The Relationship of Neighborhood Socioeconomic Characteristics to Birthweight Among 5 Ethnic Groups in California

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Objectives. This study sought to examine relationships between neighborhood socioeconomic characteristics and birthweight, accounting for individual socioeconomic characteristics, among 5 ethnic groups.

Methods. Birth records were linked to census block-group data for 22 304 women delivering infants at 18 California hospitals during 1994–1995. Information on income and additional factors was obtained from a surveyed subset of 8457 women. Neighborhood levels of poverty, unemployment, and education were examined.

Results. After adjustment for mothers' individual socioeconomic characteristics and other risk factors, less-favorable neighborhood socioeconomic characteristics were associated with lower birthweight among Blacks and Asians. No consistent relationship between neighborhood socioeconomic characteristics and birthweight was found among Whites, US-born Latinas, or foreign-born Latinas overall, but birthweight increased with less-favorable neighborhood socioeconomic characteristics among foreign-born Latinas in high-poverty or high-unemployment neighborhoods. These findings were not explained by measured behavioral or cultural factors.

Conclusions. In addition to individual socioeconomic characteristics, living in neighborhoods that are less socioeconomically advantaged may differentially influence birthweight, depending on women's ethnicity and nativity. (*Am J Public Health.* 2001;91:1808–1814)

The association between lower socioeconomic status (SES) and poor birth outcomes has been well documented in the United States.[1–5] In recent years, several studies, after accounting for the personal socioeconomic characteristics of mothers, have reported an association between measures of neighborhood socioeconomic deprivation and poor birth outcomes.[6–12] These studies support a growing literature demonstrating increased risks of adult mortality,[8,13–16] long-term illness,[17] self-rated health,[18] cardiovascular disease,[19] and smoking[20] associated with poorer socioeconomic conditions of neighborhoods. Such studies highlight the importance of the social environment, in addition to individual socioeconomic standing, in shaping individual behaviors and health outcomes.[21–23]

Although some studies have shown that neighborhood effects on adult health vary by the individual's age, sex, and ethnicity,[22,23] ethnicity-specific findings with respect to birth outcomes have been reported in only 1 study. That study found that the risk of low birthweight was lower among children born to White women and US-born Black women living in middle- or high-income census tracts in New York City, relative to those living in low-income tracts, although the trend was reversed among foreign-born Blacks.[11] The only study of birthweight that included ethnic groups other than Whites and Blacks did not present ethnic-specific results.[6] Among US-born, but not foreign-born, Mexican American mothers, those living in poor census tracts in Chicago had an increased risk of delivering low-birthweight infants compared with those living in less-poor tracts; however, that study did not adjust for the mothers' socioeconomic characteristics.[24] No study adjusted for the mothers' personal or family income, leaving open the possibility that unmeasured socioeconomic characteristics of mothers might account for the observed associations.

In this study, we explored the relationship between selected neighborhood socioeconomic factors and birthweight among women delivering in California. The sample included sufficient numbers of Asians and Latinas as well as Blacks and Whites for subgroup analyses. We hypothesized that the magnitude of association between neighborhood socioeconomic factors and birthweight would vary by ethnicity, as in studies of individual-level socioeconomic measures.[1,25] Information was available on Medi-Cal (California Medicaid) coverage and educational attainment; a large subsample also provided information on family income, which was adjusted for family size, and other risk factors.

METHODS

Data Sources

Subjects were women delivering live infants at 18 public and private hospitals in California selected for a statewide representative postpartum survey on access to maternity care.[26,27] Eligible hospitals were randomly selected within strata defined by geographic region, proportion of deliveries to Black women, and prevalence of private health insurance. An additional hospital that participated in the survey was excluded from this analysis, because birth certificates in that hospital's county were unavailable for geocoding.

We obtained birth certificate data for all deliveries occurring at the 18 hospitals during the interview phase of the study (August 1994 to July 1995). Of these 23 922 birth certificates, 94.3% were geocoded and subsequently linked to information from the 1990 Census of Population and Housing corresponding to census tract and block-group areas. Excluding women with multiple births (229) and those whose children's birth certificates had geocodes that lacked valid census data (18), the final overall sample (hereafter referred to as the "overall

sample") for this analysis was 22 304 women.

