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Maternal Depression, Perceptions of Children's Social Aptitude, and Reported Activity Restriction among former Very Low Birth Weight Infants

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Abstract

Objective—Maternal depression is common among mothers of very low birth weight (VLBW) infants. In a cohort of mother-VLBW infant dyads followed to preschool age, we assessed the impact of maternal depression on mothers' perceptions of their children's social aptitude, and reported participation in age-appropriate preschool activities.

Methods—Longitudinal multivariable analysis of a nationally representative sample of VLBW infants in the United States. Models were adjusted for children's developmental abilities according to the Bayley Scales of Infant Development, Mental Development Index.

Results—800 VLBW singletons (mean gestational age 28.9 weeks) were analyzed. During the preschool years, depressed mothers perceived their children's social abilities more negatively than non-depressed mothers. Specifically, they saw their children as less likely to be able to share with others (aOR 0.37, 95% CI 0.14, 0.96), make friends (aOR 0.58 95% CI, 0.35, 0.96), or play independently (aOR 0.30 95% CI, 0.16, 0.58). These negative perceptions were not shared by the children's preschool teachers. Children of depressed mothers were also less likely to participate in age-appropriate preschool activities (aOR 0.30 95% CI, 0.16, 0.58). Each of these associations either lost significance or were substantially attenuated in a separate population of former healthy term infants.

Conclusion—Among former VLBW infants, maternal depression is associated with negative perceptions of children's social abilities and decreased participation in preschool activities. Maternal mental health should be considered in ongoing efforts to maximize the social-emotional development of preterm infants.

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The author group is unaware of any competing interests having to do with this paper.

Dr. Silverstein had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

No co-author has any conflict of interest or competing interests to declare.

Keywords

prematurity; maternal depression; vulnerable child

Introduction

Currently in the UK, 8% of infants are born prematurely.¹ In the US, this figure is estimated to be as high as 13%,² an increase of approximately 30% from the early 1980s. Among these infants, those of very low birth weight (VLBW, <1500 grams) are at greatest risk for poor health and developmental outcomes;³⁻⁶ and in recent years, considerable attention has been given to efforts to optimize the long term developmental trajectories of these children. These efforts, summarized in the 2006 Institute of Medicine report *Preterm Birth*, have focused on improving the clinical care of preterm infants and their mothers, and the health systems through which this care is provided.⁷ Less prominent, however, has been discussion or analysis of the emotional health and wellbeing of the family, and how such contextual issues – particularly maternal depression – may impact the development of a medically vulnerable VLBW infant.

Maternal depression's adverse impact on child development and behavior has been well described.⁸⁻¹¹ Although maternal depression is disproportionately common among mothers of premature infants,^{12,13} few studies have examined its impact, specifically, on this growing segment of the pediatric population. Among such infants, the superimposition of social risk (due to maternal depression) on an actual or perceived medical vulnerability (due to prematurity) could result in unique – or particularly severe – outcomes not observed among otherwise healthy children. Some have described parenting a former premature infant as a balance between recognizing the child's genuine vulnerabilities, but not overreacting to them; and ensuring safety, but allowing participation in typical activities.¹⁴ We hypothesize that maternal depression may disrupt this balance and lead to unnecessary activity restriction among these children.

Pursuant to this hypothesis, we sought to assess the impact of maternal depressive symptomatology on perceptions of children's social abilities, and participation in age-appropriate activities among a nationally representative US sample of VLBW infants over the children's first four years of life. Because VLBW infants are the fastest growing segment of the pediatric population, and because depression is disproportionately prevalent among mothers of these children, understanding such patterns is important. Furthermore, because maternal depression is treatable – and its negative impact on children, reversible – understanding its relationship to potentially unnecessary activity restriction among children has implications for intervention development and health service delivery.

Methods

Data source and study sample

We extracted data from the Early Childhood Longitudinal Survey, Birth Cohort (ECLS-B). The ECLS-B draws from a nationally representative sample of US children born in 2001, and employs face-to-face parent interviews, preschool teacher surveys, and direct cognitive and developmental assessments.¹⁵ Details of the ECLS sampling strategy – which included the oversampling of preterm infants – are available at <http://nces.ed.gov/ecls/birth.asp>. Our study population comprised VLBW (<1500g) infants. Variables included in the analysis were collected longitudinally at two time points: baseline (approximately 11 months of age) and preschool (approximately 4 years). Because of the unpredictable impact of birth defects

on healthcare utilization and activity participation, we excluded infants with congenital anomalies. We further restricted the analysis to singleton births.

