Multiple births are a risk factor for postpartum maternal depressive symptoms

Short title: Multiple births and maternal depressive symptoms

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ABSTRACT (289 words)

Objectives Despite the dramatic increase in the multiple birth rate in the United States over the last two decades and recognition of the impact on obstetric and neonatal risks, little is know about its impact on maternal depression. The purpose of the study was to assess the relation between multiple births and maternal depressive symptoms measured 9 months after delivery.

Methods Data came from the Early Childhood Longitudinal Study – Birth Cohort, a longitudinal study following a nationally representative sample of children born in 2001. Depressive symptoms were measured at 9 months using an abbreviated version of the Center for Epidemiologic Studies Depression (CES-D) scale. Logistic regression analyses were conducted to study the association between multiple births and maternal depressive symptoms, adjusted for demographic and household socioeconomic characteristics and maternal history of mental health problems. A total of 8069 mothers were included for analyses.

Results Prevalence of moderate-to-severe depressive symptoms was estimated to be 16.0% (95% CI: 15.0%-17.1%) and 19.0% (95% CI: 16.0%-21.9%) at 9 months after delivery among mothers of singletons and multiples, respectively. Adjusted odds ratio of having moderate-to-severe depressive symptoms was 1.43 (95% CI: 1.12-1.84) for mothers of multiples compared to mothers of singletons. Only 27.0% (95% CI: 23.8%-30.2%) of those who had moderate-to-severe depressive symptoms reported talking about emotional or psychological problems with a mental health specialist or a general medical provider within the 12 months prior to the interview. The percent of women with depressive symptoms receiving mental health services did not vary by plurality status.

Conclusions Mothers of multiples had a 43% increased odds of having moderate to severe 9-month postpartum depressive symptoms compared to mothers of singletons. Greater attention is needed in pediatric settings to address maternal depression in families with multiple births.

INTRODUCTION

About 139,000 multiple births occurred in 2004 in the United States, accounting for 3.4% of all live births. The multiple births rate (i.e., the proportion of live multiple births out of all live births) has increased over the last two decades and reached a record high in 2004 (33.9 per 1000 live births), 76% higher than in 1980 (19.3 per 1000 live births).[1] Although the increase in the multiple birth rate has been greatest among non-Hispanic whites and among those 35 years or older, the increasing trend has been observed in all races and age groups.[1] Risks associated with multiple births such as preterm labor, low birth weight, and prematurity have been well-documented.[1-3] The infant mortality rate among multiple births was estimated to be 30.5 per 1000 live births in 2004, 5 times higher than 5.9 per 1000 among singleton births,[4] and the impact of increasing multiple births on overall infant mortality trends has been identified.[5]

Nevertheless, the impact of multiple births on maternal mental health, in particular postpartum depression, has been under-studied.[6] Undergoing a high-risk pregnancy and delivery of multiples are stressful life events, and the unique demands of parenting multiples can result in high parental stress, fatigue, and social isolation.[7] In a prospective study of 175 women who conceived following in vitro fertilization (IVF) treatment, mothers of multiples were three times more likely to show clinically significant depressive symptoms 6 weeks after birth compared to mothers of singletons.[8] Another study reported mothers of multiples conceived through IVF had higher levels of parental stress and anxiety one year after the birth compared to mothers of singletons conceived through IVF or naturally, while there was no significant difference between mothers of

singletons regardless of the conception mode.[9] Higher parental stress and more prevalent maternal depressive symptoms were still reported at 2-5 years after delivery among mothers of multiples conceived through IVF compared to mothers of singletons conceived through IVF.[10]

However, drawing inferences about the effects of multiple gestation on maternal depression is complicated because known risk factors for depression, such as prematurity,[11] use of assisted reproductive technologies,[6,12] and caesarean delivery[13] are more common among mothers of multiples than among mothers of singletons. Little is known about the population prevalence of postpartum depression among mothers of multiples. Only a few small, facility-based studies have examined the differential impact of multiple births on maternal depression and parental stress compared to singleton births, controlled for infertility,[8,9,12] but the results are limited by potential selection bias in their samples. One population-based study reported higher prevalence of emotional disturbance indicative of depression among mothers of multiples 5 years after birth, but the analysis was limited by the small number of multiple births sampled.[14] The primary purpose of the study was to asses the relation between multiple births and maternal depressive symptoms, using a nationally representative population-based survey, the Early Childhood Longitudinal Study – Birth Cohort (ECLS-B).

