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ABSTRACT

OBJECTIVE: We examined the association between county-level structural racism indicators and the odds of severe maternal morbidity (SMM) in New York State.

DESIGN: We merged individual-level hospitalization data from the New York State Department of Health Statewide Planning and Research Cooperative System (SPARCS) with county-level data from the American Community Survey and the Vera Institute of Justice from 2011 to 2013 (n = 244 854). Structural racism in each county included in our sample was constructed as the racial inequity (ratio of black to white population) in female educational attainment, female employment, and incarceration.

RESULTS: Multilevel logistic regression analysis estimated the association between each of these structural racism indicators and SMM, accounting for individual- and hospital-level characteristics and clustering in facilities. In the models adjusted for individual- and hospital-level factors, county-level racial inequity in female educational attainment was associated with small but statistically significant higher odds of SMM (odds ratio [OR] = 1.17, 95% confidence interval [CI] = 1.47, 1.85). County-level structural racism indicators of female employment inequity and incarceration inequity were not statistically significant. Interaction terms examining potential effect measure modification by race with each structural racism indicator also indicated no statistical difference.

CONCLUSIONS: Studies of maternal disparities should consider multiple dimensions of structural racism as a contributing cause to SMM and as an additional area for potential intervention.

KEYWORDS: severe maternal morbidity, structural racism, multilevel regression

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Introduction

The prevalence of severe maternal morbidity (SMM)—potentially fatal health problems during labor and delivery—is increasing on global, national, and local levels.[1,2] This increase has serious consequences including more cases of adverse maternal postnatal health, higher health care costs, longer hospitalization stays, and higher health service utilization.[3,4] Moreover, there are significant racial and ethnic disparities in SMM in the United States[5,6] and these racial disparities have continued to persist over time.[7] Non-Latina black women have the highest prevalence of SMM; SMM occurred in 231 per 10 000 delivery hospitalizations in the United States from 2012 to 2015 to compared with 139 per 10 000 delivery hospitalizations to non-Latina white women.[8]

Research on preventable risk factors associated with SMM has largely focused on individual- and hospital-level, but not neighborhood-level characteristics. Individual-level characteristics such as older age, low socioeconomic status and the presence of chronic disease are associated with higher risk for SMM.[9,10] More recent studies have identified important hospital-level factors associated with SMM such as non-teaching status, low volume of delivery, and having a large proportion of racial/ethnic minority patient population.[9–13] To date, only one study incorporated neighborhood-level factors (eg, number of gynecologists/obstetricians per 10 000 deliveries in the neighborhood. % family below poverty level), in addition to individual- and hospital-level characteristics, reporting the lack of significant associations between neighborhood-level factors with SMM in New York State.[13]

However, given the vast body of research on neighborhood and area effects on maternal health,[14] it remains likely that area-level characteristics are associated with SMM. Studies have shown measures of segregation to be consistently associated with adverse maternal characteristics. For example, high scores on residential segregation indices have been associated with higher self-reported stress among pregnant women[15] and higher odds of smoking during pregnancy among black women.[16] Residential segregation measures are commonly used indicators of structural racism.

Racism is a system that oppresses people of color. It can be manifested as interpersonal internalized (ie, negative ideas about her own culture within an individual), interpersonal (ie, negative actions/statements toward a different race/ethnicity), and structural racism.[17] *Structural racism specifically* refers to the public policies and institutional practices that produce and perpetuate racial inequities in the United States.[18–20] Structural racism can directly impact health through individually mediated (eg, stress response and related physiological processes) pathways.[21] Beyond individually mediated biological processes, structural racism may adversely affect health by restricting the access of persons of color to employment and higher education opportunities while increasing their exposure to social structures that are detrimental to health such as persistent contact with the criminal justice system.[19,22,23] Therefore, structural racism is a fundamental cause of inequities in health, creating barriers that persist even in the absence of any interpersonal racism.[19,24–26]

Research on structural racism and adverse maternal and infant health have largely using indices of residential segregation to operationalize structural racism.[27] However, structural racism may be manifested in other area-level inequities besides residential segregation. Furthermore, the use of multiple indicators representing subtle but important variations in inequity may be important to characterize different aspects of structural racism.

