Ethnicity, Maternal Risk, and Birth Weight Among Hispanics in Massachusetts, 1987–89

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Synopsis

National data reveal that low birth weight and infant mortality rates among Hispanics are, in general, between the rates for whites and those for blacks. The question remains, do differences in low birth weight reflect distributions of known risk factors, or do ethnic differences persist after simultaneously adjusting for intervening variables?

In this study, Massachusetts birth certificate data for 206,973 white non-Hispanic infants and 19,571 Hispanic infants are used to examine differences in low birth weight between white non-Hispanic and Hispanic infants, as well as variation among seven subgroups of Hispanic mothers—Puerto Rican, Dominican, Central American, South American, Mexican, Cuban, and other Hispanic. Regression analysis is used to estimate the association between risk factors and birth weight and the relative risk of low birth weight. Risk factors include ethnicity, demographic characteristics, biological factors, access to prenatal care, and infants' conditions.

Results indicate substantial variation in mean birth weight, low birth weight, and levels of risk among Hispanic subgroups and between Hispanics and white non-Hispanics. Puerto Rican infants had the lowest mean birth weight and, in general, the highest level of risk factors in this population. None of the adjusted odds ratios for low birth weight for any Hispanic group was significantly elevated at the 95 percent level compared with white non-Hispanics.

Findings in this study confirm the previous observations of the wide variation among Hispanic subgroups and the high level of risk among Puerto Ricans. Results of this study also raise some interesting questions about the differential relationship between ethnicity and birth weight, ethnicity and low birth weight, and the significance of maternal place of birth as a proxy measure of adaptation or acculturation.

During the 1980s, public health surveillance and research literature in the United States recognized the importance of differentiating Hispanics from whites and blacks in investigating infant outcomes. National data revealed that low birth weight and infant mortality rates among Hispanics were comparable with those of whites and substantially lower than those of black infants (*1–3*). Multivariate analyses consistently demonstrated that differences in adverse infant outcomes between white and Hispanic infants, on the one hand, and black infants, on the other hand, persist even after adjusting for a broad range of maternal risks, socioeconomic status, and access to prenatal care (*4–7*).

National investigations indicate large and consistent variations in adverse infant outcomes associated with ethnicity and national origin among Hispanics, with low birth weight and infant mortality rates highest among Puerto Rican infants and lowest among Cuban Americans and Mexican Americans (*1–3*). Other investigations reveal that foreign- and Puerto Rican-born Hispanics have consistently lower rates of low weight births than women of the same ethnicity born in the continental United States (*8,9*) and that Mexican American mothers who are less acculturated into mainstream American culture have lower rates of low birth weight than those who are more acculturated (*10*).

The birth weight differences cited in the literature between Hispanic and non-Hispanic infants and the variation among Hispanics yield this crucial research issue: do differences in low birth weight reflect different distributions of known risk factors such as sociodemographic characteristics, maternal biological characteristics, access to care, and infant characteristics, or do ethnic differences in low birth weight persist even after simultaneously adjusting for these variables? This article addresses this issue.

Methods

Single live births to mothers residing in Massachusetts who identified themselves as white non-Hispanic (N = 207,132) or Hispanic (N = 19,606) and delivered during 1987, 1988, or 1989 constitute the base cohort for this study. Newborns weighing less than 500 grams were eliminated (N = 194), yielding a final cohort of 206,973 white non-Hispanic infants and 19,571 Hispanic infants.

Following current conventions of the National Center for Health Statistics, live births were classified into racial and ethnic groups based on the mother's race and ethnicity as indicated on the Massachusetts certificate of live birth. During hospitalization for delivery, mothers are asked to complete a parent worksheet for birth certificates that contains separate questions on maternal race and ethnicity. The mothers are asked to indicate one of five options "which you feel best describes your race": white, black, Asian, American Indian, other. The mothers are then asked to indicate one of 43 options "which you feel best describes your ancestry or ethnic heritage."

Infants whose mothers indicated any race and chose one of the seven Hispanic ancestry-ethnicity responses were classified as Hispanic. The seven choices coded as Hispanic were Puerto Rican, Cuban, Dominican, Mexican, Central American, South American, and Other Hispanic. ("Other Hispanic" includes mothers who chose this designation. This category includes women born in the United States as well as in many other countries.) Infants whose mothers indicated white race and did not choose any of the Hispanic ancestry-ethnicity responses were classified as white non-Hispanic.

All other variables included in the analysis were also derived from the parent or hospital worksheet for the Massachusetts certificate of live birth. The continuous sociodemographic variables, maternal age, and education were each aggregated into categories for purposes of statistical analysis. Marital status was coded as a dichotomous variable. Maternal place of birth was categorized into U.S. mainland and not U.S. mainland.

