Beyond the Cross-Sectional: Neighborhood Poverty Histories and Preterm Birth

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Objectives. We examined associations between longitudinal neighborhood poverty trajectories and preterm birth (PTB).

Methods. Using data from the Neighborhood Change Database (1970–2000) and the American Community Survey (2005–2009), we categorized longitudinal trajectories of poverty for California neighborhoods (i.e., census tracts). Birth data included 23 291 singleton California births from the Maternal and Infant Health Assessment (2003–2009). We estimated associations (adjusted for individual-level covariates) between PTB and longitudinal poverty trajectories and compared these to associations using traditional, cross-sectional measures of poverty.

Results. Compared to neighborhoods with long-term low poverty, those with long-term high poverty and those that experienced increasing poverty early in the study period had 41% and 37% increased odds of PTB (95% confidence interval [CI] = 1.18, 1.69 and 1.09, 1.72, respectively). High (compared with low) cross-sectional neighborhood poverty was not associated with PTB (odds ratio = 1.08; 95% CI = 0.91, 1.28).

Conclusions. Neighborhood poverty histories may contribute to an understanding of perinatal health and should be considered in future research. (*Am J Public Health.* 2015;105:1174–1180. doi:10.2105/AJPH.2014.302441)

Compared with infants born full-term, those born preterm are at increased risk for neonatal and infant mortality, as well as respiratory, intestinal, immune, neurological, cardiovascular, hearing, and vision problems that can appear in childhood and adulthood.[1–4] Despite decades of research on the determinants of preterm birth (PTB), its causes remain poorly understood and little progress in prevention has been made. Individual factors such as maternal age, current income, education, and health behaviors do not fully account for the high prevalence of PTB (12% of US live births in 2010),[5,6] raising questions about whether broader contextual factors, such as an individual's neighborhood environment, may also influence birth outcomes.[7,8] Many studies have found relationships between neighborhood characteristics and birth outcomes, even after adjustment for individual-level factors.[7,8] Hypothesized mechanisms through which neighborhood environments may influence birth outcomes include social factors (e.g., social organization and norms, crime, racial segregation, and residential stability), availability of resources (e.g., health care, food, tobacco and alcohol, quality education, recreational activities, and police protection), and physical attributes (e.g., exposure to pollution, toxins, and noise; exposure to advertising; and housing conditions).[7]

Adverse neighborhood environments (i.e., those characterized by attributes such as high crime, limited access to resources, and poor housing conditions) are generally closely aligned with socioeconomic disadvantage, which many studies use as an indicator of a potentially health-damaging neighborhood environment. A growing body of literature demonstrates that low neighborhood socioeconomic status (SES) is associated with increased odds of PTB.[9–12] These studies—as well as most studies examining associations between neighborhood characteristics and health—have typically used measures of neighborhood disadvantage from 1 point in time (usually the most recent US Census or inter-Census estimates).

These cross-sectional measures, however, fail to reflect the fact that neighborhood environments are formed over decades as a result of dynamic economic, social, and political forces.[13] For example, neighborhoods that have experienced decades of socioeconomic disadvantage may differ from neighborhoods that have experienced more recent socioeconomic decline with respect to the social factors, availability of resources, and physical attributes that may influence birth outcomes. Compared with shorter-term socioeconomic disadvantage, long-term disadvantage may be correlated with a greater lack of infrastructure, more racial segregation, or higher crime, factors associated with poor birth outcomes.[14–16] Similarly, neighborhoods with a history of socioeconomic advantage will likely differ from those that have only recently experienced economic growth. Neighborhood economic improvement may lead to increased private and public investment, perceived safety, and access to resources such as health care and healthy food,[17,18] but it may also act as a stressor for families struggling to cope with rising rents and property taxes, and incoming residents may be less invested in the social structure of the neighborhood.[19]

To date, little research has attempted to measure the long-term socioeconomic characteristics of neighborhoods and link them with health outcomes. We aimed to (1) describe longitudinal trajectories of neighborhood poverty using neighborhood-level data from 1970 to 2009 and (2) compare associations between longitudinal and cross-sectional measures of neighborhood poverty and PTB in a statewide survey of postpartum women.

