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Original article

The Role of School Environments in Explaining Racial-Ethnic Disparities in Body Mass Index Among U.S. Adolescents

Nancy Nicosia, Ph.D. [a,*], Victoria Shier, M.Phil. [a], and Ashlesha Datar, Ph.D. [b]

[a] *RAND Corporation, Santa Monica, California*
[b] *Center for Economic and Social Research, University of Southern California, Los Angeles, California*

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A B S T R A C T

Purpose: Policymakers have focused substantial efforts on how school environments can be used to combat obesity. Given this intense focus, this article examined whether disparities in body mass index (BMI) noted among black and Hispanic adolescents relative to whites were explained by the well-documented differences in the school socioeconomic characteristics, and food and physical activity environment.

Methods: Data from the fifth- and eighth-grade waves of the Early Childhood Longitudinal Study—Kindergarten Class were analyzed. Unadjusted linear regression models of BMI percentile that included only indicators for child's race/ethnicity were estimated first followed by adjusted models that iteratively added sets of child, family, and ultimately school covariates. Separate models were estimated by grade and gender. School covariates included detailed indicators for the school socioeconomic characteristics, and the food and physical activity environments.

Results: For Hispanic boys and girls and for black boys, substantial shares of the disparities in BMI were explained by differences in birth weight, BMI at school entry, and current child and family characteristics. Substantial disparities in BMI remained among black girls relative to white girls. Characteristics of the child's school during fifth and eighth grade—specifically, the schools' socioeconomic characteristics as well as measures of the food and physical activity environment—did not explain the disparities for any of the demographic groups.

Conclusions: Differences in the school environment had little additional explanatory power suggesting that interventions seeking to reduce BMI disparities should focus on early school years and even before school entry.

IMPLICATIONS AND CONTRIBUTION

Policymakers have focused substantial efforts on how schools and their food and physical activity environments can be used as a tool to combat obesity. However, in this study, differences in the school environment had little additional explanatory power with respect to racial/ethnic disparities in body mass index once the analysis controlled for factors that predated school entry. This finding suggests that interventions seeking to reduce disparities in body mass index should focus on early school years and even before school entry.

The potential for costly long-term health consequences has made childhood obesity a critical public health concern [1–3]. Approximately one in three youth in the United States is considered overweight or obese [1]. Strong evidence from nationally representative data suggests that excess weight begins early in childhood and becomes pronounced through school years [4–6]. While overweight and its consequences represent a population-wide concern, racial/ethnic disparities in childhood overweight and obesity are striking. Hispanic and black children have higher body mass index (BMI) on average and greater rates of overweight and obesity than white children at school entry and during school years [4]. From 1970 to 2002, the prevalence of overweight tripled among white children ages 6–11 years but increased fivefold among black children [5]. Using data for California, Madsen documents that BMI disparities continue to

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* Address correspondence to: Nancy Nicosia, Ph.D., RAND Corporation, 1776 Main Street, Santa Monica, CA 90401.
E-mail address: nicosia@rand.org (N. Nicosia).

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increase for certain demographic groups during school years including black girls [7]. Given the well-established link between childhood obesity and adult obesity and morbidity, understanding and alleviating BMI disparities during childhood is an important public health priority [8].

Considerable attention has been focused on the role of schools in combating childhood obesity because children spend a large share of their waking (and hence, active) hours and consume a substantial share of their daily calories at school. School food and activity environments have been suggested as key influences for children's obesogenic behaviors and outcomes. For example, school resources such as play areas, equipment, and supervision affect children's physical activity, and those resources are more common in more affluent schools [9]. Given that racial/ethnic minorities are more likely to attend lower socioeconomic status schools that are also more likely to have worse food and physical activity environments, an important concern is to what extent racial/ethnic disparities in BMI can be explained by differences in school environments.

This article examines whether a broad range of school environment factors contribute to the racial/ethnic disparities in BMI among a nationally representative sample of children during elementary and middle school. Specifically, we examine whether disparities in BMI among black and Hispanic adolescents relative to whites during fifth and eighth grades decrease once we control for differences in the school socioeconomic and safety characteristics and factors related to the food and physical activity environment. Importantly, our longitudinal data, which track BMI from kindergarten entry until the eighth grade, allow us to differentiate the role of school-level factors from pre-existing differences in BMI before school entry and from a host of child and family characteristics that represent potential confounders in previous efforts to understand how school environments contribute.

