

# Childhood Body Mass Index in Community Context: Neighborhood Safety, Television Viewing, and Growth Trajectories of BMI

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The United States is currently experiencing an epidemic of children who are overweight or obese. Recently, research on child obesity has begun to examine the relationship between neighborhood environments and the health behaviors of youths. The current study used growth curve analysis based on multilevel modeling to examine the relationship between parents' perceptions of neighborhood safety and children's body mass index (BMI). Parents' perceptions of neighborhood safety had a significant association with children's BMI, and this relationship was fully mediated by television viewing. The results of this study suggest that when parents perceive their neighborhood to be unsafe, they will restrict their children's outdoor activities and increase the likelihood of sedentary indoor activity. Policies aimed at reducing overweight and obesity in children should take into account the neighborhood contexts in which children live.

KEY WORDS: *body mass index; multilevel analysis; neighborhood effects; television watching*

The percentage of children six to 11 years of age who are overweight has more than doubled from 6.5 percent to 18.8 percent between the late 1970s and 2000, and the percentage of overweight adolescents ages 12 to 19 years tripled during the same period, from 6.1 percent to 17.4 percent (Ogden et al., 2006). Although the increases in overweight and obesity cut across all racial, ethnic, and gender lines, the prevalence of children who are overweight is increasing most rapidly among African Americans, Latinos, and the poor and middle classes (U.S. Department of Health and Human Services, 2001). In 2004, about 22 percent of African American and Latino children ages 6 to 11 were overweight, compared with 17.7 percent of white children (Ogden et al., 2006).

The increasing rates of overweight and obesity pose significant health risks. A recent report from the U.S. Surgeon General revealed that 300,000 Americans died in 2000 from obesity-related causes and that the United States expended \$117 billion in obesity-related economic costs (U.S. Department of Health and Human Services, 2001). Overweight and obesity in adolescence are associated with a range of physical problems, including hypertension, high cholesterol, impaired glucose tolerance, and sleep apnea (Dietz & Gortmaker, 2001). Incidence of

type 2 diabetes, until recently thought to be almost exclusively an adult-onset disease, has dramatically increased among youths (Dietz & Gortmaker, 2001).

Overweight and obesity are the result of complex and interacting factors, including genetic, metabolic, behavioral, environmental, cultural, and socioeconomic factors (U.S. Department of Health and Human Services, 2001). The majority of research has focused primarily on individual-level determinants of body mass index (BMI). However, more recent research on child health and development has attempted to identify the relationship between environmental factors and health and health behavior. How might neighborhood conditions be associated with the health behaviors of children and adolescents? The current study used growth curve analysis based on multilevel modeling to examine the relationship between parents' perceptions of neighborhood safety and children's BMI. Perceptions of safety may be one mechanism through which neighborhood disadvantage affects health and health behavior. Building on previous research, it was hypothesized that parent perceptions of a neighborhood as unsafe would be correlated with increases in children's BMI and that this relationship would be mediated, or statistically explained,

by increased television watching. Although several studies have examined the relationship between neighborhood safety and BMI (Cohen, Finch, Bower, & Sastry, 2006; Lumeng, Appugliese, Cabral, Bradley, & Zuckerman, 2006; Robert & Reither, 2004), all of these studies have been cross-sectional and restricted to certain age groups. The current study contributes to the body of knowledge in this area through the use of longitudinal growth curve analysis. The longitudinal nature of the data allows for an examination of the relationship of perceptions of neighborhood safety with the growth trajectory of BMI over time.

### NEIGHBORHOODS AND HEALTH

Earls and Carlson (2001) argued that research on child health and development must extend beyond sets of relatively proximal relationships, such as family and peer influences, to include more distal contexts and relationships found in neighborhoods. Much research has identified health disparities based on economic and structural characteristics of neighborhoods (Diez-Roux, Nieto, & Muntaner, 1997; Humphreys & Carr-Hill, 1991; Katz, Kling, & Liebman, 2001; Leventhal & Brooks-Gunn, 2000; Robert & Reither, 2004; Yen & Kaplan, 1999). However, research on neighborhoods has evolved in recent years to focus more on the mechanisms that explain *why* neighborhoods matter for a range of health-related outcomes (Browning & Cagney, 2003; Sampson, Morenoff, & Gannon-Rowley, 2002).