METHODS

We analyzed data from the 2003 to 2009 Maternal and Infant Health Assessment (MIHA) in California. The MIHA is an annual, statewide-representative mail and telephone survey that collects health-related information from postpartum women who gave birth to a live infant during the index year. Overall response rates ranged from 70% to 74%

during the period 2003 to 2009. We linked the MIHA data (described in detail elsewhere[20]) with birth certificate information and weighted them to reflect the sampling design and to be representative of all women delivering an infant in California in the index year.

Following methodologies from previous work,[21,22] we used census tracts as approximations of neighborhoods. We used census-tract poverty rates (i.e., percentage of persons below 100% of the federal poverty level [FPL]) as an indicator of SES. Neighborhood poverty data for the years 1970 through 2000 came from the Neighborhood Change Database, published by Geolytics Inc, in cooperation with the Urban Institute[23] and data for the final time period came from the American Community Survey (2005–2009. All data in the Neighborhood Change Database are from the US Bureau of the Census (1970, 1980, 1990, and 2000 decennial censuses), and because the geographic tract boundaries change over time, the data were recalculated and weighted to correspond to census 2000 boundaries so that data represent the same geographic areas over time.[23] The American Community Survey is an ongoing annual survey conducted by the US Census that collects data similar to that obtained in the decennial census; we used data combined across the years 2005 through 2009, which provides information at the census-tract level (also based on 2000 census tract boundaries).

We linked MIHA data to census tracts on the basis of addresses in birth certificate data. The analytic sample included singleton births to women whose addresses were accurately geocoded to the census-tract level (23 291 of 23 968 total singleton births, or 97.2%) by the geocoder (Mapping Analytics; http://www.mappinganalytics.com). For example, post office boxes, which can only be geocoded to the zip code level, were excluded. These mothers lived in 6141 census tracts in California (out of a total of 7049), with an average of 3.8 mothers per tract (range = 1–42). Approximately 79% of the census tracts had 5 or fewer sampled mothers per tract, indicating little clustering by tract.

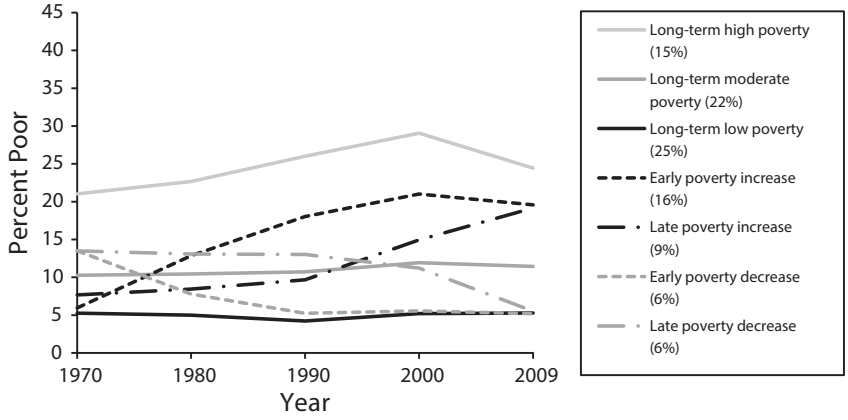
Individual Measures

Our primary outcome variable was PTB, based on the birth certificate estimate of gestational age (calculated from last menstrual period to delivery date), and defined as fewer than 37 weeks of completed gestation. Other individual measures included continuous maternal age at delivery, marital status (unmarried vs married [reference]), parity (first birth [reference], 2–4 births, ≥ 5 births), and race/ethnicity–nativity (based on birth certificate data and categorized into 5 mutually exclusive groups: Asian/Pacific Islander, non-Hispanic Black, immigrant Hispanic, US-born Hispanic, and non-Hispanic White [reference]). We categorized Hispanic women according to nativity because previous research demonstrates that birth outcomes differ by nativity[24,25]; other racial/ethnic groups did not have sufficient numbers to categorize by nativity. Maternal socioeconomic variables included the mother's and her parents' educational attainment (categorized as < high school, high school or graduate equivalency diploma, some college, and college graduate), and income during pregnancy. The mother's parents' educational attainment was defined as the highest education level that had been attained by either parent or main guardian when the respondent was 13 years old. We calculated income by using the total before-tax annual family income converted into a categorical variable as100% increments of the FPL based on family size. The highest education or income level was the reference group.

