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Preeclampsia Outcomes at Delivery and Race

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Abstract

OBJECTIVE: The objective of this study was to assess how race is associated with adverse maternal outcomes in the setting of preeclampsia.

STUDY DESIGN: This retrospective cohort study utilized the National (Nationwide) Inpatient Sample (NIS) from the Agency for Healthcare Research and Quality for the years 2012 to 2014. Women age 15 to 54 with a diagnosis of preeclampsia were included. Race and ethnicity were categorized as non-Hispanic white, non-Hispanic black, Hispanic, Asian or Pacific Islander, Native American, other, and unknown. Overall risk for severe morbidity based on Centers for Disease Control and Prevention criteria was analyzed along with risk for specific outcomes such as stroke, acute heart failure or pulmonary edema, eclampsia, and acute renal failure. Risk for severe morbidity was stratified by comorbid risk and compared by race. Log-linear regression models were created to assess risk for severe morbidity with risk ratios and associated 95% confidence intervals as measures of effect.

RESULTS: A total of 101,741 women with preeclampsia from 2012 to 2014 were included in this analysis. Risk for severe morbidity was significantly higher among non-Hispanic black women (9.8%) than non-Hispanic white, Hispanic, and all other women respectively (6.1%, 7.7%, and 7.5% respectively, $p < 0.01$). For non-Hispanic black compared to non-Hispanic white, Hispanic, and all other women risk was higher for stroke (17.1 versus 6.5, 12.7, and 9.3 per 10,000 deliveries respectively, $p < 0.01$) and pulmonary edema or heart failure (56.2 versus 32.7, 30.2, and 38.4 per 10,000 deliveries respectively, $p < 0.01$). Non-Hispanic black women were also more likely than non-Hispanic white women to experience renal failure (136.4 versus 60.4 per 10,000 deliveries, $p < 0.01$). Adjusting for comorbidity, black women remained at higher risk for severe morbidity ($p < 0.01$). Risk for death was higher for black compared to non-black women (121.8 per 100,000

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deliveries, 95% CI 69.7-212.9 versus 24.1 per 100,000 deliveries, 95% CI 14.6-39.8, respectively, $p<0.01$)

CONCLUSION: Black women were at higher risk for severe morbidity and mortality associated with preeclampsia.

Keywords

Racial disparities; preeclampsia; maternal risk

INTRODUCTION

Preeclampsia is a leading cause of severe maternal morbidity and mortality. While hypertensive disorders of pregnancy have decreased as a proportionate cause of maternal death in the United States,¹ risk may be increasing for preeclampsia in general and severe preeclampsia in particular.² Risk for death and in particular stroke and stroke-related death related to preeclampsia may be preventable. Maternal death reviews have found 33% to 60% of deaths related to preeclampsia avoidable.³⁻⁵ Timely administration of antihypertensive medications may be associated with decreased risk for both fatal and non-fatal stroke.^{4,6,7} Other interventions such as magnesium sulfate to reduce risk of eclampsia may further reduce risk.⁸ Finally, given that preeclampsia may result in-life threatening cardiopulmonary complications, timely identification of women with end-organ injury related to preeclampsia and providing appropriate supportive care may be of benefit.⁹

Maternal race is another major risk factor for severe maternal mortality and severe morbidity.¹ A number of prior analyses have addressed disparities in overall risk for severe morbidity and mortality.^{10,11} Data from the Centers for Disease Control and Prevention's (CDC) Pregnancy Mortality Surveillance System (PMSS) demonstrated risk for mortality is highest among non-Hispanic black women with a 3.4 mortality ratio for non-Hispanic black compared to non-Hispanic white women.¹ While risk for severe morbidity based on CDC criteria also differs significantly based upon race, a prior analysis focusing specifically on postpartum hemorrhage found large mortality differentials related this conditions despite differences in morbidity being relatively modest.¹²

While it is known that race is associated with differing rates of preeclampsia, there is little recent data on how severe morbidity and mortality associated when a diagnosis of preeclampsia. Given that severe morbidity and mortality outcomes in the setting of preeclampsia may account for an important part of overall maternal disparities, the objective of this study was to determine how race is associated with risk for mortality and severe morbidity in the setting of this common obstetrical condition.