A growing body of research has set out to identify the specific mechanisms linking neighborhood structural disadvantage with variations in individual-level health. Morenoff (2003) hypothesized that neighborhood social environments affect health; stressful neighborhood conditions, such as crime and disorder, can negatively affect the health of children, whereas the availability of supportive social relationships and collective efficacy can facilitate healthy behaviors. Neighborhood-level social characteristics have been linked to self-reported health (Sampson, 2003), low birthweight, and infant mortality (Buka, Brennan, & Rich-Edwards, 2003; Morenoff, 2003).

Browning and Cagney (2003) argued that structurally disadvantaged neighborhoods may be less capable of building and sustaining health-promoting social networks because of low levels of trust. Sampson, Raudenbush, and Earls (1997) posited that collective efficacy—the capacity for action on

behalf of community goals—is one key intervening mechanism linking community structure to health outcomes. Mutual trust and shared expectations for prosocial action are theorized to affect children's well-being on a number of levels. Sampson et al. (1997) found that collective efficacy had significant associations with rates of violence; the authors suggested that health may be influenced by high levels of collective efficacy through decreased violent victimization, illicit substance abuse, child abuse and neglect, or other reckless behavior. Browning and Cagney (2003) found that collective efficacy was related to the self-rated health of adults after controlling for neighborhood structural characteristics.

### Neighborhood Safety and Child and Adolescent Obesity

Recent increases in overweight and obesity are thought to directly result from a combination of decreases in physical activity and increases in caloric intake (Dietz & Gortmaker, 2001). A number of environmental factors are hypothesized to contribute to changes in both physical activity and caloric intake; however, research has only begun to uncover the multiple mechanisms through which environment ultimately affects children's physical health and BMI. Participation in regular physical activity depends in part on the availability and proximity to such facilities as community recreation or walking and bicycling trails, often scarce in low-income communities. Parents who are worried about their children's safety in the neighborhood may keep their children indoors and otherwise restrict their social and physical behavior (Burdette & Whitaker, 2005; Dietz & Gortmaker, 2001; Lumeng et al., 2006). Perceived neighborhood violence might discourage residents from walking, exercising, or adopting other healthful behaviors that could protect them against overweight and obesity (Sampson, 2003). Although several studies have examined the potential links between neighborhood disadvantage and BMI, the results have been mixed and further research is necessary.

Robert and Reither (2004) argued that community disadvantage may explain racial differences in adult BMI. The authors hypothesized that disadvantaged communities may lack the resources necessary to support sufficient physical activity and a healthy diet; increased levels of crime and disorder in disadvantaged communities may restrict physical activity by deterring people from walking

or exercising in the neighborhood. Although the authors found community structural disadvantage to be significantly related to adult BMI, that relationship was not mediated by physical activity.

In a cross-sectional, multilevel study of adolescents in Los Angeles, Cohen et al. (2006) found that neighborhood collective efficacy was a significant predictor of adolescent BMI and overweight status. Cohen et al. (2006) identified two potential pathways through which neighborhood collective efficacy may affect BMI. The first is related to allostatic load, which represents the cumulative wear and tear of everyday stress on the body. Residents of low collective efficacy neighborhoods may experience higher levels of day-to-day stress, which, over time, increases cortisol excretion and can lead to weight gain. The second pathway involves physical activity; neighborhoods with low collective efficacy may not foster healthy local environments that facilitate walking or other physical activity.