Of this overall sample, a subset of 8457 women had participated in the face-to-face survey in English or Spanish during their postpartum stays and had records that could be linked with census data (hereafter referred to as the "survey subsample"). Compared with the overall sample, the subsample underrepresented mothers younger than 18 years and foreign-born Asian mothers, consistent with age and language inclusion criteria.

Variable Definitions

The main outcome for this study was infant birthweight, as recorded on birth certificates. We studied birthweight as a continuous variable because maternal education has been associated with birthweight along the entire birthweight continuum.[3] Use of birthweight as a continuous outcome also improves statistical power.[28] We also dichotomized birthweight, with weights of less than 2500 g representing low birthweight.

We used census data at the tract and block-group levels to characterize neighborhood socioeconomic conditions. Block groups typically include 1000 residents; tracts include 2500 to 8000 residents. Census variables included poverty (percentage of residents whose family income was below the federal poverty level); unemployment (percentage of males 16 years or older who were unemployed); and low education (percentage of adults 25 years or older with less than a high school education). We present results for measures at the level of block groups (referred to as "neighborhoods"); tract-level results were very similar and are available on request.

Individual or family socioeconomic measures included the mother's educational attainment; Medi-Cal coverage during pregnancy; and family income, adjusted for family size. Information on years of education was obtained from birth certificates and modeled as a continuous variable. Self-reported information on family income as a percentage of poverty level was available for the survey subsample only and was treated as a continuous variable. We assessed family income during the 12 months before the interview by using income categories that were specific to family size. Each income category consisted of a range of incomes that represented 50% increments of the federal poverty level in 1994 (e.g., 0%–50%, 51%–100%). Less than 5% of women in the survey subsample were missing income information. For the overall sample, Medi-Cal coverage during pregnancy, as reported on birth certificates, was used as a measure of income. With rare exceptions, women with Medi-Cal have incomes at or below 200% of the poverty level; however, one third of women in the postpartum survey with family incomes at or below 200% of the poverty level were privately insured.[27] Birth certificate reporting of Medi-Cal coverage has been shown to be very reliable.[26]

The mother's self-identified ethnicity and birthplace were defined according to survey responses for the survey subsample and according to birth certificates for the overall sample; agreement between these 2 sources is excellent.[29] Latinas were further grouped by nativity as foreign-born or US-born, because the 2 groups showed distinct relationships between socioeconomic measures and birthweight in preliminary analyses. We also studied foreign-born Asians separately. Subgroup numbers were insufficient, however, to stratify by nativity status among Blacks and Whites (in the overall sample, 78% of Latinas, 10% of Whites, 7% of Blacks, and 87% of Asians were foreign born).

Potential explanatory factors for associations between neighborhood-level socioeconomic conditions and birthweight include the mother's age, parity, and receipt of first-trimester prenatal care, which were described on birth certificates for all study subjects. In addition, survey participants reported self-perceived health status before the pregnancy. Among women born outside the United States, 2 measures of acculturation were used: the number of years respondents had lived in the United States and speaking a language other than English at home. Women in the survey subsample with family incomes less than 400% of the poverty level also reported whether they smoked during pregnancy, felt their neighborhood was unsafe, or lacked a supportive person to turn to during pregnancy.

Statistical Analyses

To minimize the contribution of individual-level socioeconomic factors in estimates of neighborhood-level associations, we used linear regression models that adjusted for the mother's education and family income or Medi-Cal status to examine the impact of neighborhood factors within each ethnic group. Preliminary analyses suggested nonlinear relationships between income and birthweight among Whites, Asians, and foreign-born Latinas; therefore, we included quadratic and cubic terms for income in the models for more complete adjustment of income–birthweight relationships. We also used quadratic and cubic terms to investigate nonlinear relationships between neighborhood characteristics and birthweight. We use tables to present linear coefficients for neighborhood characteristics; we use figures to represent nonlinear models.

