions of how summary variables were computed, psychometric properties of these variables, extensive documentation of study procedures, data collection forms, and a full variable dictionary linking each variable to the source form and to the data set where it can be found. Review of the documentations and merging of the data files were performed to create a working data file that had all variables of interest.

Data were first checked for inconsistencies and outliers. Missing, minimum, and maximum values, along with cross-tabulations were checked for accuracy of the data. Univariate analysis including frequency, percent, mean, and standard deviation were used to describe the variables of interest.

Analysis of the CES-D Scores and Prevalence of Maternal Depression

The "My Feelings" (CES-D) scale is scored as follow: four items are reverse scored (that is, a response of 1 = 4, 2 = 3, 3 = 2, and 4 = 1). These items are #3, #11, #14, and #16 on the version of the scale. Once these scores are reversed, the responses are simply summed to create a total score, which can range from 20 to 60. To make our scores match those commonly used in the literature, we should actually rescore all items so 1 = 0, 2 = 1, 3 = 2, and 4 = 3. The standard scoring has scores ranging from 0 to 60 as the highest score, with a score of 16 or higher considered to have clinical significance.

Prevalence of depression was described. The prevalence and levels of CES-D score were analyzed and compared by sex, age group, maternal employment status, and ethnicity.

Descriptive and Bivariate Analysis

Descriptive statistics (including mean, standard deviation, percentage, line chart) and bivariate analysis such as t-test, Chi-square test, and correlation analysis were used as appropriate to describe maternal depression at different time points. The descriptive and bivariate statistics were used to describe the maternal depression for the study sample as a whole and for the subgroups categorized by maternal education, maternal employment, family income, family structure, child's gender, and race. Simple bivariate analyses were used in which each independent variable was evaluated, one at a time, for its association with the outcome variable. After the important independent variables had been identified in the simple analyses, a multivariate examination was done to determine whether the independent variables retain their importance in the simultaneous context of the other variables (Panzarine et al., 1995).

Potential risk factors and CES-D scores: Each of the potential risk factors was used as a categorical or continuous variable for this analysis, and CES-D scores were used as continuous variables. Mean levels of CES-D scores for various potential risk factors were compared using Analysis of Variance (ANOVA).

Potential risk factors and maternal depression: When CES-D scores were used as categorical variable (for example, $CES-D \geq 16$ that is defined as depression), prevalence of maternal depression was stratified by different categories of a variable. Differences in maternal depression prevalence across the different categories were compared using Chi-square test. The analysis set a basis for more complicated analysis described below.

Multivariable Models

Multiple logistic regression analysis was used to assess the relationship between maternal depression and potential risk factors after adjusting covariates. The odds ratios

and 95% confidence intervals of maternal depression for the different potential risk factors were obtained from the logistic regression model to measure the associations with the adjustment of multiple covariates. The potential confounding effects could be assessed by multiple linear regression and logistic regression models. The first set of models included analysis of demographic variables on CES-D scores of maternal depression. The second set of models included effects of possible risk factors adjusting for the social variables. The third set of models included effects of possible risk factors adjusting for the child factors. Multiple logistic regression analysis was used to analyze the relationship between the possible risk factors and maternal depression with adjustment for covariates. The regression coefficients were used to assess the association. The multiple variables that seemed important may be assigned simple rating scores and combined into a single risk score used for predicting outcomes of individual patients. The choice of these ratings can be aided by the regression coefficients found in the multivariable analysis (John, Alvan, & Theodore, 1993).

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RESULTS

Participant characteristics

Table 3 showed the characteristics of the participants attained at 1st Month after birth. The results were in detail below:

The mean age of women at child 1 month old was 28.11 years (SD=5.63 years). A majority of women had a high school education or higher. Women were ethnic diverse in backgrounds, with more than four fifths of the sample (82.6%) reporting white ethnicity. Almost the whole sample of women (95.5%) was not of Hispanic origin. Approximately three twentieths of the sample (14.4%) was single (i.e., not married or living with their partner), 22.7% were in poverty, and 81.2% had no public assistance. About half of women (50.8%) were not employed in last 12 months and not now employed. Most women reported that their health was very good or excellent. In addition, administrative support or clerical and professional rank top two in survey of occupation of Mom before baby. Majority of child's ethnicity was white (80.4%). The number of boys and girls was similar. Occupational data were available for 1,126 mothers at the 1st month after birth. The most frequent occupational categories reported were: administrative support or clerical (21.4%); professional (19.6%); service (11.7%); executive, administrative, or sales (10.2%), and managerial (8.4%).

Table 3

Characteristics of the Participants: Information Attained at 1 Month After Birth

Characteristic	Participants	
	<i>n</i>	Proportion (%)
Maternal Age		
18-24	386	28.3
25-34	796	58.4
35-46	182	13.3
Maternal Ethnicity		
American Indian, Eskimo, Aleut	8	.6
Asian or Pacific Island	30	2.2
Black or Afro-American	174	12.8
White	1,127	82.6
Other (Specify)	25	1.8
Mother is Hispanic?		
No	1,303	95.5
Yes	61	4.5
Poverty status		
Poverty	964	22.7
Not Poverty	310	70.7
Public Assistance		
No	1,107	81.2
Yes	257	18.8
Child Gender		
Male	705	51.7
Female	659	48.3
Child Ethnicity		
American Indian, Eskimo, Aleut	5	.4
Asian or Pacific Island	22	1.6
Black or Afro-American	176	12.9

Table 3 (continued)

Characteristic	Participants	
	<i>n</i>	Proportion (%)
White	1,097	80.4
Other (Specify)	64	4.7
Mother's Employment Status		
Employed in 12 months	536	39.3
Not employed in last 12 months but now employed	135	9.9
Not employed in last 12 months and not now employed	693	50.8
Mother's Education		
Less Than High School	139	10.2
High School Diploma (including GED)	287	21.0
Some college but no degree, AA degree or vocational school beyond high school	455	33.4
Bachelor's degree from college or university	284	20.8
Some graduate work or a master degree	161	11.8
Law degree	14	1.0
More than one master degree or a doctor degree	23	1.7
Marital Status		
Married, living together	1,044	76.5
Partnered, living together	122	8.9
Separated, not living together	12	0.9
Divorced, not living together	2	0.1
Widowed	1	0.1
Never married but have a continuing romantic relationship, not living together	87	6.4
Never married but and not involved in a romantic way, not living together	85	6.2
Other	9	0.7

Table 3 (continued)

Characteristic	Participants	
	<i>n</i>	Proportion (%)
Single or Not Single?		
Not single	1,166	85.5
Single	196	14.4
Maternal Health Status		
Poor or fair	68	5.0
Good	590	43.3
Excellent	706	51.8
Total Family Income		
Under \$20,000	371	27.2
Above \$20,000 and below \$ 40,000	454	33.3
Above 40,000	448	32.8
Occupation		
Executive, administrative, or managerial	115	8.4
Professional	267	19.6
Technician or related support	55	4.0
Sales	139	10.2
Administrative support or clerical	292	21.4
Private household	14	1.0
Protective service	3	0.2
Service	160	11.7
Farm operation or management	5	0.4
Mechanic or repairer, construction or other trade	7	0.5
Machine operator, assembler, or inspector	50	3.7
Transportation or material moving	4	0.3
Handler, equipment cleaner, helper, or laborer	15	1.1

Descriptive Statistics of CES-D and Prevalence of Maternal Depression were analyzed at five periods (see Table 4). The means of CES-D of the whole sample at the

different times were 11.36, 8.97, 9.05, 9.40, and 9.22. The prevalence was 25.6% at 1st month, 16.3% at 6 months, 15.4% at 15 months, 15.0% at 24 months, and 15.0% at 36 months of child's age. The distribution of means of CES-D is seen in Figure 4.

