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Race and Ethnicity, Medical Insurance, and Within-Hospital Severe Maternal Morbidity Disparities

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Abstract

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OBJECTIVE: To examine within-hospital racial and ethnic disparities in severe maternal morbidity rates and determine whether they are associated with differences in types of medical insurance.

METHODS: We conducted a population-based cross-sectional study using linked 2010-2014 New York City discharge and birth certificate datasets (N=591,455 deliveries) to examine within-hospital Black-White, Latina-White, and Medicaid-commercially insured differences in severe maternal morbidity. We used logistic regression to produce risk-adjusted rates of severe maternal morbidity for patients with commercial and Medicaid insurance and for Black, Latina, and White patients within each hospital. We compared these with-in hospital adjusted rates using paired t-tests and conditional logit models.

RESULTS: Severe maternal morbidity was higher among Black and Latina than White women (4.2%, 2.9% vs.1.5%, p<.001) and among women insured by Medicaid than those commercially insured (2.8% vs. 2.0%, p<.001). Women insured by Medicaid versus those with commercial insurance had similar risk for severe maternal morbidity within the same hospital (p=.54). In contrast, Black versus White women had significantly higher risk for severe maternal morbidity within the same hospital (p<.001) as did Latina women (p<0.001). Conditional logit analyses confirmed these findings with Black and Latina versus White women having higher risk for severe maternal morbidity (adjusted odds ratio=1.52; 95% CI 1.46-1.62 and adjusted odds ratio=1.44; 95% CI 1.36-1.53, respectively) and women insured by Medicaid compared to those commercially insured having similar risk.

CONCLUSION: Within hospitals in New York City, Black and Latina women are at higher risk of severe maternal morbidity than White women that is not associated with differences in types of insurance.

PRECIS

Within-hospital racial and ethnic disparities in severe maternal morbidity rates exist in New York City hospitals but are not associated with differences in type of medical insurance.

Introduction

Research has documented racial and ethnic disparities in severe maternal morbidity rates and that between-hospital differences -- i.e., Black and Latina mothers receiving care at hospitals with worse outcomes -- explain a sizable portion of these disparities.[1-3] However, less attention has been paid to within-hospital disparities -- whether Black and Latina mothers have worse outcomes than White mothers who deliver in the *same* hospital.[1,3]

Medicaid covers nearly half of the deliveries in the United States and Black and Latina pregnant women are more likely to be insured by Medicaid than are White pregnant women.[1,3,4] In other areas of medicine research has documented that patients insured by Medicaid tend to receive lower quality of care than patients insured by commercial insurance even within the same hospital.[5] There are reasons to suspect that insurance type may contribute to racial and ethnic severe maternal morbidity disparities within the same hospital. Pregnant women insured by Medicaid may be cared for by a different set of physicians. Reimbursement levels for delivery are lower for Medicaid versus commercially insured

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deliveries.[6] Few studies have examined whether insurance status contributes to within-hospital racial disparities in severe maternal morbidity rates.

Our objective was to examine within-hospital racial and ethnic disparities in severe maternal morbidity rates and to determine whether they are associated with differences in types of medical insurance.

METHODS

We conducted a cross-sectional study using Vital Statistics birth records linked with New York State discharge abstract data - The Statewide Planning and Research Cooperative System (SPARCS) for all delivery hospitalizations in New York City from 2010 to 2014. Data linkage was conducted by the New York State Department of Health and Institutional Review Board approvals were obtained from the New York City Department of Health and Mental Hygiene, the New York State Department of Health, and the Icahn School of Medicine at Mount Sinai. Delivery hospitalizations were identified based on ICD-9-CM diagnosis and procedure codes and DRG delivery codes.[7] Ninety eight percent of maternal discharges were linked with infant birth certificates. The final sample included 591,455 deliveries to live infants at 40 New York City hospitals.

New York City birth records include self-identified race and ethnicity data. We created a race/ethnicity variable by combining the race and information on Latina ethnicity into the following categories: non-Latina Black, Latina, non-Latina White, Asian and other race. We refer to non-Latina Black as Black and non-Latina White as White in this manuscript. We focus our analyses on Black, Latina, and White mothers. We ascertained patient insurance status from SPARCS and categorized it as “commercial”, “Medicaid”, “self-pay”, and “other”. Medicaid included all public insurance plans.

We used a published algorithm to identify severe maternal morbidity, using diagnoses for life-threatening conditions and procedure codes for life-saving procedures defined by investigators from the Centers for Disease Control and Prevention (CDC).[8,9]

We compared sociodemographic characteristics and clinical conditions of Black, Latina and White deliveries as well as deliveries covered by Medicaid versus those covered by commercial insurance using chi-squared tests for categorical variables and ANOVA for continuous variables.

