

# Prenatal Care, Birth Outcomes and Newborn Hospitalization Costs: Patterns Among Hispanics in New Jersey

By Nancy E. Reichman and Genevieve M. Kenney

**Context:** *With the influx of Latin American immigrants to the United States and the relatively high fertility of Hispanic women, the importance of understanding patterns of birth outcomes within the heterogeneous Hispanic community is growing.*

**Methods:** *Vital statistics data linked with hospital discharge files for single, liveborn infants delivered in New Jersey to state residents in 1989 and 1990 are used to examine the effects of maternal birthplace and Hispanic ethnicity on early initiation of prenatal care, low birth weight, infant mortality and newborn hospital costs. Multivariate analyses control for a range of demographic, economic, behavioral and medical factors.*

**Results:** *White women of Puerto Rican descent have a significantly higher risk than both non-Hispanic whites and other Hispanic whites of having a low-birth-weight baby. However, their infants do not have an increased risk of mortality, and newborn hospitalization costs are not elevated for this group. Mexican-born white women begin prenatal care later than their U.S.-born counterparts, but do not have worse birth outcomes. The sharpest contrasts are not among Hispanics but between non-Hispanic black and non-Hispanic white women born in the same place.*

**Conclusions:** *Ethnicity and birthplace affect prenatal care and birth outcomes but are probably not as significant as racial differences. Poor outcomes without elevated newborn costs may indicate less access to high-quality neonatal care among some ethnic groups.*

Family Planning Perspectives, 1998, 30(4):182–187 & 200

Latin American immigration to the United States has surged in the last three decades,<sup>1</sup> and Hispanic women have relatively high fertility rates.<sup>2</sup> In 1990, 14% of births in the United States were to Hispanic women, according to data from 48 states and the District of Columbia.<sup>3</sup> Although earlier figures were based on data from only 23 states plus the District of Columbia, births to Hispanics appear to be rising dramatically nationwide. As a result, it is increasingly important for policy-makers and program planners to understand patterns in birth outcomes within the heterogeneous Hispanic community.

Disparities in birth outcomes by race have been well documented and have been the source of much policy discussion. Babies born to black women are twice as likely as those whose mothers are white to be low-birth-weight and to die before age one, and this differential remains even after maternal education, income and other risk factors are taken into account.<sup>4</sup> Maternal race, as well as insurance status and prenatal care use, also is a factor in access to neonatal intensive care services,<sup>5</sup> which are largely responsible for the roughly 50% decline in the U.S. infant mortality rate that occurred between 1970 and 1987.<sup>6</sup> Given differential access to services, newborn hospitalization costs also may differ systematically.

Since low birth weight is a leading cause of infant mortality,<sup>7</sup> varying rates of this outcome among Hispanic subgroups may translate to similarly varying patterns in infant mortality. On the other hand, if access to neonatal intensive care services differs by maternal birthplace or ethnicity, then infant mortality rates might not reflect differences in low-birth-weight rates among Hispanic subgroups.

As a broad group, Hispanic women tend to have favorable birth outcomes, but outcomes vary among those of different origins. For instance, Puerto Rican women, whether born on the mainland or on the island, have a higher risk of delivering low-birth-weight babies than other Hispanic women (as well as a higher risk than non-Hispanic white women).<sup>8</sup> In addition, their infants have a higher mortality rate than babies born to other Hispanic women.<sup>9</sup> Women of Mexican descent, particularly those born in Mexico, tend to have favorable birth outcomes despite poor use of prenatal care services and low socioeconomic status,<sup>10</sup> a phenomenon known as the “Mexican paradox.” Thus, cultural and lifestyle factors likely play a role in birth outcomes, and analysis of specific subgroups of Hispanic women can have important implications for public policy.

Using data on births in New Jersey in

1989 and 1990, we expand here upon previous research on ethnic patterns in birth outcomes in three ways: First, since low birth weight is a marker for infant mortality and other, long-term adverse outcomes, we estimate the effects of maternal birthplace and Hispanic ethnicity not only on prenatal care use and low birth weight, but also on infant mortality and newborn hospitalization costs.

Second, since the most comprehensive study of ethnic patterns in New Jersey births to date did not control for residence,<sup>11</sup> some of the ethnicity and birthplace effects it found may actually reflect characteristics that vary by residence. To test this, we conduct analyses controlling for the woman’s area of residence. Since there is evidence of considerable residential clustering by maternal ethnicity both in the United States as a whole and in New Jersey,<sup>12</sup> these results will have implications for the geographic targeting of programmatic interventions.

Third, we evaluate the birth outcomes of different Hispanic groups by using both non-Hispanic women and other Hispanic women as comparison groups, and we investigate the relationships between conventional risk factors and birth outcomes for Hispanic and non-Hispanic women separately.

## Methods

### Data

The data for this analysis come from linking birth and death records of single, liveborn infants delivered in New Jersey by state residents in 1989 and 1990 with uniform billing hospital discharge information. Linkage, which the state health department conducted using a set of approximately 10 personal identifiers, was achieved for more than 95% of births. Results of two-sample t-tests and a discrim-

Nancy E. Reichman is a research staff member at the Office of Population Research, Princeton University, Princeton, NJ; Genevieve M. Kenney is a senior research associate at The Urban Institute, Washington, DC. The authors thank Maryanne J. Florio, Virginia Dato and many others at the New Jersey Department of Health for providing data and otherwise expediting the study on which this article is based; Tom Espenshade for sparking their interest in studying birth outcomes of immigrants; and the library and support staff at the Office of Population Research.

inant analysis indicate that the linked and unlinked groups did not vary significantly in terms of birth weight, timing of first prenatal visit or other relevant characteristics.

We focus on prenatal care use, selected birth outcomes and newborn hospitalization costs for women born in the United States, Cuba, Mexico and Puerto Rico.\* To examine associations with ethnicity, we divide U.S.-born women into non-Hispanics, Puerto Ricans and other Hispanics; where the numbers are large enough for analysis, we also look separately at those of Cuban, Mexican and Central or South American descent. For prenatal care, we examine whether women initiated care in the first trimester of pregnancy. The birth outcomes measured are whether the baby was low-birth-weight (less than 2,500 g) and whether the infant died within 364 days after birth. Most data for these three measures come from the birth records; mortality data are from death certificates.

Hospital discharge records yielded data on insurance status and newborn hospitalization costs. Birth certificates provided data for all other individual-level measures, as reported by the woman herself (e.g., smoking and alcohol use) or by clinicians (e.g., birth weight); the prenatal care data recorded on birth certificates were either taken from clinical records or reported by the mother.

The cost measure is the sum of charges reported on the uniform bill by the hospital in which the infant was born; for the 953 infants transferred to another hospital within the state, we use reported charges from both hospitals, but for the 137 who were transferred out of state, we use only the charges from the New Jersey hospital.

Reported newborn hospitalization charges are based on the projected costs for direct services rendered to an individual (such as room and board, X rays and medications), as well as the indirect (overhead) costs of providing these services. We use this measure rather than the actual payment because New Jersey operated under a disease-related group system between 1985 and 1992, and the actual payments therefore represented the average cost of treating a given disease-related group, not the value of resources used in the care of an individual patient. Thus, the reported charges are likely to be a more accurate measure of the true cost of hospitalization than are actual payments.

### *Variables and Analytic Techniques*

Using the infant health production function framework, in which birth outcomes are expressed as a function of multiple fac-

tors (e.g., prenatal care and the woman's biological characteristics),<sup>13</sup> we view low birth weight, infant mortality and newborn costs as reflecting the product of several demographic, economic, medical, behavioral and other risk factors. One of these factors is prenatal care use, which in turn is a function of price, income and other factors.

Since many factors associated with the use of prenatal care are unobserved, we use several individual characteristics as proxy variables to measure the determinants of first-trimester care. We expect that out-of-wedlock pregnancy, teenage pregnancy, low levels of education and Medicaid enrollment result in later care, increased probabilities of low birth weight and infant mortality, and higher hospital costs. Furthermore, we hypothesize that smoking and alcohol use, previous induced or spontaneous abortions, parity and prior loss of a child reflect the general degree of wantedness of the current pregnancy and therefore influence the level of care.<sup>14</sup> In addition, we include the father's birthplace because a foreign-born father's degree of assimilation in the United States may affect access to services. Finally, women with pregnancy-related hypertension are expected to have an increased probability of bearing a low-birth-weight infant, while women with diabetes are likely to have heavier babies.

Since first-trimester care, low birth weight and infant mortality are dichotomous dependent variables, we use logistic regression to estimate the extent to which they are influenced by the above risk factors. We use ordinary least-squares regression to estimate the effects on the natural logarithm of hospital costs, which yielded a better model fit than did the charges themselves.

Black and white women are analyzed separately because of the well-established racial differences in the relationships between prenatal risk factors and birth outcomes.<sup>15</sup> For each race, we present separate calculations for all women and for Hispanic women because preliminary tests indicated that the results varied by ethnicity.<sup>†</sup> The analyses include sets of dichotomous variables for both mother's birthplace and ethnicity. The regressions for all black women contain birthplace indicators for Puerto Rico and for other non-U.S. locales (with U.S.-born as the reference category in each instance), and ethnicity indicators for Puerto Rican and other Hispanic (with non-Hispanic as the reference category for each).

The calculations for white women contain dichotomous birthplace indicators for

Cuba, Mexico, Puerto Rico and other countries outside the United States (each compared with U.S.-born), as well as dummy variables for Central or South American, Cuban, Mexican, Puerto Rican and other Hispanic ethnicities (compared with non-Hispanics). Although women born in many other countries and of other races live in New Jersey, limitations of the data set preclude analysis of other groups.

For the analyses of Hispanic women only, the excluded birthplace category is the United States, and the excluded ethnic category is other Hispanic. Also included in most of the calculations are categorical variables for the woman's county of residence and for the population of the city in which she lives (less than 50,000; 50,000–75,000; or more than 75,000).

Prenatal care use is not included in the birth outcome analyses because it is most certainly endogenous and therefore would likely produce biased estimates. Since unobserved factors correlated with cigarette smoking or alcohol use also may bias the estimates of the effects of these behavioral factors on birth outcomes and newborn costs,<sup>16</sup> we conducted analyses both with and without smoking and alcohol use (results not shown). The results were largely consistent across the two specifications; therefore, smoking and alcohol use are included in the birth outcome analyses, since they represent behaviors that are potentially modifiable through public policy. More research is needed, however, to assess the validity of these estimates.

