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## Neighborhood effects on birthweight: An exploration of psychosocial and behavioral pathways in Baltimore, 1995–1996<sup>☆</sup>

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### ABSTRACT

Neighborhood characteristics have been proposed to influence birth outcomes through psychosocial and behavioral pathways, yet empirical evidence is lacking. Using data from an urban, low-income sample, this study examined the impact of the neighborhood environment on birthweight and evaluated mediation by psychosocial and behavioral factors. The sample included 726 women who delivered a live birth at Johns Hopkins Hospital in Baltimore, Maryland, USA between 1995 and 1996. Census-tract data were used to create a principal component index of neighborhood risk based on racial and economic stratification (% Black, % poverty), social disorder (violent crime rate), and physical deterioration (% boarded-up housing) ( $\alpha = 0.82$ ). Information on sociodemographic, psychosocial, and behavioral factors was gathered from a postpartum interview and medical records. Random intercept multilevel models were used to estimate neighborhood effects and assess potential mediation. Controlling for sociodemographic characteristics, a standard deviation increase in neighborhood risk conferred a 76 g birthweight decrement. This represents an approximate 300 g difference between the best and worst neighborhoods. Although stress (daily hassles), perceived locus-of-control, and social support were related to birthweight, their adjustment reduced the neighborhood coefficient by only 12%. In contrast, the neighborhood effect was reduced by an additional 30% and was no longer statistically significant after adjustment for the behavioral factors of smoking, drug use, and delayed prenatal care. These findings suggest that neighborhood factors may influence birthweight by shaping maternal behavioral risks. Thus, neighborhood level interventions should be considered to address multiple maternal and infant health risks. Future studies should examine more direct measures of neighborhood stress, such as perceived neighborhood disorder, and evaluate alternative mechanisms by which neighborhood factors influence behavior (e.g., social norms and access to goods and services).

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### Introduction

Fueled by the appealing efficiency of population-based prevention, there is a growing body of literature linking the

residential environment in which women live to birth outcomes, particularly contextual indicators of socioeconomic disadvantage and residential segregation (Culhane & Elo, 2005). Neighborhood effects on birthweight, low and very low birthweight, and their subcomponents of preterm birth and growth restriction, have been observed independent of various individual-level characteristics. The notion of “independent” effects, however, may be fallacious as neighborhood influences on individual health must ultimately operate through some mechanism on the individual. A frequent exhortation of contextual critiques is to

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move beyond “black box” epidemiology toward the examination of theory-based exposures and pathways through which neighborhoods influence health (Diez Roux, 2001; Galea & Ahern, 2006; Kawachi & Subramanian, 2007; O’Campo, 2003; Sampson, Morenoff, & Gannon-Rowley, 2002).

While many researchers have proposed psychosocial and behavioral pathways for neighborhood effects on birth outcomes (Buka, Brennan, Rich-Edwards, Raudenbush, & Earls, 2003; Culhane & Elo, 2005; Dikken, Sigala, & Macfarlane, 2006; Farley et al., 2006; Grady, 2006; Messer, Kaufman, Dole, Savitz, & Laraia, 2006; Morenoff, 2003; Pearl, Braveman, & Abrams, 2001; Pickett, Ahern, Selvin, & Abrams, 2002; Rauh, Andrews, & Garfinkel, 2001; Roberts, 1997), empirical exploration with individual-level psychosocial or behavioral measures is lacking (Ahern, Pickett, Selvin, & Abrams, 2003; Reagan & Salsberry, 2005). Observed independent effects may be due to confounding by omitted sociodemographic variables that influence the selection of neighborhoods or true effects whose mediators have not been identified or properly evaluated. Largely due to the data constraints of vital records, few multilevel studies of birth outcomes have controlled for the individual-level characteristics that parallel aggregated census variables (Rajaratnam, Burke, & O’Campo, 2006), making it difficult to distinguish contextual versus compositional effects. Moreover, no studies have evaluated psychosocial pathways via stress or self-efficacy, and most have controlled for the behavioral factors that may mediate rather than confound the effects of neighborhood context. Likewise, the bulk of perinatal research conducted at the individual level identifies psychosocial, behavioral, and biological risk factors divorced from the contextual/environmental factors that may shape and sustain them.