METHODS

Data

The ECLS-B follows a nationally representative sample of children born in 2001, with an oversampling of selected ethnic minority groups, low birth weight infants, and twins. Births were sampled within primary sampling units from the National Center for Health Statistics vital statistics system, and primary sampling units were stratified based on geographical region, median household income, proportion minority population, and metro versus non-metro area. Children who died or were adopted before 9 months of age or children born to women younger than 15 years of age were excluded.[15]

Three data sources inform the analyses: a parental self-administered questionnaire and parental interview at 9 months and birth certificate. The self-administered questionnaire included items regarding depressive symptoms during the prior week and life-time episodes of alcohol or drug abuse problems and hospitalization due to mental health problems. The interview reported: demographic and socioeconomic characteristics; maternal health care utilization before and during pregnancy; and consultation with health care providers regarding mental health problems within the preceding 12 months. Interviews were conducted in both English and Spanish.[15] Birth certificates provided information on obstetric and neonatal characteristics.

At 9 months, 9878 parents or guardians of 10,688 children completed parental interviews. Among them, 9747 were biologic mothers living with the sampled child, and 9672 of those reported whether she had a singleton or multiple birth. We included the 8069 mothers who completed all of the depressive symptom questions (83.4%). Rates of completion of the questions did not vary by plurality.

Measures

Maternal depressive symptoms at 9 months after delivery were measured using an abbreviated form of the Center for Epidemiologic Studies Depression Scale (CES-D).[16] A high CES-D score does not constitute a clinical diagnosis of depression, but higher scores are more common among clinically depressed patients and the CES-D correlates highly with other depression rating scales.[17] The original 20-item and various abbreviated forms of CES-D have been widely used to screen for depression among general populations.[18-22] The abbreviated form used in ECLS-B includes 12 symptoms with each item coded on a 4-point scale between 0 (never) and 3 (often). The range of total score is 0 to 36, and Cronbach's alpha for the study sample was 0.88, comparable to that in previous studies.[20,23] A total score between 10 and 14 and ≥15 represents moderate and severe depressive symptoms, respectively.[20]

The main independent variable of the study is whether a mother had a multiple birth. We also included variables associated with postnatal maternal stress and/or depression, such as neonatal and obstetric characteristics at birth (prematurity,[11] cesarean section,[13] complications during labor and delivery[24]), demographic and socioeconomic characteristics (age,[25,26] parity,[24] race,[24] marital status,[24,27] household income,[24,27] and education[24,28,29]), and history of mental illness.[24,27,30] Gestational age at delivery was examined as a categorical variable: ≥ 37 weeks (full-term), 33-36 weeks (moderate preterm), and <33 weeks (severe preterm). Mode of delivery was coded as: vaginal delivery or cesarean section. A single binary variable was constructed to mark whether a

mother had one or more of the fourteen obstetrical complications during labor and delivery specified in the birth certificate (Table 1).

We examined mother's age at interview as a continuous variable, since we found minimal non-linear age effects based on a categorical transformation of maternal age. Maternal parity was coded as: primapara or multipara. Current marital status was categorized as: currently married or currently not married (divorced, separated, widowed, or never married). Models in which the separate categories of non-marriage were independently assessed did not alter the principal findings about the effects of multiple births on depression. Maternal race/ethnicity was categorized as: non-Hispanic white, non-Hispanic black, Hispanic, and other. We also used a household socioeconomic status (SES) index variable, defined by ECLS-B, that included household income, parental education, and occupation.[31,32] This was coded into 3 groups: low, middle, and high SES if a household's SES index score belonged to the lowest quintile, middle three quintiles, and the highest quintile among all sampled households. Finally, two binary variables for maternal life-time history of mental health problems were constructed: history of hospitalization due to mental health problems and history of alcohol and/or drug abuse problems.

Mothers also reported whether they had ever talked to a mental health specialist or a general medical provider (i.e., a psychiatrist, psychologist, doctor, or counselor) for any emotional or psychological problem in the preceding 12 months. A binary variable measured: talking once or more *vs.* never.