We used linear and logistic regression that incorporated generalized estimating equations to account for within-hospital correlation. Although correlation among study subjects may result from inclusion of neighborhood-level variables in regression models,[30] the majority of block groups we analyzed contained only 1 study participant, and there was no evidence that the independence assumption of ordinary least squares regression was violated by inclusion of block-group–level variables.

RESULTS

Table 1 presents maternal, infant, and neighborhood characteristics for the overall sample and additional factors for the surveyed subsample, stratified by maternal ethnicity. White women lived in neighborhoods with less poverty, lower concentrations of residents with low education, and lower male unemployment rates than Blacks and Latinas. Foreign-born Latinas lived in neighborhoods with the highest concentration of residents with low education, but similarly high concentrations of poverty and unemployment were observed among neighborhoods of Black women. The correlation coefficients for neighborhood-level factors ranged from 0.5 for education and unemployment to 0.7 for education and poverty.

TABLE 1—Characteristics of Overall Sample and Surveyed Subsample of Women Delivering at 18 Hospitals, by Ethnicity: California, 1994–1995

	All Women, % (N = 22 304)	White, % (n = 5666)	Black, % (n = 2390)	Foreign-Born Latinas, % (n = 9097)	US-Born Latinas, % (n = 2592)	Asians, % (n = 2226)
Individual-level characteristics of overall sample						
Age, y						
<18	6	3	9	5	14	2
18–19	8	5	12	8	15	3
20–34	75	76	68	79	64	75
≥35	12	16	10	9	7	20
Mother's education						
<High school	39	10	19	70	36	13
High school completed	30	36	44	20	39	28
>High school	31	54	38	10	25	59
Medi-Cal coverage	47	18	42	71	45	27
Parity						
1	40	43	43	34	47	46
2–4	55	54	51	59	48	50
≥4	6	3	6	7	5	4
Received 1st trimester prenatal care	77	86	80	70	75	83
Infant birthweight, g (mean)	3380	3498	3184	3395	3369	3239
Low birthweight (<2500 g)	6	4	11	4	6	7
Neighborhood[a] characteristics of overall sample						
>25% of residents were poor	21	4	33	32	21	10
>8% of adult men were unemployed	29	11	40	39	32	15
>40% of adults had less than high school education	37	5	34	62	40	14
Survey subsample characteristics		(n = 2005)	(n = 907)	(n = 3832)	(n = 950)	(n = 653)
Family income, % of poverty level						
≤100		19	54	71	50	18
101–200		18	17	21	22	18
201–400		37	21	7	21	35
>400		26	7	1	6	29
Self-rated prepregnancy health was fair or poor		6	13	18	18	9
Felt neighborhood was unsafe[b]		11	14	11	12	9
Had no supportive person[b]		3	4	5	3	4
Smoked during pregnancy[b]		23	17	4	10	6

Note. Characteristics are expressed as percentages, except for mean birthweight. Data are from birth records with linked census data of 22 304 women who delivered in 18 California hospitals chosen for a statewide postpartum survey between August 1994 and July 1995. Subsample data are from interview data from subsample of 8457 women whose records were linked with birth records and census data; differences between overall sample and survey subsample are noted in text.
[a]Census block group.
[b]Variable available for women in survey subsample with household income ≤400% poverty level.

The individual- and neighborhood-level characteristics of the survey subsample were generally similar to those of the overall sample, except for expected differences deriving from the survey's exclusion of very young teens. There were fewer mothers with less than a high school education and fewer primiparous women in the survey subsample than in the overall sample.

Coefficients for neighborhood-level factors in Table 2 represent the average change in birthweight (in grams) associated with 10% increments of neighborhood-level variables, after adjustment for Medi-Cal and mother's education. These results for neighborhood and individual-level measures differed little from unadjusted results. Overall, increasing neighborhood poverty and unemployment were associated with decreasing birthweight. When stratified by ethnicity and birthplace, neighborhood socioeconomic characteristics were related to decreasing birthweight among Blacks and Asians only (Figure 1). For example, among Black women, living in block groups where 20% of males were unemployed was associated with smaller birthweight—on the order of 62 g—compared with