The presence of maternal medical risk factors, such as rubella, hepatitis, or diabetes, was defined as positive responses to any of the conditions delineated on the hospital worksheet. The presence of congenital anomalies, such as club feet, cleft palate, or Down's Syndrome, was defined as positive responses to any of the conditions delineated on the hospital worksheet. The presence of abnormal conditions of the newborn, such as jaundice, fetal alcohol syndrome, or meningitis, was defined as positive responses to any of the conditions delineated on the hospital worksheet. (Dr. Cohen can provide a complete listing of these conditions and factors.)

Number of live births was categorized as 1, 2–3, or 4 plus. Gestational age was calculated from response to the hospital worksheet question "date last menses began" and was categorized into preterm (less than or equal to 36 weeks) or term (37 weeks or more). Gestational age information was available for 95 percent of women delivering infants of at least 500 grams.

Maternal smoking during pregnancy was derived from a twofold question on the parent worksheet "did you smoke during pregnancy," and "if yes, how many cigarettes did you smoke daily?" Responses were categorized into no smoking, smoking less than or equal to 10 cigarettes daily, or smoking more than 10 cigarettes daily.

The number of prenatal care visits was used as a continuous variable, truncated at 17 visits. Approximately 2.6 percent of the mothers indicated more than 17 prenatal care visits; two percent were unknown. Zero prenatal care visits indicates no prenatal care was received.

Finally, payment source for prenatal care was derived from the parent worksheet question "what was the primary payment source for your prenatal care?" Responses were aggregated into two categories: private, including Blue Cross, commercial insurance, and health maintenance organizations; and other, including Medicaid, Medicare, Healthy Start, other government, self-pay, and free care.

Multiple linear regression was employed to estimate the association between individual risk factors and birth weight (continuous birth weight from 500 to 8,165 grams, with birth weight greater than 8,165 grams recoded to 8,165 grams). Macrosomia

Table 1. Percentages of perinatal characteristics by ethnicity, Massachusetts, 1987–89

Variables	Puerto Rican (N = 11,929)	Dominican (N = 2,723)	Central American (N = 1,758)	South American (N = 1,605)	Other Hispanic (N = 743)	Mexican (N = 501)	Cuban (N = 312)	White non-Hispanic (N = 206,973)
Sociodemographic								
Age (years):								
Younger than 20	28.4	11.1	10.6	5.7	20.2	9.6	9.9	6.4
20–24	37.9	33.7	34.2	24.9	32.2	31.5	28.5	19.3
25–29	21.0	29.4	31.3	35.6	27.5	32.3	31.1	34.6
30–34	8.8	19.0	15.9	22.7	12.1	20.2	19.2	28.3
35 and older	3.8	6.8	7.8	11.1	7.9	6.4	11.2	11.4
Education (grade):								
Less than 10	29.1	22.6	36.5	14.1	17.0	20.3	9.4	4.0
10–11	25.6	18.1	11.2	9.5	17.5	8.9	11.0	7.2
12	28.6	36.2	29.7	32.5	34.1	26.6	24.9	32.9
13 or more	16.7	23.1	22.6	43.9	31.4	44.2	54.7	55.9
Marital status:								
Married	34.9	54.1	56.4	75.3	53.3	79.4	71.2	84.2
Place of birth:								
Not U.S. mainland	65.4	92.3	89.4	94.5	44.5	46.8	68.9	6.5
Maternal-biological								
Maternal conditions present	32.6	26.8	28.5	25.9	33.4	23.4	27.7	25.7
Live births:								
1	40.5	41.7	42.2	56.0	47.5	44.1	50.8	45.8
2–3	45.8	47.6	44.4	38.6	43.5	45.1	41.4	48.2
4 or more	13.7	10.7	13.4	5.4	9.0	10.8	7.8	6.0
Smoking:								
None	82.6	93.7	93.9	92.5	89.0	90.8	86.2	77.0
1–10 cigarettes daily	13.7	4.9	4.4	6.4	8.0	6.8	10.3	13.6
11 or more daily	3.7	1.4	1.7	1.1	3.0	2.4	3.5	9.4
Access to care								
Number of prenatal visits (mean)	10.3	10.6	10.3	11.1	10.7	10.8	11.3	11.7
Payment source:								
Private	22.7	25.8	41.6	52.6	42.5	58.5	58.7	80.1
Public, self, no pay	77.3	74.2	58.4	47.4	57.5	41.5	41.3	19.9
Infant risk factors								
Congenital anomalies	3.7	5.0	3.0	3.6	6.1	3.0	5.2	3.1
Abnormal conditions	16.8	17.1	9.1	11.7	19.8	7.8	15.6	10.4
Female sex	49.4	47.4	49.5	51.5	48.7	48.9	49.0	48.7
Early gestational age	10.0	7.6	7.5	6.0	9.1	6.3	6.0	5.0

Table 2. Distribution of birth weights by mothers' ethnicity, Massachusetts, 1987–89