Statistical Analysis

The unit of analysis was a biologic mother living with the sampled child. Logistic regression was conducted to study associations between the moderate-to-severe depressive symptoms (CES-D score ≥ 10) and covariates. Only covariates which had a p-value <0.2 in unadjusted models were included in multivariate modeling. In adjusted models, we started with the initial model with the multiple births variable only, and introduced other covariates in the order of: prematurity; obstetric variables; maternal demographic variables; household socioeconomic characteristics; and maternal history of mental health problems. Any changes in the coefficient of the multiple birth variable following an inclusion of an additional set of covariates suggests that any differential outcome by plurality status is associated with the newly introduced covariates.

In addition, mental health consultation history was analyzed among all mothers as well as among those with moderate-to-severe depressive symptoms. Percent of mothers who had obtained mental health consultation were estimated by maternal demographic, household socioeconomic, and maternal mental health history variables. All estimates of means, proportions, regression coefficients and standard errors were adjusted for sampling weights used in the survey. A p-value of 0.05 was considered statistically significant. STATA 9.0 statistical software (Stata Corporation, College Station, TX, USA) was used for all analyses. The study was declared exempt by the Committee on Human Research at the Johns Hopkins Bloomberg School of Public Health.

RESULTS

The higher risk of obstetric and neonatal complications in multiple gestations is apparent (Table 1). Maternal demographic and household socioeconomic characteristics varied significantly between mothers of singletons and multiples. Mothers of multiples were more likely to be older, to be currently married, to be educated, and to have higher household SES. There was no significant difference in maternal history of mental health by plurality status.

The mean CES-D score was 4.9 (95% CI: 4.8-5.1) and 5.3 (95% CI: 4.8-5.7) among mothers of singletons and multiples, respectively. Prevalence of moderate-to-severe depressive symptoms (CES-D score $\geq$ 10) was 16.0% (95% CI: 15.0%-17.1%) among mothers of singletons and 19.0% (95% CI: 16.0%-21.9%) among mothers of multiples. Prevalence of severe depressive symptoms (CES-D score $\geq$ 15) was estimated to be 6.5% (95% CI: 5.8%-7.2%) and 6.7% (95% CI: 4.9%-8.6%) among mothers of singletons and multiples, respectively.

The unadjusted odds of having moderate-to-severe depressive symptoms was 1.23 among mothers of multiples, compared to mothers of singletons (Table 2). In bivariate models, severe preterm delivery (<33 weeks), age, race, marital status, socioeconomic status, and history of mental illness were associated with the outcome (Table 2). Adjusted for preterm delivery, the odds ratio of multiples was no longer significant, but, controlled for additional demographic and socioeconomic covariates, multiples showed a positive association with maternal depressive symptoms (Table 3). In the full model, the odds of

depressive symptoms was 43% higher among mothers of multiples compared to mothers of singletons (Table 3). Non-Hispanic black mothers had 27% higher odds compared to non-Hispanic white mothers. Mothers with history of hospitalization due to mental health problems and alcohol/drug abuse also had significantly increased odds (OR 1.84 and OR 2.67, respectively). On the other hand, variables for currently married, Hispanic ethnicity, and high household SES were negatively associated with the outcome. We examined interaction effects on depressive symptoms of multiple births by marital status or by Hispanic ethnicity, but did not find statistical significance possibly due to a small number of women in each of the interaction categories. We further conducted multivariate analyses excluding 70 mothers of triplets or higher order multiples from our sample, and estimated associations between multiple births and maternal depressive symptoms were comparable with those estimated using the full sample of all mothers of multiples.

Of the 8069 mothers included in this study, 7972 completed questions on mental health consulting (completion rate 98.8%). The completion rate did not vary by depressive symptom status. Overall, about 11.4% (95% CI: 10.4%-12.3%) of mothers reported talking to a mental health specialist or a general medical provider for any emotional or psychological problem in the 12 months prior to the interview. The estimate was significantly higher among those with moderate-to-severe depressive symptoms (27.0%, 95% CI: 23.8%-30.2%) than among their counterparts (8.4%, 95% CI: 7.5%-9.3%). Among those with depressive symptoms, the percent of consulting was nearly twice as high among mothers who had a history of mental health problems and non-Hispanic

White mothers, compared to their counterparts (Table 4). The level of consulting did not vary by plurality, age, parity, marital status, or household SES.

DISCUSSION

We examined associations between multiple births and maternal depressive symptoms, using nationally representative data. Our study suggests that 19% of mothers of multiples had moderate-to-severe depressive symptoms 9 months after delivery, compared to 16% among mothers of singletons. Mothers of multiples were about 40% more likely to have depressive symptoms compared to their singleton counterparts, adjusted for demographic and socioeconomic characteristics.