We estimated risk-adjusted severe maternal morbidity using logistic regression controlling for maternal sociodemographic (e.g., self-identified race and ethnicity, age, education, parity, country of birth), clinical and obstetric factors (e.g., multiple pregnancy, history of previous cesarean delivery, body mass index, prenatal care). Similar to previous research we also adjusted for patient risk factors that could lead to maternal morbidity and were likely present on admission to the hospital (e.g., diabetes, hypertension, premature rupture of membranes, disorders of placentation).[10-13] Model fit was assessed by using the area under the receiver operating characteristic curve statistics (c=0.780).

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The risk-adjusted severe maternal morbidity rates for each hospital were estimated by calculating the number of observed events over expected events for a hospital and multiplying it by the mean severe maternal morbidity rate for New York City.[14] We ranked the hospitals from lowest to highest risk-adjusted severe maternal morbidity using this approach.[14]

Next, using the same approach we estimated the risk-adjusted severe maternal morbidity rates for Black versus White and Latina versus White deliveries and for deliveries insured by Medicaid versus those insured by commercial insurance and compared within-hospital adjusted rates using paired t tests. We calculated the difference in risk-adjusted severe maternal morbidity rates for Black vs. White, Latina vs. White and Medicaid vs. commercially insured deliveries for each hospital and then performed a t-test to assess whether those differences were significantly different from zero. Because we analyzed differences in rates for the same hospital, the paired t-test analysis controlled for all unobserved within hospital characteristics that might confound the relationship between insurance and maternal morbidity.[5] Women for whom insurance status was categorized as self-pay or other (<2%) were excluded from these analyses. We conducted a confirmatory analysis using conditional logit. A conditional logit model—also known as fixed-effects logit model--is an extension of logistic regression that produces adjusted odds ratios that are conditional on the group to which an observation belongs, the hospital, in our case. The odds ratio on race from a standard logistic regression model measures disparities due to both within hospital (i.e., Black mothers have worse outcomes than White mothers within each hospital) and between hospitals (i.e., Black mothers deliver at hospitals that treat all mothers poorly) factors.[15] By conditioning on the hospital, conditional logit models eliminate any between-hospital influences on the odds ratios, leaving only within hospital estimates of racial differences. We tested for differences by insurance status on the within-hospital association of race and severe maternal morbidity by including interactions between race and insurance and ethnicity and insurance in these conditional models. We conducted two sensitivity analyses. First, we reran the conditional logit models on severe maternal morbidity without blood transfusion, as blood transfusions are a major component of the severe maternal morbidity measure. Second, we restricted the sample to hospitals between 20–80% of Medicaid deliveries because the distribution of Medicaid-insured patients across hospitals is skewed in New York City. Within-hospital differences in severe maternal morbidity by insurance are difficult to detect when only a small percentage of births are covered by either Medicaid or commercial insurance and therefore this restriction would increase the likelihood of finding a statistically significant within-hospital disparity in severe maternal morbidity by insurance, if one exists.

Given prior research demonstrating the association of Medicaid with health outcomes at the hospital-level,[16] we also explored whether hospital performance for severe maternal morbidity is lower for hospitals with a higher percentage of patients insured by Medicaid. We calculated a Pearson correlation coefficient to assess the correlation between hospital-level rates of risk-adjusted severe maternal morbidity and percent Medicaid deliveries. We also divided hospitals into quartiles based on percent Medicaid and examined hospital risk-adjusted severe maternal morbidity rates using chi-square tests.

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All statistical analysis was performed using the SAS system software version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

Black mothers accounted for 21%, Latina mothers for 30%, and White mothers for 31% of the 591,455 deliveries in New York City in 2010–2014. Medicaid insured 60.7% (n=358,897) of deliveries during this period (Table 1). Black and Latina versus White mothers were more likely to be insured by Medicaid (72%, 80% vs. 35% respectively, p<.001). (Figure 1). Severe maternal morbidity occurred in 15,158 deliveries (2.6%) and was higher among Black (4.2%) and Latina (2.9%) versus White (1.5%) mothers (p<.001) and among women insured by Medicaid (2.8%) versus women insured by commercial insurance (2.0%; p<.001). Similar racial and ethnic differences in severe maternal morbidity with and without blood transfusion existed when stratified by insurance (Table 2).