Race, ethnicity group	Birth weight category rate per 1,000 live births			Mean birth weight	95 percent confidence interval
	500–1,499 grams	1,500–2,499 grams	Total 500–2,499 grams		
Puerto Rican	11.7	61.3	73.0	3,248	3,238,3,258
Dominican	8.8	43.4	52.2	3,375	3,354,3,396
Central American	10.8	37.7	48.5	3,349	3,323,3,375
South American	6.3	28.2	34.5	3,400	3,374,3,425
Other Hispanic	20.4	51.6	72.0	3,311	3,267,3,354
Mexican	4.0	36.2	40.2	3,449	3,402,3,496
Cuban	3.2	29.0	32.2	3,432	3,372,3,492
White non-Hispanic	6.2	34.6	40.8	3,461	3,459,3,463

among Hispanic infants of Mexican descent is well-documented (*11*). Because of the small number of Hispanic infants of Mexican ancestry in Massachusetts, we did not analyze separately relatively high birth weight among Hispanic groups.

Risk factors included in the multiple linear regression models include ethnicity (white non-Hispanic and each of the seven previously identified Hispanic ancestry groups); maternal sociodemographic characteristics (age, marital status, education, place of birth); maternal biological characteristics (medical risk factors, smoking, and par-

Table 3. Percentage of low birth weight infants among different ethnic groups for selected characteristics, Massachusetts, 1987–89

Characteristic	Puerto Rican (N = 11,929)	Dominican (N = 2,723)	Central American (N = 1,758)	South American (N = 1,605)	Other Hispanic (N = 743)	Mexican (N = 501)	Cuban (N = 312)	White non-Hispanic (N = 206,973)
Sociodemographic								
Age (years):								
Younger than 20	8.48	8.61	6.99	5.49	11.56	6.25	3.23	6.27
20–24	6.41	5.25	4.99	2.76	9.24	4.49	2.27	4.55
25–29	7.00	3.63	4.01	2.99	3.47	3.73	3.13	3.67
30–34	6.68	4.07	4.68	3.87	5.62	3.00	5.00	3.62
35 and older	10.74	9.78	5.07	4.55	3.39	3.13	2.86	4.47
Education (grade):								
Less than 10	9.24	5.74	4.53	6.17	13.93	3.88	6.45	6.90
10–11	7.39	5.88	4.69	3.72	6.40	4.17	2.86	6.53
12	6.20	5.57	4.54	2.96	7.02	7.63	5.33	4.58
13 or more	5.89	4.44	5.45	2.48	2.25	1.87	1.78	3.23
Married	5.30	3.54	4.96	3.24	4.82	3.04	1.80	3.50
Not married	8.38	7.21	4.71	4.09	9.94	7.84	6.82	7.16
Place of birth:								
U. S. mainland	7.70	4.81	7.65	4.49	7.41	4.96	5.15	4.09
Not U. S. mainland	7.08	5.23	4.53	3.39	6.13	2.99	2.35	3.85
Maternal-biological								
Maternal conditions:								
Yes	14.03	10.26	10.02	7.62	15.29	6.45	8.24	8.60
No	4.05	3.34	2.80	2.03	3.06	2.92	1.36	2.52
Live births:								
1	7.48	7.22	6.42	3.60	9.57	2.75	3.82	4.81
2–3	6.61	3.59	4.27	2.61	4.39	4.93	1.57	3.29
4 or more	8.97	4.86	1.71	7.06	7.69	5.56	18.70	4.84
Smoking:								
None	6.17	5.23	4.62	3.25	6.72	3.10	3.36	3.29
1–10 cigarettes daily	12.06	3.73	7.79	6.86	12.07	11.76	3.23	6.02
11 or more daily	15.19	10.81	10.00	[1]0.00	[1]9.09	[1]16.7	[1]0.00	7.69
Access to care								
Prenatal visits:								
0–8	12.3	7.6	8.4	6.2	14.7	8.5	7.5	11.3
14 or more	3.8	3.3	3.2	0.7	3.4	0.0	0.0	2.5
Payment source:								
Private	6.32	4.71	5.49	3.58	4.76	4.14	1.64	3.52
Public, self, no pay	7.59	5.41	4.40	3.31	9.03	3.86	5.51	6.35
Infant risk factors								
Congenital anomalies:								
Yes	15.75	10.53	7.84	10.71	13.64	[1]7.14	[1]12.5	11.00
No	6.97	4.91	4.76	3.20	6.69	3.93	2.76	3.86
Abnormal conditions:								
Yes	21.10	13.13	12.58	11.54	21.13	18.42	12.77	14.10
No	4.55	3.57	4.08	2.42	3.73	2.83	1.54	2.92
Sex of infant:								
Male	6.8	4.6	5.2	3.0	6.1	2.0	2.5	3.9
Female	7.8	5.9	4.5	3.9	8.3	6.2	3.9	4.3
Gestational age:								
Less than 37 weeks	36.5	32.8	31.5	27.9	43.5	33.3	[1]29.4	39.2
37 weeks or more	3.8	2.9	2.4	2.1	3.3	2.0	1.1	2.1

[1]Low birth weight rate is based on less than 30 cases in the denominator.

ity); access to care (number of prenatal care visits and payment for prenatal care); and infant conditions (gestational age, sex, presence of abnormal conditions, and presence of congenital anomalies). In the regression analysis, gestational age responses below 20 weeks were recoded to 20 and above 45 weeks were recoded to 45.

