



The Epidemiology of Hospitalized Postpartum Depression in New York State, 1995–2004

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PURPOSE: The purpose of this study is to describe the patterns of hospitalization for depression in the year after delivery in relation to social, demographic, and behavioral characteristics.

METHODS: Data on births were linked to hospitalizations for depression over the subsequent year to describe the frequency and patterns of hospitalized postpartum depression among 2,355,886 deliveries in New York State from 1995 to 2004. We identified “definite postpartum depression” based on International Classification of Diseases (ICD) codes indicative of “mental disorders specific to pregnancy,” and “possible postpartum depression” by ICD codes for hospitalization with any depressive disorders.

RESULTS: In New York State, we identified 1363 women (5.8 per 10,000) who were hospitalized with definite postpartum depression, and 6041 women (25.6 per 10,000) with possible postpartum depression, with lower risks in the New York City area. Postpartum depression was more common in later years and among mothers who were older, Black, smokers, lacking private insurance, and with multiple gestations, and was rarer among Asians. For possible postpartum depression, socioeconomic gradients were enhanced.

CONCLUSIONS: Risk of hospitalized postpartum depression is strongly associated with socioeconomic deprivation and varies markedly by ethnicity, with direct implications for screening and health services, also providing suggestions for etiologic studies.

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KEY WORDS: Postpartum Depression, Pregnancy, Ethnicity.

INTRODUCTION

Postpartum depression, the most common complication associated with childbirth, affects an estimated 10%–15% of women after delivery (1), with a wide range of severity. The Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) (2) defines postpartum depression as major depression, using the same diagnostic criteria but with onset of depressive symptoms within 4 weeks after delivery. However, researchers often extend the time window for identifying pregnancy-related depression to the full year after birth (3). Given that pregnancy itself is a common event, postpartum depression constitutes a major public health concern deserving improved information on etiology and service needs. Although there are multiple etiologic pathways that may explain the disorder, with genetic, endocrine hormone, neurotransmitter, psychosocial, and

psychoanalytic hypotheses (4), the genesis of postpartum depression remains poorly understood.

Major depressive episodes subsequent to birth result in marked functional impairment and distress (5), as well as an increased risk for suicide (6). Maternal depression is also known to impact the health of the child through several pathways (7–9), including shortened duration of breast-feeding (10, 11) and renewal of maternal smoking (12, 13). Interactions of depressed mothers and their children are of lower quality than those of nondepressed mothers (7, 14, 15), adversely affecting neurobehavioral development and increasing the risk of conduct disorders and greater child insecurity in attachment relationships (16–21). The lack of energy and inability to cope effectively with the demands of the period after birth constitute a serious threat to the infant’s well-being (22).

Much of the previous research on postpartum depression has used small, convenience samples from clinics or hospitals that cannot generate normative data and are subject to varying diagnostic criteria. Additionally, most studies focus on depressive symptomatology rather than clinical diagnoses of depression, with markedly higher rates of depressive symptoms when minor or transient episodes are included (1). Of the studies examining diagnosed depression, few differentiate between minor and major depression (23). We report here on the frequency and pattern of severe depression leading to

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Selected Abbreviations and Acronyms

DSM = Diagnostic and Statistical Manual of Mental Disorders
ICD = International Classification of Diseases
ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification

hospitalization in the year after delivery in a population of over 2.3 million women giving birth in New York State over a 10-year period.

METHODS**Study Population**

Hospital discharge data from the New York State Department of Health's Statewide Planning and Research Cooperative System were used to identify maternal hospitalizations for delivery from 1995 to 2004, and linked on an individual basis to subsequent hospitalizations within the 12 months after delivery. Deliveries were identified by an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) (24) diagnosis code of V27 (outcome of delivery) or a federal or state diagnosis related group code of 370–375 (delivery services). Unique identifiers permitted extraction of all hospitalizations of the mother in New York State during the 12 months after delivery. For residents of New York City only (excluding residents of New York State outside New York City), we linked birth records from the New York City Department of Health and Mental Hygiene to the hospital discharge data. Because of administrative restrictions, New York State birth records were not available for this purpose.