As one response to the potential limitations of a segregation-based measure of structural racism, Lukachko et al[28] proposed a set of area-level ratio-based indicators representing the systematic exclusion of people of color from access to socioeconomic resources and opportunities in a study on structural racism and myocardial infarction. The appeal of these black-white ratio-based indicators is their ability to capture race-based differential access to specific resources. Moreover, these indicators use administrative data instead of relying on self-reports. Recent studies have applied these set of state-level indicators to infant health outcomes, finding structural racism indicators—ratios of blacks to whites who were employed, were incarcerated, and had a bachelor's degree—were associated with higher odds of small-for-gestational age.[29] Decreasing racial inequity in education was associated with an approximately 10% reduction in the black infant mortality rate.[30] One of the recent study using a traditional segregation-based structural racism indicator and a county-level ratio-based indicator of the black-white ratio in elected office structural racism indicator found both were associated with lower birth weight among black and white babies.[31]

Among this limited but growing literature on structural racism, no study, to date, has used structural racism indicators that are gender-specific despite the recognition that there are gender-specific racial discrimination experiences on the interpersonal level.[32] Persistent inequalities in the United States between women and men in career opportunities and educational attainment remain. Gender-specific structural racism indicators may be especially important for maternal health outcomes because it might reflect the intersectionality of race and gender that black women encounter. No study, to date, has examined these indicators of structural racism and maternal health.

Our study examines the association between these three structural racism indicators and the odds of SMM in New York State, adjusting for individual- and hospital-level characteristics. Furthermore, we chose to examine this association using county-level characteristics rather than state-level characteristics. County-level may be more policy amenable than smaller geographical areas but still large enough as a geographical unit to capture measures of area-level structural racism processes.[33]

Methods

Sample

In this retrospective study, our sample was drawn from New York State Department of Health Statewide Planning and Research Cooperative System (SPARCS) New York State birth hospitalization records between January 1, 2011, and December 31, 2013. SPARCS provides patient, hospital, health care provider, and hospitalization stay details for hospital care in New York State. We identified hospitalizations for obstetric deliveries using previously published methodology.[34] If more than one potential birth record was available for a woman, ie, the woman had more than one birth during this time period, we randomly chose just one birth record to include. Discharge records were excluded if the county code of the patient or the hospital identifier was missing.

The sample was merged with county-level data available from the U.S. Census American Community Survey (2011-2013) and county-level information from the Vera Institute of Justice. All county-level data from American Community Survey (ACS) were a 3-year average from 2011 to 2013. Publicly available hospital-level information from the New York State Department of Health was merged with the individual-level SPARCS records based on reported facility of birth.

Exposure

County-level indicators of structural racism focused on three common domains that represent the degree blacks are systematically excluded from community resources—employment, educational attainment, and judicial treatment.[35] Conceptually, each indicator captures race-based differences to specific types of socioeconomic opportunity and resources. We used ACS data to construct the ratio of black to non-Latina white (white) female unemployment rates and to construct the ratio of black to white female 4-year college education rates. Our county-level educational and unemployment structural racism indicators were gender-specific to better capture the contextual disparities facing pregnant women in these counties. Both ACS county-level indicators were transformed into a binary variable based on a median split. The median split for educational attainment comparing black with white female college graduates was 0.54; the proportion of black female college graduates was almost half

of their white counterparts. The median split used for the ratio of black-white female unemployment was 2.1, black females more than doubled the proportion of white females who were unemployed.