Several studies have examined the impact of neighborhood safety on child and adolescent obesity. Motivated by anecdotal evidence that parents in poor, urban neighborhoods express reluctance to allow their children to play outside because of fear of crime and delinquent behavior, Lumeng et al. (2006) analyzed a national cross-sectional sample of seven-year-old children. The authors found that parents' perception of their neighborhood as unsafe was independently associated with an increased risk of overweight at age 7 years. In another cross-sectional analysis of three-year-old children, Burdette and Whitaker (2005) tested the hypothesis that preschool children have a higher prevalence of obesity, spend less time playing outdoors, and spend more time watching television when they live in neighborhoods that their parents believe to be unsafe. The authors found that perceptions of neighborhood safety were correlated with children's television watching, but not with outdoor play or risk for obesity. One potential reason for these findings could be that the impact of neighborhood safety on BMI does not manifest until school age or later.

The current study contributes to the literature on neighborhoods and child health through the use of longitudinal analysis with nationally representative data. Although other studies have been cross-sectional and restricted to certain ages, the current study examined the BMI trajectories of children over four time periods. The longitudinal nature of the data allows for a more careful examination of

the impact of neighborhood safety on the development of children's BMI for two major reasons. First, by definition, in a longitudinal study, time can be included as a covariate. Second, as Diggle, Heagerty, Liang, and Zeger (2002) have observed, longitudinal studies are able to make use of both within-person and between-person variation and may therefore have statistical power to detect effects not observed in cross-sectional research.

## METHOD

### Sample

The sample was composed of children and their parents in the National Longitudinal Survey of Youth (NLSY) (Center for Human Resource Research, 2002). The NLSY began following young men and women in 1979 and collects data through in-home interviews; in 1986, the NLSY started conducting interviews with the children of women from the original sample. Data from mothers and their children were merged to create the sample used in the current analysis. In some cases, multiple children for a given mother were included. To model growth in BMI over time, data from four waves—1994, 1996, 1998, and 2000—were used and children with at least one data point were included. Although measurements of children's height and weight were collected starting in 1986, the NLSY did not include questions about neighborhoods prior to 1994. The NLSY stopped collecting neighborhood data after the 2000 wave of data collection. Data were arranged in person-period format to allow for longitudinal analysis. The sample was restricted to children between ages 5 and 20 at each time point because of the nature of the measures that comprised the research question. The final sample included 5,886 children.

### Measures

**BMI.** BMI is an approximate measure of body fat based on height and weight. In every wave of data collection, the NLSY collects information on children's height and weight, which allowed for the computation of children's weight and height. In addition, for descriptive purposes, a BMI *z*-score, used to determine BMI-for-age, was calculated for every child at each time point using parameters provided by the Centers for Disease Control and Prevention (2006). BMI-for-age is often used for children and adolescents because children's body fatness changes over the years as they grow and develop. Therefore,

BMI-for-age is age and gender specific; it is plotted on gender-specific growth charts to assess risk of overweight and obesity throughout the developmental years. A BMI  $z$ -score of 1.645 corresponds to the 95th percentile, which is the medical cutoff for overweight. A BMI  $z$ -score between 1.034 and 1.645 corresponds to the 85th to 95th percentile and is used to determine at-risk status. The simple BMI variable was used as the outcome in the multivariate analyses.

**Neighborhood Safety.** A six-item scale of neighborhood safety was created using questions from in-home interviews. Mothers were asked, "How would you rate this neighborhood as a place to raise children?" and responded on a five-point scale ranging from "poor" to "excellent." In addition, mothers were asked, "How much of a problem are the following in your neighborhood?" and were given three response options: "not a problem," "somewhat of a problem," or "a big problem." Five items were included in the neighborhood safety scale: "crime and violence," "abandoned or run-down buildings," "not enough police protection," "people don't care what goes on in the neighborhood," "people don't respect rules or laws." The neighborhood safety scale was standardized with a mean of 0 and a variance of 1.

