

RACIAL AND ETHNIC DIFFERENCES IN PRETERM DELIVERY AMONG LOW-RISK WOMEN

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Background: Preterm delivery is the leading cause of infant mortality in the United States. The risk of preterm delivery and the prevalence of factors associated with preterm delivery differ by racial and ethnic groups.

Objective: To examine racial and ethnic differences in preterm delivery among women without the common risk factors for preterm delivery.

Methods: We used data from the Pregnancy Risk Assessment Monitoring System (PRAMS) for singleton births occurring in selected US states between 1988 and 2002. PRAMS is a cross-sectional study of state residents who delivered a live birth within the state. We defined risk status using maternal age, education, marital status at delivery, parity, interpregnancy interval, tobacco or alcohol use, source and amount of income, and prepregnancy body mass index.

Results: Only 9.6% (18,815) of women were low risk. Between 2.4% (Native Americans) and 12.4% (Asian-Pacific Islanders) were low risk. Low-risk women were 29.0% (95% CI: 23.0%, 34.0%) less likely to deliver preterm than non-low-risk women. Among low-risk women, African American women had more preterm births than White women (PR: 1.3, 95% CI: 1.0, 1.6), but only among multiparous women whose most recent prior birth was neither low birth weight nor preterm.

Conclusions: Traditional risk factors explain about half of the excess prevalence of preterm births among African Americans and explain all of the excess among other racial and ethnic groups. The remaining excess among African American appears to be due to risk factors among multiparous women that occur between pregnancies. (*Ethn Dis.* 2010;20:261–266)

Key Words: Preterm Births, Continental Population Groups, Hispanic Americans

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INTRODUCTION

Preterm delivery is the largest cause of infant mortality¹ and a major contributor to healthcare costs in the United States.² Racial and ethnic differences in the risk of preterm delivery are well documented; in 2002, 17.8% of African American births and 13.1% of Native American births were preterm, compared to 11.1% of White births and 10.4% of Asian/Pacific Islander births.³ Hispanic births were slightly more likely than non-Hispanic births to be preterm (11.6% vs 11.0%).³

African American women and Hispanic women are less likely to receive prenatal care in the first trimester or to gain adequate weight during their pregnancy, while White and Native American women are more likely to smoke during pregnancy.³ When compared to White women, a higher percentage of African American women give birth when they are teenagers or unmarried.³

If the differences in preterm delivery between racial and ethnic groups are due to demographic or behavioral risk factors, it should be possible to define a population without these risk factors within which racial or ethnic disparities do not exist. Several researchers have tried to identify such a population. All found that even low-risk African American women were more likely to deliver preterm than low-risk White women. Access to prenatal care does not reduce the disparity in birth outcomes between African American and White women. African-American women with access to early, free health care from a health maintenance organization,⁴ clinical trial,⁵ or a family member's military service⁶ were up to 2.3 times more likely to deliver preterm. Among military-enlisted women, who by virtue of military service requirements were healthy and

drug-free before pregnancy, African American women were 1.3 times more likely than White women to deliver preterm.⁷

Although socioeconomic status (SES) is associated with both race⁸ and birth outcomes,^{9,10} differences in SES do not explain the racial disparity in birth outcomes. African American graduates from four Atlanta universities were 1.3 times more likely to deliver preterm than White graduates.¹¹ African American residents of high income Chicago neighborhoods were twice as likely to deliver preterm as White women living in the same neighborhoods, although after adjusting for individual risk factors, the disparity became insignificant.¹² African American families that have been of high SES for at least two generations still had higher preterm delivery rates (11.2% in the first generation and 8.2% in the second generation) than a White cohort of more moderate SES (2.9%).¹³

Demographic and behavioral factors from birth certificates have been used to retrospectively classify women as low risk.^{14,15} Compared to low-risk White women, low-risk African American women were 1.7 times more likely to have delivered preterm,¹⁵ 2.8 times more likely to have had a low birth weight infant,¹⁵ 2.6 times more likely to have a small for gestational age infant, and 1.6 times as likely to have an infant die in the first year of life.¹⁴

The studies to date have examined several risk factors related to preterm birth, but the available sample size or data have prevented them from using a comprehensive definition of low risk that includes behavioral, demographic and socioeconomic characteristics. In this study, we examine racial and ethnic differences in preterm delivery among