Starting with 2,526,504 deliveries, we excluded 64,197 (2.5%) records: 9,483 (0.4%) records with an AIDS flag that precluded use of identifiers needed to carry out data linkages; 13,199 (0.5%) duplicates or non-unique identifiers indicative of database errors; and 41,515 (1.6%) non-New York residents who are not part of the population of interest. This resulted in 2,355,886 deliveries for New York residents from 1995 to 2004, and 106,421 episodes of maternal hospitalization in the year after delivery.

Study approval was obtained from the Mount Sinai School of Medicine Program for the Protection of Human Subjects, the New York State Department of Health Data Protection Review Board, the New York State Department of Health Institutional Review Board, and the New York City Department of Health and Mental Hygiene Institutional Review Board.

Measures

We include, as cases, hospitalized diagnoses of depression occurring within 12 months postpartum as ascertained by

review of hospital discharge records. Using ICD-9-CM codes we created categories of “definite” and “possible” postpartum depression. Definite postpartum depression required an ICD-9-CM code of 648.40–648.42 or 648.44. These codes explicitly link “mental disorders specific to pregnancy” within the first 4 weeks postpartum, and if used properly, they reflect episodes of postpartum depression. The available data, however, included all hospitalization discharges with depression diagnoses within 12 months postpartum, allowing us to examine possible postpartum depression by also including ICD-9-CM associated with unipolar and bipolar depression: 296.20–296.26, 296.80–296.82, 296.89, 309.0, 309.1, 309.24, 309.28, 309.29, and 311. It is likely that this broader grouping sacrifices specificity for increased sensitivity, but the extent of this misclassification is unknown.

Statistical Analysis

Maternal demographic and health characteristics were identified from the hospital discharge record for all New York State residents, including delivery year, season of delivery, maternal age, maternal race/ethnicity, plurality, insurance type, and residential location, classified by New York State region and urban/rural status. Plurality was identified by the third digit of ICD-9-CM code V27 indicating a single or multiple gestation. Insurance type was determined by the expected reimbursement type and coded as “Private” (including workers’ compensation, Blue Cross, commercial insurance company, health maintenance organization, Champus/Veteran’s Administration, or self-administered plan), “Public” (including Medicare, Medicaid, other governmental plan, or federal, state or local corrections services), “Self-pay,” or “Other” (including records marked no charge, other, or no-fault). New York was divided into six administrative regions (New York City, Long Island, Hudson Valley, Central, Western, Northern) based on county of residence (25). Urban/rural status was categorized according to National Center for Health Statistics guidelines based on county population size (26) listed from most urban to most rural: metropolitan area: large central counties in metro area greater than 1 million population; metropolitan area: large fringe counties in metro area greater than 1 million population; medium metropolitan area: counties in metro area 250,000–999,999 population; small metropolitan area: counties in metro area 50,000–249,999 population; micropolitan counties; non-core counties.

For births to residents of New York City we restricted the analysis to singleton births to facilitate matching to the birth certificate. Of the 1,124,073 New York City deliveries, 900,726 were singletons with a matched birth certificate record. For this subset we were also able to consider information obtained from the birth certificate, but not available from

hospital discharge data: parity (0, 1, 2+), nativity (U.S. or foreign born), education (<12, 12, 13–16, 17+ years), prenatal tobacco use (smoker, nonsmoker), and trimester of prenatal care initiation (1st, 2nd, 3rd, no prenatal care).

We calculated the risk of definite and possible postpartum depression per 10,000 deliveries for the whole population and subsets defined by attributes of interest, noted above. Prevalence odds ratios (OR) and 95% confidence intervals (CI) were estimated for each covariate using logistic regression. Missing and/or unknown were included as a distinct category for the bivariate analyses. Multivariate prevalence ORs and 95% CIs were also derived, with adjustment for all other covariates. We were not able to account for repeat births to the same mother so variance estimates are slightly underestimated due to non-independence of observations. For multivariate models, unknown race/ethnicity was included as a separate category, but the few individuals missing data on other characteristics were excluded. Because the demographic characteristics and availability of birth records differed between New York City and other parts of New York State, we analyzed and presented results for these subsets separately. All analyses were carried out using SAS version 9.2 (SAS Institute, Cary, NC).