Neighborhood Poverty Measures

We first created a cross-sectional measure of neighborhood poverty based on the 2005 to 2009 American Community Survey data alone, classifying tracts with less than 5% poverty as low poverty (reference group), those with 5% to 20% poverty as moderate poverty, and those with more than 20% poverty as high poverty. We chose more than 20% as the definition of high poverty on the basis of the US Census definition of poverty areas (https://www.census.gov/prod/1/statbrief/sb95_13.pdf). Because there are no established thresholds for moderate and low poverty, we chose these cutoffs on the assumption that less than 5% represents a neighborhood with very few poor families. We also examined cutoffs on the basis of the distribution of the data (quintiles) in subsequent analyses. We excluded from the cross-sectional measure 13 census tracts that were missing data from the 2005 to 2009 time period.

Next, using the same 3 poverty categories (low, moderate, high), but based on data at all 5 time periods (1970, 1980, 1990, 2000, and 2005–2009), we categorized neighborhoods into 7 poverty trajectories defined a priori by our study team. First, we hypothesized that many neighborhoods would have consistent levels of poverty over time (i.e., long-term low, long-term moderate, or long-term high). Second, we hypothesized that some neighborhoods



Note. Data were taken from US Census tracts. The sample size was n = 7049.

FIGURE 1—Longitudinal neighborhood poverty trajectories with mean poverty rate at each time period and percentage of neighborhoods represented by each trajectory: California, 1970–2009.

TABLE 1—Characteristics of the Study Sample: Maternal and Infant Health Assessment, California, 2003–2009

Characteristic	No. (Weighted %)
Total	23 291
Age, y	
< 22	4 347 (17.5)
22–34	15 050 (65.4)
≥ 35	3 894 (17.1)
Marital status	
Unmarried	9 394 (37.8)
Married	13 727 (62.2)
Race/ethnicity	
Asian/Pacific Islander	2 179 (11.1)
Non-Hispanic Black	3 343 (5.2)
Hispanic, immigrant	6 875 (32.5)
Hispanic, US-born	4 159 (20.1)
Non-Hispanic White	6 285 (31.1)
Parity	
First birth	9 379 (40.0)
2–4 births	12 882 (55.9)
≥ 5 births	1 030 (4.1)
Maternal education	
< high school	4 961 (20.6)
High school or GED	6 045 (26.2)
Some college	6 143 (26.0)
College graduate	5 990 (27.2)
Mother's parents' education	
< high school	7 261 (35.6)
High school or GED	4 716 (21.5)
Some college	4 091 (17.9)
College graduate	5 287 (24.9)
Income, % of FPL	
Missing	2 235 (9.4)
0–100	8 168 (33.8)
101–200	4 591 (19.7)
201–300	1 994 (8.7)
301–400	1 482 (6.5)
≥ 400	4 821 (21.9)
Preterm birth	2 225 (9.2)
Cross-sectional neighborhood poverty categories	
High poverty	6 459 (26.7)
Moderate poverty	12 809 (55.3)
Low poverty	4 023 (18.0)
Longitudinal neighborhood poverty categories	
Long-term high poverty	4 270 (17.8)
Long-term moderate poverty	5 520 (23.7)
Early poverty increase	1 483 (6.4)
Late poverty increase	1 116 (4.9)
Early poverty decrease	4 192 (17.9)
Late poverty decrease	2 263 (9.5)
Long-term low poverty	4 391 (19.5)

Note. FPL = federal poverty level (according to US Census); GED = general equivalency diploma.

would experience either an increase or decrease in poverty over time. Of these changing neighborhoods, we hypothesized that it would be important to understand whether these socioeconomic changes started relatively early (in 1990 or before) or later (after 1990) in the study period.

Using these hypothesized trajectories, we then categorized neighborhood poverty trajectories as follows:

1. long-term low (all time periods were either low or a combination of low and moderate with no discernible pattern);
2. long-term moderate (all time periods were moderate);
3. long-term high (all time periods were either high or a combination or high and moderate with no discernible pattern);
4. low or moderate to moderate or high with early increase, hereafter labeled "early poverty increase" (tracts were low or moderate in 1970, became high or moderate by 1990 or earlier, and remained high or moderate after that);
5. low or moderate to moderate or high with late increase, hereafter labeled "late poverty increase" (tracts were low or moderate in 1970, became high or moderate after 1990, and remained high or moderate after that);
6. moderate or high to low or moderate with early decrease, hereafter labeled "early poverty decrease" (tracts were high or moderate in 1970, became low or moderate by 1990 or earlier, and remained low or moderate after that); and
7. moderate or high to low or moderate with late decrease, hereafter labeled "late poverty decrease" (tracts were high or moderate in 1970, became low or moderate after 1990, and remained low or moderate after that).

Of a total of 7049 California census tracts, 13 tracts missing the most recent poverty estimate and 39 tracts that did not fall into any of the trajectories were excluded from the longitudinal measure.

We also used 2 empirical methods of categorizing neighborhoods into longitudinal poverty trajectories: latent class growth modeling[26,27] and a nonparametric clustering method known as hierarchical ordered partitioning and collapsing hybrid based on partitioning around the medoid (HOPACH-PAM[28]; described in Appendices A and B, respectively, available as a supplement to the online version of this article at http://www.ajph.org).

Statistical Analyses

We first examined the prevalence of PTB and the distribution of maternal characteristics in the MIHA sample overall and by neighborhood category. Next, we estimated 2 separate logistic regression models to compare the relationship between PTB and neighborhood poverty categories (1 model using poverty categories based on cross-sectional data and 1 model using categories based on longitudinal data). For each model, we estimated the crude (unadjusted) odds of PTB for each neighborhood poverty category compared with the lowest poverty category. We then estimated models controlling only for maternal demographic characteristics (i.e., age, parity, marital status, and race/ethnicity–nativity). Finally, we estimated models adjusting for both demographic and socioeconomic characteristics (i.e., respondent's own and parents' educational attainment, and income). We conducted all analyses using survey weighting to account for the stratified sample design of MIHA. We used SAS software version 9.2 (SAS Institute, Cary, NC) for all analyses.

RESULTS

On the basis of the cross-sectional data only (2005–2009), 21% of all 7049 neighborhoods

in California had high poverty, 55% had moderate poverty, and 23% had low poverty. According to the longitudinal method of categorizing neighborhood poverty trajectories, 15% of neighborhoods had long-term high poverty, 22% had long-term moderate poverty, and one quarter had long-term low poverty (Figure 1). Another 16% experienced early poverty increase, and less than one tenth of neighborhoods experienced late poverty increase, early poverty decrease, or late poverty decrease (Figure 1).

Description of Sample

Table 1 shows the characteristics of the 2003 to 2009 MIHA sample (n = 23 291). The majority of mothers were 22 to 34 years old, more than 60% were married, and 40% were primiparous. The largest racial/ethnic–nativity groups were immigrant Hispanic and non-Hispanic Whites. Nine percent of births were preterm. Almost half of the sample had no more than a high school education and more than half had household incomes below 200% of FPL. As illustrated by Table 1, almost 27% of MIHA women lived in high-poverty neighborhoods classified using cross-sectional data, and almost 18% lived in long-term high-poverty neighborhoods. Young, unmarried, non-Hispanic Black, and Hispanic mothers and those with lower education or income were more likely to live in neighborhoods with current or long-term high poverty, compared with older, married, Asian/Pacific Islander and non-Hispanic White mothers and those with higher education or income (Appendices C and D, available as a supplement to the online version of this article at http://www.ajph.org).

Associations Between Neighborhood Poverty and Preterm Birth

Cross-sectional neighborhood poverty categories. In unadjusted models, living in a neighborhood with high (compared with low) cross-sectional poverty was significantly associated with increased odds of PTB (odds ratio [OR] = 1.29; 95% confidence interval [CI] = 1.12, 1.50). However, this association was no longer significant after adjustment for maternal demographic and socioeconomic characteristics (Table 2). To assess whether this null finding was due to how we categorized poverty, we also examined quintiles of neighborhood poverty based on the 2005 to 2009 data, which yielded similar findings (Appendix E, available as a supplement to the online version of this article at http://www.ajph.org). We also examined cross-sectional measures of poverty based on the 2000 data to assess whether measurement differences in the American Community Survey data might explain these null findings; again, findings were similar (Appendix E). Table 2 also shows other significant predictors of increased odds of PTB, which included (in the fully adjusted model) maternal age, non-Hispanic