Birthplace and ethnicity may be correlated with unobserved factors, leading to significant effects in the multivariate models. Rates of drug use, dietary habits, cultural norms and values, fluency in English and kinship network patterns are thought to have an impact on reproductive behavior and birth outcomes. Although none of these variables could be directly included in the analysis because of limitations of the data, important unobserved factors may be correlated with residential location, and the inclusion of county fixed-

\*Although Puerto Rico is part of the United States, it is treated as a separate birthplace because the reproductive outcomes of Puerto Rican women differ substantially from those of other U.S.-born women.

†We conducted analyses for all women testing the interactions of each demographic, economic, medical and behavioral risk factor with Hispanic ethnicity. Tests of joint significance of the interaction terms indicate that for all outcomes except infant mortality, results differ significantly between Hispanic and non-Hispanic women. The p value for first-trimester care was .02 for blacks and .0001 for whites; for low birth weight, .01 for blacks and .001 for whites; for infant mortality, .65 for blacks and .40 for whites; and for costs, .0001 for both blacks and whites.

**Table 1. Number and percentage distribution of births, and percentage in which the mother was white, by mother's birthplace, New Jersey, 1989-1990**

Mother's birthplace	N	All births	White mother
United States	168,504	78.2	78.5
Cuba	1,288	0.6	94.6
Mexico	1,132	0.5	90.4
Puerto Rico	6,693	3.1	95.4
Unknown	37,760	17.5	59.8
Total	215,377	100.0	75.9

Notes: Extremely small numbers of women were born in the Virgin Islands and Canada; these women were excluded from the analysis. On the basis of a study of accuracy in maternal birthplace coding for 1992, it appears likely that most of the mothers in 1989 and 1990 whose birthplace was unknown were not born in the United States, Cuba, Mexico, Puerto Rico, Canada or the Virgin Islands. (Source: Martin RM, New Jersey Department of Health, personal communication, Jan. 25, 1995.)

effects and city-size dummies therefore might effectively control for these factors.\*

Complete information for the multivariate analyses was available for more than 80% of the infants born to more than 200,000 women. The tables present the coefficients from the regression analyses. For prenatal care and the birth outcomes, these coefficients represent the increase or decrease in the log odds of having the event occur; exponentiating the coefficients gives the effect of the variable on the relative odds that the outcome will occur. For newborn hospitalization costs, exponentiating the regression coefficients yields estimates of relative costs.

**Table 2. Percentage of births in which the woman received first-trimester prenatal care, percentage that had an adverse outcome and mean newborn hospitalization cost, all by mother's race, birthplace and ethnicity**

Mother's characteristics	N	First-trimester care	Low birth weight	Infant mortality	Mean cost
<b>Black</b>	<b>39,889</b>	<b>62.7</b>	<b>11.7</b>	<b>1.5</b>	<b>\$1,927.72</b>
U.S.-born					
Non-Hispanic	31,559	60.3	12.6	1.6	2,003.24
Puerto Rican	261	63.2	6.8	0.4	1,249.43
Other Hispanic	577	64.8	10.2	1.2	1,197.59
Mexican-born	84	21.4	3.6	0.0	860.43
Puerto Rican-born	184	65.2	6.0	0.5	919.13
Unknown birthplace					
Hispanic	1,021	70.7	5.0	0.6	1,167.69
Non-Hispanic	6,040	73.9	8.9	1.5	1,806.44
<b>White</b>	<b>158,992</b>	<b>86.2</b>	<b>4.4</b>	<b>0.5</b>	<b>1,156.12</b>
U.S.-born					
Non-Hispanic	120,300	90.2	3.9	0.5	1,116.32
Puerto Rican	6,121	67.0	7.9	1.0	1,394.35
Mexican	205	73.7	5.3	0.5	1,165.08
Cuban	327	87.8	4.5	0.3	1,502.05
Central or South American	424	73.6	5.9	0.5	1,443.30
Other Hispanic	1,606	74.0	5.6	0.7	1,227.49
Cuban-born	1,191	91.2	4.7	0.7	1,225.02
Mexican-born	961	46.7	5.4	0.6	1,243.38
Puerto Rican-born	5,980	65.1	7.5	0.8	1,388.44
Unknown birthplace					
Hispanic	10,683	71.8	4.8	0.6	1,268.50
Non-Hispanic	10,859	83.5	4.2	0.5	1,166.00

Notes: Data for black women exclude several subgroups that contained too few women for analysis. For a given birthplace, the numbers of black and white women may not add to the total shown in Table 1 because Table 1 also includes women of other races. Ns may vary across outcomes because of missing data; the Ns shown indicate the minimum number of women in the rows. The total numbers of black women and of white women include small numbers of women born in Canada and the Virgin Islands.

## Results

### Descriptive Statistics

For the majority of births (78%) for which linked data were available, the mother was born in the United States; for 3%, she was born in Puerto Rico; for 1% each, she was born in Cuba and Mexico; and for the remainder, her birthplace was categorized as unknown (Table 1). Depending on the mother's birthplace, 79-95% of infants had white mothers. Virtually all babies born to U.S.-born mothers had U.S.-born fathers, compared with about one-third of those born to women from Cuba or Puerto Rico and one in 10 of those from Mexico (not shown).