The majority of the 40 hospitals were private, had Level 3/4 nurseries, and were teaching hospitals. The median percent of Medicaid deliveries for New York City hospitals was 81.1% (IQR 48.7%−92.4%). Figure 2 shows within-hospital risk-adjusted severe maternal morbidity rates for Medicaid versus commercially insured, for Black versus White, and for Latina versus White deliveries across hospitals ranked from lowest to highest rates of risk-adjusted severe maternal morbidity.

Paired t-tests demonstrated that women insured by Medicaid and those commercially insured had similar risk-adjusted severe maternal morbidity rates within the same hospital (p=.54). In contrast, Black women had statistically significant higher risk for severe maternal morbidity within-hospital (p<.001) as did Latina women (p<.001). Conditional logit analyses confirmed these findings with Black and Latina versus White women having higher within hospital risks for severe maternal morbidity (adjusted odds ratio [AOR]=1.52; 95% CI 1.46–1.62 and AOR=1.44; 95% CI 1.36–1.53, respectively) and women insured by Medicaid versus those commercially insured having similar risk (AOR=1.05; 95% CI 0.99–1.11). Sensitivity analyses excluding blood transfusions from the severe maternal morbidity outcome corroborated these findings with Black and Latina versus White women having higher risk for severe maternal morbidity (AOR=1.51; 95% CI 1.38–1.67 and AOR=1.27; 95% CI 1.15–1.40, respectively). Further, sensitivity analysis of hospitals with 20–80% of deliveries insured by Medicaid also confirmed these analyses. (Figure 3). The interactions between race and insurance and ethnicity and insurance were insignificant in the conditional logit model suggesting that within-hospital association between race and severe maternal morbidity or ethnicity and severe maternal morbidity did not vary by insurance.

In the analysis testing the association between the percent of deliveries insured by Medicaid at the hospital level and risk-adjusted severe maternal morbidity, we found a positive association (rho=0.13, p=0.01) (See Figure 4). However, hospitals with low rates of severe maternal morbidity were found among both low and high percent Medicaid hospitals. The risk-adjusted severe maternal morbidity rate for hospitals in the highest quartile of Medicaid deliveries was 3.1% compared with 2.3% for the hospitals in the lowest quartile of Medicaid deliveries (p=0.03).

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DISCUSSION

Our data demonstrate that Black and Latina women are more likely than White women to experience a severe maternal morbidity within the same hospital after accounting for patient sociodemographic and clinical characteristics. These disparities were not explained by type of medical insurance. In fact, women insured by Medicaid and those with commercial insurance had similar risks for severe maternal morbidity within the same hospital.

Growing attention has focused on the potential contribution of Medicaid to racial and ethnic disparities in maternal health outcomes, even within the same hospital for a few reasons. First, pregnant women insured by Medicaid are often seen by resident physicians with attending coverage that may differ from attending physicians caring for commercially insured women. In other areas of medicine, researchers found that Medicaid patients were treated by lower-quality physicians.[17,18] Second, Medicaid reimbursement for delivery hospitalization is far less than that for commercially insured and research suggests that physicians may alter their treatment practices based on the generosity of patients' insurers.[19] To our surprise, our data do not suggest that any differences in treatment patterns were reflected in worse outcomes for Medicaid-covered and commercially insured mothers within the same hospital. These results indicate that pathways other than insurance are responsible for the higher risks of severe maternal morbidity among Black and Latina versus White women that were observed in our study.

Disparities are a complex phenomenon and multiple pathways contribute to their occurrence.[20] One pathway, documented by a growing body of research, is structural racism and bias in health care and in maternal health care specifically.[21] More detailed research examining causes of variations in care for pregnant Black and Latina versus White women within the same hospitals such as patient-doctor communication, structural racism, bias, language issues, shared decision-making, and differential use of obstetrical quality tools is needed as these could be important levers to reduce disparities within hospitals. There is a large focus on implementation of implicit bias training in hospitals to address bias in patient care but more research is needed to assess its effect on patient outcomes.[22] Additional research is also needed to better understand how community and social factors, as well as prenatal care factors, contribute to within-hospital racial and ethnic disparities. Richer data are needed to understand these pathways and multiple research designs should be considered, including mixed-methods, qualitative and interventional studies.[23]

Our findings that hospitals heavily reliant on Medicaid experienced higher severe maternal morbidity rates is consistent with previous health policy research documenting that payer mix and other hospital characteristics are associated with health outcomes.[16,24,25] The median percent Medicaid deliveries in our sample was high and higher rates of severe maternal morbidity in Medicaid-reliant hospitals may be related to resource constraints. Our results raise the hypothesis that effects of reduced reimbursement for Medicaid may operate at the hospital but not at the individual level. Previous studies that examined hospitals that predominantly served disadvantaged patients had insufficient nursing resources to provide high quality care.[26,27] Interestingly, in our analysis the association between hospital rates of severe maternal morbidity and percent Medicaid deliveries was not strictly uniform, in that

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high-Medicaid hospitals could be found in the lowest and highest clusters of risk for severe maternal morbidity (Figure 3). High performing Medicaid-reliant hospitals may have specific organizational practices, policies and procedures, or other characteristics that explain their strong performance and exploring this is an important area for future research.