Maternal depression

At the baseline and preschool time points, respondent mothers answered a 12-item version of the Center for Epidemiologic Studies Depression Scale (CES-D), a valid and reliable measure of depressive symptoms.¹⁶ Following convention, we combined responses to individual CES-D items to create a raw symptom score, and considered only those with a raw score >9 to have clinically significant depressive symptomatology. We chose this cut point because it corresponds with the most commonly used clinical cut point, indicative of depression (> 15), on the full CES-D.¹⁷

Child and Family Characteristics

From baseline ECLS data, we extracted the child's gestational age, birth weight, length of NICU stay, mother's age, and number of other siblings and caregivers in the home. We categorized infants as either ELBW (<1000g) or VLBW (1001-1500g). Household socioeconomic status was quantified by a continuous summary measure, which comprised parental education, household income, and social prestige of parental occupations – the last of which was computed to reflect the average of the 1989 US General Social Survey prestige score.¹⁸ We also extracted each child's score, at two years of age, on the Mental Developmental Index (MDI) of the Bayley Scales of Infant Development, Second Edition (BSID II).

Outcome Measures

We assessed mothers' perceptions of their preschool children's abilities: the ability to share, make friends, play independently, and help others. To test the hypothesis that differential maternal perceptions were related to being depressed (as opposed to a consistent assessment of the child across observers and settings), we sought – where possible – corroborating opinions by children's preschool teachers. Lastly, we assessed the proportion of preschool-aged children to take part in at least one of following common childhood activities: sports, dance, music, creative arts, or arts and crafts. Such activities account for a large proportion of preschool-aged children's activities in the US and provide the opportunities recommended by the US Department of Education to prepare preschool children for kindergarten.¹⁹

Data Analysis

At the preschool time point, we compared children whose mothers reported significant depressive symptoms to those whose mothers did not. We also compared children whose mothers reported symptoms at both time points to those whose mothers reported symptoms at neither.

We used individual level sampling weights from ECLS-B's complex sampling design to yield valid national estimates. On weighted data, we used the chi-square test to study associations with categorical outcome data; the t-test, for continuous data. We used multivariable logistic regression to estimate odds ratios and linear regression to estimate differences in continuous data. We used the Taylor Series estimation to accommodate ECLS-B's complex sampling design to arrive at valid confidence intervals. Variables were selected for inclusion in the models because of their documented or theoretical relevance to the outcomes of interest. All models were adjusted for mother's age, child's age and sex, number of siblings in the home, family SES, English (or other) as mother's primary language, dual versus single parent household, number of siblings in the home, whether the

mother had had a previous premature infant, and child's percentile T-score on the BSID II. To determine if our findings were unique to the VLBW population, we replicated all multivariable models among a separate population of healthy term infants.

We adjusted all models for BSID II scores to address the issue of whether the children of depressed mothers were actually sicker than those of non-depressed mothers. Although the BSID II has been shown to have suboptimal predictive validity for cognitive function at school age,²⁰ it is considered the gold standard for assessing current child developmental status and has demonstrated reasonable performance characteristics in the near term.^{21,22} Because the BSID II is only valid for use in children ≤ 42 months, models of preschool assessments (mean age, 52 months in our sample) were adjusted for scores of BSIDs performed at 2 years of age.

We performed all analyses using Stata 9.1 (College Station, Texas). The Boston University Medical Center institutional review board exempted this study from review. Pursuant to the terms of the ECLS restricted data use license, this manuscript was reviewed by the National Center for Educational Statistics prior to publication. All sample sizes reflecting unweighted data are rounded to the nearest 50 subjects, but reported percentage estimates and odds ratios reflect the actual data.

Results

Population.*

Among the ~10,700 infants included in the ECLS-B cohort, ~1,150 were VLBW. Among the VLBW infants, ~50 were reported to have congenital anomalies and ~350 were non-singletons, and therefore excluded from the analysis. This left a cohort of ~800 mother-infant dyads at baseline. At baseline, ~700 mothers (89%) had complete information on depression; at the preschool time point, ~550 (71%) had complete information on depression (Figure). At baseline, ~150 mothers (21%) had CES-D scores indicating moderate to severe depressive symptomatology; and at the preschool time point, ~150 mothers (26%) reported moderate to severe symptomatology. Approximately 50 mothers reported moderate to severe symptoms at both time points, and ~300 at neither time point.

The average gestational age among the full baseline cohort was 28.9 weeks (SD 0.14); the average birth weight, 1043 grams (SD 13); and the average length of stay in the NICU, 59 days (SD 1.5). Of the VLBW study cohort, ~300 (43%) were ELBW.