Table 4

Descriptive Statistics of CES-D and Prevalence of Maternal Depression at Five Periods

Months	N	CES-D		Depression	
		Mean	SD	N	Percent (%)
1	1,363	11.36	9.018	349	25.6
6	1,278	8.97	8.339	222	16.3
15	1,241	9.05	8.176	210	15.4
24	1,119	9.40	8.632	205	15.0
36	1,202	9.22	8.307	205	15.0

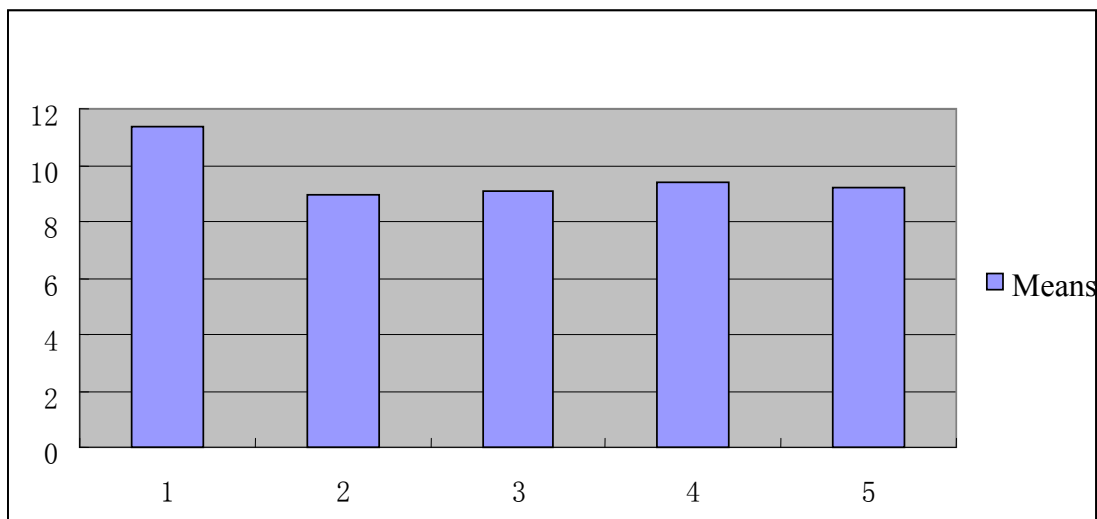


Figure 4 Means of CES-D at Different Months After Birth

Correlation coefficients of CES-D at five times are seen in Table 5. CES-D at different months of child age was significantly related. The correlation coefficients of

month 1 and month 6, month 1 and month 15, month 1 and month 6, month 1 and month 24, month 1 and month 36 were 0.521, 0.450, 0.406, and 0.445 respectively. The correlation coefficients between month 6 and month 15, month 6 and month 24, month 6 and month 36 are 0.582, 0.518, 0.466 respectively. The correlation coefficients between month 15 and month 24, month 15 and month 36 were 0.527, 0.500 respectively. The correlation coefficient between month 24 and month 36 was 0.535.

Table 5

Pearson's Correlation Coefficients of the CES-D at Different Months After Birth

		CES-D	CES-D	CES-D	CES-D
		month 6	month 15	month 24	month 36
CES-D	Correlation	.521(**)	.450(**)	.406(**)	.445(**)
month 1	Sig. (2-tailed)	.000	.000	.000	.000
	N	1,278	1,241	1,119	1,202
CES-D	Correlation		.582(**)	.518(**)	.466(**)
month 6	Sig. (2-tailed)		.000	.000	.000
	N		1,222	1,101	1,181
CES-D	Correlation			.527(**)	.500(**)
month 15	Sig. (2-tailed)			.000	.000
	N			1,103	1,182
CES-D	Correlation				.535(**)
month 24	Sig. (2-tailed)				.000
	N				1,093

**Correlation is significant at the 0.01 level (2-tailed).

Correlation coefficients between potential risk factors and CES-D are seen in Table 6. The analysis revealed that social support, poverty-income-to-needs ratio, total family income, maternal education, maternal age, child health status, and maternal health status had significantly negative correlations with CES-D. When the values of these variables increased, the value of CES-D decreased. The parent distress index had a positive correlation with CES-D.

Table 6

Pearson's Correlation Coefficients Between Potential Risk Factors at First Month and CES-D at Different Months After Birth

Correlation	CES-D				
	1 month	6 month	15 month	24 month	36 month
Social Support	-.347(**)	-.289(**)	-.244(**)	-.216(**)	-.217(**)
Life Stress(PSI parent distress index)	.486(**)	.279(**)	.242(**)	.223(**)	.256(**)
Poverty-income-to-needs Ratio	-.177(**)	-.185(**)	-.171(**)	-.213(**)	-.165(**)
Total family income	-.178(**)	-.171(**)	-.147(**)	-.200(**)	-.148(**)
Mother Health Status	-.247(**)	-.252(**)	-.250(**)	-.225(**)	-.243(**)
Child Health Status	-.167(**)	-.085(**)	-.065(*)	-.065(*)	-.095(**)
Maternal Age	-.206(**)	-.177(**)	-.189(**)	-.229(**)	-.197(**)
Maternal Education	-.232(**)	-.213(**)	-.247(**)	-.280(**)	-.240(**)

** Correlation is significant at the 0.01 level (2-tailed).

From Table 7, the prevalence of depression was highest for mothers under 24 years old consistently for the different time points. For maternal ethnicity, blacks had highest prevalence of depression in the three groups including whites and others, which is

shown by Figure 5 below. The prevalence for single mothers was distinctly higher than that for nonsingle mothers at the different time points. The preterm status, days of stay after delivery, child gender, and Hispanic ethnicity were not statistically significant in relation with maternal depression at each assessment point. The maternal health status includes three levels: poor or fair, good, and excellent. Table 7 presents the distribution of reported maternal health status at each assessment period (1, 6, 15, 24, and 36 months). Statistically significant differences in the prevalence of depression were found for the groups of different maternal health status. Mothers who got a better health status had a lower prevalence of depression. Table 7 also presents the results for the "General Health of Child" variable poor or fair child health was associated with maternal depression at the child 1 month and 36 months but not at child 6, 15, and 24 months.

Table 7

Prevalence of Maternal Depression at Different Months of Child Age by Demographic Characteristics

	CES-D ≥ 16 (%)														
	01			06			15			24			36		
	n	%	p	N	%	p	n	%	P	n	%	p	n	%	p
Age			**			**			**			**			**
18-24	144	37.4		93	27.6		92	28.4		88	33.0		80	25.9	
25-34	185	20.7		116	13.5		104	12.4		107	13.8		118	14.5	
35-46	20	23.3		13	15.5		14	17.3		10	13.5		7	8.8	
Maternal ethnicity			**			**			**			**			**
Black	68	39.1		46	29.7		39	26.5		37	29.8		31	22.8	
White	266	23.6		164	15.4		163	15.7		157	16.6		165	16.3	
Other	15	23.8		12	21.1		8	14.0		11	23.4		9	16.4	

Table 7 (continued)

		CES-D ≥ 16 (%)														
		01			06			15			24			36		
		n	%	P	N	%	p	n	%	p	n	%	p	n	%	p
Marriage Status				**			**			**			**			**
Single	80	40.8			58	34.1		46	28.4		51	37.2		47	29.9	
Not single	268	23.8			163	14.7		163	15.1		154	15.7		158	15.1	
Preterm																
Yes	10	18.5			10	20.4		8	16.3		7	15.9		6	12.5	
No	333	25.8			210	17.3		199	16.9		197	18.6		196	17.2	
Hispanic																
Yes	16	26.2			10	18.9		12	22.2		10	25.6		9	18.0	
No	333	25.6			212	17.3		198	16.7		195	18.1		196	17.0	
Maternal Health Status				**			**			**			**			**
Poor or fair	37	55.2			31	52.5		27	48.2		21	45.7		20	37.7	
Good	183	31.0			118	21.4		107	20.1		103	21.5		113	21.7	
Excellent	129	18.3			73	10.9		76	11.7		81	13.6		72	11.5	
Days of stay after delivery																
0-3	237	24.6			151	16.8		143	16.3		141	17.9		136	16.1	
3-6	107	27.8			67	18.4		64	18.2		61	19.2		68	19.8	
7-10	5	33.3			4	28.6		3	21.4		3	23.1		1	7.7	

