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Race/Ethnic Differences in Birth Outcomes in Philadelphia: The Role of Residential Segregation, Crime, and Neighborhood-level Socioeconomic Disparities

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Short Abstract

This paper contributes to the literature on neighborhood context and race/ethnic disparities in birth outcomes. We integrate individual and community-level determinants in a multilevel analysis of preterm and small-for-gestational age births with a specific focus on the role of residential segregation, crime, and neighborhood deprivation. To date, individual-level socio-demographic variables, health behaviors, health service use, and biomedical conditions have not fully explained race/ethnic differentials in birth outcomes. We base our analysis on 2000 Philadelphia resident live birth records of which approximately 95% were successfully geocoded based on the mothers' address reported on the birth record. The birth records were merged with block group level measures of residential segregation, (index of dissimilarity, exposure, and isolation), crime rates (measured as property crimes and crimes against persons), and a composite measure of neighborhood deprivation. Individual-level characteristics available from birth certificates are also included. The analyses focus on non-Hispanics blacks, non-Hispanic whites, and Hispanics.

Extended Abstract

This paper contributes to the growing literature on the role of neighborhood context on race/ethnic disparities in birth outcomes. We integrate both individual and community-level determinants in a multilevel analysis of preterm and small-for-gestational age births with a specific focus on the role of residential segregation, crime, and neighborhood deprivation.

Despite the vast literature on the determinants of birth outcomes and infant mortality in the United States, the reasons behind the persistent racial/ethnic variation in these outcomes are not well understood. In recent years, renewed attention has been focused on the possible role of the broader social context, including neighborhood conditions, in producing adverse birth outcomes (e.g., Buka et al. 2003; Culhane and Elo 2005; Morenoff 2003; Sastry and Hussey 2003). Neighborhood conditions are hypothesized to influence health, either directly or indirectly, through several potential pathways such as availability of social support, adaptation of coping strategies, access to health-related goods and services, and exposure to acute and chronic stress (Robert 1999; Kawachi and Berkman 2003).

Residential context may be particularly salient for explaining race/ethnic differentials in birth outcomes because residential segregation has led to profound race/ethnic differences in exposure to adverse neighborhood conditions, differences that are most pronounced between white and black women. Black women are more likely than white women to live in disadvantaged neighborhoods with fewer medical and social services, poorer housing quality, higher rates of crime and violence, factors that have been hypothesized to contribute to poorer maternal health and more adverse birth outcomes (Anderson *et* al., 1996; Geronimus 1996, 2000; LeClere, Rogers and Peters 1998; Robert, 1999; Messer et al. 2006a; Morenoff 2003). Closely associated with residential segregation are other forms of racial discrimination with potential adverse health consequences, including adverse birth outcomes. However, residential segregation is not always associated with poor health. For example, Mexican Americans living in ethnic enclaves may retain attachment to traditional culture and this in turn may have health protecting effects.

In this paper, we look specifically at the associations between residential segregation, crime and neighborhood-level socioeconomic conditions and adverse birth outcomes defined as (1) a preterm birth (PTB, < 37 weeks of gestations) and (2) a small for gestational age birth (SGA, < 10th percentile of gestational age specific birth weight) among non-Hispanic blacks, non-Hispanic Whites and Hispanics in Philadelphia, Pennsylvania. We chose preterm birth because it is a major public health problem with increasing rates over the last decade. In addition, there continues to be a significant, persistent, and troubling race/ethnic disparities – in 2003, 11.3% of non-Hispanic white, 17.8% of non-Hispanic black, and 11.9% of Hispanic infants were born preterm (Martin et al. 2005). To date, individual-level socio-demographic variables, health behaviors, health service use, and biomedical conditions have not fully explained these disparities (Institute of Medicine 2006). An SGA birth was also selected because it is a variable that combines gestational age and birth weight. Infants born small independent of their gestational age are at greater risk of poor long-term health and cognitive outcomes compared to their gestational age matched heavier counterparts (Paz et al. 1995; Strauss 2000).

Data

We base our analysis on 2000 Philadelphia resident live birth records of which approximately 95% were successfully geocoded based on the mothers' address reported on the birth record. The birth records were then merged with block group level measures of residential segregation, (index of dissimilarity, exposure, and isolation), crime rates (measured alternatively as property crimes and crimes against a person), and a composite measure of neighborhood deprivation (Massey and Denton 1988; Messer et al. 2006b). We use block-level data to calculate two residential segregation measures for block groups: (1) segregation between non-Hispanic blacks and non-Hispanic whites, and (2) segregation between Hispanics and non-Hispanic whites. The residential segregation measures and the neighborhood deprivation index are derived from the 2000 Census of Population and Housing. We use administrative record data on police reports of various crimes in Philadelphia available from the Neighborhood Information System database housed at the Cartographic Modeling Lab at the University of Pennsylvania (http://www.cml.upenn.edu/nis/).

Several individual-level characteristics available from birth certificates are also included. Maternal socio-demographic characteristics include maternal age and education, birth order, and marital status. Maternal health behaviors consist of indicators for smoking and drinking during pregnancy and the Kotelchuck Adequacy of Prenatal Care Utilization Index (APNCU) (Kotelchuck 1994). In addition, we include the child's sex, maternal hypertension, and whether the mother had given birth to a previous preterm or low birth weight infant.

Although nationally representative data on birth outcomes would be desirable, detailed studies can be carried out more effectively at the local level, where richer datasets can be assembled. Philadelphia provides an ideal setting for this study. It is one of the most residentially segregated cities in the country, but also has a number of integrated neighborhoods, and race/ethnic disparities in birth outcomes in Philadelphia are similar to those in several other large U.S. cities.

Analytic Strategy

We use multilevel modeling techniques to assess the magnitude of neighborhood effects on birth outcomes (Goldstein 1995). We estimate both random-intercept models and random-coefficient models to assess the associations between neighborhood context and our two birth outcomes of interest. Of particular interest in the analysis is whether the associations between neighborhood context and birth outcomes vary by race/ethnicity. Previous research has shown that socio-economic characteristics such as education interact with race/ethnicity in determining poor birth outcomes. We pursue this line of research using random-coefficient models to assess the extent to which racial disparities in birth outcomes vary across neighborhoods. In other words, in this specification we allow the social context to affect not just the level of the outcome, but also racial differentials.

We fit three different models. Model 1 includes only neighborhood-level characteristics. Model 2 adds maternal race and other individual-level socio-demographic attributes, including infant's sex and birth order. Model 3 adds the more proximate determinants, i.e., maternal risks factors and health behaviors. The last model includes not only the main effects of these variables but also their interactions with race/ethnicity. This analysis allows us to obtain estimates of

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race/ethnic differentials in birth outcomes that are net of observed individual attributes as well as observed neighborhood characteristics. We should note that several of the individual-level characteristics may be endogenous to the model in that they themselves could at least in part reflect previous social context in which case we would could potentially underestimate neighborhood effects (Morenoff 2003: 991).

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