We would expect that women who are most at risk for initiating prenatal care late in pregnancy would also have the worst outcomes across the board. Indeed, as Table 2 illustrates, a smaller proportion of births among black women than among whites were preceded by first-trimester care (63% vs. 86%), and black infants were at much greater risk for low birth weight (12% vs. 4%) and mortality (1.5% vs. 0.5%). They also had higher hospitalization costs (approximately \$1,900 vs. \$1,200).

An examination of births among black women revealed that non-Hispanic U.S.-born mothers were less likely to receive first-trimester care than all others except those born in Mexico. Their babies had the highest rates of low birth weight and infant mortality, as well as the highest mean

hospitalization costs. In contrast, among white mothers, U.S.-born non-Hispanics had a higher rate of first-trimester care than any group except Cuban-born women. Infants of U.S.-born non-Hispanic women had the lowest rate of low birth weight, a lower rate of mortality than any other group except infants of U.S.-born Cubans and Central or South Americans, and the lowest mean hospitalization costs.

Puerto Rican white women, regardless of where they were born, initiated care later than did all other whites except the infants born in Mexico, and their infants had the highest rates of low birth weight and mortality among all whites. Although Puerto Rican black women were similar to their white counterparts in their prenatal care use and birth outcomes, these figures compare favorably with those of other black women.

Finally, newborns of both mainland- and island-born Puerto Rican white women had higher hospitalization costs than did all other white groups except the infants of U.S.-born women of Cuban and Central or South American descent. In contrast, the costs for infants of black women born in Puerto Rico were much lower than for all of the other black groups except women born in Mexico; they were also lower than costs for all of the white groups.

Table 2 reveals evidence of the Mexican paradox. White women born in Mexico were only about half as likely as U.S.-born non-Hispanic white women to receive first-trimester care, U.S.-born white women of Mexican descent were more likely than non-Hispanics and white women of Cuban birth or descent to delay care beyond the first trimester, and black women born in Mexico were much less likely than all other blacks to receive first-trimester care. Nevertheless, birth outcomes among black women from Mexico compared quite favorably with other black women's, and outcomes among Mexican-born white women did not reflect the differences found for prenatal care.

\*Preliminary analyses revealed considerable variation by subgroup in the residential distribution across counties, especially for blacks. For example, roughly 40% of black mothers born in Puerto Rico and 32% of mainland-born Puerto Rican black mothers lived in Hudson County (near New York City) in 1989-1990. In contrast, non-Hispanic U.S.-born blacks, non-Hispanic foreign-born blacks and other Hispanic U.S.-born blacks were heavily concentrated in Essex County (which contains the city of Newark). Roughly 64% of the black mothers born in Mexico lived in Passaic County (in the northernmost part of the state). White women generally were somewhat more dispersed geographically; however, regardless of birthplace, Cuban mothers were concentrated in Hudson County, and roughly 37% of mothers born in Mexico lived in Passaic. To the extent that any unobserved factors vary across groups within an area of residence, however, significant birthplace and ethnicity effects may remain.



**Table 3. Regression coefficients indicating the effect of various risk factors on the likelihood that women will obtain first-trimester care, experience adverse birth outcomes and encounter elevated newborn hospitalization costs, among all white women and Hispanic white women**

Risk factor	First-trimester care		Low birth weight		Infant mortality		Newborn hospitalization costs	
	All (N=136,941)	Hispanics (N=23,516)	All (N=139,215)	Hispanics (N=24,178)	All (N=139,380)	Hispanics (N=24,211)	All (N=137,490)	Hispanics (N=23,819)
<b>Birthplace/ethnicity</b>								
Mother's birthplace								
Cuba	0.078	0.294	0.099	0.111	0.905	0.959	0.018	0.016
Mexico	-0.643**	-0.452**	-0.219	-0.171	-0.429	0.031	0.117**	0.093*
Puerto Rico	-0.060	-0.030	0.021	0.004	0.304	-0.198	0.013	0.007
Other non-U.S.	-0.323**	-0.060	-0.038	-0.111	-0.239	0.237	-0.013	0.005
United States	ref	ref	ref	ref	ref	ref	ref	ref
Mother's ethnicity								
Central or South American	-0.241**	-0.023	0.013	0.041	-0.154	-0.089	0.067**	0.036*
Cuban	0.337*	0.747**	-0.059	-0.174	-0.523	-0.252	0.012	0.018
Mexican	-0.461**	-0.186	0.275	0.220	0.251	0.476	-0.015	-0.037
Puerto Rican	-0.304**	-0.014	0.292**	0.205*	0.127	0.540	0.004	0.012
Other Hispanic	-0.292**	ref	0.009	ref	-0.149	ref	0.025*	ref
Non-Hispanic	ref	na	ref	na	ref	na	ref	na
U.S.-born father	0.472**	0.258**	-0.041	0.099	-0.196	0.108	-0.021**	-0.014
<b>Demographic and economic</b>								
Married	0.656**	0.405**	-0.260**	-0.203**	-0.509**	-0.426*	-0.020**	-0.014
Education (yrs.)	0.078**	0.047**	-0.031**	-0.012	-0.027	0.019	-0.005**	-0.005*
Age >35	0.232**	0.387**	0.339**	0.246*	0.109	0.482	0.099**	0.149**
Age <20	-0.701**	-0.477**	0.081	0.264**	0.135	0.245	-0.073**	-0.057**
Covered by Medicaid	-1.128**	-0.844**	0.175**	0.071	0.100	0.001	0.008	0.026*
Covered by other government insurance or no insurance†	-1.274**	-1.033**	0.273**	0.160*	0.365**	0.165	-0.031**	0.037**
<b>Medical and behavioral</b>								
Smoked during pregnancy	-0.411**	-0.304**	0.663**	0.543**	0.306**	0.471	-0.004	0.026
Drank during pregnancy	-0.079	-0.406**	0.056	0.222	0.004	0.091	-0.014	0.213**
Live birth in last 20 mos.	-0.558**	-0.605**	0.143**	0.130	0.202	-0.158	-0.008	-0.025
Parity	-0.181**	-0.153**	-0.170**	-0.080**	0.055	-0.143	-0.043**	-0.040**
Prior loss of child	0.327**	0.200	0.646**	0.606**	0.995**	1.441**	0.169**	0.102**
Previous termination‡	0.014	0.080*	0.112**	0.051	0.272**	0.438*	0.011*	0.038**
Female baby	na	na	0.198**	0.167**	-0.265**	-0.255	-0.103**	-0.089**
Pregnancy-related hypertension	na	na	1.274**	1.397**	0.383	0.294	0.297**	0.347**
Diabetes	na	na	0.051	-0.065	0.063	0.295	0.170**	0.230**
<b>Constant</b>								
<i>R</i> <sup>2</sup>	0.018	0.089	-2.833**	-3.073**	-4.469**	-5.931**	6.841**	6.877**
$\chi^2$	na	na	na	na	na	na	0.06**	0.09**
<i>d.f.</i>	2,4667.7**	3,832.5**	1,776.6**	343.8**	207.9**	67.0**	na	na
	44	43	47	36	47	28	na	na

