Published in final edited form as:
Soc Sci Med. 2011 March ; 72(5): 668–676. doi:10.1016/j.socscimed.2010.12.015.

Young children in urban areas: Links among neighborhood characteristics, weight status, outdoor play, and television watching

Rachel Tolbert Kimbro,
Rice University

Jeanne Brooks-Gunn, and
Columbia University

Sara McLanahan
Princeton University

Abstract

Although research consistently demonstrates a link between residential context and physical activity for adults and adolescents, less is known about young children's physical activity. Using data from the U.S. Fragile Families and Child Wellbeing Study (N=1822, 51% male), we explored whether outdoor play and television watching were associated with children's body mass indexes (BMIs) at age five using OLS regression models, controlling for a wide array of potential confounders, including maternal BMI. We also tested whether subjective and objective neighborhood measures - socioeconomic status (from U.S. Census tract data), type of dwelling, perceived collective efficacy, and interviewer-assessed physical disorder of the immediate environment outside the home -were associated with children's activities, using negative binomial regression models. Overall, 19% of the sample were overweight (between the 85th and 95th percentiles), and 16% were obese (≥95th percentile). Hours of outdoor play were negatively associated with BMI, and hours of television were positively associated with BMI. Moreover, a ratio of outdoor play to television time was a significant predictor of BMI. Higher maternal perceptions of neighborhood collective efficacy were associated with more hours of outdoor play, fewer hours of television viewing, and more trips to a park or playground. In addition, we found that neighborhood physical disorder was associated with both more outdoor play and more television watching. Finally, contrary to expectations, we found that children living in public housing had significantly more hours of outdoor play and watched more television, than other children. We hypothesize that poorer children may have more unstructured time, which they fill with television time but also with outdoor play time; and that children in public housing may be likely to have access to play areas on the grounds of their housing facilities.

Introduction

Despite trends indicating a recent stabilizing in the upward obesity trend for children and adolescents in the U.S., child overweight remains a significant public health issue, with 31.9% of children aged 2–19 overweight or obese (Ogden, Carroll, & Flegal, 2008), and significant disparities by socioeconomic status (SES) (Singh, Siahpush, & Kogan, 2010). One prominent explanation is that children are spending too little time playing outdoors and too much time watching television, and furthermore that low levels of outdoor play are due to mothers' concerns about neighborhood safety. Although some studies have examined these hypotheses, very few have used nationally representative data, few have focused on young children, and few have attempted to integrate both objective and subjective measures

of neighborhood quality (Foster & Giles-Corti, 2008; Grow et al., 2010; Sallis & Glanz, 2006), which is crucial for establishing a direct association between neighborhood context and young children's activities. Our paper fills this gap by using data from a large, birth cohort study of urban children to address two questions: (1) are the activity patterns (outdoor play and television watching) of five-year-old children associated with their weight status, and (2) are children's residential contexts, as assessed by both subjective and objective measures, associated with their activity patterns?

Children's physical and sedentary activities and obesity

It is clear from experimental intervention studies that regular exercise is beneficial for older children's weight status (Goran, Reynolds, & Lindquist, 1999). Moreover, children who spend more time engaged in sedentary activities like watching television or playing video games are more likely to be overweight (Escobar-Chaves & Anderson, 2008; Gable, Chang, & Krull, 2007), although at least one study did not find a link between three-year-olds' television viewing and body mass index (BMI) (Burdette & Whitaker, 2005). Thus, in the first step of our analysis, the associations among television watching, outdoor play and children's BMI at age five are documented, controlling for maternal BMI, an important predictor of child weight status (Whitaker, Jarvis, Beeken, Boniface, & Wardle, 2010). This first step, which we view as validation for the analysis that follows, also provides context for the second set of analyses, which seek to evaluate the influence of residential context on children's physical and sedentary activities.

Residential context and children's physical activity

Recent scholarly attention in the U.S. has focused on neighborhood environments as determinants of adults' weight status and physical activity. Generally, individuals in more disadvantaged neighborhoods have lower levels of physical activity and higher rates of obesity, controlling for individual-level SES (Boardman, Saint Onge, Rogers, & Denney, 2005; Fisher, Li, Michael, & Cleveland, 2004; Humpel, Owen, & Leslie, 2002). These links may be due to safety concerns (crime; poorly lighted streets), the built environment (lack of parks, playgrounds, and walkable destinations such as churches, restaurants, and grocery stores), access to and affordability of healthy foods (Lang & Caraher, 1998; Rose & Richards, 2007), or to differences in neighborhood social processes such as collective efficacy or social cohesion (e.g. Giles-Corti & Donovan, 2002; Humpel et al., 2002; Kawachi & Berkman, 2000; Moore, Diez Roux, Evenson, McGinn, & Brines, 2008).

Two recent U.S. studies documented a link between neighborhood SES and obesity in older children (Grow et al., 2010; Singh et al., 2010), but in general research on children and adolescents is mixed, with some studies showing strong correlations between neighborhood context, obesity, and physical activity and others showing little to no effect. The mixed findings may have to do with study design; some studies ask about overall physical activity, which could occur within or outside of the neighborhood (Davison & Lawson, 2006), some focus on specific age groups (Burdette & Whitaker, 2004; Cradock, Kawachi, Colditz, Gortmaker, & Buka, 2009; Franzini et al., 2009; Molnar, Gortmaker, Bull, & Buka, 2004), some are crosssectional (Burdette & Whitaker, 2005; Franzini et al., 2009) rather than longitudinal (Lumeng, Appugliese, Cabral, Bradley, & Zuckerman, 2006), and some do not control for important potential confounders such as maternal BMI or individual-level SES (Gable et al., 2007; Lumeng et al., 2006).

In this paper, we hypothesize that residential context influences children's physical activity patterns primarily through parental concerns about safety, which manifest via two main pathways -- concerns about the physical environment, and concerns about the social environment -both of which may be related to neighborhood SES. The physical environment

includes aspects of the built environment such as safe sidewalks and access to parks and playgrounds, as well as the immediate residential context the child experiences (e.g. type of home). The social environment refers to how comfortable mothers feel about their neighborhood. Parental concern about child safety correlates with children's physical activity and weight status (Carver, Timperio, & Crawford, 2008; Davison & Lawson, 2006; Gable et al., 2007; Lumeng et al., 2006; Timperio, Salmon, Telford, & