ELSEVIER

Why African-American Women Are at Greater Risk for Pregnancy-Related Death

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PURPOSE: Our study aim was to identify factors that may contribute to the racial disparity in pregnancy-related mortality.
METHODS: We examined differences in severity of disease, comorbidities, and receipt of care among 608 (304 African-American and 304 white) consecutive patients of non-Hispanic ethnicity with one of three pregnancy-related morbidities (pregnancy-related hypertension, puerperal infection, and hemorrhage) from hospitals selected at random from a statewide region.
RESULTS: African-American women had more severe hypertension, lower hemoglobin concentrations preceding hemorrhage, more antepartum hospital admissions, and a higher rate of obesity. The rate of surgical intervention for hemorrhage was lower among African-Americans, although the severity of hemorrhage did not differ between the two racial groups. More African-American women received eclampsia prophylaxis. After stratifying by severity of hypertension, we found that more African-Americans received antihypertensive therapy. The rate of enrollment for prenatal care was lower in the African-American group. Among women receiving prenatal care, African-American women enrolled significantly later in their pregnancies.
CONCLUSIONS: We have identified racial differences in severity of disease, comorbidities, and care status among women with pregnancy-related complications that would place African-Americans at disadvantage to survive pregnancy. These differences are potentially modifiable.
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KEY WORDS: Racial Disparity, Pregnancy-Related Mortality, Pregnancy-Related Morbidity.

INTRODUCTION

The risk of pregnancy-related death is increased 3- to 4-fold for black women compared with white women in the United States. The magnitude of this racial disparity, one of the largest in reproductive health, has remained, whereas the overall pregnancy-related mortality for the nation has declined (1, 2). Elucidating the causes of this racial disparity is essential to design strategies to eliminate it.

Two previous population-based studies compared cases of pregnancy-related death to all women with a live birth outcome who survived and reported no significant decrease in the risk for pregnancy-related death associated with race after adjusting for socioeconomic and medical risk factors (3, 4). A study from Illinois of high-risk women compared cases of pregnancy-related death with survivors and similarly found that African-American (AA) women had a greater than 3-fold increased risk of dying compared with high-risk white women after adjustment for other factors (5). These studies all used vital records data.

Investigations of racial disparities in other health outcomes have found differences in quality of care, severity of medical disorders, and comorbidities between AA and white populations (6). African-Americans are less likely to be offered and to receive many types of medical services and procedures, including cardiac catheterization, renal transplantation, treatment for early-stage malignancy, and adequate analgesia (7–12). Racial differences in general medical disorders and timing of entry into the health care system, factors that clearly affect the risk of mortality, also have been reported (13). These factors may be of crucial importance in understanding the racial disparity in pregnancy-related mortality but are not available from the types of data sources previously used (3–5). To fill this gap in our knowledge, we conducted a cross-sectional study of a sample of non-Hispanic black and white women with pregnancy-related morbidities from hospitals selected at random within the State of North Carolina. We hypothesized that differences in the receipt of appropriate diagnostic or therapeutic interventions, severity of disease, and comorbidities among women with pregnancy-related

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Selected Abbreviation and Acronym

AA = African-American

morbidities contribute to the racial disparity in pregnancy-related mortality.

MATERIALS AND METHODS

We selected three pregnancy-related morbidities for study: hypertensive disorders, postpartum hemorrhage, and puerperal infection. These conditions are reported to be the most common causes of serious morbidity after childbirth (14). Hypertensive disorders, obstetric hemorrhage, and puerperal infection are also among the leading causes of pregnancy-related death in North Carolina (15), with cause-specific, pregnancy-related mortality ratios (deaths per 100,000 live births) for 1992 through 2004 as follows: hypertensive disorders, 2.15; hemorrhage, 1.46; puerperal infection, 1.11.

To obtain a statewide sample of study subjects, a listing of all hospitals providing labor and delivery services within the geographic region of the State of North Carolina was compiled. A description of the state's population and hospitals has been previously published (16). Each hospital was placed into one of nine strata, based on three regions and three volumes. Hospitals were first classified according to their location in one of three regions within the State. These three regions, Coastal Plains, Piedmont, and Mountains, differ in characteristics of racial composition, population density, economic base, proximity to tertiary medical care, and topography. Hospitals were then further classified on the basis of the volume of live births per year as less than 1500 (small); 1500 to 3500 (medium); or greater than 3500 (large). Within each stratum, hospitals were assigned consecutive numbers, based on alphabetical order. A random sequence was then created, using a random-numbers table. Beginning with the first in the random sequence within each stratum, consecutive hospitals were contacted and invited to participate until nine hospitals, one from each of the strata, were recruited.