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METHODS

We examined racial differences in preterm delivery among low-risk women using data from the Pregnancy Risk Assessment Monitoring System (PRAMS). The system is an ongoing, population-based survey of women with recent live births conducted in 37 states and New York City.¹⁶ The PRAMS sample is drawn from state live birth registries two to six months after delivery, with almost all women sampled within 90 days of delivery. Women from selected groups are oversampled. Data are weighted to account for sampling design, non-response, and non-coverage. Demographic and delivery information are retained from the birth certificate, and additional information is obtained through mailed questionnaires and telephone interviews. We used data from PRAMS for singleton births occurring in selected US states between 1988 and 2002. We included data from a state for a given birth year if the state had a 70% response rate and collected data on maternal income for that year.

We used a very strict definition of low risk to minimize residual confounding. Low-risk women were defined as

those who met the following criteria: aged 18 to 34 years at delivery, at least 12 completed years of education, married at delivery, parity of 4 or less, prenatal care in the first trimester, interpregnancy interval of 6 months or more, nonsmoker in the 3 months before pregnancy, alcohol consumption before pregnancy of 3 drinks per week or less, no income from public assistance and income at or above median for state and year, and prepregnancy body mass index (BMI) >19.8 and ≤ 25.9 .

Information needed to determine gestational age (infant's birth data, date of last menstrual period [LMP], and clinical estimate [CE] of gestational age) was taken from the birth certificate. Gestational age was calculated using the composite of LMP and CE described by Alexander.¹⁴ The LMP age was used if LMP age and CE age differed by ≤ 13 days, and CE age was used if LMP age was unknown or differed from CE age by ≥ 14 days. If neither LMP nor CE age was available, gestational age was calculated from the mother's due date reported on the questionnaire. Observations were dropped if the birth weight-gestational age combination was implausible based on the birth weight for gestational age ranges reported by Adams.¹⁵

Assessment of Selection Bias

We assessed the potential for bias introduced through the selection of low-risk women. Women who did not return the questionnaire, and women with missing data for variables used in the definition of low risk were excluded. This process could introduce bias if the data were not missing randomly. We were particularly concerned about the effect of excluding women who did not respond to the questions regarding prepregnancy BMI and income, which were missing for 10%–20% of women in some states. We assessed the potential bias from nonresponse by comparing preterm delivery among respondents and nonrespondents who were defined

as low risk based on birth certificate variables. We assessed the sensitivity of our results to the exclusion of women missing data on income or body mass index by reclassifying these women as low risk and determining the change in preterm delivery rates by race and ethnicity.

Analytic Methods

We compared the risk of prematurity between White, African American, Native American (including Alaskan Native), and Asian women (including Pacific Islands) and between Hispanic and non-Hispanic White women. We conducted post-hoc analysis to investigate factors to examine potential reasons for remaining disparities.

We used SUDAAN to calculate the prevalence of preterm delivery and the relative risk between racial and ethnic groups and to perform logistic regression to assess the effect of residual confounding on racial differences in preterm delivery. We examined residual confounding by the continuous variables maternal age, income, parity and maternal BMI, and by pregnancy intention, which was not included in the original definition of low risk. We also investigated the relationship between the outcome of the birth immediately prior to the sample birth and that of the sampled birth.

RESULTS

A total of 18,815 women, 9.6% of the 343,988 sampled, were low risk by our definition (Table 1). The racial distribution was 91.5% White, 4.6% African-American, 3.5% Asian-Pacific Islander, and .4% Native American. About 5% were of White, Hispanic ethnicity. The proportion of women who were low risk ranged from 2.4% of Native Americans to 12.4% of Asian-Pacific Islander women.

Nonrespondents to the questionnaire generally had slightly higher rates

Table 1. Race and ethnicity of low-risk women. Pregnancy Risk Assessment Monitoring System, United States, 1988–2002