**Independent Variables.** Demographic data including children's gender and race, mother's education, and family income were readily available from the NLSY data. Both mother's education and family income were constructed to be time-invariant variables. The highest value for mother's education over the six-year period was used, and an average of family income over all four time points was used. Age was centered around five years for ease of interpretation.

**Mediating Variables.** The mediating variable of interest in this study was the amount of television that children watch. This was measured through mother reports; mothers were asked, "How many hours of TV does your child watch on an average weekday?" Responses ranged from zero to 24 hours, but were top-coded at eight hours.

## Analysis

When used with longitudinal data, multilevel modeling allows the researcher to analyze the relationship of a set of independent variables with the growth trajectory of a dependent variable (Grogan-Kaylor, 2005), in this case BMI. A growth curve model

captures two aspects of the data: (1) the starting point and the trajectory followed by the response variable, which is measured repeatedly on each individual (within-subject growth); and (2) the extent to which both starting points and trajectories vary separately and simultaneously as a function of other independent variables that are used to differentiate individuals (between-subject growth) (Boyle & Willms, 2001). For this study, a three-level hierarchical model was used. Repeated observations of an individual child were considered nested within a child who was, in turn, nested within a family.

The basic strategy for modeling within-subject growth was to include a measure of time as an independent variable at level 1, in this case age. Each child has his or her own growth curve, specified by the individual regression coefficients that in turn may depend on individual attributes. Inspection of fitted ordinary least squares trajectories for individual children suggested that there was a nonlinear relationship between BMI and age; therefore, a quadratic term was added to the models.

Model development then proceeded by adding other covariates to the model. The final model was a three-level model because there were observations nested inside individuals nested inside mothers.

## RESULTS

### Descriptive Statistics

Descriptive statistics are reported in Table 1. The mean  $\pm$  standard deviation (*SD*) age for children in the sample was  $12.04 \pm 3.99$ . The mean  $\pm$  *SD* BMI was  $20.39 \pm 5.17$ , with a range of 12.28 to 57.39. The mean BMI  $z$ -score for the sample was 0.382, which is quite high given that the mean for the sample used by the Centers for Disease Control and Prevention is 0. The distribution of  $z$ -scores in the NLSY is skewed to the right (see Figure 1), possibly due to the oversampling of black and Latino children. Approximately 15 percent of the sample were overweight ( $z$ -score  $> 1.645$ , or the 95th percentile), and another 15 percent were at risk of overweight ( $1.034 < z$ -score  $< 1.645$ , or the 85th to 95th percentile).

Bivariate analyses were then conducted and are reported in Table 2. In bivariate analyses, black and Latinos children were more likely than white children to be overweight or at risk of overweight. Overweight children had mothers who were less educated and had lower incomes than children who were not overweight. In addition, overweight chil-

**Table 1: Descriptive Statistics**

Variable	Mean/ Percent	SD	Min	Max
BMI	20.39	5.18	12.28	57.39
BMI z-score	0.382	1.18	-3.09	3.06
Overweight (%)	15.19			
At risk of overweight (%)	15.40			
Age (years)	12.04	3.99	5	20
Gender (%)				
Boy	49.30			
Girl	50.70			
Race (%)				
Latino	21.22			
Black	32.47			
White	46.31			
Mother's education (years)	12.72	2.3	0	20
Annual family income (\$)	47,042	51,846	0	974,100
Neighborhood safety	-0.01	0.75	-2.43	0.76
Television (hours per day)	3.75	2.48	0	8

Note: Min = minimum; Max = maximum; BMI = body mass index.

dren watched 30 minutes more television per day on average than children who were not overweight.

Using the neighborhood safety scale, neighborhoods were divided into three categories: low (least safe), medium, and high (safest) (see Table 3). Bivariate analyses of BMI and neighborhood safety groups revealed that children living in neighborhoods that their parents perceived as unsafe had, on average, a BMI that was one point higher than that for children living in neighborhoods that their parents perceived as relatively safe. Moreover, 16.6 percent of children living in unsafe neighborhoods were overweight compared with only 13.9 percent of children living in safe neighborhoods. Children in unsafe neighborhoods watched, on average, 1.2 more hours of television a day than did children in safe neighborhoods. Black and Latino children were far more likely than white children to live in neighborhoods that they perceived to be unsafe.