METHODS

The National (Nationwide) Inpatient Sample (NIS) from the Agency for Healthcare Research and Quality for the years 2012 to 2014 was used for this analysis. The NIS is the largest publicly available, all-payer (Medicaid, commercial, and other insurance) inpatient database in the United States and contains a sample of approximately 20% of all

hospitalizations for all conditions nationally. These hospitalizations are selected via a stratified systemic random sample to generate a population systematically drawn from a list of hospitalizations sorted on discharge characteristics across medical specialties, and includes academic, community, nonfederal, general and specialty-specific centers. For this analysis, index delivery hospitalizations were captured with International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes 650 and V27.x. These criteria ascertain >95% of delivery hospitalizations.¹³ The years 2012 through 2014 were used for the analysis given that the proportion of missing data for race in the NIS for these years is small compared to preceding iterations.¹⁴ Because the data is de-identified, the Columbia University institutional review board deemed this analysis exempt.

Women aged 15-54 years with a diagnosis of preeclampsia were included in the analysis and subcategorized as mild preeclampsia (ICD-9-CM code 642.4x), superimposed preeclampsia (642.7x), and severe preeclampsia/eclampsia (642.5x, 642.6x, or both). The primary exposure evaluated was self-reported maternal race and ethnicity as categorized by the NIS: non-Hispanic white, non-Hispanic black, Hispanic, Asian or Pacific Islander, Native American, other, or unknown. The primary outcome of this study was severe maternal morbidity among women with preeclampsia as defined by the CDC. The CDC definition of severe maternal morbidity includes 21 diagnoses and procedures including shock, stroke, heart failure, transfusion, and other conditions all identified using ICD-9-CM codes.¹⁵ Additionally, because the most common diagnosis in the severe morbidity composite is transfusion (ICD-9-CM 99.0x) a sensitivity analysis was performed excluding transfusion and restricted to the remaining 20 diagnoses and procedures representative of non-transfusion severe morbidity.

We evaluated three secondary outcomes. First, we evaluated individual risk for severe morbidity diagnoses specifically associated with preeclampsia including stroke, pulmonary edema/acute heart failure, renal failure, and eclampsia. These diagnoses were based on CDC criteria. Second, we evaluated risk for maternal in-hospital death for women with preeclampsia. Third, we evaluated risk for severe morbidity among women with preeclampsia by race stratified by an obstetric comorbidity index which measures underlying patient risk.¹⁶ This comorbidity index provides weighted scores for comorbidity for individual patients based on the presence of specific diagnosis codes and demographic factors present in administrative data. Higher scores are associated with increased risk for severe morbidity. In the initial study validating the comorbidity index in a general obstetric population, patients with the lowest score of 0 had a 0.68% risk of severe morbidity whereas a score of >10 was associated with a risk of severe morbidity of 10.9%.¹⁶ This comorbidity index was subsequently validated in an external population.¹⁷ We categorized women based on comorbidity index scores: 0 (lowest risk), 1 or 2, and >2 (highest). Given that the comorbidity index includes hypertensive diagnoses including chronic hypertension, gestational hypertension, and preeclampsia, we excluded these diagnoses in calculating the comorbidity index score. Because maternal age is included as a separate variable in adjusted analyses, this factor was additionally excluded from the comorbidity index in the adjusted analyses; in calculating severe morbidity risk by comorbidity score maternal age was included.

Demographic and hospital characteristics were evaluated by NIS race categories. Hospital characteristics included bed size (small, medium, or large), location and teaching status (urban teaching, urban non-teaching, and rural), and region (Northeast, Midwest, South, or West). Demographic categories included year of delivery, insurance status (Medicaid, private, Medicare, other, uninsured), and ZIP code income quartile. Demographic comparisons and temporal trends were evaluated using the chi-squared test. Adjusted risk ratios (aRR) for severe morbidity with 95% confidence intervals (CI) as measures of effect accounting for demographic, hospital factors, and comorbidity were derived from fitting a log-linear regression model. All analyses were performed with SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

A total of 101,741 births (4.5% of all deliveries) to women aged 15 to 54 years complicated by preeclampsia were included in this analysis. Ascertainment of race was consistent in the NIS with the proportion of missing data lowest in 2012 (5.2%) and highest in 2013 (6.1%). Most women with preeclampsia (62.9%) delivered at urban teaching hospitals (Table 1). Deliveries among non-Hispanic black and non-Hispanic white women were most common in the South (56.1% and 42.6% of deliveries to these women respectively) while deliveries among Asian and Hispanic women were most likely to occur in the West (51.8% and 40.3%, respectively). Non-Hispanic white women were most likely to have private insurance (63.4%), while non-Hispanic black and Hispanic women were most likely to have Medicaid insurance (62.9% and 64.1% respectively).