\*p<.05. \*\*p<.01. †Also includes those who paid for care out of pocket. ‡Includes both spontaneous and induced abortions. Notes: Analyses also controlled for city population (<50,000; 50,000–75,000; ≥75,000) and county of residence. Exceptions are that in the analyses for Hispanic women, cell sizes were too small to permit controlling for county in the birth outcome calculations. na=not applicable. ref=reference category.

Since the groups varied in terms of risk factors for both late care and poor outcomes, these differences by ethnicity and birthplace may be reduced when observed risk factors are taken into account. For example, U.S.-born black mothers were less likely than their foreign-born counterparts to be married, more likely to be teenagers, and more likely to smoke cigarettes and to drink (not shown). Among white mothers, mainland- and island-born Puerto Rican women were the least likely to be married, the most likely to be covered by Medicaid and among the least educated. The multivariate analysis will determine if effects associated with birthplace and ethnicity remain even after important risk factors are controlled for.

**Multivariate Results**

The multivariate results support the Mexican paradox for white women (Table 3), but among blacks, the number of Mexican

women was too small for analysis (Table 4, page 186). White women born in Mexico initiate care later but do not have worse outcomes than U.S.-born women with the same risk factors. White ethnic Mexicans begin care later than non-Hispanic whites, but are not at increased risk of poor outcomes and have no higher newborn costs. Furthermore, while Mexican-born white women have the lowest rates of preterm delivery and cesarean delivery of all white women in this sample (not shown), they have higher newborn costs than U.S.-born whites.

Exponentiating the coefficients shows that among white women, those of Puerto Rican ancestry are about 30% more likely than non-Hispanics (relative risk of 1.34) and 20% more likely than other Hispanics (1.23) to deliver a low-birth-weight infant. However, neither the infant mortality risk nor the newborn hospitalization costs for these women's babies are significantly el-

evated. These results are surprising, given that the descriptive statistics indicate higher infant mortality and elevated costs for white women born in Puerto Rico.

In view of research suggesting that mean birth weights vary among ancestral and cultural groups because of differences in factors such as maternal height and nutrition,<sup>17</sup> we assumed that if the low-birth-weight cutoff of 2,500 g is higher than what might be appropriate to distinguish "healthy" from "unhealthy" babies among Puerto Rican white women, the significant effects in this analysis would be misleading. Therefore, to test the robustness of the results for ethnic Puerto Rican white women, we redid the low-birth-weight analyses using 2,000 g as the cutoff. The results remained substantially unchanged, implying that white women of Puerto Rican ancestry are indeed at increased risk of delivering low-birth-weight babies.

Other ethnic differences are less dra-

**Table 4. Regression coefficients indicating the effect of various risk factors on the likelihood that women will obtain first-trimester care, experience adverse birth outcomes and encounter elevated newborn hospitalization costs, among all black women and Hispanic black women**