Methods

We analyzed data from the fifth and eighth grade waves of the Early Childhood Longitudinal Study—Kindergarten Class (ECLS-K), a longitudinal survey of a nationally representative cohort of U.S. kindergarteners in fall of 1998. The ECLS-K used a multistage probability sample design where the primary sampling units (PSUs) were counties or groups of counties. Schools were sampled within PSUs and children within schools [10]. Students were followed from kindergarten through eighth grade (1999–2007). Sponsored by the National Center for Education Statistics, the study collected information on children's cognitive, health and developmental outcomes, and contextual data on their families, teachers, and schools. Attrition between kindergarten and fifth grade is largely due to children who changed schools between waves and were not selected for follow-up. The ECLS-K followed a random subsample (50%) of movers in each wave until fifth grade and all movers thereafter to minimize potential attrition bias. We focused on fifth and eighth grades because data on the school food environment, an important component of school-based interventions, were only available in these waves. Approximately 5,860 children had complete data in the fifth grade. Attrition decreased this number to 5,450 in eighth grade—a 7% loss relative to the fifth-grade sample. ECLS-K provides weights, which were used to make the remaining sample nationally representative of children entering kindergarten in 1998. Children with incomplete BMI data were more likely to be black, Hispanic, and of lower socioeconomic status, but there were no statistically significant differences in mean BMI, obesity, gender, and age at kindergarten. The study was approved by the institutional review board at RAND.

Dependent variables

Body mass index percentile during fifth and eighth grades. Trained ECLS-K staff measured children's height and weight at each wave using the Shorr Board (accuracy = .01 cm) and a Seca digital bathroom scale (accuracy = .1 kg), respectively. Height and weight were measured twice to minimize error. Composite height and weight were computed by ECLS-K staff from the two readings, which were then used to compute a composite BMI. We calculated age- and gender-specific BMI percentiles based on the 2000 BMI-for-age growth charts issued by the Centers for Disease Control and Prevention [11] to account for differential trends in body growth and fat change across age and gender.

Explanatory variables

The main explanatory variables of interest are children's race/ethnicity, which we categorize as non-Hispanic white, non-Hispanic black, Hispanic, Asian, and other race or multirace. In addition, four sets of additional explanatory variables are analyzed. The first set includes child-level correlates of BMI that predate school: (1) birth weight categorized as low (<2,500 g), normal (2,500–3,999 g), and heavy (4,000 g or more) and (2) BMI percentile at kindergarten entry. The second set of variables includes current child and family covariates in fifth and eighth grades including disability status, socioeconomic status (a five-category variable based on income, parental education, and parental occupation), single-parent household, and number of siblings in the household. The third set of variables includes school-level socioeconomic and safety characteristics (hereafter, socioeconomic characteristics). School-level socioeconomic characteristics include indicators for private school, share of minority children in the school, and school size. School safety was measured as the school administrator's assessment of problems in the school neighborhood including (1) tensions from racial, ethnic, or religious differences; (2) gangs; (3) selling or using drugs or excessive drinking in public; (4) vacant houses and buildings; and (5) crime and four variables relating to problems during the school year: children or teachers being physically attacked, vandalism of school, children bringing or using alcohol at school, children bring or using illegal drugs at school. The final set of variables captures the school food and physical activity environment. The ECLS-K contains a rich set of elements that are often the focus of federal, state, and local efforts to make the school environment more conducive to healthy BMI. With respect to physical activity, the aspects measured include total physical education time and total recess time as well as the adequacy of school facilities including the gymnasium and playground. With respect to the food environment, data include whether the school has a cafeteria; whether the school sells foods and beverages of minimal nutritional value junk food; whether the school offers breakfast, time allocated for lunch; and whether the school has competitive food and beverage outlets such as vending machines, school store, and a la carte.

Statistical analyses

Ordinary least squares regression models for BMI percentile are estimated separately for fifth and eighth grades and