RESULTS

During the period 1995–2004 for New York State as a whole, we identified 1,363 women (5.8 per 10,000) who were hospitalized in the year after delivery specifically for depression related to childbirth. The broader definition of possible postpartum depression, increasing sensitivity at the expense of specificity, identified over four times as many hospitalizations (6041 in total for a prevalence of 25.6 per 10,000) (data for all of New York State not shown). Results are presented separately for New York State outside of New York City and for New York City because of social and demographic differences and the availability of birth certificate information for New York City only. Focusing first on definite postpartum depression, some striking patterns were apparent in New York State outside of New York City (Table 1): increased frequency in the latter part of the time period, for multiple gestations (adjusted OR [aOR] = 2.1, 95% CI: 1.5–3.0), among Black women (aOR = 1.4, 95% CI: 1.2–1.7), mothers age 35 or older (aOR = 1.5, 95% CI: 1.3–1.8), and among women with public insurance (lower socioeconomic status) (aOR = 3.3, 95% CI: 2.8–3.8). Reduced risk was noted for Asian women (OR = 0.5, 95% CI: 0.2–1.0) and among residents of Long Island and the Hudson Valley. More modest and non-monotonic variation was found in relation to urban-rural residence. In New York City, most of the same trends were found as in New York State outside of New York City (Table 2), including increasing risk in more recent years, and elevated risks for African-American mothers

(aOR = 1.7, 95% CI: 1.2–2.4) and mothers who had public insurance (aOR = 1.7, 95% CI: 1.3–2.3), the latter lower in magnitude than the increase found in New York State. Smokers were at markedly elevated risk (aOR = 3.0, 95% CI: 2.0–4.5). Modest decreases were noted for parous women and foreign-born women. Adjustment for confounding had little impact on most measures of association, except for a marked reduction in the risk for non-Hispanic black women and for Hispanic women (in New York City), which was due largely to adjustment for indicators of socioeconomic status that is a far stronger predictor than race/ethnicity.

Despite markedly greater numbers for possible postpartum depression, the patterns were generally quite similar as for definite postpartum depression. In New York State (exclusive of New York City), a higher risk of possible postpartum depression was found for more recent births, multiple gestations, and births to Black women and those lacking private insurance. Lower risk was again noted for Asian women and residents of Long Island and the Hudson Valley (Table 1). The same contrast of possible and definite postpartum depression also generated a number of similarities in the New York City population (Table 2): elevated risks for the more recent time period, for Black women, women on public insurance, and smokers, and reduced risks for Asians and foreign-born women. In addition, however, the more inclusive definition identified elevated risk for Hispanic mothers, mothers greater than 20 years old, women of parity 2 or greater, a sharper gradient by educational level, and increased risks for those with late or no prenatal care. In general, there seem to be more and perhaps stronger socioeconomic gradients for possible than for definite postpartum depression.

DISCUSSION

The proportion of women in the United States with postpartum depression severe enough to require hospitalization is unknown, with little opportunity to compare our population-based rates to other populations or time periods that focus on milder cases. Studies from Scotland (27), Denmark (3), and Sweden (28) yielded hospitalization rates in the first three months postpartum broadly comparable to the ones obtained here, ranging from 10.3 to 21.9 per 10,000, respectively. The differing time periods for inclusion after delivery, varying scope of psychiatric hospitalizations included, and different calendar time periods and geographic settings limit the ability to make meaningful comparisons with our frequencies of hospitalized depression.

Although comparison of absolute rates between our study and other studies is tempered by the noncomparability of case definitions, examinations within our population may generate more comparable information. Frequency of postpartum depression has been reported to vary by race and

TABLE 1. Maternal hospitalization for depression within 12 months of delivery, New York State (excluding New York City), 1995–2004 (n = 1,231,813 Deliveries)

