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Poverty, ethnicity, and risk of obesity among low birth weight infants

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ABSTRACT

The independent and joint effects of family and neighborhood poverty and ethnicity upon weight trajectories from age two to six-and-a-half were examined using data from the Infant Health and Development Program (N=985), an early intervention program for low birth weight children and families. At age two, family poverty was associated with higher body mass index (BMI), whereas neighborhood poverty and ethnicity were not. Over time, the BMI of toddlers from poor and near poor neighborhoods increased nonlinearly, while those from nonpoor neighborhoods remained stable. BMIs of Hispanic-American toddlers increased steadily over time, unlike African-American and Anglo-American toddlers. Although initially similar, over time African-American toddlers' BMIs increased more rapidly than Anglo-American toddlers. Family and neighborhood poverty and ethnicity were associated with BMI. More work is needed on how poverty and ethnicity contribute to differences in early weight gain in conjunction with sociocultural and environmental factors in the home and community.

Health disparities in morbidity and mortality associated with socioeconomic status (SES) are a concern in the United States (US) as well as in other high-income countries (National Research Council, 2013). Gains in US life expectancy slowed from the 1980s to the current decade, relative to other developed nations, which has heightened attention to the origins of these disparities (Dow & Rehkopf, 2010; Martinson, Teitler, & Reichman, 2011). SES gradients for a range of chronic health conditions (cardiovascular disease, diabetes, and obesity) exist, with more educated or higher income adults having better health than less educated or lower income adults (Adler & Stewart, 2010). Similar gradients have been found between ethnicity and health outcomes, with European-American adults having better health than African-American, Hispanic-American, or Native-American adults (Russell, 2010). Often separate estimates of health conditions for SES and ethnicity are presented since research does not account for the covariation among education, income, and ethnicity (Adler & Stewart, 2010). Concern about the origins of these health disparities has prompted research interest in the health of young children.

Researchers believe that the origins of social inequalities in physical health start early, and that these early differences are associated with adult morbidity and mortality (Adler & Stewart, 2010; Cohen, Janicki-Deverts, Chen, & Matthews, 2010). Since children in general are healthier than any other age group, relatively little is known about their health disparities. However, SES (parental education and income) and ethnic differences in conditions such as obesity, asthma, low birth weight, lead exposure, and other toxin exposure have been documented (Chen, Matthews, & Boyce, 2002; Currie, 2005; Reichman, 2005). Early socioeconomic conditions, thus, help shape children's life-long health trajectories (Case, Lubotsky, & Paxson, 2002; Evans, Chen, Miller, & Seeman, 2012).

The childhood obesity epidemic has figured prominently in health disparity research. Obesity rates have increased considerably over the past three decades. About one-third of US children are overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). Rates are highest for poor and minority children even though increases over time have been seen in all groups (Anderson & Butcher, 2006; Irigoyen, Glassman, Chen, & Findley, 2008; Wang & Beydoun, 2007). If these rates persist, the current generation of children will become the first in US history to be sicker and die earlier than their parents (Robert Wood Johnson Foundation, 2012). Early origins of elevations in body mass index (BMI) are important to understand, since children who have above average BMIs are much more likely to be overweight as preteens (Nader et al., 2006; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997).

The goal of the present study is to examine BMI trajectories from age two to six-and-a-half as a function of ethnicity and poverty. However, unlike other studies, we distinguish between poverty at the family and neighborhood level and examine the association between BMI and family and neighborhood poverty, controlling for the effects of ethnicity. Our data come from the Infant Health and Development Program (IHDP), a longitudinal study of children who were born low birth weight (LBW<2500 g). We examine this specific sample of children because LBW children are at risk for early elevations in BMI (Law, 2001; Ong, Preece, Emmett, Ahmed, & Dunger, 2002). Our examination of early BMI draws upon the life course perspective, Bronfenbrenner's bioecological model of development (Bronfenbrenner & Morris, 2006), and the research on the economic constraints upon ethnic groups.

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Most research on health disparities has not taken a developmental approach. Cross-sectional data on obesity often begin in early childhood, at age four or five. Relatively little longitudinal data on BMI trajectories start from infancy and extend through late childhood or adolescence (The National Institute of Child Health and Human Development and the Early Childhood Longitudinal Study-Birth Cohort are exceptions, although the latter only follows children through kindergarten; Fragile Families Child Wellbeing Study examines weight longitudinally through age nine; Brooks-Gunn, Fink, & Paxson, 2005). The general research focus has not been on charting the health of children in the first few years of life, examining predictors of health conditions or changes in predictors over time. Thus, developmental psychologists have not applied life course perspectives to health conditions the way they have been to cognitive and behavioral outcomes (Elder, Johnson, & Crosnoe, 2003; Elder & Shanahan, 2007). A life course perspective emphasizes the many forces that shape an individual's multiple trajectories and their developmental implications. Both opportunities and constraints of social structure and culture may influence such life trajectories (Elder, 1998).

Much of Elder's initial work focused upon archival data from children of the Great Depression, where family resources were seen as powerful forces in successful outcomes (Elder, 1998). The life course perspective recognizes that many aspects of child development are not linear. Moreover, such models emphasize the trajectories initiated by early SES exposures, which few longitudinal studies have examined in the context of children's BMI (Evans et al., 2012).