TABLE 2—Change in Birthweight Associated With Mother's Individual and Neighborhood Socioeconomic Characteristics, by Ethnicity, Among 22 304 Women Delivering at 18 Hospitals: California, 1994–1995

	Overall (n = 22 304) Coef (SE)	White (n = 5666) Coef (SE)	Black (n = 2388) Coef (SE)	Foreign-born Latina (n = 9097) Coef (SE)	US-Born Latina (n = 2592) Coef (SE)	Asian (n = 2226) Coef (SE)
Model 1						
Neighborhood poverty	−12** (4)	−5 (13)	−24 (13)	5[a] (3)	2 (13)	−18 (16)
Mother's education	−5 (3)	14** (4)	34** (6)	−2 (1)	7 (7)	0 (4)
Medi-Cal coverage	−45* (19)	−50 (36)	−31 (18)	−20 (22)	−63 (37)	−64** (20)
Model 2						
Neighborhood unemployment	−23* (11)	20 (18)	−62* (31)	24*[a] (11)	−33 (33)	−82 (45)
Mother's education	−5 (3)	15** (4)	34** (6)	−2 (1)	5 (7)	0 (4)
Medi-Cal coverage	−47* (19)	−53 (36)	−43** (13)	−21 (22)	−59 (36)	−60** (20)
Model 3						
Low neighborhood education	−3 (3)	4 (8)	−24** (8)	0 (4)	−6 (6)	−19** (7)
Mother's education	−5* (2)	15** (4)	33** (7)	−2 (1)	5 (7)	−2 (4)
Medi-Cal coverage	−47* (19)	−53 (36)	−20 (21)	−20 (22)	−58 (37)	−60** (20)

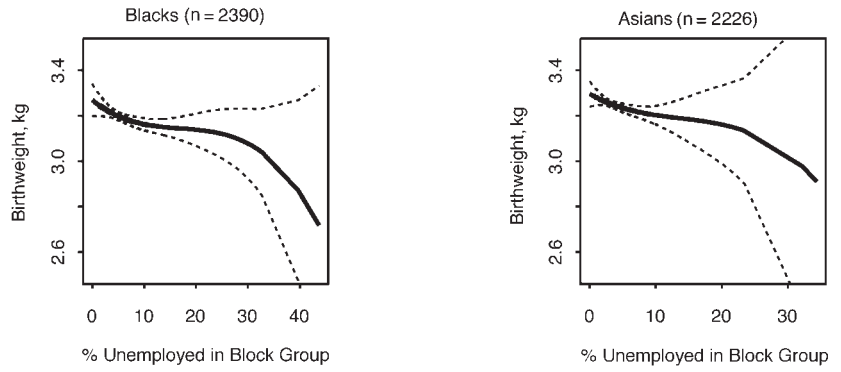
Note. Coefficient (coef) represents average increase or decrease in birthweight (g) associated with a 10-percentage-point increase in the specified neighborhood (census block group) characteristic (e.g., from 10% to 20% of neighborhood residents with income below poverty level). Coefficients and standard errors are from separate linear regression models of birthweight that used generalized estimating equations to account for hospital clustering. All models include mother's education and Medi-Cal coverage.
[a]Nonlinear relationships with birthweight were found for these neighborhood variables; see Figure 2.
*P < .05; **P < .01.

living in block groups with 10% male unemployment. When the analysis was limited to foreign-born Asians, the negative associations between birthweight and neighborhood unemployment and education were similar in magnitude to those among Asians overall and remained statistically significant after all adjustments.

The linear estimates for foreign-born Latinas presented in Table 2 mask nonlinear associations between neighborhood-level measures and birthweight among foreign-born Latinas (Figure 2). Block-group poverty and unemployment were unrelated to birthweight at low concentrations (<25% of persons with household incomes below the poverty level or <8% unemployment). At levels of neighborhood poverty above 25% and unemployment above 8%, however, birthweight unexpectedly increased linearly with increasing poverty (β = 40, SE = 11, P < .01) and unemployment (β = 87, SE = 19, P < .01), after adjustment for education and Medi-Cal.