Sample description by exposure group

Across depression groups, there was no significant difference in children's or mothers' age, the ratio of girls to boys, the ratio of VLBW to ELBW infants, or number of siblings in the home at each time point. Family SES, however, was lower among mothers endorsing significant depressive symptoms (Table 1). At neither time point were there significant differences in BSID II scores between the children of depressed and non-depressed mothers. There were also no significant differences in BSID II scores when comparing children of mothers depressed at both time points to mothers depressed at neither.

Children's social skills and activity participation

Depressed mothers perceived many of their preschool children's abilities more negatively than non-depressed mothers (Table 2). Whereas 15% of non-depressed mothers perceived

*Per the terms of the ECLS restricted use data license, all sample sizes reflecting unweighted data are rounded to the nearest 50 subjects.

their children as able to share with others, 7% of non-depressed mothers had this perception (aOR 0.37, 95% CI 0.14, 0.96). Whereas 46% of non-depressed mothers felt their children made friends easily, 34% of depressed mothers felt this way (aOR 0.58, 95% CI 0.35, 0.96). Regarding children's self-regulatory capacities, depressed mothers saw their children as less likely to be able to play independently (33% vs. 16%; aOR 0.30, 95% CI 0.16, 0.58). Preschool teachers were specifically questioned regarding each child's ability to share, make friends, and play independently; in no case did they respond differently based on mothers' depression status.

Regarding participation in typical preschool age activities (sports, dance, music, creative arts, and arts and crafts), whereas 42% of children of non-depressed mothers participated in at least one activity, 25% of children of depressed mothers did so (Table 2; aOR 0.30 95% CI 0.16, 0.58). Children of mothers depressed at both time points appeared even less likely to participate in at least one of the common preschool activities (aOR 0.21, 95% CI 0.08, 0.53).

Social skills and activity participation among healthy term infants

To determine if the above findings were unique to the VLBW population, we replicated all multivariable models among a separate population of healthy term infants (Table 3). In this population (n=4500), all associations between maternal depression and perceptions of children's social abilities either lost significance or were substantially attenuated. Furthermore, there was no association between maternal depression and activity restriction (aOR 0.83, 95% CI 0.67, 1.03).

Discussion

Among a nationally representative US sample of VLBW infants followed to preschool age, maternal depression is associated with negative perceptions of children's abilities to share, make friends, and play independently – perceptions not corroborated by children's teachers. Former VLBW preschool children whose mothers report depression symptomatology are approximately one third as likely to participate in typical age-appropriate child activities as those whose mothers do not. Furthermore, children whose mothers report depression symptoms at both the baseline and preschool time points are only about one-fifth as likely to participate in such activities. These associations are substantially attenuated or lose significance all together when tested among a separate population of healthy term infants.

In recent years, much attention has been given to efforts to maximize the long term developmental and social outcomes of VLBW infants. Many of these efforts, summarized in the recent IOM report *Preterm Birth*, have focused on the need to develop evidence-based standards for NICU follow-up care and to organize care delivery around such standards.⁷ In this paper, we provide evidence that maternal depression, which is disproportionately common in mothers of VLBW infants, is associated with negative maternal perceptions of their preschool-aged children's social abilities – and more importantly, with reported activity restriction. If activity such restriction is accepted as a negative social outcome, our results argue for efforts to address maternal depression in this population to prevent further negative sequelae among the children.

One theoretical paradigm through which our results might be viewed is the vulnerable child syndrome. Originally described in 1964 by Green and Solnit,²³ the vulnerable child syndrome describes a constellation of phenomena in which a child with real or imagined illness early in life becomes the target of altered attachment by her parents, including the perception of susceptibility to illness or lack of capacity for age-appropriate behaviors.²⁴ The vulnerable child syndrome has been previously described among children born

prematurely,^{25,26} and some studies have invoked it to explain activity restriction among presumed-healthy children well into the school-age years.²⁷ While our study provides no proof that the vulnerable child syndrome represents the mechanism by which maternal depression is linked to activity restriction, it may represent a useful paradigm through which to plan future family centered interventions to optimize the developmental trajectories of VLBW infants.

Our study has a number of limitations. First, depression tends to be a waxing and waning illness; therefore, documenting depressive symptoms at each of our study's time points does not necessarily shed light on the mothers' symptom burden between time points or address the issue of whether or not depressed mothers received treatment for their condition. Second, our measure of depressive symptoms, the CES-D, is a symptom inventory; and although it has well documented performance characteristics with cut points highly predictive of clinically significant depressive symptomatology, it does not quantify functional status – an element inherent in the definition of major depressive disorder.