| | Total sampled* | | Racial and ethnic distribution of represented population* | | Low-risk respondents* | | Low-risk proportion of total population* | | Racial distribution of low-risk population* | |
|---------------------------------------|----------------|-------|---|------------|-----------------------|-------|--|------------|---|------------|
| | n | % | % | 95% CI | n | % | % | 95% CI | % | 95% CI |
| Total | 343,988 | 100.0 | 100.0 | | 18,815 | 100.0 | 9.6 | 9.4, 9.8 | | |
| Maternal race | | | | | | | | | | |
| White | 225,693 | 65.6 | 78.6 | 78.4, 78.8 | 16,291 | 86.6 | 11.2 | 10.9, 11.4 | 91.5 | 91.0, 92.1 |
| African-American | 74,049 | 21.5 | 17.1 | 17.0, 17.3 | 980 | 5.2 | 2.6 | 2.4, 2.8 | 4.6 | 4.2, 5.1 |
| Asian-American/ Pacific Islanders | 18,640 | 5.4 | 2.7 | 2.7, 2.8 | 1,162 | 6.2 | 12.4 | 11.1, 13.7 | 3.5 | 3.1, 3.8 |
| American Indian /Alaskan Native | 22,849 | 6.1 | 1.6 | 1.5, 1.6 | 303 | 1.6 | 2.4 | 1.8, 3.1 | .4 | .3, .5 |
| Missing | 2,757 | .8 | | | | | | | | |
| Maternal ethnicity (White women only) | | | | | | | | | | |
| Hispanic | 30,730 | 8.9 | 14 | 13.4, 13.9 | 621 | 3.3 | 3.5 | 3.1, 4.0 | 4.9 | 4.3, 5.5 |
| Non-Hispanic | 219,563 | 63.8 | 86 | 86.1, 86.6 | 13,225 | 70.3 | 12.6 | 12.3, 12.9 | 95.1 | 94.5, 95.7 |
| Unknown† | 93,695 | 27.2 | | | 4,969 | 26.4 | | | | |

N, number; CI, Confidence interval.

* Sampled – in sample drawn from state birth certificates; Population – total population represented by sample, weighted for sample design, nonresponse, and noncoverage; Respondents – women who responded to the survey.

† Hispanic ethnicity was not recorded by many states prior to 1995.

of preterm delivery, but the difference was less than 10% of the estimated prevalence (data not shown). Inclusion of women excluded only because of missing data on income or BMI decreased the estimated prevalence of preterm delivery among African American women by .4% (from 8.5% to 8.1%) and increased the estimated prevalence among Asian-Pacific Islander women by .5% (from 7.1% to 7.6%).

As expected, low-risk women were significantly less likely to have delivered preterm than women who were not low risk (relative risk [RR]: 0.71; 95%

confidence interval [CI]: 0.66, 0.77). Compared to non-low-risk women of the same racial or ethnic group, low-risk women were 1.6% to 5.2% less likely to deliver preterm (Table 2). The prevalence of preterm delivery was similar among low-risk Asian-Pacific Islander, White non-Hispanic, and White Hispanic women, ranging from 6.7% to 7.2%. while it was lower (4.2%) among low-risk Native American women. At 8.5%, the prevalence of preterm delivery among low-risk African American women was 30% higher (RR: 1.30, 95% CI: 1.00, 1.64) than that of low-

risk White women. In contrast, African American women who were not low risk were 60% more likely to deliver preterm than White women (13.7% and 8.4%, respectively).

The prevalence of preterm delivery was related to pregnancy history and race. As expected, preterm delivery was more common among primiparous women, although the difference was statistically significant only for White women (Table 3). The highest prevalence of preterm delivery (20.5%) was found among women whose prior live-born infant was either low birth weight

Table 2. Prevalence and relative risk of preterm delivery by risk status and by race and ethnicity. Pregnancy Risk Assessment Monitoring System, United States, 1988–2002

| | Not low risk | | Low risk | | Risk status* | | Race/ethnicity† | |
|-----------------------------------|--------------|------------|----------|-----------|--------------|-----------|-----------------|------------|
| | % | 95% CI | % | 95% CI | RR | 95% CI | PR | 95% CI |
| Total | 9.4 | 9.3, 9.6 | 6.8 | 6.3, 7.2 | .71 | .66, .77 | | |
| Maternal race | | | | | | | | |
| White | 8.4 | 8.2, 8.6 | 6.7 | 6.2, 7.2 | .79 | .73, .86 | reference | |
| African-American | 13.7 | 13.3, 14.1 | 8.5 | 6.5, 10.5 | .62 | .49, .79 | 1.3 | 1.00, 1.64 |
| Asian-American/ Pacific Islanders | 9.1 | 8.2, 10.1 | 7.1 | 4.8, 9.4 | .78 | .56, 1.09 | 1.1 | .77, 1.49 |
| American Indian /Alaskan Native | 10.0 | 8.9, 11.0 | 4.2 | 2.1, 6.2 | .42 | .25, .69 | .6 | .38, 1.02 |
| Maternal ethnicity | | | | | | | | |
| Non-Hispanic | 8.8 | 8.6, 9.1 | 7.2 | 6.6, 7.9 | .82 | .75, .90 | reference | |
| Hispanic | 8.7 | 8.1, 9.3 | 6.9 | 4.0, 9.8 | .79 | .52, 1.21 | 1.0 | .63, 1.46 |

RR – relative risk; CI - confidence interval.