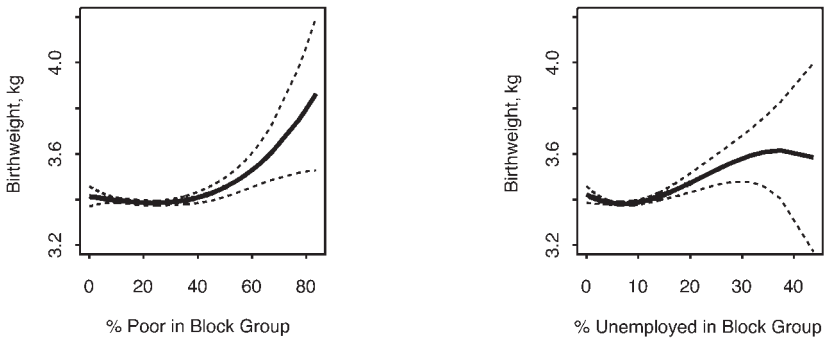
Similar results for the survey subsample, adjusted for individual-level income, are presented in Table 3. Among Blacks and Asians, lower birthweights were associated with increasing unemployment but not with other neighborhood measures. As observed in the overall sample, birthweights were unexpectedly higher among foreign-born Latinas living in neighborhoods with high concentrations of poverty or unemployment. Foreign-born Latinas in the subsample with higher education levels and those with family income less than 200% of the poverty level also delivered babies with lower birthweights.

Further adjustments for mothers' age, parity, and timing of prenatal care initiation had little effect on the results presented in Tables



Note. Neighborhood unemployment modeled with quadratic and cubic terms. Data are from birth records with linked census data of women who delivered in 18 California hospitals chosen for a statewide postpartum survey between August 1994 and July 1995. Dotted lines represent 95% confidence bounds, including indicator variables for hospitals to reflect hospital sampling.

FIGURE 1—Relationship of birthweight to neighborhood unemployment among Blacks and Asians in the overall sample, after adjustment for Medi-Cal and mother's education.



Note. Neighborhood poverty and unemployment modeled with quadratic and cubic terms. Data are from birth records with linked census data of 9097 Latinas born outside the United States who delivered in 18 California hospitals chosen for a statewide postpartum survey between August 1994 and July 1995. Dotted lines represent 95% confidence bounds, including indicator variables for hospitals to reflect hospital sampling.

FIGURE 2—Relationship of birthweight to neighborhood poverty and unemployment among foreign-born Latinas in overall sample, after adjustment for Medi-Cal and mother's education.

2 and 3. Among Black women in the subsample with a full range of interview data, adjustment for income, education, age, timely prenatal care, fair or poor prepregnancy health, having a supportive person, living in a perceived unsafe neighborhood, parity, and smoking did not diminish the negative association between unemployment level and birthweight (β=−88, SE=38, $P<.05$ vs β=−86 in the income- and education-adjusted model for the same subset). For foreign-born Latinas, adjustment for acculturation in addition to the foregoing factors did not appreciably affect the positive linear association between birthweight and increasing poverty or unemployment at higher concentrations of these neighborhood factors. The association between increasing neighborhood unemployment and lower mean birthweight among foreign-born Asians remained after adjustment for acculturation and the foregoing factors (β=−131, SE=63, $P<.05$).

Results of logistic models predicting low birthweight mirror those for continuous birthweight. After adjustment for all factors among Asians in the overall sample, the odds ratio (OR) for low birthweight associated with a 10% increment in neighborhood unemployment was 1.8 (95% confidence interval [CI] 1.0, 2.8; $P<.05$). The risk of low birthweight increased for Blacks living in neighborhoods with higher unemployment, but the odds ratio was statistically significant

TABLE 3—Change in Birthweight Associated With Mother's Individual and Neighborhood Socioeconomic Characteristics, by Ethnicity, Among the Survey Subsample of 8457 Women Delivering at 18 Hospitals: California, 1994–1995