Our analysis has some limitations. We used administrative data (ICD-9 procedure and diagnosis codes) that do not contain important clinical data on severity of illness. Although vital statistics and SPARCS have limitations with reliability of specific variables,[28,29] we combined both sources as recommended to optimize validity.[30] We used a published algorithm to identify severe maternal morbidity cases but did not conduct a medical chart review for case ascertainment. The CDC algorithm using ICD-9 codes for severe maternal morbidity has been reported to have good sensitivity but average positive predictive value.[31] Our classification of Latina ethnicity combined Latinas of diverse ancestry, therefore not capturing the intersection of race and Latina ethnicity. Likewise, “Black” combines diverse groups such as Haitian immigrants and US-born Black women. We were unable to assess unmeasured community and social factors that may contribute to racial and ethnic disparities. In addition, we were unable to examine prenatal care factors and management of preexisting health conditions that may also contribute to disparities.

Racial and ethnic disparities in severe maternal morbidities within the same hospital are disconcerting and demand immediate attention. Multiple factors may be driving these disparities. Optimizing the quality of care at all delivery hospitals including standardizing care, enhancing communication skills, implementing bias trainings, improving translation services, using disparities dashboards that stratify quality metrics by race and ethnicity, implementing quality improvement activities targeting gaps identified in care, and strengthening community partnerships are recommended steps that can address racial and ethnic disparities both within and between-hospitals.[32,33] Differences in quality of care, whether within the same hospital or between hospitals, are potentially modifiable and actionable targets that we can address *now*.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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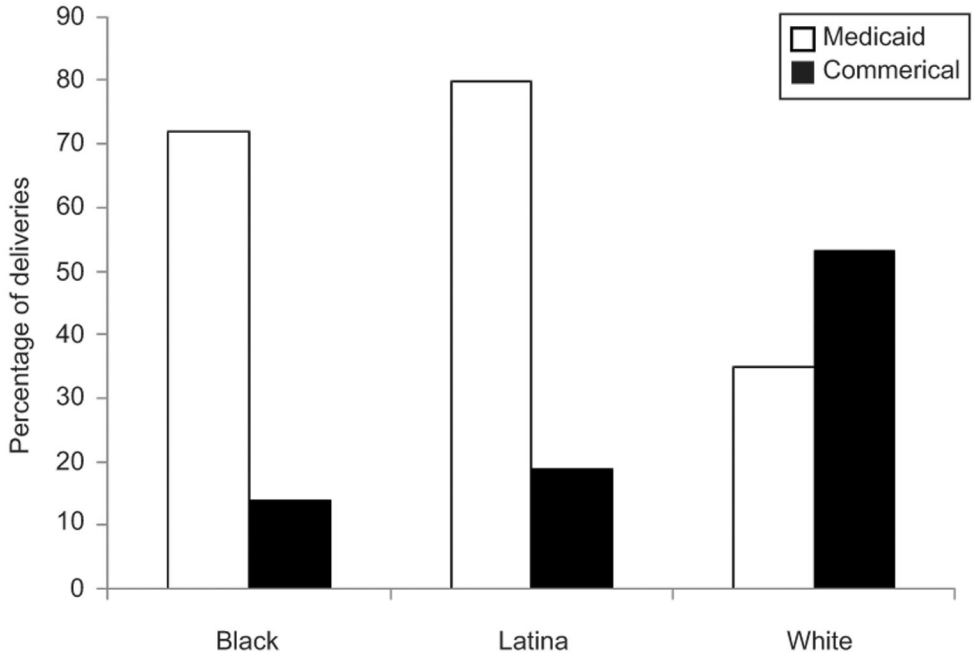

Figure 1.
Maternal insurance status of black, Latina, and white deliveries in New York City hospitals, 2010–2014.