TABLE 2—Odds Ratios for Preterm Birth by Cross-Sectional Neighborhood Poverty Categories and Individual-Level Covariates: Maternal and Infant Health Assessment, California, 2005–2009

Variable	Crude,[a] OR (95% CI)	Demographic, OR (95% CI)	Full, OR (95% CI)
Cross-sectional neighborhood poverty			
High poverty	1.29 (1.12, 1.50)	1.18 (1.00, 1.38)	1.08 (0.91, 1.28)
Moderate poverty	1.16 (1.01, 1.32)	1.12 (0.97, 1.29)	1.06 (0.91, 1.22)
Low poverty (Ref)	1.00	1.00	1.00
Age	1 (0.99, 1.01)	1.01 (1.00, 1.02)	1.01 (1.00, 1.02)
Parity			
First birth (Ref)		1.00	1.00
2–4 births	1.01 (0.92, 1.11)	1.02 (0.92, 1.13)	0.96 (0.86, 1.08)
≥ 5 births	1.44 (1.17, 1.78)	1.38 (1.09, 1.75)	1.13 (0.87, 1.48)
Marital status			
Unmarried	1.27 (1.15, 1.39)	1.19 (1.07, 1.33)	1.10 (0.97, 1.24)
Married (Ref)	1.00	1.00	1.00
Race/ethnicity			
Asian/Pacific Islander	1.06 (0.89, 1.27)	1.08 (0.90, 1.29)	1.12 (0.93, 1.35)
Non-Hispanic Black	1.72 (1.49, 1.99)	1.53 (1.31, 1.79)	1.45 (1.23, 1.71)
Hispanic, immigrant	1.13 (1.00, 1.28)	1.04 (0.91, 1.19)	0.84 (0.70, 1.01)
Hispanic, US-born	1.31 (1.14, 1.50)	1.21 (1.05, 1.41)	1.09 (0.92, 1.28)
Non-Hispanic White (Ref)	1.00	1.00	1.00
Maternal education			
< high school	1.56 (1.36, 1.79)		1.52 (1.24, 1.88)
High school or GED	1.37 (1.20, 1.57)		1.31 (1.08, 1.58)
Some college	1.33 (1.16, 1.52)		1.19 (1.01, 1.40)
College graduate (Ref)	1.00		1.00
Mother's parents' education			
< high school	1.20 (1.05, 1.36)		0.97 (0.81, 1.16)
High school or GED	1.08 (0.93, 1.25)		0.90 (0.76, 1.06)
Some college	1.09 (0.93, 1.27)		0.96 (0.81, 1.13)
College graduate (Ref)	1.00		1.00
Income, % of FPL			
Missing	1.49 (1.24, 1.79)		1.29 (1.03, 1.62)
0–100	1.53 (1.33, 1.75)		1.30 (1.07, 1.58)
101–200	1.42 (1.22, 1.66)		1.24 (1.02, 1.51)
201–300	1.29 (1.06, 1.57)		1.15 (0.92, 1.42)
301–400	1.29 (1.04, 1.61)		1.17 (0.93, 1.48)
≥ 401 (Ref)	1.00		1.00

Note. CI = confidence interval; FPL = federal poverty level (according to US Census); GED = general equivalency diploma; OR = odds ratio. Models exclude 12 records that were missing data on preterm births. The sample size was n = 23 279.
[a]Crude associations between individual covariates and preterm birth from bivariate logistic models including only those covariates.

TABLE 3—Odds Ratios for Preterm Birth by Longitudinal Neighborhood Poverty Categories and Individual-Level Covariates: Maternal and Infant Health Assessment, California, 1970–2009