The primary aim of the analyses was to identify similarities and differences between the medical care provided to AA and white women across all the participating hospitals. A sample size of 600 women was determined to be necessary to provide 80% power to detect odds ratios of 2.8 or greater for care variables with prevalences of 20% or 80%, or 2.4 or greater for care variables with prevalences of 30% or 70% and of 2.3 or greater for prevalences of 40% or 60%. These power benchmarks were viewed as sufficient to detect disparities of a magnitude that could explain the marked disparity in maternal death rates.

We worked with the staff in medical records departments within each participating hospital to access successive medical records, starting with the most recent discharges, for women by race and by specific International Classification of Disease-9 diagnoses. The number of records requested was proportionate to the number of annual live births for each hospital, to yield a total of at least 600 subjects. Sampling was stratified by hospital so that the numbers of subjects within the six groups (two races by three diagnoses) were equal at each hospital. Race was determined by self-report as recorded in the medical record.

The medical records were abstracted by trained and certified study personnel, using uniform data abstraction forms. To ensure the highest level of quality control, a 10% sample of charts was reabstracted to determine inter-rater agreement. The data forms were designed to capture sociodemographic information and detailed information about severity of disease, comorbidities, and the receipt of diagnostic and therapeutic interventions. Indicators of severity of disease and appropriate care for the three pregnancy-related morbidities were derived from technical bulletins and committee opinions from the American College of Obstetrics and Gynecology and review of current, standard, obstetric textbooks.

All study charts were abstracted for subject's age, race, marital status, gravidity, parity, and method of delivery. Gestational age at the first prenatal visit and at delivery were recorded and were based on the assigned estimated date of confinement on the labor and delivery summary. Payer status was coded as private third-party, self-pay, government, or missing. To assess comorbidities, other medical conditions were listed and enumerated; the number of antepartum and postpartum admissions was determined, and maternal weight at the delivery admission was recorded.

We abstracted both morbidity-specific and general measures of disease severity and diagnostic and therapeutic variables of care (Table 1).

Responses were entered into Visual Foxpro, a relational database management system with preset acceptable ranges. Periodic double data entry was conducted to assess error rates. Frequency distributions and means were compared by using χ^2, Fisher's exact test, *t*-test, or Wilcoxin test, as appropriate. Analyses were performed by using SAS software (SAS Institute Inc. Cary, NC). A p value of 0.05 was selected as an indication of statistical significance.

The study was reviewed and approved by the Institutional Review Boards of Wake Forest University School of Medicine and the participating hospitals. Data abstraction was completed before April 14, 2003, the deadline for

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TABLE 1. Measures of severity of disease and care received

Pregnancy-related morbidity	Measures of severity of disease	Variables of care
Hypertensive disorders of pregnancy	BP on admission and highest BP during the delivery hospitalization. Frequency of systolic BP >160 or diastolic BP >105	Treatment for systolic BP >160 or diastolic BP >105 during the hospitalization
	Degree of proteinuria by dipstick and quantitative 24 hour measurements	Prophylaxis for eclampsia intrapartum
	Measures of renal impairment, hepatic involvement, hemolysis and thrombocytopenia	Prophylaxis for eclampsia postpartum
	Occurrence of eclampsia, pulmonary edema or stroke	Fetal surveillance
Postpartum hemorrhage	Degree of hemorrhage as measured by change in hemoglobin or hematocrit	Medical treatments
	Number of episodes of hemorrhage	Surgical treatments
	Occurrence of diffuse intravascular coagulopathy	Intervention radiology treatments
		Prescribing of iron supplementation at discharge
Puerperal infection	Duration of febrile illness	Timing from first febrile episode to first assessment and initiation of treatment
	Highest temperature	
	Occurrence of sepsis, abscess or septic shock	Antibiotic therapy
		Laboratory investigation including cultures
		Imaging studies
All subjects	Occurrence of mechanical ventilation	Obstetrical ultrasound
	Length of hospital stay	Antenatal steroids among women delivering preterm

BP = blood pressure.

compliance with the Health Insurance Portability and Accountability Act of 1996.