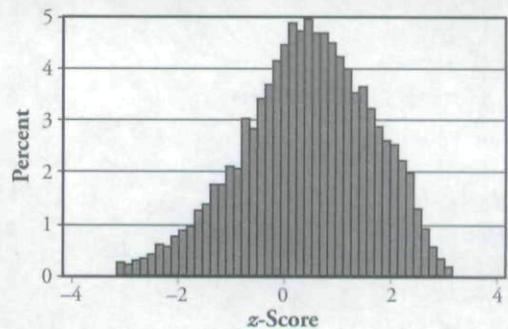
#### Initial Growth Curve Models of BMI

Multivariate results are reported in Table 4. In a growth curve model with longitudinal data, the unconditional intraclass correlation coefficient (Rabe-Hesketh & Skrondal, 2005) is a measure of the amount of variation that can be accounted for by differences between individuals. We calculated that an estimated 40 percent of the variation in BMI lay between individual children, an estimated 24.5

percent lay between families, and the remaining 35.2 percent occurred within children over time.

Adding time to the model allowed us to evaluate the baseline amount of change over time in BMI (model 2). The change in the within-person variance from the unconditional means model to the unconditional growth model from 3.09 to 2.44 revealed that 38 percent of the within-person variance was associated with linear change over time. The baseline rate of change in BMI over time was 0.74. BMI increased, on average, 0.74 points with every year of age.

**Figure 1: Distribution of BMI z-Scores in NLSY Data**



**Table 2: Characteristics of Overweight and At-Risk Children**

Characteristic	Overweight	Risk of Overweight	Not Overweight or at Risk
Race (%)			
Latino	16.3	16.0	67.7
Black	19.2	16.1	64.7
White	11.9	14.6	73.5
Gender (%)			
Boy	15.9	14.9	69.2
Girl	14.4	15.9	69.7
Mother's education (years): <i>M (SD)</i>	12.4 (2.3)	12.6 (2.3)	12.8 (2.3)
Annual family income (\$): <i>M</i>	40,162	45,504	48,260
Neighborhood safety: <i>M (SD)</i>	-0.08 (0.8)	-0.06 (0.8)	0.006 (0.7)
Television (hours per day): <i>M (SD)</i>	4.2 (2.5)	3.8 (2.4)	3.7 (2.5)

In model 3, demographic characteristics at the child and family level were added to the intercept of the growth curve model. Girls had a higher BMI at age 5 than did boys, and black and Latino children had a higher BMI at age 5 than did white children. Mother's education was not a significant predictor of BMI at age 5; however, income did have a significant but small effect.

### Neighborhood Safety and BMI

Parents' perceptions of neighborhood safety had a significant association with children's BMI, while controlling for demographic factors (model 4). However, the negative associations of living in an unsafe neighborhood did not manifest in differences in BMI until age 11. To understand how percep-

tions of neighborhood safety might be related to the health behaviors of children, the number of hours of television watched on an average weekday was added to the model (model 5). The addition of this variable rendered the direct neighborhood effects insignificant, suggesting that the connection of neighborhood safety with BMI was mediated by increased indoor sedentary behaviors such as television watching.