Parental stress in raising multiples has been suggested as a primary cause for maternal depression among mothers of multiples.[8,9] Although no direct causal relationship has been documented between postpartum depression and neurobiologic factors, little information is available regarding the magnitude and duration of hormonal changes and dysregulation pertaining to multiple births.[33] The adverse impact of maternal depression on child health and development has been well documented,[34-38] and multiple-birth children can be in double jeopardy due to increased risk of developmental delay from prematurity and low birth weight[39-42] as well as maternal depression.

Estimates of postpartum depression prevalence vary greatly due to the use of different diagnostic tools and varying times of symptom assessment. While the clinical definition of postpartum depression is limited to the onset of symptoms during the first 4 weeks

following childbirth,[43] many studies on maternal depression include women whose symptoms began 3-12 months following delivery.[30] A meta-analysis reported that the prevalence of maternal depression 6 months after delivery was about 10%, similar to that of the general population,[44] but prevalence in the first 5 weeks postpartum was 3 times higher compared to that of the general population.[45] Our results are limited to only 9 months after delivery, and, at earlier postpartum months, the prevalence of maternal depressive symptoms as well as the differential risk by plurality may vary from our estimates.

The low numbers of women receiving mental health counseling despite depressive symptoms highlights the need for facilitating better referral of patients with depressive symptoms. A high index of suspicion for depression should be maintained among mothers of multiples, as well as among mothers with a history of mental health problems and non-married mothers. Mothers of multiples have more regular contact with health care providers throughout the pre-pregnancy, antenatal, and postpartum periods, allowing ample opportunities for health care providers to educate women about depression. In our study sample, 24.6% of mothers of multiples had ovulation stimulation and/or artificial insemination for the pregnancy. Mothers of multiples had on average 20.7 antenatal visits (95% CI: 19.7-21.8), compared to 14.2 visits (95% CI: 14.0-14.4) among their counterparts. Parents of multiples also are likely to obtain more frequent pediatric care due to the higher prevalence of neonatal complications among multiple births than singleton births. Nevertheless, in our study we found that the level of mental health

consultation was low among those with moderate-to-severe depressive symptoms, regardless of their plurality status.

The importance of providing education and screening for postpartum depression has been addressed previously.[36-38,46-49] Considering that a routine postpartum visit is recommended only at 4 to 6 weeks following delivery,[50] routine pediatric visits – recommended at least 3 times during the first 2 months and 7 times during the first 12 months[51] – may provide better opportunities for timely education, screening, referrals, and preventive interventions for postpartum depression. Maternal depression screening at well-child visits is accepted by mothers, and is a feasible and effective means of providing early detection and referral for postpartum depression.[47,52] Pediatric practice guidelines recommends that pediatricians ask parents about stress and specific depressive symptoms.[53] Such screening in pediatric practices also may increase health service seeking for mothers at risk of depression.[19] However, current guidelines for maternal depression screening identify risk factors for maternal depression, such as poverty, chronic maternal health conditions, domestic violence, substance abuse, and marital discord, but multiple births are not included.[54]

Our analysis was limited in identifying mechanisms of the increased risk of depressive symptoms among mothers of multiples, due to the lack of potential key psychosocial covariates of maternal depression, including spousal/partner support and marital relationship[24,27,29,49,55,56] and social support[24,27,30,49,56], which were independent of maternal depressive symptoms at the time of interview. Multiple births have been

associated with an increase in stress and anxiety levels for fathers as well,[9] an increase in social isolation for mothers,[7] and a decrease in marital adjustment.[7] Any differential impact of multiple births by quantity and quality of spousal support should be further assessed. The lower risk of depressive symptoms among Hispanic mothers also needs to be examined further with family support variables, since Latino fathers show higher level of engagement with their children[57-60] and extended family provides primary social support network to Latino mothers.[60,61] Finally, although the ECLS-B sample is nationally representative, mothers who completed all 12 depressive symptom questions were significantly more likely to be currently married and from higher household socioeconomic quintiles, compared to those who did not complete the questions (results not shown), partially compromising the national representation of the sample.