We used data provided by Vera Institute of Justice to calculate the ratio of black to white total (male and female) incarcerated persons. The county-level incarceration structural racism indicator differed from the structural racism indicators constructed using ACS data in two important ways. First, gender-specific county-level incarceration data were not available. Second, incarceration data were not available for the individual counties within New York City (NYC). For that reason, the four NYC counties in our dataset were assigned the same incarceration rate. The median split for the black-white incarceration ratio varied by year from 12.2 in 2011 to 9.9 in 2013, with blacks about 10-12 times more likely to be incarcerated than whites. Although gender-specific incarceration rates were not available at the county-level for inclusion in our study, overall incarceration is still an important marker of structural inequity. The criminal justice system systematically disadvantages the black community in the United States. While women may be less likely than men to be incarcerated, those who are incarcerated face the same racial disparities as men.[36,37] Black women are also more likely than their white woman to have indirect contact with the criminal justice system through the incarceration of a household member.[38] Mass incarceration of black males has a documented impact on maternal support,[39] housing insecurity,[40] and the likelihood of mothers' engagement in harmful perinatal behaviors.[41] For these reasons, the non-gender-specific incarceration rates may still provide valuable indicator of structural racism. All binary variables were coded with 1 indicating greater than the median black-white inequality.

Outcome

We defined SMM using a widely used Centers for Disease Control (CDC) algorithm.[42] This algorithm uses administrative discharge data reflecting clinical, hospital, and billing information. A case was characterized as SMM if the hospitalization was (1) determined to be for a delivery and (2) identified as having one or more codes from 25 ICD-9-CM code categories or a diagnosis code designated as SMM indicators. These SMM indicators are diagnosis and procedure codes that capture potentially life-threatening maternal conditions that occur during labor and delivery.[2,10,42]

Covariates

Adjusted models included individual-level covariates that are potential confounders: age (less than 20, 20-39, 40, and over), medical insurance (Medicaid, other government, private, other), and cesarean delivery[43,44] Maternal medical conditions were summarized as a single covariate using the Comorbidity Index for Use in Obstetric Patients, an index that was created to reflect increased risk of maternal morbidity and mortality.[45] This index is composed of chronic disease and adverse medical conditions that are considered to be a valid measure of comorbidity specifically in an obstetric population and includes preeclampsia, congenital heart disease, asthma, HIV status, and alcohol-related disorder. Although the comorbidity index incorporates the mother's method of delivery, we chose to include C-section as an independent binary covariate because it is known to be strongly associated with SMM,[46] in part, because the procedure is done to treat *serious morbidity*.

Hospital characteristics included ownership (public vs private), teaching status, annual number of deliveries, and whether the hospital is predominantly minority-serving based on the proportion of deliveries to non-white mothers during this time period. These hospital characteristics were included in a previous study on SMM.[11] In addition, we incorporated a quality measure indicating whether the facility was recognized for nursing excellence, an accreditation from the American Nurses Credentialing Center. While accreditation is a voluntary program, it is associated with lower mortality risk and overall better patient experience.[47,48] Finally, we included the absolute level of each indicator to isolate the effects of the structural racism.

Analysis

Our analytical sample consisted of respondents with complete information on structural racism indicators, individual-level covariates, facility characteristics, and the outcome (n = 344 792) from counties with at least a hundred births from black and white mothers (n = 25 counties). Further restriction was necessary due to the limitations of our exposure; race-specific information needed for the structural racism indicators were only available for nine counties. Our final analytical sample consisted of 244 854 individuals residing in nine counties of which four (*) were in NYC (Bronx*, Erie, Kings*, Monroe, Nassau, New York*, Queens*, Suffolk, and Westchester).

Descriptive statistics characterized SMM rates and all contextual indicators. We fitted two-level multilevel models accounting for correlations by facility to examine the association between county-level structural racism indicators, hospital-level characteristics, and individual-level risk factors with SMM. We calculated the intraclass correlation coefficient (ICC) for our multilevel logistic regression models assuming that the dichotomous outcome comes from an unknown latent continuous variable with a level-1 residual that follows a logistic distribution with a mean of 0 and a variance of 3.29 (Snijders and Bosker, 1999). We ran additional models including an interaction term between race and individual for each of the structural racism indicators to investigate possible effect measure modification. Interaction terms were not statistically significant and, consequently, not presented below. The study protocol was reviewed by the

Institutional Review Board of New York City, Department of Health and Mental Hygiene.