RESULTS

The records of 608 women were abstracted for the variables of interest. The number of subjects from the different hospitals ranged from 26 to 95. The inter-rater agreement from the 10% repeat sample averaged 95.7% across 139 abstraction items. The cohort was evenly distributed among the three morbidities and by race. Sociodemographic and baseline medical variables for the two racial groups are summarized in Tables 2 and 3. The AA women were on average younger, of higher parity, less likely to be married, and more likely to have government-sponsored health insurance when compared with the white women. The rate of reporting tobacco use was lower but the rate of reporting cocaine use was higher among AA women. Interestingly, there was no difference in the rate of very early preterm delivery. The rates of chronic medical conditions were low and did not vary significantly by race.

Analysis of indicators of receipt of care revealed mixed results (Table 4). For the cohort with postpartum hemorrhage, there were no differences in severity of hemorrhage or the distribution of causes of hemorrhage, but AA women were less likely than whites to have a surgical intervention other than curettage. Surgical procedures for hemorrhage included uterine artery ligations, exploratory laparotomies, and hysterectomies. Among the cohort with hypertension, AA women were more likely than white women to receive antihypertensive medication for systolic blood pressures over 160 or diastolic blood pressures over 105 and to receive seizure prophylaxis with magnesium sulfate before delivery. AA women were less likely to have an obstetric ultrasound examination. Among women delivering before 36 weeks' gestation, AA women were less likely to receive antenatal steroids. Among women receiving prenatal care, AA women entered care later. The difference in the rate of receipt of prenatal care was statistically significant, but this rate was high for both groups.

We identified significant differences in severity of diseases (Table 5). Among the cohort with hypertension, a greater proportion of AA women had systolic blood pressures over 160 and diastolic blood pressures over 105 and at least one indicator of severe preeclampsia. Also, a higher proportion of the AA women had a urine protein concentration of at least 200 mg/dL. For the cohort with hemorrhage, AA women had lower starting hemoglobin values. No differences in severity of disease were found in the cohort with puerperal infection.

We identified significant differences in measures of comorbidity (Table 6). AA women were heavier on average than were white women. In addition, a significantly higher proportion of AA women weighed in excess of 210 pounds (equivalent to a body mass index of 35 for a height of 64 inches).

TABLE 2. Sociodemographic and baseline medical variables by race

Variable	African-American	White	*p* Value
Mean age in years(SD)	25.5 (6.4)	27.3 (6.1)	<0.001
Mean parity (SD)	1.0 (1.2)	0.5 (0.9)	<0.001
Proportion married	0.28	0.73	<0.001
Proportion with government-sponsored health insurance	0.66	0.37	<0.001
Mean gestational age at delivery in weeks	37.6 (4.0)	37.2 (4.1)	0.22
Rate of delivery at <28 weeks	4.1%	5.1%	0.55
Primary cesarean section rate	33.9%	35.2%	0.73
Total cesarean section rate	44.1%	42.4%	0.68
Proportion smoking	0.18	0.28	0.004
Proportion using alcohol	0.02	0.02	0.99
Proportion using cocaine	0.037	0.007	0.01

SD = standard deviation.

When the three different cohorts were examined, the difference in weight was greatest in the cohort with pregnancy-related hypertension (215 ± 58 versus 198 ± 45, $p = 0.02$.). AA women also had more antepartum hospital admissions.

No differences existed by race among the cohort with hypertension in the frequency of eclampsia, pulmonary edema, or stroke. Five women (2.5%) had an eclamptic seizure. Eight women (3.9%) had pulmonary edema and four women (2%) had a stroke. There was no difference in fetal assessment, including ultrasound examinations or nonstress tests. Seventy-one percent of AA women and 65% of white women received magnesium sulfate after delivery; this difference was not statistically significant.