	White (n = 2005) Coef (SE)	Black (n = 907) Coef (SE)	Foreign-Born Latina (n = 3832) Coef (SE)	US-Born Latina (n = 950) Coef (SE)	Asian (n = 653) Coef (SE)
Model 1					
Neighborhood poverty	–1 (16)	–28 (20)	17** (7)	1 (15)	–56 (38)
Mother's education	11 (7)	–7 (14)	–11** (3)	8 (13)	–12 (12)
Household income[a]	↑ up to 400% poverty level	↑ up to 200% poverty level	↑ up to 200% poverty level**	Slight ↑ up to 200% poverty level	↑ up to 300% poverty level, then ↓**
Model 2					
Neighborhood unemployment	72 (38)	–104** (41)	32 (22)	–2 (45)	–163* (83)
Mother's education	12 (7)	–8 (14)	–11** (2)	8 (14)	–13 (12)
Household income[a]	↑ up to 400% poverty level	↑ up to 200% poverty level*	↑ up to 200% poverty level**	Slight ↑ up to 200% poverty level	↑ up to 300% poverty level, then ↓**
Model 3					
Low neighborhood education	7 (10)	–24 (12)	0 (4)	8 (8)	–25 (16)
Mother's education	12 (7)	–7 (15)	–12** (3)	8 (14)	–13 (13)
Household income[a]	↑ up to 400% poverty level	↑ up to 200% poverty level	↑ up to 200% poverty level**	Slight ↑ up to 200% poverty level	↑ up to 350% poverty level, then ↓**

Note. Coefficient (coef) represents average increase or decrease in birthweight (g) associated with a 10-percentage-point increase in the specified neighborhood (census block group) characteristic (e.g., from 10% to 20% of neighborhood residents with income below poverty level). Coefficients and standard errors are from separate linear regression models of birthweight that used generalized estimating equations to account for hospital clustering. All models include mother's education and family income.

[a]Nonlinear relationships between family income as percentage of poverty and birthweight were modeled with quadratic and cubic terms. The ↑ and ↓ symbols describe direction of birthweight curve as income increases, after adjustment for mother's education and neighborhood characteristic (e.g., ↑ indicates that birthweight increases with increasing income).

*$P<.05$; **$P<.01$.

only among the survey subsample (OR=1.8, 95% CI=1.3, 2.4; $P<.05$ for subsample; OR=1.3, 95% CI=0.9, 1.7; $P=.13$ overall). For foreign-born Latinas, the risk of low birthweight decreased at high levels of neighborhood unemployment. The positive association between increasing neighborhood unemployment and risk of low birthweight remained strong among Blacks and Asians in the survey subsample after adjustment for potential explanatory factors.

DISCUSSION

This study indicates that the nature of the relationship between neighborhood socioeconomic characteristics and birthweights of infants born to California residents varies greatly, depending on the ethnicity of the mother and the area-level characteristic considered. Among White women and US-born Latinas, the neighborhood socioeconomic characteristics we examined generally were unrelated to birthweight; among Asians and Blacks, birthweight declined in a linear fashion with lower neighborhood SES, as measured by higher unemployment levels. Paradoxically, among foreign-born Latinas, living in the neighborhoods with the highest rates of poverty and unemployment was associated with higher mean birthweights and lower risk of low birthweight. Adjustment for family income and other individual-level factors available for the surveyed subsample did not account for the observed associations of neighborhood SES with mean birthweight or risk of low birthweight.

Previous studies have observed lower birthweights with greater neighborhood socioeconomic disadvantage, as well as lower personal SES[6–8,11]; only 1 study reported findings by ethnicity, however.[11] Unlike that study, ours did not find a neighborhood association with birthweight among Whites. This study is the first to report specifically on the nature of the relationship between socioeconomic characteristics measured at individual and neighborhood levels and birthweight among Asians and Latinas, among whom nativity status appears to play an important role.