Table 7 (continued)

	CES-D ≥ 16 (%)														
	01			06			15			24			36		
	n	%	p	N	%	p	n	%	p	n	%	p	n	%	p
Child Gender															
Male	193	27.4		104	15.7		107	16.8		108	18.7		101	16.3	
Female	156	23.7		118	19.1		103	17.1		97	17.9		104	17.8	
Child Ethnicity															
			**			**			**			**			
Black	70	39.8		46	29.5		39	26.4		37	29.4		33	23.9	
White	250	22.8		153	14.7		151	15.0		146	15.9		157	15.9	
Other	29	31.9		23	28.0		20	24.1		22	30.6		15	19.2	
Child Health Status															
			**												**
Poor or fair	16	41.0		10	28.6		9	27.3		9	33.3		9	29.0	
Good	113	32.7		64	19.9		55	17.6		52	18.8		61	19.9	
Excellent	220	22.5		148	16.1		146	16.3		144	17.7		135	15.6	

**Group comparison is significant at the 0.01 level (2-tailed).

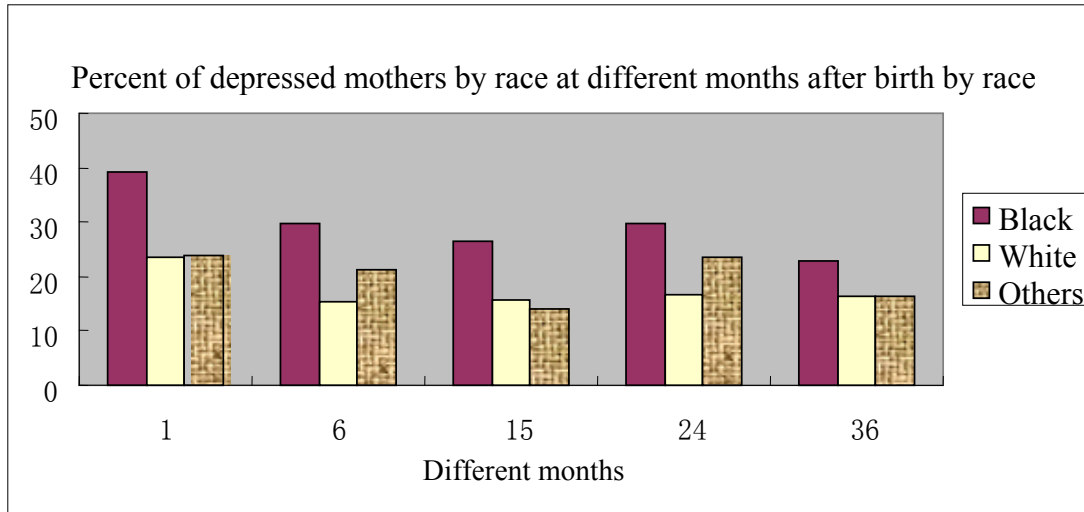


Figure 5 Percent of Depressed Mothers at Different Months After Birth by Race

The prevalence of depression at different times after birth was analyzed for employment status and occupation status (see Table 8). Mothers who were not employed had a higher risk of depression than mothers who were employed. This is consistent for the different assessment points except child 24 months old. We find that occupation of machine operator, assembler, or inspector, service, technician or related support, and sales might have higher risk for getting depression.

Table 8

Prevalence of Depression at Different Times After Giving Birth by Social Characteristics

	CES-D ≥ 16 (%)														
	01			06			15			24			36		
	n	%	p	n	%	p	n	%	p	n	%	p	n	%	p
Employment status			**			**			**						**
Not employed	165	30.8		121	24.8		112	23.6		86	20.5		99	21.7	
Employed and at work	19	14.1		17	13.1		15	12.2		19	16.7		14	11.4	
Employed and on leave	165	23.8		84	12.7		83	12.9		100	17.1		92	14.8	
Occupation			**			**			**			**			**
1	18	15.7		14	12.5		8	7.3		12	11.4		16	15.4	
2	47	17.6		23	8.9		24	9.6		21	9.0		18	7.3	
3	17	30.9		10	20.4		9	18.4		7	16.3		8	18.2	
4	39	28.1		20	15.7		29	24.6		22	21.4		25	20.7	
5	64	21.9		42	15.1		49	17.9		53	21.3		50	18.9	
6	56	35.2		37	25.7		27	18.8		33	26.8		29	20.7	
7	20	40.0		8	18.2		10	25.0		7	23.3		9	24.3	
8	16	33.3		6	13.6		7	16.3		10	25.6		8	19.5	

**Group comparison is significant at the 0.01 level (2-tailed).

***1= Executive, administrative, or managerial, 2= Professional, 3= Technician or related support, 4= Sales, 5= Administrative support or clerical, 6= Service, 7= Machine operator, assembler, or inspector, 8= Other (including: Farm operation or management, mechanic or repairer, construction or other trade, transportation or material moving, handler, equipment cleaner, helper, or laborer, private household, protective service).

Mothers in poverty and receiving public assistance had a higher prevalence of depression. Total family income below \$20,000 was also found associated with a higher prevalence comparing to higher income family (see Table 9). Therefore, poor family which might need public assistance and low family income might be risk factors for maternal depression. Figure 6 below shows the prevalence of maternal depression by total family income.

Table 9

Prevalence of Depression at Different Times After Birth by Family Income and Poverty

	CES-D \geq 16(%)														
	01			06			15			24			36		
	n	%	p	n	%	p	n	%	p	n	%	p	n	%	p
Poverty Status			**			**			**			**			**
Poor	126	40.8		81	30.1		73	28.7		67	30.3		66	26.7	
Not poor	193	20.0		114	12.3		121	13.3		117	14.0		119	13.5	
Public Assistance			**			**			**			**			**
Yes	107	41.8		65	29.7		61	29.6		59	32.8		57	28.4	
No	242	21.9		157	14.8		149	14.4		146	15.5		148	14.8	
Total family income			**			**			**			**			**
<\$20,000	133	35.9		98	30.1		82	26.4		80	29.6		73	24.5	
\$20,000-\$40,000	111	24.4		54	12.3		66	15.5		66	16.9		65	15.8	
\geq 40,000	74	16.5		43	10.0		45	10.6		38	9.6		47	11.2	

**Group comparison is significant at the 0.01 level (2-tailed) from χ^2 test.

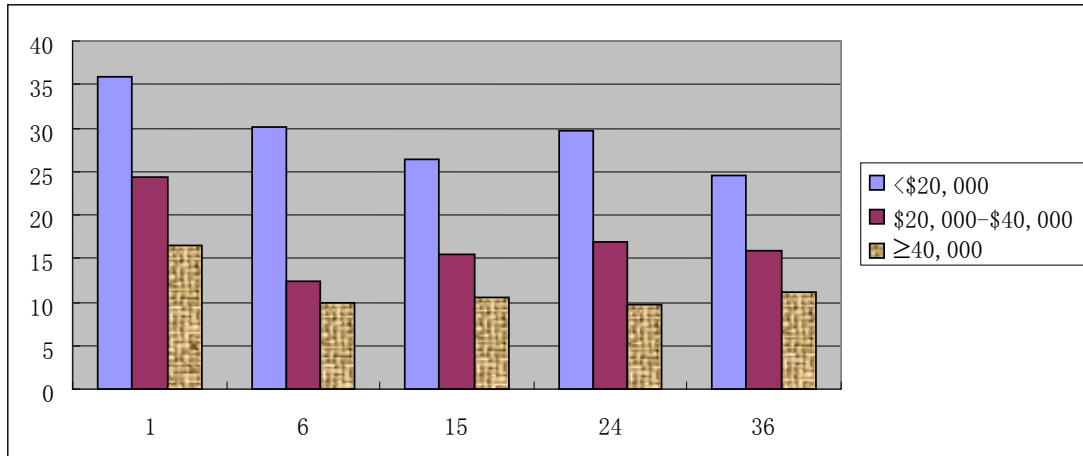


Figure 6 Prevalence of Depression at Different Times After Birth by Total Family Income Level

Two ways were used to reflect the relationship between maternal education status and prevalence of depression at different times (Table 10). It was found that mothers who did not have a bachelor degree had a higher risk of depression at different time points than mothers who had a bachelor or above. Second, mothers whose education were less than high school had highest prevalence of maternal depression (46.0% at assessment month 1, 33.6% at month 6, 34.9% at month 15, 40.2% at month 24, and 38.2% at month 36 respectively) than mothers who had more education.