Risk for severe morbidity including transfusion was significantly higher among non-Hispanic black women (9.8%) than non-Hispanic white, Hispanic, or all other women (6.1%, 7.7%, and 7.5% respectively, $p<0.01$) (Figure 1A). Excluding transfusion, morbidity remained significantly higher for non-Hispanic black women (5.5%) than non-Hispanic white, Hispanic, or all other women respectively (3.4%, 3.9%, and 4.2% respectively, $p<0.01$) (Figure 1B). Evaluating specific morbidity diagnoses, non-Hispanic black women were at higher risk for stroke (17.1 per 10,000 deliveries) compared to non-Hispanic white, Hispanic, or all other women respectively (6.5, 12.7, and 9.3 per 10,000 deliveries respectively, $p<0.01$) (Figure 2A). Non-Hispanic black women were at highest risk for pulmonary edema or acute heart failure (56.2 per 10,000 deliveries) compared to non-Hispanic white, Hispanic, and all other women respectively (32.7, 30.2, and 38.4 per 10,000 deliveries respectively, $p<0.01$) (Figure 2B). Non-Hispanic black women were at highest risk for renal failure (136.4 per 10,000 deliveries) compared to non-Hispanic white, Hispanic, and all other women respectively (60.4, 66.0, and 96.1 per 10,000 deliveries respectively, $p<0.01$) (Figure 2C). Finally, non-Hispanic black women were at highest risk for eclampsia (171.1 per 10,000 deliveries) compared to non-Hispanic white, Hispanic, and all other women respectively (133.6, 156.0, and 142.4 per 10,000 deliveries respectively, $p<0.01$) (Figure 2C).

Figure 3 demonstrates risk for severe morbidity by comorbidity index score by race. Women with higher comorbidity scores were at increased risk for morbidity in the setting of preeclampsia: a score of 0 was associated with risk for severe morbidity of 6.4%, 1 or 2 with

risk for severe morbidity of 8.4%, and >2 with risk for severe morbidity of 13.0% ($p<0.01$). Non-Hispanic black women had significantly higher risk for severe morbidity than non-Hispanic white women across comorbidity index scores. A score of 0 was associated with an 8.1% risk of severe morbidity for non-Hispanic black women versus a 5.3% risk for non-Hispanic white women. Scores of 1 or 2 were associated with risks of 11.3% versus 7.1% respectively for non-Hispanic black and white women, while scores of >2 were associated with risks of 20.2% versus 11.3%, respectively ($p<0.01$ for all three comparisons).

Table 2 demonstrates adjusted and unadjusted models for severe morbidity. In the adjusted model risk for severe morbidity was higher among women aged 15-17 compared to those aged 18-24 (aRR 1.36, 95% CI 1.20-1.53), women on Medicare and uninsured compared to private insurance (aRR 1.60, 95% CI 1.33-1.91, aRR 1.37 95% CI 1.19-1.59), and non-Hispanic black compared to non-Hispanic white women (aRR 1.36, 95% CI 1.28-1.45). Risk for severe morbidity was higher among women with scores >2 and 1 or 2 compared to those with scores of 0 (aRR 4.20, 95% CI 3.49-5.05, aRR 1.42, 95% CI 1.35-1.49).

Maternal in-hospital death was most common among non-Hispanic black women; of 22 maternal deaths 10 occurred among non-Hispanic black women compared to 12 among non-black women. Risk for death for non-Hispanic black women was significantly higher than for non-black women (48.9 per 100,000 deliveries, 95% CI 26.9-89.9 versus 14.8 per 100,000 deliveries, 95% CI 14.6-39.8, respectively, $p<0.01$). Deaths by race for other groups are not reported because of small cell size (<10). The relative risk for mortality for non-Hispanic black compared to non-black women was 3.3 (95% CI 1.4-7.7).