Neighborhood-level characteristics measure a dimension of socioeconomic conditions that may not be captured by individual-level measures such as income or education. Among all ethnic groups, neighborhood-level results were largely unaffected by inclusion of individual-level socioeconomic measures, and vice versa. Thus, it is likely that both community and individual pathways link socioeconomic conditions to birth outcomes. To some degree, these census-derived variables serve as surrogate measures for aspects of the social, service, and physical environments on which we might intervene,[31] such as community support for health-promoting behaviors or access to health care or nutritious foods. Community joblessness itself may be a strong indicator of neighborhood deterioration, as well as a key contributor to problems of social organization and isolation that can shape individual habits and behaviors.[32]

These findings also suggest that the meaning of aggregate measures may vary with ethnicity and nativity. Wilson has observed that Blacks living in poor, inner-city neighborhoods are more likely to suffer discrimination and are more sensitive to exploitation than Mexican American immigrants who have come from areas of intense poverty. In addition, poor neighborhoods dominated by Mexican Americans tend to have more businesses and services.[32] Kinship ties within the community are an important support for Mexican Americans,[33] and these local kin networks may be stronger in poorer communities. Studies that seek to adjust for socioeconomic influences by using neighborhood measures should consider ethnic groups separately.

Neighborhood-level associations observed after adjustment for measured individual socioeconomic factors may reflect unmeasured socioeconomic influences at the individual level.[22,23] Recent family income, along with education and Medi-Cal coverage, may not adequately represent accumulated economic assets and socioeconomic conditions experienced early in life, which could have important health effects. To the extent that personal income and education result from socioeconomic conditions of neighborhoods, however,[34] adjustment for individual-level socioeconomic factors may remove part of the neighborhood effect. Therefore, the estimate of neighborhood-level effects may be conservative.

Low rates of low birthweight among Latina mothers in the United States in spite of low education levels and underutilization of prenatal care have been described as an epidemiologic paradox.[35] Foreign-born Mexican Americans have lower rates of low birthweight than US-born Mexican Americans.[24,36,37] In addition, having a US cultural orientation (defined by language preference, ethnic identification, and birthplace) has been associated with an increased risk of low birthweight relative to having a Mexican cultural orientation,[38] although speaking only Spanish vs English has been associated with increased risk for preterm birth among Mexico-born women in California.[39] In the present sample of foreign-born Latinas, language spoken at home was not associated with birthweight; although time lived in the United States was associated with increasing birthweight in unadjusted analyses, this relationship was explained entirely by family income and parity. Acculturation did not appear to explain neighborhood-level findings among foreign-born Latinas.

Dietary factors were not measured in this study, but they provide another potential explanation for the paradoxical findings among foreign-born Latinas. The diets of Latinas born in Mexico are higher in calcium, folate, protein, vitamin A, and ascorbic acid than those of US-born Latinas.[40] Among Mexican Americans, diets characterized as nutrient rich and protein dense are related to increased birthweight, whereas diets that are high in fat, sugars, and cereals are associated with lower birthweight.[41] To the extent that Latinas living in the poorest neighborhoods adhere to traditional diets, poor neighborhoods may be associated with higher birthweight.

The consistency of neighborhood-level socioeconomic differences in birth outcomes suggests a small but real effect among certain ethnic groups that is not explained by several known risk factors. Our findings suggest that regardless of individual financial resources, living in a community with high levels of poverty or unemployment can result in lower-birthweight infants for Black and Asian women. For these groups, neighborhood influences may compound individual socioeconomic disadvantages. In contrast, foreign-born Latinas appear to have more favorable birth-

weights in the most socioeconomically deprived neighborhoods. Searching for protective factors among those communities may strengthen our understanding of the factors that determine birthweight and aid in the development of policies and interventions to improve birthweight and birth outcomes generally. ■

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This article was accepted July 5, 2001.

Contributors

Michelle Pearl conceptualized and conducted the analysis and wrote the paper. Paula Braveman designed and directed the maternity care survey and contributed to the writing of the paper. Barbara Abrams contributed to the analytic plan and interpretation of results.

Acknowledgments

This work was supported in part by the Maternal and Child Health Bureau (grant MCJ-067951). We wish to thank Steve Selvin, PhD, and John Neuhaus, PhD, for statistical guidance and Jeff Gould, MD, for analytic suggestions in preliminary analyses. We also wish to acknowledge Kristen Marchi, MPH, and Susan Egerter, PhD, who played major roles in designing, conducting, and analyzing the maternity care survey.

Approvals for these analyses were obtained from institutional review boards of the University of California, San Francisco and Berkeley, and the California Department of Health Services.

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