In addition, maternal depressive symptoms also are reported to be associated with history of infertility[6,62] and use of assisted reproductive technology.[6,63] However, few studies examined the association between maternal depressive symptoms and infertility treatment controlling for multiple births due to the small number of multiples sampled.[12] We were also unable to study associations among maternal depressive symptoms, multiple births, and infertility, since infertility information was asked to only mothers of multiples in the ECLS-B. In our study sample, nevertheless, mothers of multiples who had infertility counseling for the pregnancy had depressive symptom prevalence of 13.9% (n=234, 95% CI: 9.2%-18.5%), compared to 21.1% (n=540, 95% CI: 17.4%-24.8%) among mothers of multiples who never had infertility counseling. However, adjusted for maternal education and household socioeconomic status, the odds of having depressive symptoms did not

vary by infertility counseling status among mothers of multiples. Further studies are needed to better understand associations among maternal depressive symptoms, multiple births, and infertility treatment, which can provide clinical implications for counseling infertility patients.

In conclusion, mothers of multiples had a 43% increased risk of having moderate to severe 9-month postpartum depressive symptoms compared to mothers of singletons using population-based data. Pediatric practices should make an additional effort to educate new and expecting parents of multiples regarding their increased risk for maternal postpartum depression. Furthermore, pediatric well-child visits are potentially valuable opportunities to provide education, screening, and referrals for postpartum depression among mothers of multiples.

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Table 1 Characteristics of study population by plurality: percent of mothers with specified characteristics (N=8069)

	Mothers of singleton birth (N=7293)		Mothers of multiple births (N=776)		
	%	(95% CI)	%	(95% CI)	
Neonatal characteristics at birth					
Gestational age at delivery (weeks)					
Moderate preterm (33-36)	7.8	(7.1-8.6)	38.7	(34.9-42.5)	*
Severe preterm (< 33)	1.9	(1.7-2.2)	23.5	(19.8-27.2)	*
Delivery mode: cesarean section	25.5	(24.3-26.8)	66.0	(62.3- 69.7)	*
Any complication during labor/delivery [a]	31.3	(20.0-32.7)	64.1	(60.3-67.9)	*
Maternal demographic and educational characteristics					
Parity					
Primapara	41.2	(39.7-42.7)	19.2	(16.1-22.3)	*
Age at interview					
Age (year) [mean (SE)]	28.1		30.4		*
<20 [b]	7.6	(6.9-8.3)	3.2	(1.9-4.4)	*
20-34 [b]	75.5	(74.2-76.7)	72.8	(69.2-76.3)	
≥ 35 [b]	16.9	(15.8-18.0)	24.1	(20.6-27.5)	*
Race/Ethnicity [b]					
White, non-Hispanic	60.9	(59.5-62.3)	69.6	(66.0-73.2)	*
Black, non-Hispanic	13.5	(12.7-14.4)	12.4	(9.9-14.9)	
Hispanic	19.9	(18.7-21.1)	13.7	(10.9-16.5)	*
Asian Pacific Islander	3.1	(2.9-3.4)	2.7	(1.6-3.8)	
Others	2.5	(2.2-2.9)	1.6	(0.8-2.5)	
Marital status [b]					
Currently married	67.4	(66.0-68.7)	75.6	(72.2-78.9)	*
Separated	2.7	(2.3-3.2)	2.2	(1.1-3.4)	
Divorced	3.8	(3.2-4.4)	3.4	(1.8-5.0)	
Widowed	0.2	(0.1-0.4)	0.3	(0.0-0.8)	
Never married	25.9	(24.6-27.1)	18.5	(15.5-21.4)	*
Educational attainment [c]					
Graduated high school	75.3	(74.1-76.6)	82.1	(79.2-85.1)	*
Graduated college	25.5	(24.2-26.8)	35.0	(31.2-38.9)	*
Household SES index in relation with the distribution of all households in the survey					
Lowest quintile	17.6	(16.5-18.7)	13.7	(11.1-16.4)	*
Middle three quintiles	61.3	(59.9-62.8)	54.7	(50.7-58.7)	*
Highest quintile	21.0	(19.8-22.3)	31.6	(27.8-35.4)	*
Maternal life-time mental health history					
Hospitalization due to a mental health problem	4.1	(3.5-4.7)	2.9	(1.6-4.3)	
Alcohol and/or drug abuse problem	4.8	(4.2-5.5)	4.1	(2.6-5.6)	

[a] Having one or more of the following: (1) fever (>100°F); (2) moderate to heavy meconium-stained amniotic fluid; (3) membrane rupture > 12 hours; (4) abruption placenta; (5) placenta previa; (6) other excessive bleeding; (7) seizures during labor; (8) precipitated labor (<3 hours); (9) prolonged labor (>20 hours); (10) dysfunctional labor; (11) breech/malpresentation; cephalopelvic disruption; (12) cord prolapse; (13) anesthetic complications; and (14) fetal distress. The variable was treated as missing values unless information for all 14 items was complete.