Table 10

Prevalence of Depression at Different Months After Birth by Maternal Education

	CES-D \geq 16(%)														
	01			06			15			24			36		
	n	%	p	n	%	p	n	%	p	n	%	p	n	%	p
Education			**			**			**			**			**
<Bachelor	264	30.0		171	21.1		166	21.2		164	24.0		155	20.6	
\geq Bachelor	85	17.6		51	10.9		44	9.6		41	9.4		50	11.1	
Education ^Δ			**			**			**			**			**
1	64	46.0		39	33.6		38	34.9		35	40.2		42	38.2	
2	88	30.7		62	23.1		61	23.8		58	26.7		49	19.9	
3	112	24.7		70	16.4		67	16.0		71	18.7		64	16.2	
4	56	19.7		34	12.4		31	11.5		28	10.9		35	13.1	
5	24	14.9		14	9.0		10	6.5		13	8.9		12	8.0	
6	3	21.4		2	15.4		2	16.7		0	0.0		1	8.3	
7	2	8.7		1	4.3		1	4.5		0	0.0		2	9.5	

** Group comparison is significant at the 0.01 level (2-tailed).

Δ1. Less high school 2. High school grad or GED 3. Some college but no degree, AA degree or vocational school beyond high school. 4. Bachelor's degree from college or university 5. Some graduate work or a master's degree 6. Law degree (LL.B or J.D.) 7. More than one master's degree or a doctoral degree (M.D., Ph.D., Ed.D., etc.) Pearson Chi-Square: P=0.000.

Logistic Regression

Risks for maternal depression at 1st month after birth were analyzed with logistic regression (see Table 11). The analysis revealed that among all the demographic factors, maternal age, maternal health status, and marriage status were significantly associated with maternal depression without adjusting for social and child variables. After adding social variables including poverty status, public assistance, maternal employment, social support, and PSI (parent distress index) into the model, maternal age, maternal health status, maternal ethnicity, social support, and parent distress index had statistically significant associations with depression. After further adding child variables including child gender, ethnicity, and health status into the model, maternal age, ethnicity, health status, social support, and parent distress index still had statistical significance. Compared to excellent maternal health status, the odds ratio of depression is 2.445 for mother who was in poor or fair health status. For social support, the odds ratio was 0.708, thus the risk of depression decreased by 0.292 when 1 unit increased in the social support measure. Similarly for parent distress index, the odds ratio was 1.095, thus for one unit increase in parenting distress, the risk of depression increased by 0.095.

Table 11

Risks for Maternal Depression at 1 Month After Birth: Logistic Regression

CES-D \geq 16(%)												
Model 1				Model 2				Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Maternal Age												
18-24		Referent										
25-34	*	.644	.471	.882	*	.628	.427	.926	*	.639	.434	.943
35-46		.711	.445	1.135		.843	.486	1.462		.872	.501	1.518
Maternal Education												
<bachelor		Referent										
\geq bachelor		.812	.587	1.124		.768	.527	1.120		.792	.542	1.158
Maternal Ethnicity												
Whites		Referent										
Blacks		1.342	.920	1.959	*	1.612	1.017	2.554		.710	.188	2.673
Other		.743	.378	1.460		.552	.252	1.209	*	.313	.109	.895
Preterm?												
Yes		Referent										
No		1.532	.744	3.156		1.309	.563	3.044		1.379	.583	3.263
Hispanic?												
No		Referent										
Yes		1.021	.531	1.964		1.099	.531	2.275		1.120	.540	2.323
Days of stay after delivery												
0-3		Referent										
4-6		1.118	.843	1.482		1.242	.897	1.720		1.220	.880	1.693
7-10		1.027	.330	3.193		2.293	.607	8.653		2.338	.609	8.977
Maternal Health status												
Excellent		Referent										
Poor or fair	*	4.207	2.434	7.269	*	2.604	1.327	5.109	*	2.445	1.229	4.865

Table 11 (continued)

CES-D \geq 16(%)													
	Model 1				Model 2			Model 3					
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI		
			Lower	Upper			Lower	Upper			Lower	Upper	
Good	*	1.832	1.393	2.410		1.366	.992	1.881		1.359	.980	1.883	
Marriage Status													
Not single		Referent											
Single	*	1.454	1.002	2.110		.970	.559	1.682		.997	.575	1.731	
Poverty Status													
Not poor		Referent											
Poor													
						1.550	.973	2.469		1.465	.914	2.349	
Public assistance													
No		Referent											
Yes													
						1.268	.782	2.054		1.297	.799	2.105	
Maternal Employment Status													
Not employed		Referent											
Employed and at work													
						.705	.394	1.262		.681	.379	1.221	
Employed and on leave													
						1.094	.787	1.522		1.086	.780	1.513	
Social support													
						*	.707	.564	.887	*	.708	.563	.890
PSI(Parent distress index)													
						*	1.095	1.078	1.113	*	1.095	1.077	1.113
Child Gender													
Female		Referent											
Male													
										1.203	.893	1.622	
Child Ethnicity													
Whites		Referent											
Blacks													
										2.430	.637	9.262	
Other													
										1.987	.854	4.626	

Table 11 (continued)

CES-D \geq 16(%)											
Model 1			Model 2			Model 3					
P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
		Lower	Upper			Lower	Upper			Lower	Upper
Child Health Status											
Excellent	Referent										
Poor or fair								1.113	.493	2.514	
Good								1.120	.798	1.571	

* Group comparison is significant at the 0.05 level (2-tailed).

Risks for maternal depression at month 6 after birth were analyzed with logistic regression (see Table 12). Among all the demographic factors, maternal health status and marriage status were significantly associated with maternal depression status without adjusting for social and child variables. After adding social variables into the model, maternal health status, poor status, social support, and parent distress index had statistically significant relationship with depression. After further adding child variables into the model, maternal health status, social support, and parent distress index had statistically significant association with depression. Compared to excellent maternal health status, the odds ratio of depression was 3.599 for mothers who were in poor or fair health status. Mothers with more social support were less likely to have depression, while mothers who had more parenting distress were more likely to have depression.

Table 12

Risks for Maternal Depression at 6 Months After Birth: Logistic Regression

	CES-D \geq 16(%)											
	Model 1			Model 2			Model 3					
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Maternal Age												
18-24	referent											
25-34	.696	.480	1.011	.979	.629	1.524	.953	.610	1.488			
35-46	.953	.555	1.636	1.351	.739	2.470	1.344	.733	2.466			
Maternal Education												
<bachelor	referent											
\geq bachelor	.786	.530	1.165	.824	.538	1.263	.825	.536	1.269			
Maternal Ethnicity												
Whites	referent											
Blacks	1.309	.841	2.036	1.415	.847	2.365	.974	.255	3.715			
Other	1.246	.598	2.596	.741	.305	1.799	.408	.132	1.258			
Preterm?												
Yes	referent											
No	.791	.375	1.670	.895	.368	2.179	.810	.329	1.990			
Hispanic?												
No	referent											
Yes	.894	.401	1.992	1.203	.518	2.792	1.230	.531	2.851			
Days of stay after delivery												
0-3	referent											
4-6	1.008	.719	1.413	1.105	.764	1.596	1.123	.775	1.628			
7-10	1.358	.404	4.563	2.564	.668	9.837	2.415	.612	9.522			
Maternal Health status												
Excellent	referent											
Poor or fair	*	6.231	3.427	11.330	*	3.490	1.736	7.015	*	3.599	1.774	7.299
Good	*	1.975	1.413	2.759	*	1.441	.997	2.084	*	1.471	1.011	2.141