Among the cohort with hemorrhage, the distributions of causes of hemorrhage were uterine atony, 77%; retained placenta, 25%; laceration, 6%; other, 7% (total sums to more than 100% because some cases had more than one cause listed), and did not differ by racial group. Twenty-one percent of both AA women and white women received transfusions. Among women with hemoglobin levels dropping below 7 grams, 50% of AA women and 46% of white women were transfused. The average number of units of packed red blood cells transfused was 3.5 (±2.9). The difference in time from the start of hemorrhage until initiation of any treatment was 2.9 (±7.1) hours for AA women and 3.2 (±7.2) hours for white women. None of these differences were statistically significant. Medical therapies included oxytocin, Methergine, and prostaglandins and did not differ by race.

TABLE 3. Rates of chronic hypertension and diabetes by race

Diagnosis	Rate, African-American cohort	Rate, white cohort
Chronic essential hypertension	4.3%	3.9%
Preexisting diabetes	2.6%	2.0%
Gestational diabetes	3.9%	5.3%
All combined*	9.9%	9.9%

*Subjects with both diabetes and hypertension were counted only once in the combined; therefore, the combined rate is not equal to the sum of the individual rates.

Types of puerperal infection did not differ by race. Endometritis with or without parametritis was the diagnosis for 90% of cases. There were no cases of septic shock. Twenty AA women and 20 white women had diagnostic imaging studies to evaluate the source of fever. The average time from initial fever until a physical assessment by a physician or midlevel provider was documented was 6.3 (±8.7) hours for AA women and 6.2 (±8.6) hours for white women.

There was no difference in length of stay for the delivery admission: 3.1 (±1.9) days for AA women versus 2.9 (±1.6) for white women ($p = 0.38$.) Nineteen percent of AA women and 20% of white women had at least one postpartum readmission. The average number of other medical conditions coded or listed for AA women was 6.9 (±4.1) versus 7.1 (±5.5) for white women ($p = 0.6$.) There was no difference in the types of other conditions coded. A total of five women required intubation and mechanical ventilation, three AA women from the cohort with pregnancy-related hypertension and two white women, one each from the hemorrhage and puerperal infection cohorts.

COMMENTS

Reducing racial disparities in pregnancy-related health and mortality is a major public health goal that can be achieved only by understanding the multiple causes. A previous study reported that 46% of pregnancy-related deaths among African-Americans are preventable (17). The current study identified modifiable factors including differences in care received, severity of disease, and comorbidities.

The frequencies of several indicators of more severe disease and comorbidity were higher among African-Americans. No measures of comorbidity or severity of disease were more frequent among whites. These differences were most striking in the cohort with pregnancy-related hypertension, a condition that is more common among African-Americans. The AA women were on average heavier than the white women, and this difference was

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TABLE 4. Receipt of diagnostic and therapeutic interventions and prenatal care by racial group

	African-American	White	*p* Value
Cohort with hemorrhage:			
Curettage	25.7%	27.7%	0.87
A surgical procedure other than curettage	9.6%	21.2%	0.03
Hysterectomy	0	6.1%	0.03
Cohort with pregnancy-related hypertension:			
Treatment for SBP >160 and/or DBP >105	51.8%	32.8%	0.02
Intrapartum magnesium	67.0%	50.5%	0.02
Obstetric ultrasound	96.5%	99.0%	0.04
Antepartum steroids*	44.5%	68.1%	0.008
Mean gestational age at first prenatal visit	13.5 (1.1)	9.8 (4.4)	<0.001
Percent receiving prenatal care	97.3%	100%	0.004

Values are percent or mean (standard deviation).
SBP = Systolic blood pressure; DBP = diastolic blood pressure.
*Among women delivering before 36 weeks' gestation.

greatest in the cohort with hypertension. Obesity and obesity-related morbidities are known to be more frequent among minority populations (18). Although no effective prevention for hypertensive disorders of pregnancy has been identified, weight and baseline blood pressure are potentially modifiable factors through healthier nutritional practices and exercise.

Differences in the receipt of care were related to both patient and provider factors. Although the rates of prenatal care were high in both groups, AA women were less likely to receive prenatal care and among women receiving prenatal care, AA women entered care later. Research has consistently identified the receipt of prenatal care as protective (1, 16, 19). Similarly, late entry into medical care has been associated with increased risk of death for the general population (13). Receipt of care and timing of entry into care are potentially modifiable. There are multiple potential barriers including cost, waiting times, transportation, child care, cultural familiarity, and support.