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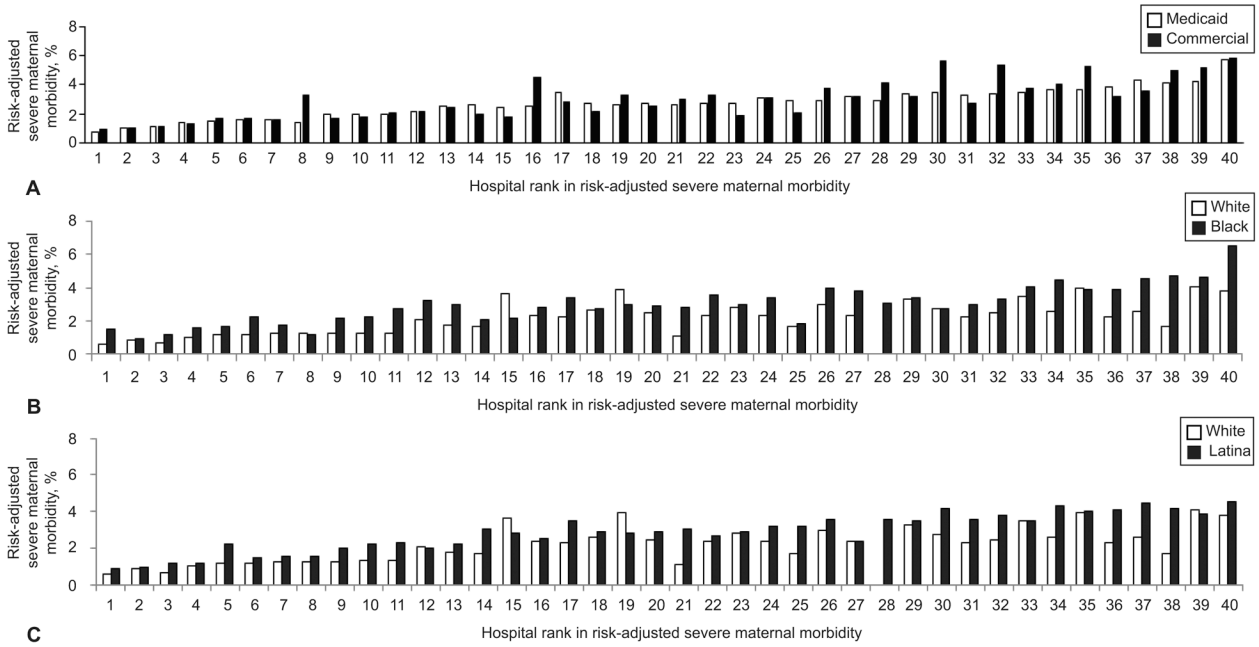

Figure 2.

Within hospital comparison of risk-adjusted severe maternal morbidity for Medicaid versus commercially-insured deliveries (P=.54) (**A**); black versus white deliveries (P<.001) (**B**); and Latina versus white deliveries (P<.01) (**C**). P values are calculated using paired t-test.

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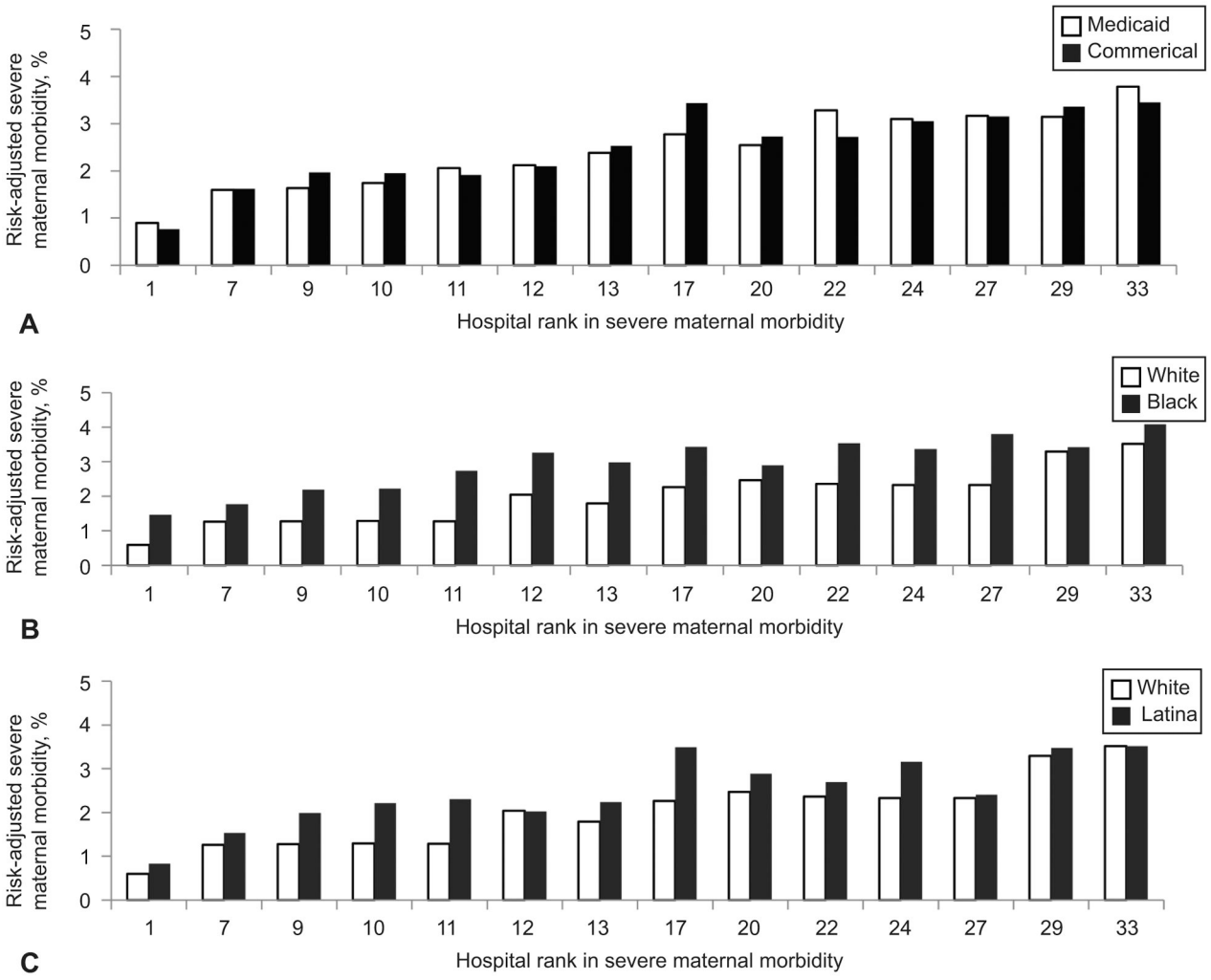

Figure 3:

Within hospital comparison of risk-adjusted severe maternal morbidity for hospitals with percentage of Medicaid deliveries between 20% and 80%: Medicaid versus commercially insured deliveries (P=.65) (**A**); black versus white deliveries (P<.001) (**B**); and Latina versus white deliveries (P<.001) (**C**). P values are calculated using paired t-test.

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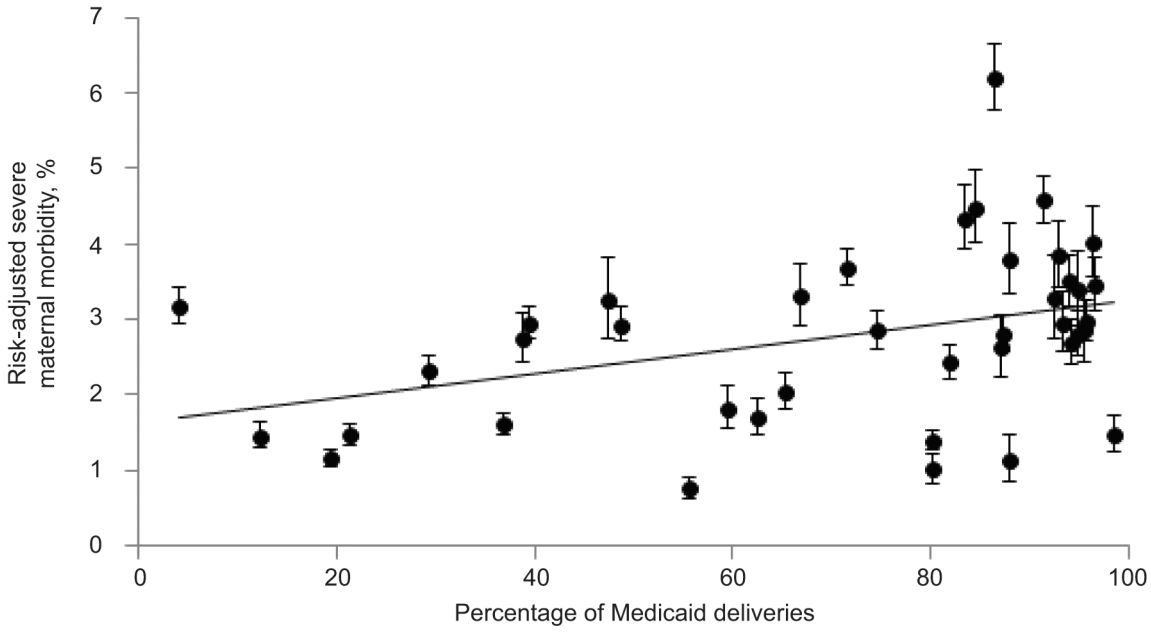

Figure 4.