Characteristic	Definite postpartum depression				Possible postpartum depression			
	Cases (n)	Proportion (per 10,000)	OR (95% CI)	aOR* (95% CI)	Cases (n)	Proportion (per 10,000)	OR (95% CI)	aOR* (95% CI)
All Deliveries	907	7.4			3914	31.8		
Year (delivery)								
1995–1998	209	4.4	1.0	1.0	1186	24.9	1.0	1.0
1999–2001	240	6.3	1.4 (1.2–1.7)	1.4 (1.2–1.7)	1135	30.0	1.2 (1.1–1.3)	1.2 (1.1–1.3)
2002–2004	458	12.2	2.8 (2.4–3.3)	2.7 (2.3–3.1)	1593	42.4	1.7 (1.6–1.8)	1.7 (1.6–1.8)
Season (delivery)								
Spring (March–May)	207	6.6	0.9 (0.8–1.1)	0.9 (0.8–1.1)	941	29.8	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Summer (June–August)	236	7.2	1.0	1.0	1006	30.9	1.0	1.0
Fall (September–November)	243	8.0	1.1 (0.9–1.3)	1.1 (0.9–1.3)	1024	33.8	1.1 (1.0–1.2)	1.1 (1.0–1.2)
Winter (December–February)	221	7.7	1.1 (0.9–1.3)	1.0 (0.9–1.2)	943	32.8	1.1 (1.0–1.2)	1.0 (0.9–1.1)
Plurality								
Single gestation	874	7.2	1.0	1.0	3813	31.5	1.0	1.0
Multiple gestation	32	14.6	2.0 (1.4–2.9)	2.1 (1.5–3.0)	97	44.3	1.4 (1.1–1.7)	1.6 (1.3–1.9)
Unknown/unspecified gestation	1				4			
Maternal age (years)								
<20	74	7.8	1.1 (0.9–1.4)	0.7 (0.5–0.9)	508	53.5	1.7 (1.6–1.9)	1.0 (0.9–1.1)
20–34	653	7.2	1.0	1.0	2826	31.0	1.0	1.0
35+	180	8.0	1.1 (0.9–1.3)	1.5 (1.3–1.8)	580	25.7	0.8 (0.8–0.9)	1.2 (1.1–1.3)
Maternal race/ethnicity								
White non-Hispanic	538	6.9	1.0	1.0	2293	29.5	1.0	1.0
Black non-Hispanic	150	14.2	2.1 (1.7–2.5)	1.4 (1.2–1.7)	693	65.6	2.2 (2.0–2.4)	1.6 (1.4–1.7)
Hispanic	45	5.6	0.8 (0.6–1.1)	0.6 (0.5–0.9)	194	24.1	0.8 (0.7–0.9)	0.6 (0.5–0.7)
Asian	7	3.1	0.4 (0.2–0.9)	0.5 (0.2–1.0)	31	13.6	0.5 (0.3–0.7)	0.5 (0.4–0.7)
Other	16	3.9	0.6 (0.3–0.9)	0.5 (0.3–0.8)	73	17.6	0.6 (0.5–0.8)	0.5 (0.4–0.7)
Unknown	151	7.4	1.1 (0.9–1.3)	1.0 (0.8–1.2)	630	30.7	1.0 (1.0–1.1)	1.0 (0.9–1.1)
Insurance type								
Private	388	4.5	1.0	1.0	1462	17.1	1.0	1.0
Public	483	14.7	3.2 (2.8–3.7)	3.3 (2.8–3.8)	2288	69.5	4.1 (3.8–4.4)	3.8 (3.5–4.1)
Self-pay	27	8.7	1.9 (1.3–2.8)	2.1 (1.4–3.2)	130	41.7	2.4 (2.0–2.9)	2.4 (2.0–3.0)
Other	9	5.7	1.3 (0.6–2.4)	1.3 (0.7–2.6)	34	21.4	1.3 (0.9–1.8)	1.3 (1.0–1.9)
New York Region								
Long Island	152	4.7	0.5 (0.4–0.6)	0.7 (0.5–0.9)	592	18.4	0.4 (0.4–0.5)	0.6 (0.5–0.7)
Hudson Valley	120	4.6	0.5 (0.4–0.6)	0.6 (0.4–0.7)	630	24.3	0.6 (0.5–0.6)	0.7 (0.6–0.7)
Central	307	9.6	1.0	1.0	1332	41.6	1.0	1.0
Western	191	11.1	1.2 (1.0–1.4)	1.1 (0.9–1.3)	744	43.1	1.0 (0.9–1.1)	1.1 (1.0–1.2)
Northern	127	9.0	0.9 (0.8–1.2)	1.1 (0.9–1.3)	592	42.1	1.0 (0.9–1.1)	1.1 (1.0–1.2)
Unknown	10	5.8	0.6 (0.3–1.1)		24	13.8	0.3 (0.2–0.5)	
Urban/rural status								
Metro area: large central counties	209	11.3	1.5 (1.3–1.9)	1.3 (1.0–1.6)	702	37.9	1.1 (1.0–1.2)	0.9 (0.8–1.0)
Metro area: large fringe counties	264	4.9	0.7 (0.6–0.8)	1.0 (0.7–1.3)	1173	21.8	0.6 (0.6–0.7)	1.1 (0.9–1.2)
Medium metro area	194	7.4	1.0	1.0	889	33.8	1.0	1.0
Small metro area	66	9.1	1.2 (0.9–1.6)	1.2 (0.9–1.6)	365	50.4	1.5 (1.3–1.7)	1.4 (1.3–1.6)
Micropolitan counties	121	10.3	1.4 (1.1–1.8)	1.2 (0.9–1.5)	574	48.8	1.4 (1.3–1.6)	1.2 (1.1–1.4)
Non-core counties	43	11.0	1.5 (1.1–2.1)	1.4 (1.0–1.9)	187	47.7	1.4 (1.2–1.7)	1.3 (1.1–1.5)
Unknown	10	5.8	0.8 (0.4–1.5)		24	13.8	0.4 (0.3–0.6)	