Multiple logistic regression was used to estimate the relative risk of low birth weight for a given level of a risk factor variable. The dependent variable was dichotomized as low birth weight (500–2,499 grams) and normal birth weight (more than 2,499 grams). Most variables were entered into the model as categorical variables, with an 0,1 dummy variable employed to represent the absence or presence of a particular risk factor.

The reference categories for the variables used in the analyses were ages 25–29, education through grade 12, married, born on the U.S. mainland, no maternal conditions, first live birth, no smoking during pregnancy, privately insured prenatal care, no congenital anomalies, no abnormal conditions of pregnancy, male sex, and gestational age of at least 37 weeks. The number of prenatal care visits was entered into the models as a continuous variable, trimmed at 17 visits.

Results

Description of the cohort. More than 91 percent (206,973) of the 226,544 infants included in the cohort were white non-Hispanic. Hispanic infants included in the sample constituted 8.6 percent (19,571 births) of the sample and included 11,929 Puerto Rican infants (5.3 percent), 2,723 Dominican (1.2 percent), 1,758 Central American (0.8 percent), 1,605 South American (0.7 percent), 743 Other Hispanic (0.3 percent), 501 Mexican (0.2 percent), and 312 Cuban (0.1 percent).

Table 1 presents a description of the cohort for each of the seven Hispanic ancestry groups and white non-Hispanics for maternal sociodemographic variables, maternal biological characteristics, access to care, and infant conditions. Substantial variation exists in the risk profiles of the Hispanic groups and between the Hispanic groups and the white non-Hispanic group. Among the Hispanic groups, Puerto Ricans generally had the highest risk profile, including highest percentages of teen births, maternal medical risk factors, mothers who smoked during pregnancy, and public payment for prenatal care, lowest percentage of married mothers, and the lowest average number of prenatal care visits.

Low birth weight and mean birth weight. Very low and low birth weight rates per 1,000 live births and mean birth weights for the Hispanic and white non-Hispanic groups are presented in table 2. Substantial variation exists among the seven Hispanic groups and the white non-Hispanic group in both percentage low birth weight and mean birth weight. Puerto Rican (73 per 1,000) and Other Hispanic infants (72 per 1,000) had the highest low birth weight rates, more than twice the rate of Cuban (32.2) and South American (34.5) infants and almost twice the rate of white non-Hispanic infants (40.8). Puerto Rican (3,248 grams) and Other Hispanic infants (3,311 grams) also had the lowest mean birth weights, significantly lower than the mean birth weight for white non-Hispanic infants (3,461 grams). Mean birth weights for Dominican (3,375 grams), Central American (3,349 grams), and South American (3,400 grams) infants were also significantly lower than the mean birth weight for white non-Hispanics. Approximately 6 percent of the cohort weighed 4,250 grams or more.

Percentages of low birth weight and risk factors. Percentages of low birth weight for levels of each risk factor for each Hispanic group and white non-Hispanics is presented in table 3. In general, Puerto Ricans and Other Hispanics have the highest percentage of low birth weight at each level of each risk factor. Among Puerto Ricans and white non-Hispanics, the two largest groups, a U-shaped relationship between age and low birth weight is evident, with infants of women younger than age 20 and older than age 35 having the highest percentage low birth weights. Among Puerto Ricans and white non-Hispanics, an inverse relationship between education and low birth weight is evident. Generally, higher percentages of low birth weight are evident for infants of unmarried women, women with medical risk factors, women with one or four or more live births, women who smoked during pregnancy, for female infants, and for infants with congenital abnormalities or abnormal conditions. Puerto Rican, Cuban, Mexican, Central American, South American, Other Hispanic, and white non-Hispanic infants of women who were born on the U.S. mainland had higher rates of low birth weight than those infants of women who were not born on the mainland. Relatively few non-Hispanic women (6.5 percent) were foreign born, however. Additionally, caution should be used when interpreting proportions based on a small number of observations; in particular, some of the cell estimates for Cubans and Mexicans represent fewer than 10 observations.

Multiple linear regression—birth weight. Multiple linear regression results are presented in table 4. The regression coefficients can be interpreted as the adjustment, in grams, to the mean birth weight of the reference category for that variable. The intercept birth weight of 3,341.9 grams is the mean birth weight for the reference categories of all the variables considered together.