Association of risk-adjusted severe maternal morbidity with percentage of Medicaid deliveries in New York City hospitals.

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Table 1.

Sociodemographic and clinical characteristics of deliveries in New York City between 2010-2014 by race/ethnicity and medical insurance.

	Black		Latina		White		P-value*	Commercial		Medicaid		P-value**
	n= 122067		N=177768		n= 185095			N=221479		N=358897		
	%	N	%	N	N			%	N	%	N	
Maternal Age							<0.001					<0.001
<20	7.1	8704	9.1	16206	1.2	2304		0.9	1969	7.3	26118	
20-29	47.9	58406	51.8	92117	34.4	63748		24.1	53314	55.9	200710	
30-34	24.6	30003	23.0	40964	34.6	64034		39.9	88278	21.9	78745	
35-39	15.3	18637	12.6	22390	22.7	42021		27	59875	11.5	41346	
40-44	4.73	5774	3.2	5741	6.4	11832		7.44	16477	3.11	11174	
45+	0.4	543	0.2	350	0.6	1156		0.71	1577	0.2	804	
Ancestry							<0.001					<0.001
US Born	57.7	70468	45.6	81028	72.5	134205		67.3	149083	43.4	155905	
Foreign Born	42.3	51599	54.4	96740	27.5	50890		31.6	69959	55.4	198647	
Insurance							<0.001					<0.001
Medicaid	72.2	88071	79.7	141719	35.0	64762						
Private	25.1	30687	18.9	33557	63.6	117750						
Other	0.8	990	0.5	823	0.7	1249						
Uninsured	1.9	2319	0.9	1669	0.7	1334						
Pre-pregnancy body mass index							<0.001					<0.001
Underweight (<18.5)	3.5	4287	3.1	5462	3.5	11001		5.4	11937	5.5	19685	
Normal weight (18.5-24.9)	37.7	45967	44.8	79671	37.7	45967		61.8	136825	47.8	171485	
Overweight (25.0-29.9)	29.2	35609	29.6	52642	18.4	33956		19.5	43125	25.7	92393	
Obese (30.0-39.9)	23.9	29133	18.8	33387	8.3	15359		10.5	23166	16.2	58207	
Morbid Obesity (≥40)	4.7	5752	2.6	4626	1.0	1891		1.5	3234	2.5	9073	
Missing BMI	1.1	1319	1.1	1980	0.4	796		1.4	3194	2.2	8054	
Smoked during pregnancy	3.7	4456	2.5	4511	2.3	4286	<0.001	1.8	3909	2.8	10047	<0.001
Alcohol use during pregnancy	1.2	1463	0.9	1505	0.9	1635	<0.001	0.9	2037	0.9	3348	<0.001
Education							<0.001					<0.001
Less than HS	20.3	24727	36.7	65221	7.9	14553		2.6	5658	33.1	118866	