DISCUSSION

Main Findings

This analysis of delivery hospitalizations for women with preeclampsia demonstrated that risk for a range of adverse outcomes was highest for black non-Hispanic women. Stroke, renal failure, pulmonary edema or heart failure, eclampsia, and death were all highest among non-Hispanic black women, with risk for overall morbidity 60% higher in the unadjusted analysis and more than a third higher in the adjusted analysis. These findings align with those from prior studies using the NIS to analyze to evaluate racial disparities related to preeclampsia with the benefit of using more recent data with a smaller proportion of missing data on race.¹⁸

Implications of the Findings and Future Research Directions

While evidence supports that timely administration of antihypertensive medications may be associated with decreased risk for stroke and use of magnesium sulfate prophylaxis with reduced risk for seizures,⁴ it is likely that a broad range of inpatient and outpatient interventions are required to comprehensively reduce maternal risk related to preeclampsia in general and racial disparities in particular. Optimal prenatal care may be of particular importance; research supports that aspirin is most effective in preventing preeclampsia when administered early in pregnancy,¹⁹ and prompt outpatient identification of preeclampsia and delivery prior to disease progression leading to increased maternal risk. Maternal death

secondary to preeclampsia may occur secondary to multiple conditions including stroke, acute heart failure, eclampsia, and other causes. Our study found differential risk across these categories, underscoring the importance of maternal death reviews in determining which factors may be most important causing and preventing mortality for black non-Hispanic.

Strengths & Weaknesses

In interpreting the results of this study there are several important considerations. First, in comparison to severe morbidity related to a condition such as postpartum hemorrhage which primarily occurs within a hospital setting, preeclampsia onset may occur before, during, or after delivery. With this study model, we are not able to partition the degree to which disparities may be related to women presenting to a hospital with a complication having already occurred versus developing while being hospitalized. We are not able to review antenatal care and determine if preeclampsia diagnoses were present prior to admission. Another important consideration is that for women with preterm severe preeclampsia at 34 weeks gestation, delivery may be delayed if the neonatal benefits of prolonging pregnancy outweigh maternal risk;^{20,21} we are not able to evaluate specific management strategies and are unable to determine the degree to which morbidity disparities are due to management factors related to preterm severe preeclampsia. Third, this study was performed with data prior to the release of major recommendations and research supporting use of aspirin for prevention of preeclampsia;^{19,22} epidemiology and outcomes related to preeclampsia routine aspirin prophylaxis may alter the risk profile of women with preeclampsia substantially. While improvement of inpatient management factors such as magnesium sulfate and antihypertensive medication administration may represent the most readily implementable means of reducing maternal risk, optimization of prenatal care and outpatient management among high risk women, while less amenable to straightforward protocols, may also be important in improving outcomes.

Another limitation of this study is that race was missing for up to more than 6% of women per year. If outcomes are differential based on race not being reported, bias is possible. The Healthcare Cost and Utilization Project HCUP provides recommendations for addressing missing data including imputation.²³ We elected not to perform imputation because data on race is unlikely to be random and non-differential across the years of the NIS included in this analysis.²³ Previous analyses have used HCUP's State Inpatient Databases including states with high proportions of complete data on race;¹⁰ we elected to use the NIS because of the large, nationally representative sample, and because from 2012 to 2014 rates of missing data were relatively low compared to prior iterations, where the rate was higher than 20% of all hospitalizations.

In summary, this analysis found that severe morbidity and mortality risk associated with preeclampsia differed significantly by race with non-Hispanic black women at the highest risk. Non-Hispanic black women were at increased risk for a number of morbidity outcomes including stroke, acute heart failure or pulmonary edema, and eclampsia as well as mortality. While evidenced based recommendations regarding antihypertensive medication administration, magnesium seizure prophylaxis, and aspirin prevention may reduce maternal

risk, mortality reviews and granular evaluation of both inpatient and outpatient maternal care will also play an important role in reducing maternal risk.

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Figure 1.

Figures 1A and 1B demonstrate risk for severe morbidity with and without transfusion by race based on CDC criteria for delivery hospitalizations complicated by preeclampsia in the Nationwide Inpatient Sample from 2012 to 2014. Black women were significantly more likely than white women to experience severe morbidity with and without transfusion ($p<0.01$).