Risk factor	First-trimester care		Low birth weight		Infant mortality		Newborn hospitalization cost	
	All (N=33,804)	Hispanics (N=2,054)	All (N=35,123)	Hispanics (N=2,075)	All (N=35,163)	Hispanics (N=2,083)	All (N=34,545)	Hispanics (N=2,030)
<b>Birthplace/ethnicity</b>								
Mother's birthplace								
Puerto Rico	0.122	-0.023	-0.165	-0.241	-0.527	-0.427	-0.105	-0.020
Other non-U.S.	0.225**	0.027	-0.390**	-0.537*	-0.588**	-0.818	-0.074**	0.004
United States	ref	ref	ref	ref	ref	ref	ref	ref
Mother's ethnicity								
Puerto Rican	0.112	-0.139	-0.675**	-0.235	-0.578	-0.152	-0.222**	0.070
Other Hispanic	-0.040	ref	-0.463**	ref	-0.434	ref	-0.284**	ref
Non-Hispanic	ref	na	ref	na	ref	na	ref	na
U.S.-born father	0.391**	0.374**	-0.196**	-0.063	-0.568**	-1.399	-0.052**	-0.036
<b>Demographic and economic</b>								
Married	0.481**	0.250*	-0.208**	-0.592*	-0.153	0.397	-0.053**	-0.052
Education (yrs.)	0.089**	0.079**	-0.043**	-0.003	-0.051	-0.017	-0.016**	-0.003
Age >35	0.256**	0.579*	0.188*	-0.365	0.039	1.203	0.150**	0.124*
Age <20	-0.562**	-0.380*	-0.160**	-0.174	-0.133	0.679	-0.098**	-0.093*
Covered by Medicaid	-0.705**	-0.728**	0.084	-0.833**	0.072	-0.018	0.031*	-0.026
Covered by other government insurance or no insurance†	-0.986**	-0.959**	0.282**	-0.340	0.485**	0.355	0.135**	0.001
<b>Medical and behavioral</b>								
Smoked during pregnancy	-0.200**	-0.095	0.502**	1.064**	0.061	1.079	0.065**	0.133*
Drank during pregnancy	-0.492**	-0.459	0.519**	0.568	0.351*	u	0.282**	0.071
Live birth in last 20 mos.	-0.664**	-0.661**	0.249**	0.207	0.300*	u	0.036*	0.057
Parity	-0.169**	-0.119*	-0.022	0.001	-0.008	-0.096	0.001	-0.027
Prior loss of child	0.304**	0.387	0.485**	1.152*	0.870**	u	0.100**	0.267*
Previous termination‡	-0.049	-0.052	0.115**	-0.301	0.239*	0.627	0.069**	-0.131**
Female baby	na	na	0.188**	0.248	0.009	-0.193	-0.084**	-0.075*
Pregnancy-related hypertension	na	na	0.932**	1.631**	-0.068	u	0.404**	0.224*
Diabetes	na	na	-0.220	u	-0.281	u	0.216**	0.072
Constant	-0.627**	0.137	-2.040**	-2.399**	-3.649**	-5.400**	7.049**	6.829**
R <sup>2</sup>	na	na	na	na	na	na	0.08**	0.13**
χ <sup>2</sup>	6,575.7**	296.5**	1,003.7**	87.9**	135.9**	14.4	na	na
d.f.	39	19	42	20	23	16	na	na

\*p<.05. \*\*p<.01. †Also includes those who paid for care out of pocket. ‡Includes both spontaneous and induced abortions. Notes: Analyses also controlled for city population (<50,000; 50,000–75,000; ≥75,000) and county of residence. Exceptions are that in the analyses for Hispanic women, cell sizes were too small to permit controlling for county in the birth outcome calculations. u=unavailable because of small cell sizes. na=not applicable. ref=reference category.

matic. Central or South American and other Hispanic white women begin care later and have higher costs than their non-Hispanic white counterparts, but they are not at increased risk for poor birth outcomes. Ethnic Cuban white women are relatively likely to get early care, and have no worse outcomes or higher costs than non-Hispanic white women.

In a few cases, ethnic and birthplace differences are consistent across the four dependent variables. Foreign-born black women, except those from Puerto Rico, initiate care earlier and have better outcomes and lower costs than U.S.-born black women (Table 4). Many foreign-born whites begin care later than their U.S.-born counterparts; however, except women from Mexico, who have higher costs, no foreign-born white group is at increased risk of having other poor outcomes.

Among black women, those whose infants' fathers were born in the United States have a tendency to begin care earlier and to have better outcomes and lower newborn costs than those whose babies' fathers were born elsewhere, although the

outcome and cost effects are not significant in the analyses for Hispanics only. Among white women, those whose babies have native-born fathers are relatively likely to initiate care early and, in the analysis for all women, have lower costs, but have no differences in other outcomes compared with those whose babies have foreign-born fathers.

Many risk factors also demonstrate effects in the hypothesized pattern across the four outcomes. As expected, for both black and white women, married mothers typically begin care earlier and have better outcomes and lower newborn costs than those who give birth out of wedlock. Also as expected, better educated women generally receive earlier care and have lower risks of low birth weight and lower hospitalization costs. Lack of insurance is also significant in the hypothesized direction across most outcomes.

White women who smoke initiate care later and have a higher probability of delivering a low-birth-weight infant than those who refrain from smoking. Cigarette smoking also significantly increases the

probability of infant mortality, but has no effect on costs for white infants. Black women who smoke initiate care later (except when the analysis is restricted to Hispanics) and have a higher probability of low birth weight and higher costs than blacks who do not smoke. Alcohol consumption demonstrates the expected pattern of later care and worse outcomes for blacks, but is nonsignificant for most outcomes among whites.