After adjusting for all other risk factors, ethnicity was significantly related to birth weight for Puerto Ricans, Dominicans, Central Americans, South Americans, and Other Hispanics. In each case, ethnic group identification was related to statistically lower mean birth weight than for white

Table 4. Linear regression analysis: predictors of birth weight, Massachusetts, 1987-89

Variable	*Regression coefficient*	*Standard error*	*Probability* > | *T* |[1]
Intercept	3,341.9	5.9	0.0001
Race, ethnicity:			
Puerto Rican	−105.3	5.8	0.0001
Dominican	−24.9	10.5	0.0178
Central American	−51.0	12.9	0.0001
South American	−30.2	13.4	0.0237
Other Hispanic	−67.8	19.2	0.0004
Mexican	0.8	23.1	0.9733
Cuban	1.1	29.3	0.9714
Sociodemographic			
Age (years):			
Younger than 20	45.7	5.2	0.0001
20–24	18.4	3.2	0.0001
30–34	−8.2	2.8	0.0036
35 and older	−21.3	3.8	0.0001
Education (grades):			
Less than 10	−51.5	5.2	0.0001
10–11	−33.0	4.4	0.0001
13 or more	37.6	2.6	0.0001
Marital status:			
Not married	−28.0	3.6	0.0001
Place of birth:			
Not U.S. mainland	−12.8	4.1	0.0018
Maternal-biological			
Maternal conditions present	−62.5	2.5	0.0001
Live births			
2–3	113.0	2.3	0.0001
4 or more	164.0	4.8	0.0001
Smoking:			
1–10 cigarettes daily	−145.0	3.2	0.0001
11 or more cigarettes daily	−245.1	4.0	0.0001
Access to care			
Number of prenatal visits	19.1	0.4	0.0001
Payment source: public, self, no pay	−23.9	3.2	0.0001
Infant risk factors			
Congenital anomalies	−74.2	6.5	0.0001
Abnormal conditions	−100.2	3.6	0.0001
Sex of infant: female	−134.7	2.1	0.0001
Early gestational age	−731.3	4.9	0.0001

[1]Test of statistical significance of the regression coefficient. > | T | is the probability that a t test would obtain a greater absolute value than that observed given that the regression coefficient is zero. This is a two-tailed significance probability generated by the SAS procedure.

NOTE: $R^2 = 0.18$

non-Hispanic infants. The largest effects were evident for Puerto Ricans (−105.3 grams) and Other Hispanics (−67.8 grams). The independent effect of Puerto Rican identification on birth weight was greater than the independent effects of age, education, marital status, maternal medical conditions, insurance status, infant congenital anomalies, maternal place of birth, and infant's abnormal conditions, all of which were also significantly related to birth weight.

Also significantly related to birth weight were 2–3 live births (+113.0 grams), 4 or more live births (+164.0 grams), smoking 1–10 cigarettes daily (−145.0 grams), smoking 11 or more cigarettes daily (−245.1 grams), female sex of infant (−134.7 grams), and early gestational age (−731.3 grams), all of which had larger impacts on birth weight than did any Hispanic ethnicity.

Separate multiple linear regressions were also developed for each Hispanic group and white non-Hispanics to determine if the same constellation of risk factors affected birth weight in each group. Due to limitations in the sizes of the smaller Hispanic cohorts, comparison of the eight individual regression models did not produce meaningful results.

Multiple logistic regression—low birth weight. Crude odds ratios of low birth weight for each Hispanic group compared with white non-Hispanics are presented in table 5, as well as adjusted odds ratios derived from the multiple logistic regression equation including all of the risk factor variables previously used in the multiple linear regression. Crude odds ratios of low birth weight for Puerto Ricans, Dominicans, and Other Hispanics were significantly elevated compared with white non-Hispanics. Infants of Puerto Rican women were 85 percent more likely than infants of white non-Hispanic mothers to be low birth weight, Dominicans 30 percent more likely, and Other Hispanics 82 percent more likely. After adjusting for other risk factors previously included in the multiple linear regression model, however, none of the adjusted odds ratios for low birth weight for any Hispanic group were significantly elevated compared with white non-Hispanics.

Table 6 presents the adjusted odds ratios for low birth weight for the other risk factors from the multiple logistic regression. After adjusting for all other risk factors, the odds ratios for having a low birth weight infant were elevated for the following risk factors: ages 35 and older, education less than 10th grade, education 10th or 11th grade, not married, presence of maternal medical conditions, smoking fewer than 10 cigarettes daily, smoking 10 or more cigarettes daily, public insurance for prenatal care, presence of congenital anomalies, presence of infant abnormal conditions, infant sex female, and preterm gestational age. The reference categories are all shown in table 6.