A. Risk for stroke per 10,000 deliveries complicated by preeclampsia **B. Risk for pulmonary edema or acute heart failure per 10,000 deliveries complicated by preeclampsia**

C. Risk for renal failure per 10,000 deliveries complicated by preeclampsia **D. Risk for eclampsia per 10,000 deliveries complicated by preeclampsia** **Figure 2.**

Figures 2A, 2B, 2C, and 2D demonstrate risk for stroke, acute heart failure or pulmonary edema, renal failure, and eclampsia respectively based on CDC criteria for delivery hospitalizations complicated by preeclampsia in the Nationwide Inpatient Sample from 2012 to 2014. Black women were significantly more likely than white women to experience each of these conditions ($p < 0.01$).

Figure 3.

Figure 3 demonstrates risk for severe morbidity based on CDC morbidity by race by obstetric comorbidity score: 0, 1 or 2, and >2. This comorbidity score analysis excluded hypertensive diagnoses (chronic hypertension, gestational hypertension, mild, severe, and superimposed preeclampsia) and included maternal age Risk for severe morbidity was significantly higher for black compared to white women for each category ($p < 0.01$).

Table 1.

Patient demographics

	White non-Hispanic	Black non-Hispanic	Hispanic	Asian/Pacific Islander	Native American	Other	Unknown
<i>All patients(n)</i>	47,684	20,454	19,557	3,317	971	4,303	5,455
	%	%	%	%	%	%	%
Maternal age							
15-17	1.8%	3.5%	4.5%	0.6%	3.9%	2.7%	2.5%
18-24	26.0%	36.5%	31.7%	10.9%	34.7%	26.8%	27.7%
25-29	28.3%	23.7%	23.2%	19.6%	24.2%	23.8%	28.7%
30-34	26.3%	20.1%	21.6%	34.1%	20.1%	24.1%	25.2%
35-39	13.4%	12.0%	14.1%	25.9%	12.7%	16.5%	12.2%
40	4.2%	4.1%	4.9%	8.9%	4.4%	6.1%	3.6%
Year							
2012	32.8%	32.8%	31.5%	31.5%	38.3%	35.4%	29.8%
2013	32.9%	32.7%	33.4%	32.7%	31.2%	31.2%	35.3%
2014	34.3%	34.5%	35.1%	35.8%	30.5%	33.4%	34.9%
Hospital bed size							
Small	12.5%	8.9%	11.2%	10.6%	17.0%	9.8%	13.8%
Medium	27.8%	30.5%	29.5%	30.9%	16.4%	29.8%	28.5%
Large	59.6%	60.6%	59.3%	58.5%	66.6%	60.4%	57.8%
Insurance status[#]							
Medicare	0.9%	1.6%	0.6%	*	*	0.6%	1.6%
Medicaid	31.8%	62.9%	64.1%	30.0%	59.5%	50.5%	33.8%
Private	62.4%	31.3%	29.1%	65.8%	29.6%	42.9%	58.9%
Other	1.2%	1.7%	3.9%	1.8%	2.1%	2.7%	1.7%
Uninsured	3.4%	2.1%	2.1%	2.0%	8.3%	3.0%	3.6%
Hospital Location							
Rural	12.5%	4.0%	3.6%	3.6%	22.9%	4.3%	14.6%
Urban non	31.7%	21.0%	30.5%	25.6%	22.2%	27.9%	22.7%
Urban teaching	55.8%	75.0%	65.8%	70.8%	54.9%	67.8%	62.7%
ZIP Income							
1 st (lowest)	23.4%	48.7%	38.2%	13.1%	42.6%	29.3%	21.8%
2nd	27.3%	22.6%	24.5%	17.2%	21.9%	23.4%	29.8%
3rd	26.4%	16.4%	21.7%	26.6%	16.5%	22.5%	26.0%
4 th (highest)	21.8%	9.8%	12.6%	41.2%	9.4%	21.2%	20.9%
Unknown	1.1%	2.6%	3.0%	2.0%	9.6%	3.6%	1.5%
Hospital Region							
Northeast	15.6%	18.0%	12.9%	18.0%	4.8%	28.5%	5.0%
Midwest	23.7%	18.5%	7.0%	10.3%	10.0%	14.2%	53.3%
South	42.6%	56.1%	39.7%	20.0%	28.6%	41.5%	21.9%
West	18.1%	7.4%	40.3%	51.8%	56.5%	15.8%	21.4%