Using a biopsychosocial framework, the present study integrates individual and contextual approaches by exploring potential individual-level pathways through which neighborhood disadvantage may influence birthweight. Specifically, psychosocial, behavioral, and biological mediation is evaluated, while controlling for individual-level sociodemographic characteristics that may confound neighborhood effects. The elucidation of neighborhood pathways may promote causal theory and holds promise to inform strategies for intervention at multiple levels.

## Background

The neighborhood variables most frequently linked to birth outcomes are census-based indicators of socioeconomic deprivation and racial composition or segregation that proxy structural attributes (Rajaratnam et al., 2006). Socioeconomic indicators, including income, education, employment, occupation, and housing, measured at the level of census block group, tract, or tract clusters have been associated with birthweight (Buka et al., 2003; Morenoff, 2003; Pearl et al., 2001; Subramanian, Chen, Rehkopf, Waterman, & Krieger, 2006), low birthweight (Johnson, Drisko, Gallagher, & Barela, 1999; O’Campo, Xue, Wang, & Caughy, 1997; Rauh et al., 2001; Rich-Edwards, Buka, Brennan, & Earls, 2003; Roberts, 1997), PTB (Ahern et al.,

2003; Kaufman, Dole, Savitz, & Herring, 2003; O’Campo et al., 2008; Reagan & Salsberry, 2005), gestational age, and fetal growth (Farley et al., 2006). Studies in Europe and Canada have shown similar associations among equivalent administrative units (Dikken et al., 2006; Jarvelin et al., 1997; Luo, Wilkins, & Kramer, 2006; Sloggett & Joshi, 1998). These studies frequently control for a single individual-level socioeconomic indicator, generally education, although a few studies have demonstrated effects independent of individual-level income (Kaufman et al., 2003; Pearl et al., 2001; Reagan & Salsberry, 2005). Racial density or segregation is also commonly associated with various birth outcomes. Black-White segregation indices and the % Black are often related to adverse outcomes including LBW and infant mortality at the census tract (Grady, 2006; Morenoff, 2003) and MSA levels (Bell, Zimmerman, Almgren, Mayer, & Huebner, 2006; Polednak, 1996), although some positive effects have been noted (Pickett, Collins, Masi, & Wilkinson, 2005; Roberts, 1997).

The actual features and processes that characterize racially and socioeconomically stratified neighborhoods and that may influence an array of health endpoints, including birth outcomes, have been largely conceptualized along dimensions of the physical, social, and service environments that impact social norms, processes, and access to resources (Culhane & Elo, 2005; Robert, 1999). Relatively few studies of birth outcomes have examined these neighborhood attributes that are not purely aggregated individual-level census variables (Rajaratnam et al., 2006).

Aspects of the physical and social environment that have been related to various birth outcomes include the stressors of vacant or boarded-up housing (Farley et al., 2006; Reagan & Salsberry, 2005) and violent crime (Collins & David, 1997; Masi, Hawkey, Piotrowski, & Pickett, 2007; Messer, Kaufman, Dole, Herring, & Laraia, 2006; Messer, Kaufman, Dole, Savitz, et al., 2006; Morenoff, 2003), air pollution (Ponce, Hoggatt, Wilhelm, & Ritz, 2005), and the positive dimension of neighborhood social cohesion (Buka et al., 2003; Morenoff, 2003).

The service environment encompasses the quantity and quality of available goods and services that influence health and behavior, including medical care and dietary intake for example. Several studies have reported no association between area availability of prenatal or primary care and birth outcomes (Gorman, 1999; Heck, Schoendorf, & Chavez, 2002), although others have found positive influences of primary care at larger levels of aggregation (Shi et al., 2004; Thompson, Goodman, Chang, & Stukel, 2005). A more recent study also found no association between various census-tract outlet densities (tobacco and alcohol outlets, supermarkets, or fast-food restaurants) and fetal growth or gestational age (Farley et al., 2006). It is possible that health behaviors may be influenced irrespective of the availability of services via social norms or psychosocial factors, and/or that the meaningful area unit for services was not measured.

## Proposed pathways

The proposed individual-level pathways through which neighborhood context may influence birth outcomes

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