Table 12 (continued)

		CES-D \geq 16(%)										
		Model 1			Model 2			Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Marriage Status												
Not single		referent										
Single	*	2.041	1.334	3.124		1.539	.858	2.760		1.510	.840	2.714
Poverty Status												
Not poor		referent										
Poor					*	1.688	1.007	2.831		1.608	.948	2.730
Public assistance												
No		referent										
Yes						.992	.582	1.692		1.004	.584	1.727
Maternal Employment Status												
Not employed												
Employed and at work						.900	.496	1.630		.918	.504	1.670
Employed and on leave						.693	.479	1.001		.697	.481	1.009
Social support												
					*	.673	.521	.868	*	.661	.511	.855
PSI(Parent distress index)												
					*	1.043	1.026	1.060	*	1.045	1.028	1.062
Child Gender												
Female		referent										
Male										.803	.573	1.125
Child Ethnicity												
Whites		referent										
Blacks										1.526	.394	5.916
Other										2.232	.929	5.361
Child Health Status												
Excellent		referent										
Poor or fair										1.338	.564	3.174
Good										.708	.473	1.058

* Group comparison is significant at the 0.05 level (2-tailed).

Risks for maternal depression at month 15 after birth were analyzed with logistic regression (see Table 13). Among all the demographic factors, maternal age, education, and health status were significantly associated with maternal depression without adjusting for social and child variables. After adding social variables into the model, maternal age, health status, social support, and parent distress index had statistically significant associations with depression. After further adding child variables into the model, maternal age, ethnicity, health status, social support, and parent distress index had statistically significant relationship with depression. Compared to excellent maternal health status, the odds ratio of depression was 2.434 for mothers who were in poor or fair health status. For social support, the odds ratio was 0.717, thus the risk of depression decreased by 0.283 when 1 unit increased in social support measure. Similarly for parent distress index, the odds ratio was 1.047, thus for one unit increased in parent distress, the risk of depression increased by 0.047.

Table 13

Risks for Maternal Depression at 15 Months After Birth: Logistic Regression

	CES-D \geq 16(%)											
	Model 1			Model 2						Model 3		
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
		Lower	Upper			Lower	Upper			Lower	Upper	
Maternal Age												
18-24		referent										
25-34	*	.558	.384	.812	*	.602	.394	.918	*	.587	.383	.898
35-46		.752	.433	1.307		.832	.462	1.498		.829	.459	1.496
Maternal Education												
<bachelor		referent										
\geq bachelor	*	.636	.423	.957		.670	.435	1.032		.673	.436	1.040

Table 13 (continued)

		CES-D \geq 16(%)											
		Model 1			Model 2			Model 3					
		P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
				Lower	Upper			Lower	Upper			Lower	Upper
Maternal Ethnicity													
	Whites		referent										
	Blacks		1.188	.750	1.879		1.290	.776	2.145		.813	.217	3.045
	Other		.634	.267	1.502		.449	.166	1.219	*	.239	.073	.780
Preterm?													
	Yes												
	No		1.040	.463	2.340		.910	.378	2.189		.847	.348	2.059
Hispanic?													
	No		referent										
	Yes		1.327	.625	2.818		1.791	.836	3.838		1.838	.857	3.941
Days of stay after delivery													
	0-3		referent										
	4-6		1.133	.804	1.595		1.229	.855	1.768		1.240	.860	1.789
	7-10		.942	.245	3.623		1.141	.280	4.651		1.060	.254	4.431
Maternal Health status													
	Excellent		referent										
	Poor or fair	*	4.669	2.538	8.588	*	2.360	1.169	4.765	*	2.434	1.192	4.969
	Good	*	1.624	1.159	2.276		1.347	.936	1.939		1.397	.964	2.023

Table 13 (continued)

		CES-D \geq 16(%)										
		Model 1			Model 2			Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Marriage Status												
Not single		referent										
Single		1.345	.860	2.102		1.473	.817	2.657		1.443	.797	2.610
Poverty Status												
Not poor		referent										
Poor						1.221	.725	2.058		1.181	.693	2.016
Public assistance												
No		referent										
Yes						.961	.567	1.628		.944	.553	1.613
Maternal Employment Status												
Not employed		referent										
Employed and at work						.756	.408	1.402		.767	.412	1.429
Employed and on leave						.721	.501	1.039		.721	.500	1.040
Social support					*	.725	.562	.937	*	.717	.554	.928
PSI(Parent distress index)					*	1.030	1.014	1.047	*	1.033	1.016	1.050
Child Gender												
Female		referent										
Male										.878	.628	1.227

Table 13 (continued)

	CES-D \geq 16(%)											
	Model 1			Model 2			Model 3					
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Child Ethnicity												
Whites	referent											
Blacks								1.653	.432	6.322		
Other								2.283	.994	5.242		
Child Health Status												
Excellent												
Poor or fair								.957	.375	2.442		
Good								.736	.493	1.097		

* Group comparison is significant at the 0.05 level (2-tailed).

Risks for maternal depression at month 24 after birth were analyzed with logistic regression (see Table 14). Among all the demographic factors, maternal age, education, maternal health status, and marriage status were significantly associated with depression. After adding social and child variables into the model, maternal age, maternal education, social support, and parent distress index had statistically significant relationship with depression. Mothers in age 18-24 years were almost double the risk for depression as the mothers who were older. The odds ratio of depression for under bachelor degree is 2.0, compared to that for mothers who had bachelor degree or above. For social support, the odds ratio was 0.762, thus the risk of depression decreased by 0.238 for one unit increase in the social support measure. For parenting distress index, the odds ratio was 1.027, thus for one unit increase in parenting distress, the risk of depression increased by 0.027.

Table 14

Risks for Maternal Depression at 24 Months After Birth: Logistic Regression

CES-D \geq 16(%)													
Model 1				Model 2				Model 3					
P	OR	95%CI		P	OR	95%CI		P	OR	95%CI			
		Lower	Upper			Lower	Upper			Lower	Upper		
Maternal Age													
	18-24	referent											
	25-34	*	.547	.373	.801	*	.487	.317	.747	*	.472	.307	.728
	35-46	*	.550	.305	.993	*	.529	.282	.991	*	.521	.277	.980
Maternal Education													
	<bachelor	referent											
	\geq bachelor	*	.522	.345	.788	*	.508	.328	.788	*	.500	.322	.777
Maternal Ethnicity													
	Whites	referent											
	Blacks		1.023	.631	1.659		.970	.563	1.671		1.173	.288	4.788
	Other		1.143	.502	2.603		1.128	.463	2.747		1.113	.368	3.372
Preterm?													
	Yes	referent											
	No		1.173	.497	2.767		1.126	.417	3.041		1.035	.381	2.815
Hispanic?													
	No	referent											
	Yes		1.151	.487	2.720		.884	.349	2.243		.886	.349	2.249
Days of stay after delivery													
	0-3	referent											
	4-6		1.136	.798	1.617		1.175	.807	1.711		1.209	.828	1.765
	7-10		.908	.233	3.534		.825	.159	4.288		.841	.164	4.319

Table 14(continued)

CES-D \geq 16(%)												
Model 1				Model 2				Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Maternal Health status												
Excellent		referent										
Poor or fair	*	2.884	1.473	5.648	1.833	.842	3.993	1.994	.903	4.404		
Good		1.365	.970	1.921	1.109	.766	1.606	1.153	.790	1.684		
Marriage Status												
Not single		referent										
Single	*	1.879	1.196	2.950	1.524	.833	2.786	1.465	.797	2.691		
Poverty Status												
Not poor		referent										
Poor					1.090	.640	1.857	1.088	.631	1.876		
Public assistance												
No		referent										
Yes					1.294	.763	2.195	1.309	.767	2.234		
Maternal Employment Status												
Not employed		referent										
Employed and at work					1.434	.787	2.615	1.490	.814	2.727		
Employed and on leave					1.363	.926	2.006	1.393	.945	2.054		
Social support					*	.772	.593	1.005	*	.762	.584	.993
PSI(Parent distress index)					*	1.025	1.008	1.043	*	1.027	1.009	1.045
Child Gender												
Female		referent										
Male								.959	.681	1.349		

Table 14(continued)

		CES-D \geq 16(%)											
		Model 1			Model 2			Model 3					
		P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
				Lower	Upper			Lower	Upper			Lower	Upper
Child Ethnicity													
	Whites		referent										
	Blacks							.797	.192			3.314	
	Other							1.036	.435			2.468	
Child Health Status													
	Excellent		referent										
	Poor or fair							1.664	.648			4.276	
	Good							.685	.449			1.043	

* Group comparison is significant at the 0.05 level (2-tailed).