Results

From 2011-2013, approximately 2.5% of women giving birth in our sample experienced SMM (Table 1). Compare with white mothers, a larger proportion of black mothers experienced SMM (4.2% vs 1.6%) overall and within each county represented in our analysis (Table 1). Prevalence of SMM by insurance status ranged from 2% of mothers with private insurance, 3% among mothers on Medicaid to 4% among mothers on other government insurance (eg, Department of Corrections, Medicare or not specified). As expected, the percentage of mothers experiencing SMM increased with higher comorbidity risk scores (2% among those with an obstetric comorbidity index score of 0, 3% among those with an index score of 1, and 5% among those with a score of 2 or more). A higher percentage of mothers who delivered via C-section experienced SMM compared with those who delivered vaginally (5% vs 1%). Hospital-level characteristics that were associated with a higher proportion of SMM in the bivariate analysis included delivering in a non-accredited vs quality-accredited hospital (3% vs 2%), delivery in a teaching vs non-teaching hospital (3% vs 2%) and delivery in a public vs private hospital (5% vs 2%).

In the nine New York State counties represented in our sample, blacks consistently had higher unemployment rates, higher incarceration rates, and lower college attainment rates (Figure 1). Having a value less than one indicates blacks were under-represented in this indicator compared with whites. Having a value larger than one indicates blacks were over-represented in this indicator compared with whites. The starkest black-white difference was in incarceration rates. Among the nine counties included in our study, the black-white ratio for incarceration ranged from a "low" of 4.70 for Suffolk County in 2013 to a high of 12.90 in Westchester County in 2012. Although we were able to construct annual incarceration rates for our sample, the same five counties were identified as having high incarceration inequity for all 3 years—Bronx, Kings, New York, Queens, and Westchester. The ACS-derived employment and education structural racism indicator were only available as an average for the years 2011-2013. From 2011 to 2013, three counties had high racial inequity for education and employment—Erie, King, and Monroe. New York county (also known as Manhattan) had high racial inequity in education but not in employment. Nassau and Westchester had high racial inequity in employment but not in education. The black-white college attainment ratio ranged from 0.36 in Monroe County to 0.74 in Nassau County. The black-white unemployment ratio ranged from 1.34 in Suffolk County to 2.40 in Erie County.

The SMM prevalence ranged from a low of 1.5% among Monroe county mothers to a high of 3.6% among Bronx county mothers. A higher proportion of SMM was noted in counties with higher (worse) inequity for each of the structural racism indicators. Compared with white births, a larger proportion of black births were in counties with high inequities for incarceration, unemployment, and education (approximately 1.5% vs 5%, Figure 1)

In the model adjusted only for individual- and hospital-level covariates, black mothers had higher odds of SMM compared with white mothers (Table 2). Other individual-level characteristics associated with higher odds of SMM included Medicaid compared with private insurance, having an obstetric comorbidity index score greater than 1 compared with 0, and having a C-section compared with vaginal delivery. Hospital characteristics associated with higher odds of SMM included

Table 1. Sociodemographic characteristics of the women giving birth according to SMM status, New York State 2011-2013.

	SMM	NO SMM
N	6164	238 690
Race: black (%)	3592 (4)	81 693 (96)
Race: white (%)	2572 (2)	156 997 (98)
Mean age (SE)	31 (6.7)	30 (6.0)
Year of delivery		
2011 (%)	1988 (2)	81 805 (98)
2012 (%)	2124 (3)	80 037 (97)
2013 (%)	2052 (3)	76 848 (97)
Insurance coverage		
Medicaid (%)	3435 (3)	101 166 (97)
Other government (%)	44 (4)	1162 (96)
Private insurance (%)	2603 (2)	133 887 (98)
Other (%)	82 (3)	2475 (97)
C-section		
No (%)	1740 (1)	155 754 (99)
Yes (%)	4424 (5)	82 936 (95)
Obstetric comorbidity index		
Score = 0 (%)	3647 (2)	166 109 (98)
Score = 1 (%)	1570 (3)	53 690 (97)
Score = 2 or more (%)	947 (5)	18 897 (95)
Quality-accredited hospital (%)	1121 (2)	57 395 (98)
Teaching hospital (%)	1526 (3)	56 692 (97)
Regional perinatal center (%)	1917 (3)	72 033 (97)
Public hospital (%)	866 (5)	17 643 (95)
Low volume of deliveries (median split) (%)	199 (3)	6592 (97)

Abbreviation: SMM, severe maternal morbidity.