## DISCUSSION AND POLICY IMPLICATIONS

### Study Limitations

There are several limitations to this study. One limitation is that the NLSY data used in this research do not contain measures of structural characteristics of neighborhoods or actual neighborhood crime

**Table 3: Neighborhood Safety, Sociodemographic Characteristics, and Body Mass Index**

Variable	Neighborhood Safety		
	Low (least safe)	Medium	High (safest)
Body mass index	20.92	20.37	19.89
Overweight (%)	16.6	15.2	13.9
At risk of overweight (%)	16.2	15.3	14.7
Total overweight and at risk (%)	32.8	30.5	28.6
Race ( <i>n</i> )			
Latino	1,694	1,407	1,140
Black	3,199	1,808	1,478
White	1,881	3,094	4,278
Mother's education (years)	12.08	12.72	13.36
Annual family income (\$)	34,450	43,768	62,669
Television (hours per day)	4.4	3.7	3.2

**Table 4: Multilevel Models Predicting Body Mass Index**

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	20.19 (.07)	15.23 (.07)	14.76 (.34)	14.81 (.33)	15.24 (.34)
Level 1					
Age		.74* (.01)	.92* (.02)	.92* (.02)	.50* (.04)
Age ^2			-.01* (.001)	-.01* (.001)	.04* (.004)
Neighborhood Safety				.19* (.07)	.10 (.08)
Neighborhood Safety × Age				-.03* (.01)	-.02 (.02)
Television					.04* (.01)
Level 2					
Female			.22* (.08)	.21* (.08)	.12 (.08)
Latino			.40* (.14)	.42* (.14)	.33* (.14)
Black			.90* (.12)	.93* (.12)	.78* (.13)
Mother's education			.02 (.02)	.02 (.02)	.01 (.02)
Income (in thousands)			.02* (.01)	.02* (.01)	.02* (.01)
Random effects					
Family	2.58 (.07)	2.04 (.06)	1.93 (.06)	1.93 (.06)	1.93 (.06)
Child	3.31 (.05)	3.01 (.04)	1.90 (.06)	1.90 (.06)	1.90 (.06)
Residual	3.09 (.02)	2.44 (.02)	2.28 (.02)	2.27 (.02)	2.28 (.02)

Notes: The numbers outside parentheses are coefficients. The numbers within parentheses are the standard errors of those  $\beta$  coefficients.  
\* $p < .05$ .

rates. However, as Lumeng et al. (2006) pointed out, studies have shown that ratings of neighborhood quality correlate highly with actual crime rates. Moreover, because the theory suggests that parents restrict their children's outdoor activity on the basis of perceptions of neighborhood safety, it is arguably more important to have measures of parents' perceptions rather than actual crime rates. However, future studies would benefit from the use of data that allow for the inclusion of neighborhood-level structural characteristics, such as crime rates and the built environment, to further explore mediating and moderating mechanisms and processes. For example, an awareness of how parents and children evaluate neighborhood safety and make decisions about everyday activities could be useful in understanding how these decisions might mediate the connec-

tion between neighborhood safety and BMI. Such research would require the inclusion of objective neighborhood-level structural measures and subjective individual-level measures. Similarly, it is possible that some family-level processes may moderate the relationship of neighborhood structural characteristics and children's BMI. For example, parental emotional support may serve as a protective factor in the context of neighborhood risk. Exploration of the interplay between neighborhood and family factors might prove fruitful.

#### Implications for Intervention and Future Research

Results for the growth curve analysis of children ages 5 to 20 in the NLSY indicate that parents' perception of their neighborhoods as unsafe is associated

with increases in BMI, but that this relationship is mediated—or statistically explained—by increased television watching. The results of this study suggest that when parents feel their neighborhood to be unsafe, they will restrict their children's outdoor activities and increase the likelihood of sedentary indoor activity.

This research makes a number of contributions to previous research in this area. First, in contrast to much previous research in this area, this research is explicitly longitudinal and takes advantage of growth curve estimation derived from the tradition of multilevel modeling. This perspective allows us to see that there is a relationship of neighborhood safety with children's BMI over the course of children's growth and development and over a wide range of ages. In particular, the parameter estimate associated with the interaction of neighborhood safety and children's age suggests that neighborhood conditions only become salient for children's BMI for older children. We are not aware of another article that has estimated the relationship of the interaction of neighborhood conditions and children's age with children's BMI. The finding that a relationship between neighborhood conditions and children's BMI does not emerge until children are older could explain Burdette and Whitaker's (2005) finding that perceptions of neighborhood safety did not have an impact on BMI in preschool-age children.