Variable	Crude, OR (95% CI)	Demographic, OR (95% CI)	Full, OR (95% CI)
Longitudinal neighborhood poverty category			
Long-term high poverty	1.53 (1.31, 1.79)	1.45 (1.22, 1.71)	1.41 (1.18, 1.69)
Long-term moderate poverty	1.25 (1.07, 1.45)	1.25 (1.07, 1.46)	1.22 (1.04, 1.44)
Long-term low poverty (Ref)	1.00	1.00	1.00
Early poverty increase	1.33 (1.07, 1.64)	1.36 (1.10, 1.70)	1.37 (1.09, 1.72)
Late poverty increase	1.08 (0.84, 1.39)	1.09 (0.85, 1.41)	1.08 (0.83, 1.41)
Early poverty decrease	1.27 (1.08, 1.49)	1.26 (1.06, 1.49)	1.17 (0.98, 1.40)
Late poverty decrease	1.21 (1.00, 1.47)	1.19 (0.98, 1.46)	1.11 (0.89, 1.37)
Age		1.01 (1.00, 1.02)	1.01 (1.00, 1.02)
Parity			
First birth (Ref)		1.00	1.00
2–4 births		1.01 (0.91, 1.13)	0.96 (0.86, 1.08)
≥ 5 births		1.36 (1.08, 1.72)	1.12 (0.86, 1.46)
Marital status			
Unmarried		1.18 (1.06, 1.32)	1.09 (0.97, 1.23)
Married (Ref)		1.00	1.00
Race/ethnicity			
Asian/Pacific Islander		1.09 (0.91, 1.30)	1.13 (0.94, 1.36)
Non-Hispanic Black		1.51 (1.29, 1.76)	1.42 (1.20, 1.67)
Hispanic, immigrant		1.01 (0.88, 1.16)	0.82 (0.68, 0.99)
Hispanic, US-born		1.20 (1.03, 1.39)	1.07 (0.91, 1.27)
Non-Hispanic White (Ref)		1.00	1.00
Maternal education			
< high school			1.51 (1.23, 1.87)
High school or GED			1.30 (1.08, 1.58)
Some college			1.19 (1.01, 1.41)
College graduate (Ref)			1.00
Mother's parents' education			
< high school			0.96 (0.80, 1.15)
High school or GED			0.89 (0.76, 1.05)
Some college			0.96 (0.82, 1.13)
College graduate (Ref)			1.00
Income, % of FPL			
Missing			1.27 (1.01, 1.59)
0–100			1.27 (1.05, 1.55)
101–200			1.23 (1.01, 1.49)
201–300			1.13 (0.91, 1.41)
301–400			1.17 (0.92, 1.48)
≥ 401 (Ref)			1.00

Note. CI = confidence interval; FPL = federal poverty level (according to US Census); GED = general equivalency diploma; OR = odds ratio. Models exclude 12 records that were missing data on preterm births. The sample size was n = 23 279.

Black (compared with non-Hispanic White) race/ethnicity, maternal educational attainment less than high school or high school–graduate equivalency diploma (compared with college graduate), and income less than 200% of FPL or missing (compared with more than 400% of FPL).

Longitudinal neighborhood poverty categories. Several of the neighborhood poverty trajectories based on the 1970 to 2009 poverty data were significantly associated with PTB, even after adjustment for individual-level characteristics. Living in a long-term high-poverty (compared with a long-term low-poverty) neighborhood was associated with a 41% increase in the odds of PTB (95% CI = 1.18, 1.69) in the fully adjusted model (Table 3). Long-term moderate-poverty neighborhoods were associated with a 22% increase in the odds of PTB (95% CI = 1.04, 1.44), and neighborhoods that experienced early poverty increase were associated with a 37% increase in odds of PTB (95% CI = 1.09, 1.72), compared with long-term low-poverty neighborhoods. By contrast, later poverty increase and poverty decrease were not significantly associated with PTB (Table 3). Associations between covariates and PTB remained similar regardless of method of neighborhood poverty categorization. Results were also similar when we used empirical methods of classifying neighborhood trajectories (Appendix F, available as a supplement to the online version of this article at http://www.ajph.org).

DISCUSSION

These findings reveal that living in a neighborhood with a long history of high poverty is associated with higher odds of PTB compared with living in a neighborhood with long-term low poverty. On the other hand, if we had used only cross-sectional measures of neighborhood poverty, we would have concluded that there were no significant associations between neighborhood poverty and PTB after adjustment for individual-level characteristics. This study is the first of which we are aware to estimate longitudinal trajectories of neighborhood poverty and link these to a health outcome. Our findings suggest that taking into account the long-term socioeconomic history of neighborhoods may be important in understanding how neighborhoods contribute to perinatal health.