Risks for maternal depression at month 36 after birth were analyzed with logistic regression (see Table 15). Among all the demographic factors, maternal age, maternal health status, and marriage status were significantly associated with maternal depression. After adding social and child variables into the model, maternal health status, days of stay in hospital after delivery, and parent distress index had statistically significant relationship with depression. Compared to excellent maternal health status, the odds ratio of depression were 2.172 and 1.547 for mothers who were in poor or fair health status and who were in good health status respectively. For parenting distress index, the odds ratio was 1.049, thus for one unit increase in parent distress, the risk of depression increased by 0.049.

Table 15

Risks for Maternal Depression at 36 Months After Birth: Logistic Regression

		CES-D \geq 16(%)									
		Model 1			Model 2			Model 3			
		P	OR	95%CI		P	OR	95%CI		P	
				Lower	Upper			Lower	Upper		
Maternal Age											
	18-24		referent								
	25-34		.702	.478	1.030	.803	.516	1.251	.782	.501	1.221
	35-46	*	.517	.281	.950	.575	.295	1.122	.566	.290	1.104
Maternal Education											
	<bachelor		referent								
	\geq bachelor		.763	.514	1.133	.771	.504	1.180	.752	.490	1.154
Maternal Ethnicity											
	Whites		referent								
	Blacks		.812	.495	1.332	.762	.432	1.344	.406	.091	1.804
	Other		.753	.334	1.698	.554	.222	1.382	.652	.208	2.046
Preterm?											
	Yes		referent								
	No		1.465	.599	3.585	1.035	.407	2.636	1.015	.393	2.618
Hispanic?											
	No		referent								
	Yes		.943	.415	2.143	1.048	.441	2.494	1.066	.447	2.539
Days of stay after delivery											
	0-3		referent								
	4-6		1.311	.936	1.837	* 1.47 8	1.029	2.124	* 1.501	1.042	2.163
	7-10		.308	.039	2.455	.520	.059	4.615	.526	.060	4.579

Tables 15 (continued)

CES-D \geq 16(%)												
Model 1				Model 2				Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Maternal Health status												
Excellent		referent										
Poor or fair	*	3.404	1.779	6.516	*	2.108	.992	4.479	*	2.172	1.007	4.687
Good	*	1.904	1.354	2.676	*	1.524	1.052	2.208	*	1.547	1.060	2.259
Marriage Status												
Not single		referent										
Single	*	1.728	1.103	2.707		1.294	.701	2.389		1.247	.672	2.316
Poverty Status												
Not poor		referent										
Poor						1.390	.819	2.359		1.382	.804	2.373
Public assistance												
No		referent										
Yes						1.245	.725	2.135		1.260	.730	2.176
Maternal Employment Status												
Not employed		referent										
Employed and at work						.783	.414	1.484		.814	.428	1.545
Employed and on leave						.945	.651	1.373		.966	.663	1.407
Social support						.798	.613	1.038		.795	.610	1.036
PSI(Parent distress index)					*	1.047	1.029	1.064	*	1.049	1.031	1.066
Child Gender												
Female		referent										
Male										.806	.574	1.131

Tables 15 (continued)

		CES-D \geq 16(%)										
		Model 1			Model 2			Model 3				
	P	OR	95%CI		P	OR	95%CI		P	OR	95%CI	
			Lower	Upper			Lower	Upper			Lower	Upper
Child Ethnicity												
Whites		referent										
Blacks									1.955	.442	8.642	
Other									.782	.306	1.997	
Child Health Status												
Excellent		referent										
Poor or fair									1.161	.466	2.893	
Good									.820	.550	1.222	

* Group comparison is significant at the 0.05 level (2-tailed).

Multiple Linear Regression Analysis

Multiple regression analysis was used for CES-D at 1st month after birth (see Table 16). Among all the demographic factors, maternal age, education, maternal health status, and marriage status were significantly associated with CES-D. After adding social and child variables, maternal education, and maternal health status, maternal ethnicity, days of stay after delivery, public assistance status, social support, and parent distress index had statistically significant association with CES-D. Education, maternal ethnicity, maternal health status, and social support had negative coefficients with depression, indicating that the level of CES-D decreased when the levels of these variables increased. Days of stay after delivery, public assistance status, and parent distress index had positive coefficients with depression. Additionally, whites had lower scores than others. As mentioned above, the level of CES-D at 1st month after birth was mainly influenced by maternal and socioeconomic factors rather than child gender, race, and health status.

Table 16

Multiple Regression Analysis for CES-D at 1 Month After Birth

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Maternal Age	-.131	.052	-.082	*	-.091	.047	-.058		-.083	.047	-.052	
Maternal Education	-.369	.117	-.102	*	-.311	.105	-.088	*	-.289	.105	-.082	*
Maternal Ethnicity												
Whites	referent											
Blacks	-1.168	.769	-.049		-1.346	.711	-.056		.087	1.980	.004	
other	-1.834	1.380	-.042		-3.197	1.250	-.073	*	-4.597	2.070	-.105	*
Preterm	.138	.165	.022		-.119	.145	-.019		-.105	.145	-.017	
Hispanic	1.014	1.217	.023		1.423	1.060	.033		1.556	1.057	.036	
Days of stay after delivery	.285	.211	.036		.456	.186	.058	*	.444	.186	.056	*
Maternal Health Status	-2.885	.421	-.188	*	-1.132	.387	-.075	*	-.966	.393	-.064	*
Marriage Status	1.558	.759	.060	*	.156	.847	.005		.177	.845	.006	
Poverty Status					1.039	.696	.050		.895	.696	.043	
Public assistance					1.374	.736	.062	*	1.466	.734	.067	*
Maternal Employment												
Not employed					referent							
Employed and work					-.453	.725	-.016		-.528	.724	-.019	
Employed and on leave					-.204	.231	-.023		-.206	.230	-.023	
Social support					-1.777	.342	-.133	*	-1.737	.341	-.130	*
PSI(Parent distress index)					.344	.021	.419	*	.339	.021	.413	*

Table 16 (continued)

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Child Gender									-.534	.410	-.030	
Child Ethnicity												
Whites									referent			
Blacks									-1.613	2.006	-.070	
Other									1.992	1.914	.055	
Child Health									-.705	.399	-.043	

* Group comparison is significant at the 0.05 level (2-tailed).

#B, Regression coefficient. SE, Standard error.

Δβ, Standardized regression coefficient.

Multiple regression analysis was used for CES-D at month 6 after birth (see Table 17). Among all the demographic factors, maternal education, maternal health status, and marriage status were significantly associated with CES-D. After adding social and child variables, maternal education, maternal health status, social support, and parent distress index had statistically significant relationship with CES-D. Maternal education, maternal health status, and social support had negative coefficient with depression, the risk of depression decreased when one unit increased. Parent distress index had positive coefficient with depression, the risk of CES-D increased when one unit in PSI increased.