* Ratio of prevalence of preterm delivery among low-risk women to that of non-low-risk women.

† Ratio of prevalence of preterm delivery among stated racial or ethnic group to that of White women.

Table 3. Relative risk of preterm delivery among low-risk women, by race and prior pregnancy outcome. Pregnancy Risk Assessment Monitoring System, United States, 1988–2002

| Maternal Race | n | Prevalence | | Relative Risk | |
|--|-------|------------|------------|---------------|------------|
| | | % | 95% CI | RR | 95% CI |
| Primiparous women | | | | | |
| Total | 9,486 | 7.2 | 7.0, 8.4 | NA | |
| White | 8,224 | 7.8 | 7.0, 8.5 | reference | |
| African American | 454 | 7.3 | 5.0, 9.7 | .95 | .68, 1.32 |
| Asian-Pacific Islander | 634 | 8.1 | 4.6, 11.6 | 1.05 | .68, 1.63 |
| Native American | 105 | 7.0 | 1.7, 12.3 | .91 | .42, 1.94 |
| Hispanic | 269 | 7.5 | 3.0, 11.9 | .91 | .49, 1.67 |
| Multiparous women whose prior birth was not low birthweight or preterm | | | | | |
| Total | 7,406 | 4.2 | 3.6, 4.8 | NA | |
| White | 6,249 | 4.0 | 3.3, 4.6 | reference | |
| African American | 364 | 8.6 | 5.1, 12.1 | 2.16 | 1.39, 3.35 |
| Asian-Pacific Islander | 423 | 5.1 | 2.3, 7.9 | 1.29 | .73, 2.27 |
| Native American | 162 | 1.7 | .6, 2.9 | .44 | .22, .87 |
| Hispanic | 208 | 5.2 | 1.6, 8.7 | 1.18 | .58, 2.40 |
| Multiparous women whose prior birth was low birthweight or preterm | | | | | |
| Total | 1,105 | 20.5 | 16.5, 24.6 | NA | |
| White | 895 | 21.0 | 16.6, 25.4 | reference | |
| African American | 88 | 18.5 | 8.0, 29.0 | .88 | .48, 1.62 |
| Asian-Pacific Islander | 65 | 11.8 | 3.7, 19.8 | .56 | .27, 1.15 |
| Native American | 17 | 14.8 | 0, 32.8 | .70 | .20, 2.44 |
| Hispanic | 40 | 18.7 | 1.7, 35.8 | .86 | .34, 2.21 |

RR – relative risk; CI – confidence interval; NA – Not applicable.

or preterm, followed by primiparous women (except for African American women), and the lowest rates were among women whose prior live-born infant was neither low birth weight nor preterm.

The disparity in preterm delivery among low-risk African American women compared to their White counterparts was limited to women whose prior birth was neither low birth weight nor preterm. Among these women, African Americans were 2.2 times as likely (95% CI: 1.4, 3.4) as White women to deliver preterm (Table 3). We conducted additional analyses to investigate this disparity. We used logistic regression to investigate the possibility of residual confounding by the continuous variables maternal age, income, number of previous live births and maternal BMI, and for unintended pregnancy. African American race remained strongly associated with preterm delivery (odds ratio [OR]: 2.4, 95% CI: 1.4, 3.9). Maternal age, income, number of previous live

births and pregnancy intention were not associated with preterm delivery (data not shown). We tested for interactions of maternal race with maternal age and with number of previous live births, but found no significant interactions. Maternal BMI was negatively associated with preterm delivery; for every 1 point increment in body mass index, the prevalence of preterm delivery decreased 10% (95% CI: 0.8, 1.0) (data not shown).