Particularly notable are the fact that early gestational age infants were 17 times more likely to be of low birth weight than normal gestational age infants, infants with abnormal conditions were 3.4 times more likely to be low birth weight than infants without abnormal conditions, infants born to women with medical conditions were 2.5 times more likely to be low birth weight than infants born to women without such conditions, and infants born to women who smoke 10 or more cigarettes daily were 2.4 times more likely to be low birth weight than infants born to nonsmoking women. After adjusting for all other risk factors, odds ratios for ages younger than 20, age 20-24, education 13 or more years, parity of 2-3, and parity of 4 or more were significantly lower than the reference categories.

Discussion

The results based on a cohort of 206,973 white non-Hispanic and 19,571 Hispanic single births from 1987 through 1989 to women residing in Massachusetts reinforce the findings of previous research and raise some new and interesting questions.

Three key findings of previous research are substantiated by the Massachusetts results. First, the current data reinforce previous findings of substantial variation associated with ethnicity in the maternal risk profiles of Hispanic women. As in national data, the Massachusetts data indicate that Puerto Ricans tend to have higher percentages of unmarried mothers and teenage mothers and the highest rate of low birth weight compared with other Hispanic ethnic groups (*9*).

Second, as documented in national data, maternal risk profiles and adverse infant outcomes for Hispanic ethnic groups other than Puerto Ricans vary widely. For example, the proportion of low birth weight deliveries for Mexican, South American, and Cuban women is comparable with the rate for white non-Hispanics (*2,9*). Third, the current Massachusetts results indicate that infants of Hispanic women not born on the U.S. mainland tend to have lower rates of low birth weight than mainland-born women in the unadjusted model.

Our Massachusetts results raise some interesting questions. First, the Massachusetts data indicate differential effects of Hispanic ethnicity on birth weight when examined as a continuous variable, on the one hand, and on low birth weight when analyzed as a categorical variable, on the other hand. After adjusting for maternal sociodemographic characteristics, maternal biological characteristics, access to care, and infant characteristics, the multiple regression model demonstrated that Puerto Rican, Dominican, Central American, South American, and Other Hispanic infants have significantly lower mean birth weights than white non-Hispanic infants. However, the adjusted odds ratios from the multiple logistic regression model using low birth weight as a categorical variable show no such significant relationship exists between ethnicity and low birth weight, after adjusting for the same risk factors as in the multiple linear regression model. This may indicate a differential relationship between ethnicity and birth weight and ethnicity and *low birth weight*.

Table 5. Crude and adjusted odds ratios for low birth weight for ethnicity variables in logistic regression, Massachusetts, 1987-89

Race, ethnicity group	Crude odds ratio	95 percent confidence interval	Adjusted odds ratio[1]	95 percent confidence interval
Puerto Rican	1.85	1.72,1.99	1.02	0.91,1.14
Dominican	1.30	1.09,1.54	0.95	0.76,1.18
Central American	1.20	0.96,1.49	0.94	0.71,1.24
South American	0.84	0.64,1.10	0.77	0.55,1.07
Other Hispanic	1.82	1.38,2.41	0.88	0.60,1.30
Mexican	0.98	0.63,1.54	0.97	0.57,1.66
Cuban	0.78	0.42,1.47	0.54	0.25,1.18
White non-Hispanic	1.00	...	1.00	...

[1]Adjusted for age, education, marital status, place of birth, presence of maternal medical risk conditions, parity, smoking, number of prenatal care visits, source of prenatal care payment, presence of congenital anomalies, presence of abnormal conditions, sex of infant, and gestational age.

Empirically, the birth weight distribution for Hispanic groups is different from white non-Hispanic infants, with the means being statistically lower for several ethnic groups. This shift in birth weight distributions may reflect biologically meaningful differences in outcomes, need for services, and access to care. Focusing only on the lowest tail of the distribution—low birth weight—may not be sensitive enough to distinguish important variation between Hispanics and other population groups.

Previous research by Yip and his colleagues has demonstrated a comparable phenomenon in a study of Chinese and white infants born in the United States. The authors point out (*12*)

> . . .among. . .(Chinese and white) infants born in the United States mean birth weight differed significantly. Infants with white parents were 200 grams heavier than infants with Chinese parents...The difference of 200 grams is a relative difference of approximately 6 percent of the total birth weight. Low birth weight rates for the...groups are similar, but the difference is statistically significant.