Interestingly, the analysis of variables designed to measure receipt of appropriate diagnostic and therapeutic interventions revealed mixed results. AA women were more likely to receive appropriate treatment for hypertensive disorders. In contrast, they were less likely to undergo surgical procedures other than curettage for hemorrhage, although there were no differences in severity of hemorrhage except lower admission hemoglobins for AA women. We found no significant differences in the cohort with infection. These findings are intriguing in the context of our case-control study from this same geographically defined population, which showed a significant difference by race in the rate of pregnancy-related death from hemorrhage (relative risk, 4.9; $p = 0.04$) but not for preeclampsia/eclampsia or infection (4). Among women delivering preterm, we found a lower rate of receipt of antenatal steroids for AA women. Although this intervention does not affect maternal health, it is an evidence-based recommendation for improving perinatal outcomes, and this disparity is disturbing. Reports of disparities in care and outcomes in other areas of medicine among minority populations prompted Congress to request an investigation by the Institute of Medicine. The committee concluded that factors leading to differences in care include system-level factors and care-process variables (6). Differences in care-process variables may explain the differences we observed in this study between treatment of hemorrhage, receipt of antenatal steroids, and treatment for hypertension. Care-process variables include clinical uncertainty. Clinical uncertainty is addressed by gaining information during a clinical encounter. If there is poor communication, from either the provider or the patient, treatment decisions and needs may not be well-matched. In the case of postpartum hemorrhage, reluctance to report

TABLE 5. Differences in severity of disease by racial group

Measure of disease severity	African-American	White	*p* Value
Highest SBP ⩾160*	78.2%	62.6%	0.02
Highest DPB ⩾105*	58.4%	34.7%	<0.001
Urine protein >200 mg/dL*	33.0%	19.8%	0.05
At least one indicator of severe preeclampsia*	86.1%	71.6%	0.01
Admission hemoglobin gm/dL†	10.9 (1.6)	11.7 (1.6)	0.001

Values are percent or mean (standard deviation).
SBP = Systolic blood pressure; DBP = diastolic blood pressure.
*Cohort with pregnancy-related hypertension.
†2 Cohort with hemorrhage.

TABLE 6. Differences in comorbidity by racial group

Comorbidity	African-American	White	*p* Value
Mean maternal weight at delivery in pounds	201 (50)	193 (45)	0.05
Frequency weight >210 pounds	38.3 %	28.7 %	0.02
Number of antepartum admissions	2.5 (1.8)	2.2 (1.7)	0.03

Values are mean (standard deviation) or percent.

or under-reporting on the part of the patient or differences in history taking and assessment on the part of the physician could lead to differences in treatment for the same degree of hemorrhage. Similarly, differences in reporting contractions or accurately assessing risk for preterm birth from history could lead to differences in administering antenatal steroids. Clinical uncertainty is also addressed by prior beliefs such as racial differences in risk. African-Americans, as a racial group, are recognized as being at increased risk for hypertension and its complications. This perception, based solely on observing the patient's race, could lead to more aggressive treatment. Recommendations published by the Institute of Medicine for eliminating differences in care-process variables include increasing awareness of racial and ethnic disparities in healthcare, strengthening patient-provider relationships in publicly funded health plans, increasing the proportion of under-represented minorities among health professionals, patient education and empowerment, and integrating cross-cultural education in the training of health care professionals (6).

The rate of pregnancy-related deaths among AA women is 3 to 4 times that of white women in the United States. This disparity is even larger than the disparity in infant mortality (20). There are multiple underlying causes. The results of this and our previous studies of this state-based population show that on average, AA women are more socioeconomically disadvantaged, access care less often and later, and have more severe disease and comorbidity. All of these factors can act to increase the risk of pregnancy-related death observed among AA women. Although we identified a few areas of unequal treatment, in most areas the two racial groups received equivalent treatment. Our study results indicated that reducing the racial gap in pregnancy-related death will require changes on several fronts: eliminating socioeconomic disadvantage, improving general health through better nutrition and exercise, identifying and eliminating barriers to accessing health care both before conception and during pregnancy, and eliminating unequal treatments.

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