DISCUSSION

Even among a population without known demographic and behavioral risk factors, African American women were more likely than White women to deliver preterm. Women from other racial or ethnic minorities did not share this increased prevalence. The increased prevalence among African American women was limited to women whose most recent prior birth was neither low

birth weight nor preterm. The prevalence of preterm delivery among primiparous women or women whose previous infant was low birth weight or preterm was similar across racial groups.

Even among a population without known demographic and behavioral risk factors, African American women were more likely than White women to delivery preterm.

The potential bias due to nonresponse or to missing data was too small (<10% of the prevalence of preterm delivery) to explain the 1.4% difference in the prevalence of preterm delivery between African American and White

women. Our study, however, does have other limitations that may affect our study results; PRAMS data collection are collected after the pregnancy, and some questions, such as asking about the outcome of the prior birth, require women to remember events that may have occurred years before data collection. Thus, women may not recall or may misreport some events. Also, gestational information on birth certificates and through maternal report may be incorrect,^{17,18} and although the algorithm we used ensured the most reliable estimate available, some misclassification may still exist. However, substantial misclassification of African-American term births as preterm, or white preterm births as term would be required to explain our results. A further limitation is that PRAMS lacks information on maternal drug use, pre-pregnancy health, and infections, which vary among racial groups and may affect the risk of preterm delivery.

PRAMS collected no data on pre-pregnancy health conditions for the years of data included in this analysis. We did not use the PRAMS or birth certificate data on pregnancy complications primarily because we felt many of these conditions lay on the causal pathway to preterm delivery, but also because the data have been shown to be of questionable validity.^{19,20}

PRAMS also offers some unique strengths for this analysis. It provides a large, population-based sample with information on many risk factors for preterm delivery, including the amount and source of household income, prepregnancy BMI, and outcome of the prior birth. The large sample size and breadth of data collected allowed for a very stringent definition of low risk and comparison of multiple racial and ethnic groups.

Low-risk African American women in our study had a 30% excess risk of delivering preterm compared to low-risk White women. This disparity is similar to that found among enlisted servicewomen,⁷ but lower than has been found in other studies, which demonstrated

disparities of 70% to 130% in the risk of preterm delivery.^{4,5,11,13,15} Our findings were consistent with those of Rawling, et al in finding that, regardless of race, approximately 20% of women who previously delivered an infant that was preterm or low birth weight delivered preterm during the studied pregnancy, and that African American women have a higher risk of preterm delivery than White women only among women with no prior low birth weight or preterm births (5.1% vs. 1.5%, $P < .001$).⁶

This study has implications for theories about the causes of preterm delivery and the racial disparity in the rates of preterm delivery. Within the population without the demographic and behavioral factors we used to define risk status, the excess in preterm birth among African-American women compared to white women was only 30%, half that found among women who were not low risk. There was no significant racial disparity in preterm delivery among first births to African-Americans compared to white women.

Preterm delivery was much more likely among women whose prior delivery was low birth weight or preterm, but it was equally likely among African American women and White women. There is a substantial recurrence risk, 20%, among women whose prior delivery was preterm or low birth weight, which may be due to shared genetic or environmental factors. Our findings are consistent with a genetic component to the risk of preterm birth, although they could also be consistent with other explanations. The similar risk of preterm delivery for first births to low risk women of different racial groups is not consistent with a genetic basis for the racial disparity in preterm birth unless the genetic factors that increase the likelihood of preterm birth are associated with one or more of the factors used in the definition of risk status. This finding is also inconsistent with other explanations of racial disparity that would be expected to impact the risk of preterm delivery in

the first birth, such as prenatal environment or childhood stress.

Our findings are consistent with one or more causes of preterm delivery among low risk African American women that develop or increase after their first birth or between pregnancies. Such causes may include infection, stress or other environmental exposures that occur independently from one birth to the next. Medical indications may also explain some of the increased risk. Adams, et al found that the increase in preterm deliveries among African-American enlisted women was concentrated in medically indicated deliveries and very preterm births.⁷ Rawling, et al found that adequate prenatal care had a stronger preventative effect among African American women than among White women, which could be explained by a higher rate of medically indicated preterm births among African American women.⁶ Receipt of adequate prenatal care, however, explained less than 15% of the difference between African-American and White women in the incidence of low birth weight.

Future research to identify the causes of the African American vs White gap in preterm delivery should focus on behavioral risks, especially ones acquired after the first birth, and into the mechanisms by which identified demographic risk factors increase the risk of preterm delivery.

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