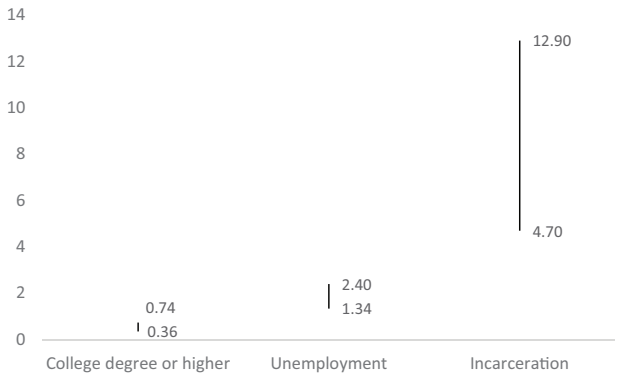

Figure 1. Distributions of county-level structural racism indicators across the nine counties in our sample, New York State 2011-2013.[a]
[a]Relative proportion of blacks to whites within each county.

delivering at a regional perinatal center, delivering at a public vs private hospital, and delivering in a hospital without a quality accreditation vs a hospital with an accreditation.

Including structural racism indicators in the fully adjusted model did not significantly change the estimates for any of the individual- and hospital-level covariates (Table 2). However, residing in a county with high educational inequity was associated with higher odds of SMM (OR = 1.47, 95% confidence interval [CI] = 1.17-1.85), compared with residing in a county with relatively low educational inequity. The estimates associated with county-level structural racism indicator of female employment inequity and the incarceration inequity were not statistically significant (OR = 1.06, 95% CI = 0.95, 1.17 for female employment inequity and OR = 1.07, 95% CI = 0.90, 1.27 for incarceration inequity, respectively). Interactions between each of the structural racism indicator and maternal race were nonsignificant.

Discussion

Severe maternal morbidity rates in the United States have more than doubled since 1987,[10] with persistent racial disparities in rates. Reducing the overall maternal morbidity rates and eliminating the racial disparities will require examining risk factors beyond the individual or facility-level. We found that residing in a county with high racial educational inequity was associated with higher odds of SMM in New York State, even after adjusting for individual- and hospital-level characteristics.

To the best of our knowledge, this is the first study to examine the association between structural racism and SMM. Our analysis extends the growing body of research that demonstrates structural indicators of racism are associated with poor infant health[30,49] by focusing on maternal health. Previous research on risk factors associated with SMM has focused on individual-level characteristics[44] and hospital-level factors.[11,50] Research on the association between area-level characteristics and SMM has been clearly lacking. A few studies have examined neighborhood deprivation on maternal health outcomes after discharge from delivery.[51] One recent study found neighborhood deprivation and access to care was not associated with SMM after adjusting for individual- and hospital-level characteristics.[13]

Structural racism refers to the systematic processes and policies that create differential access to opportunities by race. Although structural racism is acknowledged to be a contributor to adverse health outcomes, the body of literature examining its health impact is still limited.[27] Creating a universal way to measure structural racism is challenging because it is context dependent; an appropriate measure of structural racism will depend historical and geographical context.[52] Furthermore, it is important to use varied indicators to reflect the multidimensional nature of structural racism. Finally, it may be important to further refine structural racism indicators to be outcome specific. We chose to use two female-specific structural racism indicators—education and employment—in recognition that there may be gender-specific barriers directly affecting our outcome of SMM. Adding to the ongoing discussion of how best to measure structural racism, we would encourage researchers to consider the intersectionality of race and gender when examining gender-specific health outcomes.