Second, the Massachusetts data indicate that maternal place of birth is not a statistically signifi-

Table 6. Statisticially significant adjusted odds ratios for low birth weight for logistic regression model, Massachusetts, 1987–89

Variable	Adjusted odds ratio	95 percent confidence interval
Sociodemographic		
Age (years):		
Younger than 20	0.72	0.65,0.80
20–24	0.86	0.80,0.92
25–29[1]	1.00	...
35 and older	1.27	1.16,1.38
Education (grade):		
Less than 10	1.25	1.13,1.38
10–11	1.10	1.01,1.20
12[1]	1.00	...
13 or more	0.78	0.74,0.83
Marital status:		
Married[1]	1.00	...
Not married	1.15	1.07,1.23
Maternal-biological		
Maternal conditions present[2]	2.55	2.42,2.68
Live births:		
1[1]	1.00	...
2–3	0.59	0.56,0.62
4 or more	0.58	0.53,0.65
Smoking:		
None[1]	1.00	...
1–10 cigarettes daily	1.81	1.69,1.93
11 or more daily	2.37	2.20,2.55
Access to care		
Number of prenatal visits:		
None	1.00	...
8[1]	0.47	0.44,0.50
14	0.27	0.24,0.30
Payment source:		
Private[1]	1.00	...
Public, self, no pay	1.12	1.05,1.20
Infant risk factors		
Congenital anomalies[2]	1.54	1.38,1.70
Abnormal conditions[2]	3.44	3.25,3.64
Female infant[3]	1.34	1.28,1.41
Gestational age[4] <37 weeks	16.80	15.94,17.72

[1] Reference category.
[2] Reference category absence of maternal conditions, anomalies, abnormal conditions.
[3] Reference category male infant.
[4] Reference category gestational age older than 36 weeks.

cant risk factor for low birth weight among Hispanics after adjusting for other risk factors. Maternal place of birth has sometimes been used as an item in broader, multi-item acculturation and assimilation indexes and as a proxy for adaptation and acculturation. Previous research has focused on adaptation and acculturation as risk factors for a broad range of health outcomes and health behaviors, including higher rates of low birth weight (*10*), increased lifetime rates of phobia, alcohol use or dependence, and drug use or dependence (*13–15*), increased rates of psychological distress among young adults (*16*), decreased use of health care services (*17–21*), and increased rates of hypertension (*22*).

Our finding that maternal place of birth is not associated with low birth weight or mean birth weight after adjusting for other risk factors does not necessarily contradict earlier research. Rather, the finding may indicate that adaptation and acculturation are multidimensional constructs (*23,24*). Maternal place of birth alone may be an inadequate proxy for this complex phenomenon. Other variables in the model may, in fact, mediate the relationship between maternal place of birth and low birth weight, thus reducing the impact of maternal birth place in the statistical model. Furthermore, the current distribution of birth places for Hispanic subgroups in Massachusetts is skewed with more than 90 percent of Dominican, Central American, and South American births occurring to mothers born outside the U.S. mainland. As more Hispanic mothers are born in the United States, the impact of this variable may change over time (*25*).

Several other methodological issues that may have substantive impact on the findings of this study need to be considered further. First, the interrelationship between birth weight and gestational age poses several analytic problems. Real concerns over collinearity exist when both of these highly correlated variables are included in a linear model. To examine part of this relationship, we performed a variety of sensitivity analyses including eliminating gestational age from the model, using gestational age as the response variable instead of birth weight, and performing all analysis stratified by early and normal gestational age. Basically, the patterns we describe were unaffected by these changes. Further path analysis to separate the impact of these two variables would be useful. Second, the impact of socioeconomic status on the relationship of ethnicity and low birth weight was measured indirectly using two variables, method of payment for prenatal care and maternal education. Even though there was no statistically significant variation in low birth weight among ethnic groups after adjusting for the risk factors in the model, more precise measures of socioeconomic status may clarify the variation in mean birth weight, low birth weight, and risk patterns among diverse ethnic groups. To reduce the impact of differing socioeconomic status in the model, we repeated the analysis restricting the population to women who received publicly financed prenatal care. The results were similar to those we present.

Third, the inverse relationship between women younger than age 20 and low birth weight was unexpected. This finding is consistent, however, with some existing literature (*26*). A finer gradation of age categories to separate the very young mothers would help elucidate the relationship between age and birth weight. Unfortunately, the sample size in this study precluded such analyses. Finally, the heterogeneity among women classified as "other Hispanic" makes it difficult to interpret the findings for those births. Again, a greater number of women in ethnicity groups not frequently found in Massachusetts is needed for further analysis.

In summary, we have begun to unravel the relationship of ethnicity and maternal risk characteristics on birth weight in Massachusetts. Although the birth certificate data used in this study are somewhat limited due to the self-reporting of many medical risk factors and behavioral characteristics, clear patterns of risk and low birth weight emerge within the Hispanic community in Massachusetts. Further analysis with more precise measures of adaptation and acculturation, socioeconomic status, and risk are needed to examine more thoroughly certain hypotheses. More births in ethnic subgroups of interest, as well as more refined analytic techniques may help us better understand these problems and design specific, targeted programs to reduce low birth weight for the populations most in need.