aOR = adjusted odds ratio; CI = confidence interval; OR = odds ratio.
*Adjusted OR include adjustment for all other covariates.

ethnicity, with Hispanics having the lowest prevalence and Native Americans the highest (29–31). The elevated risk among Hispanics in New York City but not elsewhere in New York State, suggests heterogeneity among Hispanic subgroups. The proportion Hispanic differs considerably, 6.4% in New York State other than New York City and 27.0% in New York City, but the composition in broad

categories is similar, with a sizable fraction from Puerto Rico (~37% of Hispanics in both regions) though the identity of “other Hispanics” (that constitute ~50% in both regions) cannot be compared. Recent immigration has also been noted as a risk factor, where new migrants may be socially isolated or unaware of how to access mental health services (32–35) whereas we found reduced risk for foreign-born women in

TABLE 2. Maternal hospitalization for depression within 12 months of delivery, New York City, 1995-2004 (n = 900,726 Singleton deliveries)

Characteristic	Definite postpartum depression				Possible postpartum depression			
	Cases (n)	Proportion (per 10,000)	OR (95% CI)	aOR* (95% CI)	Cases (n)	Proportion (per 10,000)	OR (95% CI)	aOR* (95% CI)
All deliveries	352	3.9			1635	18.1		
Year (delivery)								
1995-1998	106	2.9	1.0	1.0	583	16.1	1.0	1.0
1999-2001	98	3.7	1.3 (1.0-1.7)	1.4 (1.0-1.8)	459	17.4	1.1 (1.0-1.2)	1.2 (1.1-1.4)
2002-2004	148	5.4	1.8 (1.4-2.4)	2.0 (1.5-2.7)	593	21.6	1.3 (1.2-1.5)	1.6 (1.4-1.9)
Season (delivery)								
Spring (March-May)	88	4.0	1.0 (0.8-1.4)	1.1 (0.8-1.5)	400	18.0	1.1 (0.9-1.3)	1.1 (0.9-1.3)
Summer (June-August)	90	3.9	1.0	1.0	382	16.5	1.0	1.0
Fall (September-November)	85	3.7	1.0 (0.7-1.3)	1.1 (0.8-1.5)	426	18.7	1.1 (1.0-1.3)	1.2 (1.0-1.4)
Winter (December-February)	89	4.1	1.1 (0.8-1.4)	1.0 (0.7-1.4)	427	19.6	1.2 (1.0-1.4)	1.1 (1.0-1.3)
Maternal age (years)								
<20	35	4.2	1.1 (0.8-1.5)	0.7 (0.4-1.0)	205	24.4	1.4 (1.2-1.6)	0.9 (0.8-1.1)
20-34	255	3.8	1.0	1.0	1156	17.4	1.0	1.0
35+	62	4.1	1.1 (0.8-1.4)	1.1 (0.8-1.5)	274	18.0	1.0 (0.9-1.2)	1.2 (1.0-1.4)