[b] Presented in more detail categories for descriptive purposes. A continuous variable or aggregated categories (see Table 2 and Table 3) were used in regression analyses.
[c] Presented for descriptive purposes only. Not included in regression models.
* Statistically significant difference (p-value <0.05) between two groups.

Table 2 Prevalence of moderate to severe maternal depressive symptoms 9 months after delivery by selected characteristics and factors associated with the depressive symptoms: bivariate logistic regression (N=8069)

	N [a]	Prevalence of the depressive symptoms		Bivariate logistic regression [b]	
		Percent	(95% CI)	OR	(95% CI)
Neonatal and obstetric characteristics					
Plurality					
Singleton [c]	7,293	16.0	(15.0-17.1)	1.00	
Multiple	776	19.0	(16.0-21.9)	1.23	(1.00-1.51)
Missing	0				
Gestational age at delivery (weeks)					
Full-term (≥37) [c]	6,049	15.8	(14.7-16.9)	1.00	
Moderate preterm (33-36)	1,029	16.4	(13.3-19.6)	1.05	(0.82-1.34)
Severe preterm (<33)	902	21.4	(16.8-26.1)	1.46	(1.09-1.94)
Missing	89				
Delivery mode					
Vaginal delivery [c]	5,494	16.5	(15.3-17.7)	1.00	
Cesarean section	2,519	14.7	(12.8-16.5)	0.87	(0.73-1.04)
Missing	56				
Any complication during labor/delivery					
No [c]	5,001	15.6	(14.4-16.9)	1.00	
Yes	2,990	17.3	(15.4-19.2)	1.13	(0.96-1.33)
Missing	78				
Maternal demographic characteristics					
Maternal age at interview (year)					
Age (year) [d]				0.95	(0.93-0.96)
Missing	0				
Parity					
Multipara [c]	4,830	16.5	(15.1-17.9)	1.00	
Primapara	3,205	15.5	(13.9-17.1)	0.93	(0.79-1.08)
Missing	34				
Race/Ethnicity					
White, non-Hispanic [c]	3,866	14.9	(13.5-16.3)	1.00	
Black, non-Hispanic	1,301	24.2	(21.4-27.0)	1.83	(1.51-2.20)
Hispanic	1,313	13.9	(11.7-16.1)	0.92	(0.75-1.14)
Asian Pacific Islander and others	1,579	17.1	(14.3-19.9)	1.18	(0.94-1.48)
Missing	10				
Marital status					
Currently married	2,764	25.0	(22.9-27.2)	0.40	(0.34-0.47)
Currently not married [c]	5,297	11.8	(10.7-12.9)	1.00	
Missing	8				
Household socioeconomic status [d]					
Low	1,455	23.8	(21.0-26.6)	1.58	(1.32-1.89)
Middle [c]	4,793	16.5	(15.1-17.8)	1.00	
High	1,821	8.5	(6.7-10.3)	0.47	(0.37-0.60)
Missing	0				
Maternal life-time mental health history					

History of hospitalization due to mental health problems			
No [c]	7,662	15.3	(14.3-16.4)
Yes	330	33.9	(27.4-40.4)
Missing	77		
History of alcohol/drug problems			
No [c]	7,567	15.0	(14.0-16.0)
Yes	439	37.7	(31.4-44.0)
Missing	63		

[a] Un-weighted number of observations
[b] Weighted regression, excluding missing values
[c] Reference category for regression analyses
[c] Continuous variable
[d] Household SES index in relation with the distribution of all households in the survey. Low, middle, and high refer to the lowest quintile, middle three quintiles, and the highest quintile of the index, respectively.
SES, socioeconomic status

Table 3 Factors associated with moderate to severe maternal depressive symptoms 9 months after delivery: multivariate logistic regression