References

1. Becerra, J. E., Hogue, C. J. R., Atrash, H. K, and Perez, N.: Infant mortality among Hispanics: a portrait of heterogeneity. JAMA 265: 217-221, Jan. 9, 1991.
2. Kleinman, J. C.: Infant mortality among racial/ethnic minority groups, 1983-1984. MMWR 39 (SS-3): 31-39, July 1990.
3. Ventura, S. J.: Births of hispanic parentage, 1985. Monthly Vital Statistics Rep [36] No. 11 (supp). DHHS publication No. (PHS) 88-1120. National Center for Health Statistics, Hyattsville, MD, 1988.
4. Dowling, P. T., and Fisher, M.: Maternal factors and low birth weight infants: a comparison of blacks with Mexican Americans. J Fam Pract 25: 153-158 (1987).
5. Levin, J. S., and Markides, K. S.: Socioeconomic status and infant mortality among Hispanics in a southwestern city. Soc Bio 32: 61-64 (1985).
6. Shiono, P. H., et al.: Birth weight among women of different ethnic groups. JAMA 255: 48-52, Jan. 3, 1986.
7. Williams, R. L., Binkin, N. J., and Clingman, E. J.: Pregnancy outcomes among Spanish-surname women in California. Am J Public Health 76: 387-391 (1986).
8. Bureau of Maternal Services and Family Planning: Childbearing patterns among Puerto Rican Hispanics in New York City and Puerto Rico. MMWR 36: 34, 39-41, Jan. 30, 1987.
9. Ventura, S. J., and Taffel, S. M.: Childbearing characteristics of U.S.- and foreign-born Hispanic mothers. Public Health Rep 100: 647-652 November-December 1985.
10. Scribner, R., and Dwyer, J. H.: Acculturation and low birth weight among Latinos in the Hispanic HANES. Am J Public Health 79: 1263-1267 (1989).
11. Balcazar, H., Cole, G., and Hartner, J.: Mexican-Americans' use of prenatal care and its relationship to maternal risk factors and pregnancy outcome. Am J Prev Med 8: 1-7 (1992).
12. Yip, R., Li, Z., and Chong, W. H.: Race and birthweight: the Chinese example. Pediatrics 87: 688-693 (1991).
13. Amaro, H., Whitaker, R., Coffman, G., and Heeren, T.: Acculturation and marijuana and cocaine use: findings from HHANES 1982-84. Am J Public Health 80: 54-60 (1990).
14. Burnam, M. A., et al.: Acculturation and lifetime prevalence of psychiatric disorders among Mexican Americans in Los Angeles. J Health Soc Behav 28: 89-102 (1987).
15. Marks, G., Garcia, M., and Solis, J. M.: Health risk behaviors of Hispanics in the United States: findings from HHANES, 1982-84. Am J Public Health 80 (supp): 20-26 (1990).
16. Kaplan, M. A., and Marks, G.: Adverse effects of acculturation: psychological distress among Mexican American young adults. Soc Sci Med 31: 1313-1319 (1990).
17. Chesney, A. P., Chavira, J. A., Hall, R. P., and Gary, H. E.: Barriers to medical care of Mexican-Americans: the role of social class, acculturation, and social isolation. Med Care 20: 883-891 (1982).
18. Estrada, A. L., Trevino, F. M., and Ray, L. A.: Health care utilization barriers among Mexican Americans: evidence from HHANES 1982-84. Am J Public Health 80 (supp): 27-31 (1990).
19. Markides, K. S., Levin, J. S., and Ray, L. A.: Determinants of physician utilization among Mexican-Americans: a three-generations study. Med Care 23: 236-246 (1985).
20. Solis, J. M., Marks, G., Garcia, M., and Shelton, D.: Acculturation, access to care, and use of preventive services by Hispanics: findings from HHANES 1982-84. Am J Public Health 80 (supp): 11-19 (1990).
21. Wells, K. B., et al.: Which Mexican-Americans underutilize health services? Am J Psychiatry 144: 918-922 (1987).
22. Espino, D. V., and Maldonado, D.: Hypertension and acculturation in elderly Mexican Americans: results from 1982-84 Hispanic HANES. J Gerontol 45: M209-M213 (1990).
23. Mendoza, R. H.: Acculturation and sociocultural variability. *In* Chicano psychology, edited by J. L. Martinez and R. H. Mendoza. Academic Press, Inc., Orlando, FL, 1984, pp. 61-75.
24. Szapocznik, J., Scopetta, M. A., and Kurtines, W.: Theory and measurement of acculturation. Interamerican J Psychol 12: 113-130 (1978).
25. Kumanyika, S. K., and Golden, P. M.: Cross-sectional differences in health status in U.S. racial/ethnic minority groups: potential influence of temporal changes, disease, and life-style transitions. Ethnic Dis 1: 50-59 (1991).
26. Geronimus, A. T.: On teenage childbearing and neonatal mortality in the United States. Pop and Development Rev 13: 245-279 (1987).