All three of our structural racism indicators—inequity in female educational attainment, inequity in female employment rates, and inequity in overall incarceration rates—showed prominent racial inequity. Educational attainment and employment reflect unique aspects of socioeconomic position. However, only county-level racial inequity in educational attainment was associated with SMM in our study. Educational attainment may be a more comprehensive measure of socioeconomic position because it is strongly predictive of adults' occupational opportunities and income inequalities. In addition, educational attainment may also reflect knowledge resources which is not captured in employment. Finally, because education is an indicator of socioeconomic position attained relatively early in life, it may reflect more long-lasting structural racism than either incarceration or unemployment.

Racial inequity was most prominent in the incarceration rates with black incarceration rates that were four times or more compared with white incarceration rates from 2011 to 2013. Despite the large inequity, we did not find any association between racial inequity in incarceration and SMM. Males constitute a large proportion of the incarcerated in the United States.[53] The overall inequity in county-level incarceration rates may not reflect female-specific structural racism structures that specifically affect SMM. Our result of a null effect associated with incarceration inequity may also not be surprising given previous findings. A nationwide study found no statistically significant association between ratio of black to white imprisonment rate or ratio of black to white juvenile custody rate with infant mortality.[30]

Multiple pathways potentially link structural racism practices to SMM. Due to its systemic and long-lasting reach, structural racism may operate through various individual-level and hospital of delivery characteristics. For example, structural racism may

Table 2. Odds ratio and 95% confidence interval for severe maternal morbidity, New York State 2011-2013.

	ADJUSTED FOR INDIVIDUAL-LEVEL COVARIATES	ADJUSTED FOR INDIVIDUAL- AND HOSPITAL-LEVEL, AND STRUCTURAL RACISM COVARIATES		
Individual-level characteristics				
Black vs white	1.75 (1.63, 1.87)	1.76 (1.64, 1.88)	1.75 (1.63, 1.88)	1.75 (1.63, 1.88)
Maternal age: ⩾40	0.84 (0.73, 0.96)	0.84 (0.73, 0.96)	0.83 (0.73, 0.96)	0.83 (0.72, 0.96)
2012 vs 2011	1.12 (1.05, 1.19)	1.12 (1.05, 1.19)	1.12 (1.05, 1.19)	1.10 (1.03, 1.18)
2013 vs 2011	1.09 (1.03, 1.17)	1.09 (1.03, 1.17)	1.09 (1.03, 1.17)	1.10 (1.03, 1.17)
Medicaid vs private	1.23 (1.12, 1.32)	1.23 (1.15, 1.32)	1.23 (1.15, 1.32)	1.22 (1.14, 1.31)
Other government vs private	1.18 (0.86, 1.62)	1.18 (0.86, 1.62)	1.18 (0.86, 1.61)	1.21 (0.88, 1.68)
Other vs private	1.20 (0.95, 1.51)	1.20 (0.95, 1.51)	1.20 (0.95, 1.51)	1.21 (0.88, 1.68)
Comorbid score 1 vs 0	1.23 (1.16, 1.31)	1.23 (1.16, 1.31)	1.23 (1.16, 1.31)	1.23 (1.15, 1.31)
Comorbid score >1 vs 0	2.04 (1.82, 2.29)	2.04 (1.82, 2.29)	2.04 (1.82, 2.29)	2.03 (1.81, 2.28)
C-section vs vaginal delivery	4.55 (4.30, 4.82)	4.56 (4.31, 4.83)	4.55 (4.30, 4.82)	4.54 (4.28, 4.81)
Hospital-level characteristics				
None vs quality accredited	1.36 (0.99, 1.86)	1.28 (0.94, 1.73)	1.35 (0.98, 1.86)	1.35 (0.98, 1.87)
Teaching hospital	0.89 (0.62, 1.27)	0.88 (0.63, 1.23)	0.89 (0.63, 1.27)	1.12 (0.78, 1.60)
Regional perinatal center	1.75 (1.21, 2.53)	1.72 (1.21, 2.43)	1.74 (1.20, 2.50)	1.74 (1.20, 2.53)
Public vs private hospital	1.49 (1.07, 2.09)	1.53 (1.10, 2.11)	1.50 (1.07, 2.09)	1.52 (1.08, 2.13)
Low vs high volume of deliveries	1.09 (0.79, 1.51)	1.12 (0.82, 1.53)	1.08 (0.78, 1.49)	1.10 (0.79, 1.54)
Structural racism indicator				
High female educational inequity	—	1.47 (1.17, 1.85)	—	
Overall educational attainment		4.23 (1.51, 11.86)		
High female employment inequity	—	—	1.06 (0.95, 1.17)	
Overall unemployment			0.96 (0.76, 1.23)	
High incarceration inequity	—	—		1.07 (0.90, 1.27)
Overall annual incarceration rate				0.90 (0.76, 1.07)
N	244652	244854	244854	236948
Facility (SE)	0.2 (0.04)	0.18 (0.03)	0.19 (0.04)	0.19 (0.04)