	Model 1 (N=7980)		Model 2 (N=7865)		Model 3 (N=7847)		Model 4 (N=7847)		Model 5 (N=7764)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Plurality										
Single [a]	1.00		1.00		1.00		1.00		1.00	
Multiple	1.14	(0.90-1.44)	1.14	(0.90-1.46)	1.34	(1.05-1.71)	1.39	(1.09-1.77)	1.43	(1.12-1.84)
Gestational age at delivery (weeks)										
Full-term (≥37) [a]	1.00		1.00		1.00		1.00		1.00	
Moderate preterm (33-36)	1.04	(0.81-1.34)	1.03	(0.80-1.33)	0.96	(0.74-1.24)	0.93	(0.72-1.21)	0.91	(0.69-1.19)
Severe preterm (<33)	1.42	(1.05-1.92)	1.40	(1.03-1.91)	1.23	(0.91-1.66)	1.20	(0.88-1.62)	1.21	(0.89-1.66)
Obstetric characteristics										
Delivery mode										
Vaginal delivery [a]			1.00		1.00		1.00		1.00	
Cesarean section			0.84	(0.70-1.01)	0.91	(0.75-1.10)	0.89	(0.73-1.08)	0.88	(0.72-1.07)
Complications during labor/delivery										
No [a]			1.00		1.00		1.00		1.00	
Yes			1.15	(0.96-1.37)	1.11	(0.92-1.32)	1.11	(0.93-1.33)	1.12	(0.93-1.34)
Maternal demographic characteristics										
Age (years)					0.97	(0.96-0.99)	0.98	(0.97-1.00)	0.99	(0.97-1.00)
Marital status										
Currently married					0.48	(0.39-0.59)	0.53	(0.43-0.65)	0.57	(0.46-0.70)
Currently not married [a]					1.00		1.00		1.00	
Race/Ethnicity										
White, non-Hispanic [a]					1.00		1.00		1.00	
Black, non-Hispanic					1.19	(0.96-1.48)	1.13	(0.91-1.40)	1.27	(1.02-1.59)
Hispanic					0.72	(0.57-0.90)	0.65	(0.51-0.82)	0.71	(0.55-0.90)
Asian Pacific Islander and others					1.14	(0.90-1.44)	1.15	(0.91-1.46)	1.17	(0.92-1.48)
Household socioeconomic status [b]										
Low							1.27	(1.02-1.57)	1.24	(0.99-1.54)
Middle [a]							1.00		1.00	
High							0.60	(0.46-0.78)	0.63	(0.48-0.82)
History of a mental health problem										
History of hospitalization										
No [a]									1.00	
Yes									1.84	(1.30-2.62)
History of alcohol/drug problems										

No [a]	1.00	
Yes	2.67	(1.93-3.68)

[a] Reference category

[b] Household SES index in relation with the distribution of all households in the survey. Low, middle, and high refer to the lowest quintile, middle three quintiles, and the highest quintile of the index, respectively.

Table 4 Percent of mental health consulting prevalence within the 12 months prior to the interview among mothers with moderate-to-severe depressive symptoms 9 months after delivery by selected characteristics

	N	Percent	(95% CI)
All [a]	1,423	27.0	(23.8-30.2)
Plurality			
Singleton	1,268	27.0	(23.7-30.3)
Multiple	155	25.0	(17.5-32.4)
Mother's age at interview (year)			
<20	160	27.9	(18.6-37.2)
20-34	1,056	27.3	(23.6-31.0)
≥35	207	24.3	(15.5-33.1)
Parity			
Multiparous	887	26.3	(22.1-30.4)
Primaparous	531	28.3	(23.1-33.6)
Race/Ethnicity			
Non-Hispanic White	619	33.9	(29.1-38.7) [b]
Non-Hispanic Black	320	15.4	(10.6-20.3) [c]
Hispanic	209	19.0	(12.1-25.9) [c]
Asian/Pacific Islander	160	11.0	(5.2-16.8) [c]
Others	113	34.0	(18.9-49.1)
Marital status			
Currently married	698	27.0	(22.5-31.6)
Currently not married	725	26.9	(22.3-31.5)
Household socioeconomic status index			
Low	376	22.7	(16.8-28.6)
Middle	863	28.1	(24.0-32.2)
High	184	30.4	(20.1-40.8)
History of mental health			
No history of hospitalization or alcohol/drug problem	1170	22.3	(18.9-25.7) [b]
History of hospitalization or alcohol/drug problem	244	50.3	(41.7-58.9) [c]

a 28 mothers with moderate to depressive symptoms did not complete mental health consulting questionnaire.
b Reference category
c Estimate is different from that of the reference category (p-value<0.05).