Table 17

Multiple Regression Analysis for CES-D at 6 Month After Birth

	Model 1				Model 2				Model 3			
	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P
Maternal Age	-.059	.050	-.039		-.032	.048	-.022		-.029	.048	-.021	
Maternal Education	-.296	.112	-.088	*	-.229	.109	-.071	*	-.230	.109	-.072	*
Maternal Ethnicity												
Whites	referent											
Blacks	-1.084	.756	-.048		-1.002	.764	-.045		1.189	2.053	.054	
other	-1.713	1.332	-.042		-2.325	1.306	-.059		-2.983	2.169	-.075	
Preterm	-.011	.158	-.002		-.063	.151	-.011		-.063	.151	-.011	
Hispanic	.266	1.188	.006		.790	1.114	.020		.999	1.114	.025	
Days of stay after delivery	.163	.200	.022		.323	.192	.046		.308	.192	.044	
Maternal Health Status	-2.857	.406	-.201	*	-1.245	.406	-.091	*	-1.218	.412	-.089	*
Marriage Status	2.582	.749	.105	*	1.362	.911	.050		1.331	.909	.049	
Poverty Status					.944	.734	.050		.807	.737	.042	
Public assistance					.856	.779	.042		.848	.780	.041	
Maternal Employment												
Not employed				referent								
Employed and work					-.577	.744	-.023		-.546	.744	-.022	
Employed and on leave					-.395	.238	-.050		-.398	.238	-.050	
Social support					-1.904	.365	-.153	*	-1.885	.364	-.151	*
PSI(Parent distress index)					.145	.021	.193	*	.149	.022	.198	*

Table 17 (continued)

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Child Gender									.539	.426	.034	
Child Ethnicity												
Whites									referent			
Blacks									-2.353	2.082	-.112	
Other									1.091	1.996	.033	
Child Health									.177	.413	.012	

* Group comparison is significant at the 0.05 level (2-tailed).

#B, Regression coefficient. SE, Standard error.

Δβ, Standardized regression coefficient.

Multiple regression analysis was used for CES-D at month 15 after birth (see Table 18). Among all the demographic factors, maternal education, maternal health status, and marriage status were significantly associated with CES-D. After adding social and child variables, maternal education, maternal health status, marriage status, Hispanic status, employment status, social support, and parent distress index had statistically significant association with CES-D. Education, maternal health status, employment status, and social support had negative coefficient with CES-D, the risk of depression decreased when one unit in corresponding measure increased. Hispanic status, marriage status, and parent distress index had positive coefficient with depression, the risk of depression increased when one unit in corresponding measure increased. For instance, the risk of CES-D increased when one unit increased in PSI measure.

Table 18

Multiple Regression Analysis for CES-D at 15 Month After Birth

	Model 1				Model 2				Model 3			
	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P
Maternal Age	-.058	.049	-.040		-.066	.050	-.045		-.063	.050	-.043	
Maternal Education	-.449	.110	-.137	*	-.373	.113	-.114	*	-.376	.113	-.115	*
Maternal Ethnicity												
Whites	referent											
Blacks	-.389	.752	-.018		-.658	.795	-.029		1.085	2.204	.048	
other	-1.326	1.317	-.034		-2.124	1.362	-.053		-2.596	2.389	-.065	
Preterm	.166	.156	.029		.055	.156	.010		.054	.156	.010	
Hispanic	1.709	1.159	.043		2.755	1.144	.070	*	2.911	1.146	.074	*
Days of stay after delivery	.121	.197	.017		.149	.197	.021		.139	.197	.020	
Maternal Health Status	-2.586	.402	-.186	*	-1.445	.420	-.105	*	-1.457	.427	-.106	*
Marriage Status	1.938	.745	.080	*	2.233	.956	.080	*	2.201	.958	.079	*
Poverty Status					.101	.770	.005		.038	.775	.002	
Public assistance					-.026	.808	-.001		-.085	.810	-.004	
Maternal Employment												
Not employed				referent								
Employed and work					-.706	.779	-.027		-.689	.780	-.027	
Employed and on leave					-.518	.247	-.065	*	-.520	.247	-.065	*
Social support					-1.727	.380	-.136	*	-1.723	.380	-.136	*
PSI(Parent distress index)					.107	.022	.141	*	.111	.022	.146	*

Table 18 (continued)

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Child Gender									.326	.442	.020	
Child Ethnicity												
Whites									referent			
Blacks									-1.866	2.240	-.087	
Other									.772	2.196	.023	
Child Health									.317	.432	.021	

* Group comparison is significant at the 0.05 level (2-tailed).

#B, Regression coefficient. SE, Standard error.

Δβ, Standardized regression coefficient.

Multiple regression analysis was used for CES-D at month 24 after birth (see Table 19). Among all the demographic factors, maternal education, maternal health status, and marriage status were significantly associated with CES-D. After adding social variables into the model, maternal education, marriage status, social support, and parent distress index had statistically significant relationship with CES-D. After further adding child variables into the model, maternal education, maternal health status, marriage status, social support, and parent distress index had statistically significant association with CES-D. Maternal education, maternal health status, and social support had negative coefficient with depression. Marriage status and parent distress index had positive coefficient with depression, the risk of CES-D increased when one unit in corresponding measure increased.

Table 19

Multiple Regression Analysis for CES-D at 24 Month After Birth

	Model 1				Model 2				Model 3			
	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P
Maternal Age	-.095	.054	-.060		-.096	.055	-.061		-.100	.056	-.063	
Maternal Education	-.562	.122	-.159	*	-.513	.124	-.146	*	-.519	.125	-.148	*
Maternal Ethnicity												
Whites	referent											
Blacks	-.808	.854	-.033		-.774	.896	-.032		-1.438	2.444	-.059	
other	-.095	1.520	-.002		-.021	1.553	.000		-.667	2.631	-.015	
Preterm	.018	.170	.003		-.065	.171	-.011		-.070	.171	-.012	
Hispanic	.255	1.430	.005		-.377	1.407	-.008		-.397	1.415	-.009	
Days of stay after delivery	.295	.216	.039		.284	.219	.038		.281	.220	.037	
Maternal Health Status	-1.972	.451	-.132	*	-.921	.471	-.062		-.947	.482	-.064	*
Marriage Status	4.198	.840	.158	*	4.327	1.060	.145	*	4.318	1.063	.144	*
Poverty Status					-.121	.855	-.006		-.083	.864	-.004	
Public assistance					1.171	.895	.052		1.156	.900	.051	
Maternal Employment												
Not employed				referent								
Employed and work					.321	.854	.012		.365	.857	.013	
Employed and on leave					.160	.271	.019		.160	.272	.019	
Social support					-1.606	.417	-.119	*	-1.596	.418	-.118	*
PSI(Parent distress index)					.126	.025	.156	*	.129	.025	.159	*

Table 19 (continued)

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Child Gender									.371	.489	.022	
Child Ethnicity												
Whites									referent			
Blacks									.766	2.479	.033	
Other									.700	2.390	.020	
Child Health									.166	.487	.010	

* Group comparison is significant at the 0.05 level (2-tailed).

#B, Regression coefficient. SE, Standard error.

Δβ, Standardized regression coefficient.

Multiple regression analysis was used for CES-D at month 36 after birth (see Table 20). Among all the demographic factors, maternal education, maternal health status and marriage status were significantly associated with CES-D. After adding social and child variables, maternal education, maternal health status, marriage status, social support, and parent distress index had statistically significant association with CES-D. Maternal education, maternal health status, and social support had negative coefficient with depression, the risk of depression decreased when one unit in corresponding measure increased. Marriage status and parent distress index had positive coefficient with CES-D, the risk of CES-D increased when one unit increased in corresponding measure.