Although black and Latino children were much more likely than white children to live in unsafe neighborhoods, BMI differences in race and ethnicity persisted even when neighborhood safety was added to the model. Neighborhood advantage and disadvantage is complex and multidimensional; it is likely that black and Latino children live in neighborhoods that are more disadvantaged on a number of levels than the neighborhoods in which white children live, and neighborhood safety is simply one aspect of disadvantage. Again, future research should continue to examine additional dimensions of disadvantage that restrict or facilitate healthy behaviors (for example, the built environment and access to healthy foods) and that may have separate effects on BMI. Moreover, future studies should test multiple pathways through which neighborhoods may ultimately affect children's BMI. Neighborhood crime could affect BMI through psychosocial pathways; for example, children who live in high-crime areas could suffer from secondary trauma that may lead to self-regulation with food.

These results have important implications for policy and interventions. First, simple encouragement of children to exercise more may have differential effects on children from different types of neighborhoods; in other words, neighborhood safety may moderate the effects of health interventions on children. Second, this analysis suggests that policy recommendations at two levels are warranted. At a more macro level, these findings suggest that community development and improvement policies may have an impact on the health of children living in particular neighborhoods. Also, even though the effect of neighborhood safety was estimated while controlling for family income and maternal education, it is likely that there are other aspects of socioeconomic status that have an effect on the types of neighborhoods in which families are able to reside. Policies, such as living wage policies, that improve the ability of families to choose desirable neighborhoods may thus have implications for child health. On another level, the connection of television viewing and children's BMI provides further support for policy statements calling for lower amounts of television viewing.

There are some examples of new initiatives that acknowledge neighborhood barriers to outdoor play and exercise. For example, the "Where Do the Children Play" campaign seeks to "engage organizations, community groups, and concerned citizens throughout the country in efforts to address local barriers such as sprawl, violence and lack of access in order to improve the healthy educational and emotional development of children" (Michigan Public Media, 2008). Social workers, especially community organizers, could be at the forefront of these educational efforts. In addition, social workers can work with families and schools in an effort to create safe places where children can play and be physically active. In communities that face significant barriers to outdoor activities, school social workers can lead efforts to provide school-based programs in which children can play and exercise. One example, drawn from the state of Michigan, Project Healthy Schools, seeks to not only educate children about healthy diet and exercise, but also provide more structured opportunities for physical activity during and after school (University of Michigan Health System, 2008). Social workers can play a key role in these public health campaigns by bringing attention to the ways in which disadvantage structures opportunity and ability to adopt healthful behaviors.

## CONCLUSION

Childhood overweight and obesity are on the rise, and there are serious health risks to this epidemic. Although studies of individual health behaviors are important, it is equally important to understand the environmental conditions that structure health behaviors. Recent health research has shown that the social and physical characteristics of neighborhoods play a role in restricting or facilitating healthy behaviors. Children living in unsafe neighborhoods face barriers to increasing their physical activity, which ultimately affects their BMI trajectory. Future research on child health and development should further examine the mechanisms and processes that link neighborhood disadvantage to health and health behavior. **HSW**