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	Black		Latina		White			Commercial		Medicaid		
	n= 122067		N=177768		n= 185095		P-value*	N=221479		N=358897		P-value**
	%	N		%	N	N		%	N	%	N	
HS	26.9	32831	24.1	42759	18.8	34881		8.3	18331	30.3	108581	
Greater than HS	52.3	63822	39.0	69356	73.1	135216		87.9	194771	35	125524	
Missing or unknown	0.6	687	0.2	432	0.2	445		1.1	2438	1.2	4345	
Prenatal visits							<0.001					<0.001
0-5	11.9	14549	7.3	12993	3.4	6256		2.5	5464	8.8	31474	
6-8	15.8	19310	12.7	22652	9.9	18231		9.4	20722	13.6	48891	
≥9	70.3	85866	78.5	139568	86.1	159296		86.2	190927	75	269300	
Unknown	1.9	2342	1.3	2555	0.7	1312		2	4367	2.6	9232	
Parity							<0.001					<0.001
Nulliparous	43.6	53257	41.1	73092	47.1	87272		53.1	117567	39.4	141411	
Multiparous	56.2	68574	58.7	104411	52.7	97579		45.7	101162	59.3	212630	
Missing	0.2	236	0.2	265	0.1	244		1.2	2751	1.4	4856	
Type of Pregnancy							<0.001					<0.001
Singleton	98.1	119730	98.7	175436	97.3	180146		97.1	215118	98.7	354137	
Multiple	1.9	2337	1.3	2332	2.7	4949		2.9	6362	1.3	4760	
C-Section Delivery	37.4	45600	32.7	58128	28.1	52036	<0.001	36.4%	80651	30.9%	110977	
Previous Cesarean	17.0	20748	17.7	31431	13.8	25568	<0.001	15.2	33595	16.4	59004	
Primary Cesarean	23.3	28397	18.0	32027	17.8	32936	<0.001	23.0%	51011	17.0%	60833	
Vaginal Delivery	62.7	76467	67.3	119640	71.9	133059	<0.001	63.6%	140829	69.1%	247920	
Comorbidities												
Cardiac Disease	1.5	1795	0.3	541	0.6	1132	<0.001	0.6%	1431	0.3%	1011	<0.001
Renal Disease	0.4	541	0.1	137	0.04	81	<0.001	0.1%	126	0.1%	255	0.04
Musculoskeletal Disease	0.3	401	0.3	567	0.3	564	0.50	0.4%	955	0.2%	828	<0.001
Digestive Disorder	0.02	30	0.03	50	0.2	455	<0.001	0.2%	370	0.0%	172	<0.001
Blood Disease	18.8	22935	15.6	27744	10.2	18885	<0.001	11.5%	25538	14.9%	53490	<0.001
Mental Disorders	4.0	4940	3.5	6183	3.1	5714	<0.001	2.6%	5728	3.3%	11961	<0.001
CNS disease	1.2	1501	1.2	2222	1.2	2250	0.64	1.4%	3017	0.9%	3343	<0.001
Rheumatic Heart Disease	0.1	103	0.1	96	0.03	60	<0.001	0.0%	86	0.1%	210	0.001

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	Black		Latina		White			Commercial		Medicaid		
	n= 122067		N=177768		n= 185095		P-value*	N=221479		N=358897		P-value**
	%	N	%	N	%	N		%	N	%	N	
Disorder Placentation	2.2	2641	1.5	2731	1.5	2703	<0.001	1.8%	3897	1.7%	6020	0.02
Chronic Hypertension	3.0	3650	1.2	2207	0.7	1339	<0.001	1.3%	2868	1.4%	5126	<0.001
Pregnancy Hypertension	8.7	10599	6.0	10605	3.2	5836	<0.001	4.5%	9955	5.6%	19978	<0.001
Lupus	0.2	257	0.2	344	0.1	213	<0.001	0.2%	446	0.1%	493	<0.001
Collagen Vascular Disorder	0.04	47	0.03	50	0.1	124	<0.001	0.1%	200	0.0%	79	<0.001
Rheumatoid Arthritis	0.1	113	0.1	189	0.1	223	0.07	0.1%	326	0.1%	276	<0.001
Diabetes	1.2	1431	0.9	1563	0.4	714	<0.001	0.6%	1231	0.9%	3148	<0.001
Gestational diabetes	1.3	1585	1.0	1709	0.4	793	<0.001	0.6%	1407	1.0%	3476	<0.001
Asthma/Chronic bronchitis	4.3	7703	5.4	9562	4.4	8061	<0.001	4.80%	10639	5.1%	18137	<0.001

*Asian, and other race populations not shown; N= 106,525 (18.0%)

**Other insurances and uninsured not shown; N=11,077 (1.9%)

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Table 2.

Insurance, Race, Ethnicity, and Severe Maternal Morbidity with and without blood transfusions.

	Deliveries	Severe Maternal Morbidity	Severe Maternal Morbidity without Blood Transfusion Cases
	N	% (N)	% (N)
Commercially Insured	221479	2.01 (4462)	0.80 (1765)
Medicaid	358897	2.88 (10339)	0.86 (3072)
Black	122067	4.2 (5125)	1.35 (1646)
Latina	177768	2.85 (5072)	0.84 (1499)
White	185095	1.46 (2708)	0.55 (1020)
Black Commercially Insured	30687	3.73 (1146)	1.52 (466)
Latina Commercially Insured	33557	2.24 (751)	0.83 (279)
White Commercially Insured	117750	1.54 (1810)	0.61 (724)
Black Medicaid	88071	4.35 (3830)	1.29 (1133)
Latina Medicaid	141719	2.99 (4237)	0.84 (1194)
White Medicaid	64762	1.31 (850)	0.43 (281)