Table 20

Multiple Regression Analysis for CES-D at 36 Month After Birth

	Model 1				Model 2				Model 3			
	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P	B [#]	SE	β^{Δ}	P
Maternal Age	-.080	.051	-.054		-.074	.053	-.049		-.077	.053	-.052	
Maternal Education	-.384	.114	-.115	*	-.384	.118	-.115	*	-.398	.118	-.120	*
Maternal Ethnicity												
Whites referent												
Blacks	-.334	.794	-.015		-.520	.848	-.022		-.026	2.350	-.001	
other	-2.222	1.378	-.055		-2.761	1.420	-.068		-1.350	2.552	-.033	
Preterm	.126	.161	.022		-.043	.163	-.007		-.048	.163	-.008	
Hispanic	.869	1.228	.021		1.253	1.218	.030		1.245	1.220	.030	
Days of stay after delivery	.149	.205	.020		.276	.209	.038		.282	.209	.038	
Maternal Health Status	-2.597	.420	-.182	*	-1.611	.442	-.113	*	-1.611	.451	-.113	*
Marriage Status	2.689	.770	.108	*	2.179	.992	.076	*	2.156	.993	.076	*
Poverty Status					.709	.802	.035		.758	.808	.038	
Public assistance					.086	.845	.004		.078	.847	.004	
Maternal Employment												
Not employed												
Employed and work					.280	.804	.011		.383	.806	.015	
Employed and on leave					.027	.259	.003		.044	.259	.005	
Social support					-1.257	.402	-.095	*	-1.233	.403	-.093	*
PSI(Parent distress index)					.152	.023	.194	*	.155	.023	.199	*

Table 20 (continued)

	Model 1				Model 2				Model 3			
	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P	B [#]	SE	β ^Δ	P
Child Gender									.799	.462	.049	
Child Ethnicity												
Whites												
Blacks									-.510	2.379	-.023	
Other									-1.731	2.360	-.051	
Child Health									.105	.457	.007	

* Group comparison is significant at the 0.05 level (2-tailed).

#B, Regression coefficient. SE, Standard error.

Δβ, Standardized regression coefficient.

CHAPTER 5

Discussion

Summary of Findings

This study investigated longitudinally the prevalence of and the risk factors for maternal depression. It was found that the prevalence of maternal depression was highest at 1 month, and decreased at 6 months, and then kept fairly stable to 36 months of child age. Key variables found to be potential factors contributing to maternal depression are summarized below.

Family income: It was found that total family income had significantly negative correlations with CES-D, and total family income below \$20,000 was also associated with a higher prevalence at the five time points comparing to higher family income levels. In logistic regression, poverty status was only associated with maternal depression at 6 months with adjustment of demographic and social factors. In multiple linear regression, no relationship was found between poverty status and CES-D at any time point.

Education Level: Maternal education had significantly negative correlations with CES-D. In general, mothers whose education was lower had a higher prevalence of maternal depression than mothers who had more education. In logistic regression, maternal education status was found associated with depression at 15 months and at 24 months. In multiple linear regression, it was associated with CES-D at five time points with or without adjustment of covariates.

Social Support: Social support had significantly negative correlations with CES-D. In logistic regression, it was associated with all time points except 36 months. In multiple linear regression, it was associated with CES-D at all time points.

Child and Maternal Health Status: Preterm status and days of stay in hospital after delivery had no statistical significance with maternal depression at the five time points. Child health status had a statistically significant association with maternal depression only at 1 month and 36 months. And child health status had significantly negative correlations with CES-D. The data showed that mothers who were in poor or fair health status were at a higher risk for maternal depression than mothers who were in good or excellent status. In logistic regression, preterm status, days of stay in hospital after delivery, and child health status had no statistically significant relationship with maternal depression. In multiple linear regression, preterm status had statistical significance with CES-D at 1 month after birth with adjustment of social and child factors. Days of stay in hospital after delivery and child health status had no statistically significant relationship with CES-D at any time point. In bivariate analysis, maternal health status had a statistically significant association with maternal depression at five time points. Maternal health status had significantly negative correlations with CES-D. In logistic regression and multiple linear regression, data suggest that mothers who are in poor or fair health status are at a higher risk for maternal depression than mothers who are in good or excellent status at five points.

Marital Status: In bivariate analysis, marital status had a statistically significant association with maternal depression at five time points. In logistic regression, mothers who are single are at a higher risk for maternal depression than mothers who are married

at the five time points except 15 months. In multiple linear regression, marital status had a statistically significant relationship with CES-D at 1 month and 6 months without adding social and child factors, and at 15 months, 24 months, and 36 months with adjustment of all covariates.

Parenting Stress: It was found that the parent distress index (PSI) had a positive correlation with CES-D. In logistic regression, PSI was found associated with maternal depression at the five time points. And in multiple linear regression, it had a statistically significant relationship with CES-D at the five time points.

Maternal Employment Status: In bivariate analysis, maternal employment status had a statistically significant association with maternal depression at five time points. In logistic regression, it had no statistically significant relationship with maternal depression at any time point. And in multiple linear regression, it had a statistically significant relationship with CES-D at only 15 months.

In the analysis we used different models in order to get a better explanation of the risks for maternal depression. For example, in the multiple linear regression analysis for CES-D at 1 month after birth (see Table 16), a younger maternal age or single parent status (compared to both parents) was associated significantly with a worse CES-D score, indicating that young maternal age and single parent status may lead to more maternal depression. However, when public assistance, employment status, and parenting stress were added into the analysis, the associations of maternal age and marital status with CES-D became insignificant. This suggests that public assistance, parenting stress, and social support may mediate the effects of low maternal age and single parent status.

This study provides some new insights and also confirms some of the findings from previous reports on maternal depression. The assessments of maternal depression at

the five time points suggest that depressive symptoms in mothers were reasonably prevalent over time. The result of a negative correlation between the mother's depressive scores and social support was supported by Barnett et al. (1996), Hudson et al. (2000), and Logsdon et al. (2005). Barnett et al. found that maternal age and socioeconomic status did not have a significant relationship with maternal depression symptoms. For ethnicity, Barnett et al., Caldwell and Antonucci (1997), and, more recently, Birkeland and colleagues (2005) pointed out that there were no significant differences in depressive symptoms when comparing the major ethnic groups. Because we assessed the maternal depression at the five time points rather than one time point, some results conflicted with the results from previous studies. For example, single status was found to be significantly correlated with maternal depression, which was not consistent with previous studies. This may be due to the differences in study samples. It is also noted from this study that some of the factors important to maternal depression might change over the course of child-rearing. From a policy standpoint, women with the constellation of the factors contributing to maternal depression were at high risk and should be assessed for depression.

Limitations of the Study

There are several limitations of this study. Firstly, the initial data were collected in 1989, which was many years ago. The results we found may not represent current conditions. The study findings may be liable to recall bias. Topics related to depression may be very sensitive and bias in self-reporting was likely. In addition, responders might not remember accurately the situation in the past. Furthermore, there are many factors that may be involved in the development and prognosis of maternal depression as discussed in the literature review. Although a number of parental, family, social, and

child variables were analyzed in this study, many variables were not included in this study due to lack of information. Lastly, repeated assessments of maternal depression status were conducted at different time points in NICHD SECCYD. More complex analytical method for repeated assessments would be more appropriate for the data, which was beyond the requirement of a MPH thesis. However, I plan to extend my study with more advanced analytical data analysis as I proceed further in my academic career

Strengths of the Study

There are several strengths of the study. The study used a large sample of mothers recruited from different places over the United States. Therefore, the study has a good external validity. Maternal depression status was assessed at different time points over a period of child rearing. As a result, the prevalence of maternal depression over time and the pattern of change and persistence in risks were evaluated, providing a description on the dynamic process of maternal depression. Furthermore, multiple variable analyses including logistic regression and multiple linear regression were used in the study to control for confounding. Hence, the estimation of the associations of risk factors with maternal depression could be more precise compared to other studies. This study is a useful addition to the current literature on maternal depression.

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APPENDIX

Variables Pooled from NICHD Database

Family total income..... TINCAMXX
Poor status POORMXX
Public Assistance ASSTMXX
Maternal Ethnicity.....MRACEMXX
Maternal Age MAGEMXX
Mother Hispanic..... MHISPMXX
Social Support SOCSPMXX
Maternal Health Status HLTHMMXX
Maternal Employment MEMPSMXX
Stressful Events ABPSIMXX
Maternal Education MEDUCMXX
Days of hospital stay after delivery HOSPLM01
Child gestational age..... GA-M01
Marital Status MSTATMXX
Maternal Occupation MOCCUMXX
Child Ethnicity..... CRACEM01
Child's Gender CSEX-M01
Child Health StatusHLTHBMXX

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