The first seven years of life are a critical period for studying the development of childhood obesity (Rolland-Cachera, Deheeger, Mailoot, & Bellisle, 2006). During the first year of life, all infants steadily gain weight. BMIs then subsequently decline and reach nadir before increasing again. Adiposity rebound (AR) begins at the point where BMIs increase from this minimum value and marks the second increase in BMI which occurs between the ages of five and seven (Dietz, 1994; Rolland-Cachera et al., 2006). Children who rapidly gain weight early in the first year of life (Stettler, Zemel, Kumanyika, & Stallings, 2011) or who have a pattern of early AR (Baird et al., 2005) are at risk for obesity throughout life. LBW infants who tend to gain weight more rapidly over the first two years to "catch-up" with normal birth weight infants show such patterns (Law, 2001; Ong et al., 2002).

Previous work on childhood obesity also has not considered the multiple settings in which children grow up. Bronfenbrenner's bioecological model of development, which emphasizes both proximal and distal contexts, frames our analysis (Bronfenbrenner & Morris, 2006). This model views the development of an individual in the context of environments or ecological systems — from the nuclear family, peer group, neighborhood, community, and educational or occupational institutions. In the present study, we examine the influence of both the family (proximal) and the neighborhood (distal) SES environments. There is considerable research on the influences of family and neighborhood poverty upon children (Brooks-Gunn, Duncan, & Aber, 1997; Duncan & Brooks-Gunn, 1997). However, family and neighborhood poverty influences may differ by the age of the child. Associations between family poverty and children's developmental outcomes have been found as early as two years of age, while effects for neighborhood poverty have been found by age three (Klebanov, Brooks-Gunn, McCarton, & McCormick, 1998; Sampson, Sharkey, & Raudenbush, 2008). Similarly, family poverty might be associated with BMI when children are young rather than later, when neighborhood influences might begin to play a role. Finally, research has not considered how ethnic differences in children's BMI might be associated with conditions such as poverty. African-American and Hispanic-American children are about two times more likely to live in poverty than European-American children (Lin & Harris, 2009). They are also more likely to live in poor neighborhoods (Sampson, 2012; Sampson et al., 2008) and, when they move, to remain in poor neighborhoods (Sampson & Sharkey, 2008). Ethnic minority families are more constrained in the choices that they are able to make in terms of where to live (Massey, 2007; Sampson & Sharkey, 2008; Wilson, 2012), which also makes it important to consider neighborhood as well as family poverty when looking at different ethnic groups. The present study examines both environmental settings simultaneously. We now briefly present the research on family poverty, neighborhood poverty, and ethnicity as it relates to children's BMI.

While socioeconomic differences are significantly associated with disparities in adult BMI, there is only modest research support in national studies for child BMIs. An assessment of three-year-old children in the Fragile Families and Child Wellbeing Study did not find a bivariate association between family income and obesity status (Whitaker & Orzol, 2006). Using data from the same study, only a marginally significant association between family income and overweight status at age nine was found, controlling for ethnicity, sex, age, marital status, birth order, and LBW status (Martinson, McLanahan, & Brooks-Gunn, 2012). The National Health and Nutrition Examination Survey (NHANES) 1971 to 2002 did not find associations between family poverty and BMI or family poverty and overweight status (BMI≥85th percentile) for a sample of two- to nine-year-olds, controlling for age, sex, ethnicity, and wave of study (Wang & Zhang, 2006). Neither were significant associations between family income nor family poverty status and 6- to 11-year-old children's BMI or overweight status (defined as >85th percentile) found using the 1997 Panel Study of Income Dynamics controlling for ethnicity, education, age, sex, and family structure (Hofferth & Curtin, 2005).

However, two national studies have found significant associations between family poverty or income and childhood obesity. The National Longitudinal Survey of Youth found that lower family income was associated with higher rates of obesity (BMI≥95th percentile) for children 6 to 14 years of age, controlling for child's initial BMI, maternal BMI, education, marital status, ethnicity, and home environment (Strauss & Knight, 1999). The 2003 National Survey of Children's Health also found that lower family income was associated with higher rates of obesity for children age 10 to 17, controlling for child's age, gender, ethnicity, maternal marital status and education, although this study relied on parental report of child's weight (Singh, Kogan, Van Dyck, & Siahpush, 2008). A third study of families in rural upstate New York from 1995 to 2006 utilized growth curve modeling and found that family poverty was associated with higher BMI when children were nine years old. Moreover, poor children's weight gains between ages 9 and 17 accelerated faster than that of nonpoor children (Wells, Evans, Beavis, & Ong, 2010).

Similar to an extensive literature review of SES and obesity which suggested that the association between SES and obesity may increase with age (Sobal & Stunkard, 1989), of the studies reviewed here, those based on older children reported associations between family income and obesity, while those based on younger children often did not. Moreover, studies used a continuous measure of family income or a dichotomized measure of family poverty. Thus, differences in the results obtained may depend, in part, upon how each study defined family SES. None of these studies, however, has simultaneously controlled for the effects of neighborhood poverty. The present study examines the independent effect of family poverty, as well as controls for the effects of neighborhood poverty and ethnicity. Family poverty is likely to be associated independently with higher BMIs and even jointly, when controlling for ethnicity and neighborhood poverty.

No studies to date have examined the association between neighborhood poverty and young children's BMI. One cross-sectional study found that both lower neighborhood and family SES were associated with higher adolescent BMI (Chen & Paterson, 2006). Instead, there has been considerable research documenting the association between neighborhood SES and a range of other adult health outcomes, controlling for family SES (see Chen & Paterson, 2006; Diez Roux & Mair, 2010, for reviews). The present study contributes to the childhood obesity literature by examining both family and neighborhood poverty. We expect that residence in poor