restrict health care access which, in turn, may be indirectly reflected in presence of maternal chronic disease conditions, initiation of prenatal care later during the pregnancy, and in delivery in a lower quality hospital. Therefore, the regression coefficients associated with the county-level structural racism indicators in our fully adjusted models may be an underestimate of its true effects because it adjusts for the indirect effects through individual- and hospital-level characteristics.

The lack of statistical significance in our interaction term between race and each of the structural racism measure indicates that degree of structural racism did not modify the effect of race on SMM. This may reflect actual lack of differential effect by maternal race. A previous study found that the effects of structural racism indicators on myocardial infarction did not uniformly differ by race; they found that there was differential effects of structural racism by race only for selected few indicators.[28] Alternatively, it may reflect limitations in our indicators.

There are several limitations to our study that are worth noting concerning our exposure measures. First, we used an administrative dataset that had limited individual-level information. There may be residual confounding from individual-level factors previously reported to be associated with SMM (eg, previous cesarean delivery, previous births) but not available in our dataset. Second, our structural racism variables were created based on available census data. For county-level information, we had to use 3-year aggregate data to create the black-white county-level

unemployment and college graduation ratio indicators. Annual race- and gender-specific county-level information for unemployment and college graduation were not available for most of the counties in New York State due to small race- and gender-specific population sizes. Our study may have limited power since our area-level variables were restricted to the nine counties with enough information to be included in the analysis.

Our incarceration information was also limited. While the Vera Institute of Justice was able to provide annual race-specific incarceration rates, the incarceration rate in NYC could not be disaggregated into counties. As a result, the area-level variability in our structural racism incarceration measure was limited, likely contributing to the null results we saw in the models using this indicator. Third, our county-level indicators also covered approximately the same years as the individual-level SMM hospitalization. Therefore, our measures of structural racism reflect a woman's current socio-cultural context. These measures do not capture a woman's cumulative exposure to structural racism or exposure to structural racism during key developmental periods in women's lives. We recognize the inability of these three indicators to fully capture the larger social, historical, and cultural context under which structural racism operates.

Despite these limitations, our results are an important addition to the literature on structural racism and adverse health outcomes among women. Our results support the growing body of work that suggests further decreases in poor infant and maternal health outcomes will likely need a multifaceted approach that addresses the larger social context of structural inequality. Understanding the role of structural racism in health inequities can help guide the development of policy and program interventions to address persistent racial disparities in SMM. Further research should incorporate other structural racism indicators and explore other racial disparities (ie, Latina white).

Authors' Note

Zinzi Bailey is also affiliated with Jay Weiss Institute for Health Equity, Sylvester Comprehensive Cancer Center, University of Miami, Miami, USA.

Author Contributions

SYL conducted the analysis and drafted the manuscript. All authors contributed to the concept of the study, the interpretation of the results and the revision of the manuscript.

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