## REFERENCES

- Boyle, M. H., & Willms, J. D. (2001). Multilevel modeling of hierarchical data in developmental studies. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 42, 141-162.
- Browning, C. R., & Cagney, K. A. (2003). Moving beyond poverty: Neighborhood structure, social processes, and health. *Journal of Health and Social Behavior*, 44, 552-571.
- Buka, S. L., Brennan, R. T., & Rich-Edwards, J. W. (2003). Neighborhood support and the birth weight of urban infants. *American Journal of Epidemiology*, 157, 1-8.
- Burdette, H. L., & Whitaker, R. C. (2005). A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. *Pediatrics*, 116, 657-662.
- Center for Human Resource Research. (2002). *National longitudinal survey of youth 1979* (Data file). Columbus, OH: Author.
- Centers for Disease Control and Prevention. (2006). *Body mass index: About BMI for children and teens*. Retrieved October 10, 2006, from [http://www.cdc.gov/nccdphp/dnpa/bmi/childrens\\_BMI/about\\_childrens\\_BMI.htm](http://www.cdc.gov/nccdphp/dnpa/bmi/childrens_BMI/about_childrens_BMI.htm)
- Cohen, D. A., Finch, B. K., Bower, A., & Sastry, N. (2006). Collective efficacy and obesity: The potential influence of social factors on health. *Social Science & Medicine*, 62, 769-778.
- Dietz, W. H., & Gortmaker, S. L. (2001). Preventing obesity in children and adolescents. *Annual Review of Public Health*, 22, 337-353.
- Diez-Roux, A., Nieto, F., & Muntaner, C. (1997). Neighborhood environment and coronary heart disease: A multilevel analysis. *American Journal of Epidemiology*, 146, 48-63.
- Diggle, P. J., Heagerty, P., Liang, K., & Zeger, S. (2002). *Analysis of longitudinal data*. New York: Oxford University Press.
- Earls, F., & Carlson, M. (2001). The social ecology of child health and well-being. *Annual Review of Public Health*, 22, 143-166.
- Grogan-Kaylor, A. (2005). Corporal punishment and the growth trajectory of children's antisocial behavior. *Child Maltreatment*, 10, 283-292.
- Humphreys, K., & Carr-Hill, R. (1991). Area variations in health outcomes: Artifact or ecology. *International Journal of Epidemiology*, 20, 251-258.
- Katz, L. F., Kling, J. R., & Liebman, J. B. (2001). Moving to opportunity in Boston: Early results of a randomized mobility experiment. *Quarterly Journal of Economics*, 116, 607-654.
- Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, 126, 309-337.
- Lumeng, J. C., Appugliese, D., Cabral, H. J., Bradley, R. H., & Zuckerman, B. (2006). Neighborhood safety and overweight status in children. *Archives of Pediatrics & Adolescent Medicine*, 160, 25-31.
- Michigan Public Media. (2008). *Where do the children play?* Retrieved January 12, 2008, from <http://www.wfwm.org/childrenplay/index.html>
- Morenoff, J. D. (2003). Neighborhood mechanisms and the spatial dynamics of birth weight. *American Journal of Sociology*, 108, 976-1017.
- Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA*, 295, 1549-1555.
- Rabe-Hesketh, S., & Skrondal, A. (2005). *Multilevel and longitudinal modeling using Stata*. College Station, TX: Stata Press.
- Robert, S. A., & Reither, E. N. (2004). A multilevel analysis of race, community disadvantage, and body mass index among adults in the US. *Social Science & Medicine*, 59, 2421-2434.
- Sampson, R. J. (2003). The neighborhood context of well-being. *Perspectives in Biology and Medicine*, 46(Suppl.), S53-S64.
- Sampson, R. J., Morenoff, J. D., & Gannon-Rowley, T. (2002). Assessing "neighborhood effects": Social processes and new directions in research. *Annual Review of Sociology*, 28, 443-478.
- Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997, August 15). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277, 918-924.
- University of Michigan Health System. (2008). *Project healthy schools*. Retrieved January 12, 2008, from <http://www.med.umich.edu/projecthealthyschools/>
- U.S. Department of Health and Human Services. (2001). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.
- Yen, I., & Kaplan, G. (1999). Neighborhood social environment and risk of death: Multilevel evidence from the Alameda County study. *American Journal of Epidemiology*, 149, 898-907.

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Original manuscript received January 4, 2007  
Final revision received January 18, 2008  
Accepted July 8, 2008

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