For both black and white women, prior loss of a child has a positive effect on the timing of care (except when the analysis is limited to Hispanics), but significantly increases the likelihood of poor outcomes and higher costs. For both races, pregnancy-related hypertension increases the risk of low birth weight, and both hypertension and diabetes generally increase costs. Although the fewest significant effects are found for infant mortality, the results indicate that a problematic reproductive history, as captured by previous spontaneous or induced abortions and prior loss of a child, significantly increases the probability of infant mortality for both blacks and whites.

The results indicate differences between Hispanic and non-Hispanic women in the effects of several covariates. For whites in particular, low socioeconomic status (as reflected by education and insurance status) is generally associated with worse outcomes for all women combined, but has no effects for Hispanic women. The same also appears to be true for blacks, except that having Medicaid coverage reduces the low-birth-weight rate for Hispanic women. The finding that low socioeconomic status matters less for Hispanics than for non-Hispanics is consistent with explanations focusing on protective cultural factors among certain Hispanic groups that may ameliorate the negative effects of poverty.<sup>18</sup>

Differences in the effects of behavioral factors between Hispanic and non-Hispanic women are fewer and less consistent. The effects of smoking on low birth weight and newborn costs for Hispanic black women are twice those for black women overall. Also, alcohol use has significant effects in the hypothesized direction on all outcomes for black women as a group, but it appears to have no significant effects for black Hispanics.

## Conclusion

The descriptive findings indicate that Puerto Rican white women giving birth in New Jersey were twice as likely, relative to their U.S.-born non-Hispanic white counterparts, to have a low-birth-weight baby and to have an infant who died within the first year of life. In addition, their newborn hospitalization costs were 25% higher than those of U.S.-born non-Hispanic white women. The multivariate analysis indicates that even after we controlled for area of residence as well as numerous other demographic, economic, medical and behavioral risk factors, white women of Puerto Rican descent have a significantly higher risk of delivering low-birth-weight babies than other Hispanic whites and non-Hispanic white women.

One factor contributing to the low-birth-weight effect for Puerto Rican women is their late initiation of prenatal care. However, in analyses not shown here, we found that unobserved factors associated with being Puerto Rican increase the risk of low birth weight for white women, even when delayed prenatal care is taken into account. Related studies indicate that the unexplained risk could be due to poverty,<sup>19</sup> inadequate diet,<sup>20</sup> drug use,<sup>21</sup> lack of family or community support,<sup>22</sup> or sporadic use of prenatal care once it has been initiated.<sup>23</sup>

The multivariate analysis also indicates

that white women of Puerto Rican descent are not at increased risk for infant mortality. The analyses may simply have been unable to capture many effects because this outcome is relatively rare, and more effects might become significant with a larger sample. Indeed, the results on infant mortality reveal very few significant effects in general. The results for costs, however, are even more puzzling: Despite their elevated risk of having a low-birth-weight baby, Puerto Rican white women do not have higher newborn hospital costs.

One possible explanation of the seemingly contradictory results for low birth weight and costs is that the babies in question may experience difficulties after discharge from their initial hospitalization, rather than acute episodes beginning at or shortly after birth. Indeed, low birth weight is associated with a host of long-term problems, many of which can take years to become apparent (including cerebral palsy, respiratory conditions and learning disabilities);<sup>24</sup> as a result, costs for care stemming from low birth weight may mount during childhood.

Another possible explanation for the paradoxical findings on birth weight and cost is that babies born to Puerto Rican white women have an elevated risk of infant mortality that could not be detected in our sample, and these women have less access to high-quality neonatal care than others. If this is the case, the result could be elevated rates of infant death and no significant increase in newborn costs.

Although the multivariate results indicate that ethnic Puerto Rican black women begin prenatal care earlier and have better birth outcomes than non-Hispanic blacks, the descriptive statistics show that Puerto Rican blacks and Puerto Rican whites have similar levels of prenatal care use and similar birth outcomes. Puerto Ricans of both races are heavily concentrated in counties that have large black populations. The public health departments in these counties may be able to substantially improve birth outcomes by expanding their outreach activities for both family planning services and Medicaid, and by further streamlining the Medicaid enrollment process.

Although the intent of this analysis was to focus on maternal birthplace and ethnicity, the findings have broader implications for public policy. The results reinforce that unwed motherhood and cigarette smoking are clear risk factors for adverse outcomes, underscoring the potential importance of family planning and smoking cessation programs for high-risk

women of both races. The results also suggest the existence of systematic inequities in the access to and quality of newborn hospital resources. Further research is needed to determine whether not only Puerto Rican women, but all those who are at high risk for having low-birth-weight babies, face barriers to quality neonatal care.

Finally, while this study focused on birthplace and ethnic differences within racial groups, disparities by race may be at least as important as variations in birthplace and ethnicity. In particular, the starker contrasts for these New Jersey mothers were between non-Hispanic blacks and non-Hispanic whites who were born in the same place. Hispanic women, on the other hand, had many fewer racial differences. Understanding the sources of the racial disparities is important for formulating policies designed to improve birth outcomes.