Additionally, as is typical of cohort studies, the associations reported in this study are not necessarily causal, and residual confounding may exist – particularly with respect to children's actual developmental status, which may be incompletely captured by the BSID II scale. Although many of our perception-based outcomes were cross checked with preschool teacher reports (a strength of the ECLS data), our outcomes are all based on parental self-report. Specifically, although the activities included in our assessment of activity restriction are common preschool activities, their inclusion as measures are admittedly arbitrary. Lastly, there is the inherent limitation of secondary data analysis and the need to confirm findings through targeted prospective data collection.

These limitations withstanding, our data add to the growing knowledge base on maternal depression in the context of having a child with actual or perceived special needs. Among this VLBW population, maternal depression appears to be associated with negative perceptions of preschool children's social aptitude and concurrent activity restriction. Because of this, we argue that maternal depression be systematically addressed and further studied in this population, and that the conceptualization of follow-up services to VLBW infants be broadened to consider the wellbeing of entire families.

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What is already known about this topic

Maternal depression's adverse impact on child development and behavior has been well described. Although maternal depression is disproportionately common among mothers of premature infants, few studies have examined its impact, specifically, on this growing segment of the pediatric population.

What this study adds

Our data add to the growing knowledge base on maternal depression in the context of having a child with actual or perceived special needs. Among VLBW infants, maternal depression appears to be associated with negative perceptions of preschool children's social aptitude and concurrent activity restriction. Because of this, we argue that the conceptualization of follow-up services to VLBW infants be broadened to consider the wellbeing of entire families.

Figure. Unweighted sample description

Per ECLS guidelines, all unweighted figures are rounded to the nearest 50 subjects.

Table 1

Sample characteristics by maternal depression status at baseline and preschool time points

	Baseline		Preschool	
	no depression	depression	no depression	depression
n	550	150	400	150
Population estimate (weighted n)	25,900	7,500	23,500	9,900
Child characteristics				
Child's age (months, SD)	11.3(0.08)	11.2(0.13)	53.1(0.21)	52.6(0.33)
Child is male (%)	49	52	48	53
Estimated gestational age (weeks, SD)	29(0.16)	28.9(0.31)	29(0.19)	28.8(0.34)
Birth weight (grams, SD)	1041 (15)	1020 (21)	1047 (15)	1013 (22)
Birth weight strata				
VLBW 1000-1500g (%)	58	54	59	52
ELBW <1000g (%)	42	46	41	48
NICU length of stay (days, SD)	59.6(1.79)	55.9(3.01)	58.6(2)	56.4(2.9)
Mental Development Index of BSID II	42.9(0.92)	42.1(0.98)	46.2(0.58)	46.8(0.81)
Family characteristics				
Mother's age (years, SD)	27.7(0.28)	26.1(0.5)	31.5(0.32)	30.2(0.55)
Family SES score	-0.2(0.03)	-0.6(0.05)	-0.1(0.04)	-0.5(0.06)
Siblings in home (SD)	0.8(0.05)	0.8(0.09)	1.1(0.05)	1.2(0.1)
Dual parent family (%)	81	61	84	63

Table 2

Maternal perceptions of preschool children's abilities and activity participation

	Preschool Assessment		
	Depressed at time of preschool assessment vs. not depressed at time of preschool assessment		
	no depression	depression	aOR (95% CI)
n	400	150	
Population estimate (weighted n)	23,500	9,900	
Perceptions of child abilities (%)			
Shares with others *	15	7	0.37 (0.14,0.96)
Makes friends easily *	46	34	0.58 (0.35,0.96)
Plays independently *	33	16	0.30 (0.16,0.58)
Helps others	24	17	0.71 (0.38,1.33)
Child participates in at least one common preschool activity (%)	42	25	0.30 (0.16,0.58)

* These measures were specifically asked of children's preschool teachers; in no case were there differences in response based on mothers' depression status.

All models throughout the paper are adjusted for mother's age, child's age and sex, number of siblings in the household, family SES, English as primary language, dual vs single parent household, previous experience with a premature infant, and child's MDI BSID II score.

Table 3

Maternal perceptions of preschool children's abilities and activity participation among a separate population of healthy term infants

	Preschool Assessment		
	Depressed at time of preschool assessment vs. not depressed at time of preschool assessment		
	no depression	depression	aOR (95% CI)
n	3650	850	
Population estimate (weighted n)	2254500	495600	
Perceptions of child abilities (%)			
Shares with others *	20	15	0.65 (0.46,0.91)
Makes friends easily *	47	40	0.82 (0.66,1.02)
Plays independently *	37	31	0.80 (0.60,1.05)
Helps others	25	25	1.04 (0.78,1.38)
Child participates in at least one common preschool activity (%)	49	36	0.83 (0.67,1.03)

* These measures were specifically asked of children's preschool teachers; in no case were there differences in response based on mothers' depression status.