Maternal race/ethnicity								
White non-Hispanic	62	2.9	1.0	1.0	247	11.5	1.0	1.0
Black non-Hispanic	121	6.2	2.2 (1.6-2.9)	1.7 (1.2-2.4)	529	27.2	2.4 (2.0-2.8)	1.5 (1.3-1.8)
Hispanic	77	4.3	1.5 (1.1-2.1)	1.2 (0.8-1.8)	452	25.3	2.2 (1.9-2.6)	1.8 (1.5-2.1)
Asian	15	2.0	0.7 (0.4-1.2)	0.7 (0.3-1.2)	51	6.8	0.6 (0.4-0.8)	0.7 (0.5-1.0)
Other	19	3.7	1.3 (0.8-2.1)	1.3 (0.8-2.3)	58	11.2	1.0 (0.7-1.3)	1.0 (0.8-1.4)
Unknown	58	3.1	1.1 (0.8-1.5)	1.1 (0.8-1.7)	298	15.9	1.4 (1.2-1.6)	1.1 (0.9-1.4)
Insurance type								
Private	98	2.7	1.0	1.0	337	9.2	1.0	1.0
Public	246	5.0	1.9 (1.5-2.4)	1.7 (1.3-2.3)	1231	24.8	2.7 (2.4-3.1)	2.1 (1.8-2.5)
Self-pay	7	2.2	0.8 (0.4-1.8)	0.7 (0.3-1.7)	64	20.2	2.2 (1.7-2.9)	1.5 (1.1-2.0)
Other	1				3			
Parity								
0	183	4.5	1.0	1.0	618	15.2	1.0	1.0
1	75	2.8	0.6 (0.5-0.8)	0.6 (0.4-0.8)	424	15.6	1.0 (0.9-1.2)	1.0 (0.9-1.2)
2+	94	4.2	0.9 (0.7-1.2)	0.7 (0.5-0.9)	593	26.7	1.8 (1.6-2.0)	1.3 (1.1-1.5)
Unknown	0				0			
Nativity								
United States born	180	4.4	1.0	1.0	1024	25.1	1.0	1.0
Foreign born	171	3.5	0.8 (0.6-1.0)	0.8 (0.6-1.0)	592	12.2	0.5 (0.4-0.5)	0.5 (0.4-0.5)
Unknown	1				19	32.2	1.3 (0.8-2.0)	
Education (years)								
<12	109	5.0	1.3 (1.0-1.7)	1.2 (0.9-1.6)	634	28.9	1.7 (1.5-1.9)	1.3 (1.1-1.4)
12	117	3.9	1.0	1.0	527	17.5	1.0	1.0
13-16	98	3.6	0.9 (0.7-1.2)	1.0 (0.7-1.4)	382	14.1	0.8 (0.7-0.9)	1.0 (0.9-1.2)
17+	25	2.7	0.7 (0.4-1.1)	0.9 (0.6-1.5)	62	6.7	0.4 (0.3-0.5)	0.7 (0.5-0.9)
Unknown	3				30	20.9	1.2 (0.8-1.7)	
Prenatal tobacco use								
Non-smoker	318	3.7	1.0	1.0	1414	16.3	1.0	1.0
Smoker	33	11.4	3.1 (2.2-4.5)	3.0 (2.0-4.5)	213	73.9	4.6 (3.9-5.3)	2.8 (2.4-3.3)
Unknown	1				8	21.8	1.3 (0.7-2.7)	
Start of prenatal care								
1st trimester	198	3.7	1.0	1.0	811	15.3	1.0	1.0
2nd trimester	81	3.9	1.1 (0.8-1.4)	1.0 (0.8-1.3)	403	19.6	1.3 (1.1-1.4)	1.1 (1.0-1.3)
3rd trimester	22	4.2	1.1 (0.7-1.7)	0.9 (0.6-1.5)	126	23.9	1.6 (1.3-1.9)	1.2 (1.0-1.5)
None	4	3.0	0.8 (0.3-2.2)	0.5 (0.2-1.7)	56	42.2	2.8 (2.1-3.6)	1.8 (1.4-2.4)
Unknown	47	4.8	1.3 (0.9-1.7)		239	24.2	1.6 (1.4-1.8)	

aOR = adjusted odds ratio; CI = confidence interval; OR = odds ratio.
*Adjusted OR include adjustment for all other covariates.