	White non-Hispanic	Black non-Hispanic	Hispanic	Asian/Pacific Islander	Native American	Other	Unknown
<i>All patients(n)</i>	47,684	20,454	19,557	3,317	971	4,303	5,455
	%	%	%	%	%	%	%
<i>Comorbidity</i>							
0	70.1%	64.3%	70.4%	70.0%	65.6%	71.3%	70.4%
1 or 2	29.7%	35.0%	29.4%	28.9%	34.2%	28.2%	29.3%
>2	0.2%	0.7%	0.2%	1.2%	*	0.4%	0.2%
<i>Preeclampsia</i>							
Mild	52.9%	39.0%	47.6%	44.9%	48.3%	48.2%	46.7%
Superimposed	12.2%	21.8%	11.9%	14.7%	13.7%	11.9%	11.3%
Severe	35.0%	39.2%	40.4%	40.4%	38.0%	39.9%	41.9%

Comorbidity index excludes maternal age and hypertensive diagnoses.

* not reported due to cell size <10.

Table 2.

Risk for severe morbidity (including transfusion) in unadjusted and adjusted models

	RR	95% CI	aRR	95% CI
<i>Year</i>				
2012	1.00	Reference	1.00	Reference
2013	0.98	0.93-1.04	0.98	0.93-1.04
2014	1.01	0.95-1.06	0.99	0.93-1.04
<i>Hospital bed size</i>				
Small	1.00	Reference	1.00	Reference
Medium	0.99	0.91-1.07	0.91	0.84-0.99
Large	1.08	1.00-1.16	0.95	0.88-1.02
<i>Insurance status</i>				
Private	1.00	Reference	1.00	Reference
Medicaid	1.30	1.24-1.36	1.15	1.09-1.21
Medicare	1.95	1.63-2.33	1.60	1.33-1.91
Other	1.05	0.91-1.22	1.03	0.89-1.19
Uninsured	1.52	1.31-1.76	1.37	1.19-1.59
<i>Hospital Location</i>				
Urban non-teaching	1.00	Reference	1.00	Reference
Rural	0.94	0.85-1.03	1.10	1.00-1.22
Urban teaching	1.17	1.11-1.24	1.00	0.94-1.05
<i>Income Quartile</i>				
1 st (lowest)	1.00	Reference	1.00	Reference
2nd	0.93	0.87-0.98	1.03	0.97-1.10
3rd	0.88	0.83-0.94	1.02	0.95-1.09
4 th (highest)	0.90	0.84-0.96	1.05	0.98-1.14
<i>Hospital Region</i>				
Northeast	1.00	Reference	1.00	Reference
Midwest	0.80	0.74-0.86	0.84	0.77-0.91
South	0.89	0.84-0.95	0.89	0.84-0.95
West	0.87	0.81-0.94	0.90	0.83-0.97
<i>Maternal age</i>				
18-24	1.00	Reference	1.00	Reference
15-17	1.40	1.24-1.58	1.36	1.20-1.53
25-29	0.84	0.79-0.90	0.86	0.81-0.92
30-34	0.89	0.84-0.95	0.91	0.85-0.97
35-39	0.94	0.87-1.01	0.91	0.84-0.98
>39	1.09	0.98-1.22	1.02	0.91-1.14
<i>Preeclampsia</i>				
Mild preeclampsia	1.00	Reference	1.00	Reference
Superimposed preeclampsia	1.72	1.58-1.86	1.55	1.43-1.68
Severe preeclampsia/eclampsia	3.47	3.29-3.66	3.31	3.14-3.50

	RR	95% CI	aRR	95% CI
<i>Comorbidity index</i>				
0	1.00	Reference	1.00	Reference
1-2	1.48	1.41-1.54	1.42	1.35-1.49
>2	5.28	4.40-6.34	4.20	3.49-5.05
<i>Race</i>				
Non-Hispanic white	1.00	Reference	1.00	Reference
Non-Hispanic black	1.60	1.51-1.69	1.36	1.28-1.45
Hispanic	1.25	1.18-1.33	1.10	1.03-1.18
Asian or Pacific Islander	1.29	1.14-1.47	1.18	1.04-1.34
Native American	1.38	1.11-1.71	1.23	0.99-1.54
Unknown	1.06	0.95-1.18	1.00	0.89-1.11
Other	1.36	1.21-1.51	1.22	1.09-1.37

Adjusted model included all factors in this table (year, bed size, insurance status, hospital location, income quartile, hospital region, hospital teaching status, maternal age, and race). *RR*, risk ratio. *aRR*, adjusted risk ratio.