Many studies have observed PTB risk differences associated with the socioeconomic characteristics of the geographic areas where women reside,[7,10–12,15,29–33] including area-level measures of poverty and other measures of deprivation such as unemployment,[32] racial segregation,[15,29] and crime rates.[10,11] Socioeconomic factors at the neighborhood level could plausibly affect PTB through diverse causal

pathways, including those involving hazardous physical exposures, poor nutrition or prepregnancy health status, adverse health-related behaviors, lack of medical care, and stress.[7] Neighborhoods with long-standing deprivation may have more adverse conditions than neighborhoods that became disadvantaged more recently. This is suggested by the current study, in which we found that neighborhood trajectories characterized by long-term high poverty or increasing poverty early in the study period (by 1990) were associated with a 41% and 37% increase in odds of PTB (compared with long-term low-poverty neighborhoods), respectively. By contrast, trajectories characterized by increasing poverty after 1990 were not associated with PTB. When we measured neighborhood poverty cross-sectionally, these nuances were obscured: the cross-sectional high-poverty category included a mixture of trajectories of long-term high poverty (40%), early poverty increase (35%), and late poverty increase (26%; Appendix G, available as a supplement to the online version of this article at http://www.ajph.org).

The strengths of this study include the MIHA sampling plan, which resulted in a racially and ethnically diverse and statewide-representative data set in a state where one eighth of all births nationwide occur. The rate of geocoding accurately to census tracts with street addresses was very high at 97%. Moreover, we confirmed our results using 2 empirical methods of characterizing neighborhoods' poverty histories—latent class growth modeling[26,27] and a nonparametric clustering method[28]—adding to the strength of our findings.

A primary limitation of this study is the lack of information on individual mothers' residential exposures over the life course. Other studies using similar methods to estimate individual-level trajectories of exposure to neighborhood poverty have found that cumulative exposure to neighborhood poverty is important for health outcomes such as atherosclerosis.[34] Women with high cumulative exposure to neighborhood poverty may also be more likely to live in neighborhoods with long-term high poverty, confounding the associations demonstrated in this study. Neighborhood socioeconomic histories may also be less relevant for women who have lived in their current neighborhood for a short time. However, our findings suggest that the poverty history of women's neighborhoods of residence (at the time of birth) is associated with birth outcomes, independent of many key demographic and socioeconomic characteristics.

We chose to focus on 1 neighborhood factor (poverty) that is associated with perinatal health and highly correlated with a wide range of other neighborhood characteristics, but other important neighborhood measures—such as racial/ethnic composition, employment patterns, and the built environment—should be considered in future research. Future work should also investigate whether 40 years of data are needed to estimate trajectories of neighborhood poverty relevant to health or whether fewer data points would be sufficient. Furthermore, the causal pathways by which neighborhood SES—or its trajectories—affect birth outcomes remain an important subject of future study. A greater understanding of these pathways is necessary to inform appropriate public health interventions.

Finally, several previous studies reported that neighborhood income, deprivation, or disadvantage was associated with PTB only among non-Hispanic Black women[9–11]; other research reports that this association persists across racial/ethnic groups.[12] Although beyond the scope of the current study, future work should examine differences in the associations between longitudinal neighborhood poverty trajectories and PTB within diverse racial/ethnic–nativity groups and should examine the potential contribution of neighborhood socioeconomic histories to well-documented racial/ethnic and socioeconomic disparities in preterm birth.

In conclusion, this study emphasizes the importance of considering the "life histories" of neighborhoods in work examining neighborhoods and health, and it suggests that neighborhoods with a history of high poverty may be important targets for policies and public health programs aimed at improving birth outcomes. ■

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Contributors

C. Margerison-Zilko designed the study, analyzed and interpreted the data, and drafted and revised the manuscript. C. Cubbin designed and supervised the study, participated in its intellectual content, and contributed to the editorial content and manuscript revisions. J. Jun analyzed the data and reviewed the manuscript. K. Marchi, K. Fingar, and P. Braveman participated in interpretation of the data and revisions of the manuscript.

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Human Participant Protection

This research was approved by the institutional review boards at the University of Texas at Austin and the University of California, San Francisco, and by the California Committee for the Protection of Human Subjects.

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