New York City (though we did not have information on duration of time in the United States). Alternatively, there may be distinctive cultural factors affecting rates of treated postpartum depression, with some studies among Asian-American women supporting this possibility (36, 37).

Urbanization has been associated with higher rates of depressive disorders after delivery; alternatively urban residents in need may simply be more likely to access care and be counted (38, 39). We did not find any clear association with urban/rural residence in New York State, and the markedly lower rates in New York City relative to New York State are counter to such a pattern.

The effect of maternal age is indeterminate, with some studies showing that adolescents have a higher risk of postpartum depression (40), and others showing a five-fold increased risk for women over the age of 30 as compared to teens (41). We found an association between older maternal age and definite postpartum depression in New York State, but not in New York City. Primiparous women are also thought to be at higher risk (42, 43), which we found for definite cases in New York City. It has been speculated that this may reflect selective childbearing in that women who have experienced postpartum depression may be reluctant to become pregnant subsequently.

Life stressors, including major events before, during, and after pregnancy, marital discord, and adverse socioeconomic conditions have been variably associated with increased risk of postpartum depression (35, 44–52). We could not examine psychosocial stress directly in our study, the clear and strong association with insurance type, a marker of economic stress, is consistent with the reported patterns (53). However, there are multiple pathways by which insurance status may predict hospitalization for depression, including serving as a marker of risk associated with lower socioeconomic status and providing a financial resource to cover costs associated with such hospitalization.

The broadly comparable results for women in New York State and New York City are notable, despite a nearly two-fold greater absolute risk in the former as compared to the latter. For the social and demographic factors that were available for comparison (age, race/ethnicity, insurance type), the patterns were quite comparable. Despite a markedly larger number of women with hospitalization for possible rather than definite postpartum depression, the patterns were similar by race/ethnicity, insurance type, nativity, education, and tobacco use. However, the differences are notable for some of the attributes examined in New York City: possible postpartum depression showed increased risks for women of parity two or greater and women with later prenatal care initiation, not found for definite postpartum depression.

There are several limitations in our approach that should be recognized, most notably the potential for differential

access to and use of inpatient care for depression. Although the presence and severity of depression would ideally be the primary determinant of whether hospitalization occurs, the additional requirement is obtaining medical care for the condition. Women who have access to family resources, outpatient services, and other ways of managing their depression without hospitalization would be less likely to be admitted. On the other end, those women who are disconnected from medical care access due to geographic, cultural, or socioeconomic isolation would be less likely to access care and be hospitalized. In addition, the coding of postpartum depression by different service providers, a proclivity to use one diagnosis or another for similar conditions as a function of age, ethnicity, socioeconomic status, etc., will influence the patterns of risk in unpredictable ways.

We did not have information on prior episodes of depression or depression that began during rather than after the pregnancy, strong predictors of postpartum depression (54) and plausibly related to a number of the predictors of interest. The independent etiologic influence of these general markers of social and behavioral predictors is limited by the lack of detailed information on the more proximal mediators of risk for postpartum depression. Finally, we were not able to account for repeat births to the same mother, making our confidence intervals slightly narrower than they should have been, a problem that is mitigated by the extremely large population included in the study.

These data provide important new information to assess the magnitude of the public health burden associated with postpartum depression and point to potential determinants. The sizable variation in risk across geographic areas, especially across regions of New York State, and the marked increase in hospitalization over the period between 1995 and 2004, raises the possibility of differential use of health services across areas and time periods. It seems implausible that the frequency of the underlying problem could vary more than two-fold across adjacent locations and a narrow time period. A closer examination of the extent to which health care access accounts for these patterns may be warranted. The notable elevation in risk for women of lower socioeconomic status, African-Americans, and at least some Hispanic subgroups points toward the social stress of poverty, lack of resources, or possibly discrimination as potential contributors to the etiology of postpartum depression. Given that nearly all women receive prenatal care and deliver in hospitals, there are clear opportunities to prevent or intervene early in the psychiatric disorders that follow. At minimum, our data identify the women who are at greatest risk, warrant closer follow-up, and should be considered for earlier or more intensive intervention.

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