## References

1. U.S. Bureau of the Census, *Statistical Abstract of the United States, 1995*, Washington, DC: U.S. Government Printing Office, 1995.
2. Stroup-Benham C and Trevino F, Reproductive characteristics of Mexican American, mainland Puerto Rican, and Cuban-American women: data from the Hispanic Health and Nutrition Examination Survey, *Journal of the American Medical Association*, 1991, 265(2):222-226.
3. U.S. Bureau of the Census, 1995, op. cit. (see reference 1).
4. Kleinman JC and Kessel SS, Racial differences in low birth weight: trends and risk factors, *New England Journal of Medicine*, 1987, 317(12):749-753; Schoendorf KH, Kleinman JC and Rowley D, Mortality among infants of blacks as compared with white college educated parents, *New England Journal of Medicine*, 1992, 326(23):1522-1526; and Paneth NS, The problem of low birth weight, *The Future of Children*, 1995, 5(1):19-34.
5. Bronstein J et al., Access to neonatal intensive care for low-birthweight infants: the role of maternal characteristics, *American Journal of Public Health*, 1995, 85(3):357-361.
6. U.S. Department of Health and Human Services, *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*, Washington, DC: U.S. Government Printing Office, 1990; and Mason J, Reducing infant mortality in the United States through "Healthy Start," *Public Health Reports*, 1991, 106(5):479-483.
7. Taffel S, Trends in low birth weight: United States, *Vital and Health Statistics*, Series 21, No. 48, 1989.
8. Collins J and Shay D, Prevalence of low birthweight among Hispanic infants with United States and foreign-born mothers: the effect of urban poverty, *American Journal of Epidemiology*, 1994, 139(2):184-192; Reichman N and Kenney G, The effects of parents' place of birth and ethnicity on birth outcomes in New Jersey, in: Espenshade TJ, ed., *Keys to Successful Immigration: Implications of the New Jersey Experience*, Washington, DC: The Urban Institute Press, 1997, pp. 199-230; and U.S. Department of Health and Human Services, 1990, op. cit. (see reference 6).
9. Mason J, 1991, op. cit. (see reference 6); and Becerra J et al., Infant mortality among Hispanics: a portrait of het-

(continued on page 200)

## Prenatal Care...

(continued from page 187)

erogeneity, *Journal of the American Medical Association*, 1991, 265(2):217–221.

10. Ibid.; and Mason J, 1991, op. cit. (see reference 6).

11. Reichman N and Kenney G, 1997, op. cit. (see reference 8).

12. White MJ and Omer A, Segregation by ethnicity and immigrant status, in: Espenshade TJ, 1997, op. cit. (see reference 8), pp. 375–394.

13. Corman H, Joyce T and Grossman M, Birth outcome production functions in the United States, *Journal of Human Resources*, 1987, 22(3):339–360; Rosenzweig M and Schultz T, The behavior of mothers as inputs to child health: the determinants of birth weight, in: Fuchs V, *Economic Aspects of Health*, Chicago: University of Chicago Press, 1982, pp. 53–93; Rosenzweig M and Schultz T, Estimating a household production function: heterogeneity, the demand for health inputs, and their effects on birth weight, *Journal of Political Economy*, 1983, 91(5):723–746; Rosenzweig M and Schultz T, The stability of household production technology: a replication, *Journal of Human Resources*, 1988, 23(4):535–549; Corman H and Grossman

M, Determinants of neonatal mortality rates in the U.S., *Journal of Health Economics*, 1985, 4(3):213–236; Joyce T, The demand for health inputs and their impact on the black neonatal mortality rate in the U.S., *Social Science and Medicine*, 1987, 24(11):911–918; Joyce T, The impact of induced abortion on black and white birth outcomes in the U.S., *Demography*, 1987, 24(2):229–244; Joyce T and Grossman M, Pregnancy wantedness and the early initiation of prenatal care, *Demography*, 1990, 27(1):1–17; Grossman M and Joyce T, Unobservables, pregnancy resolutions, and birthweight production functions in New York City, *Journal of Political Economy*, 1990, 98(5):983–1007; and Frank R et al., Updated estimates of the impact of prenatal care on birthweight outcomes by race, *Journal of Human Resources*, 1992, 27(4):629–642.

14. Grossman M and Joyce T, 1990, op. cit. (see reference 13).

15. Corman H, Joyce T and Grossman M, 1987, op. cit. (see reference 13).

16. Rosenzweig M and Schultz T, 1982, op. cit. (see reference 13); Rosenzweig M and Schultz T, 1983, op. cit. (see reference 13); and Rosenzweig M and Schultz T, 1988, op. cit. (see reference 13).

17. Rooth G, Low birthweight revisited, *Lancet*, 1980, I(8169):639–641.

18. Guendelman S, Mexican women in the United States, *Lancet*, 1994, 344(8919):352; and Mason J, Reducing infant mortality in the United States through Healthy Start, *Public Health Reports*, 1991, 106:479–483.

19. Lemann N, The other underclass, *Atlantic Monthly*, 1991, 268:96–110.

20. Marks G, Garcia M and Solis JM, Health risk behaviors of Hispanics in the United States: findings from HHANES 1982–84, *American Journal of Public Health*, 1990, 80(Suppl.):20–26.

21. Amaro H et al., Acculturation and marijuana and cocaine use: findings from HHANES 1982–84, *American Journal of Public Health*, 1990, 80(Suppl.):54–60.

22. Guendelman S, 1994, op. cit. (see reference 18).

23. Alexander G and Korenbrot C, The role of prenatal care in preventing low birth weight, *The Future of Children*, 1995, 5(1):103–120.

24. Hack M, Klein N and Taylor H, Long-term developmental outcomes of low birth weight infants, *The Future of Children*, 1995, 5(1):176–196.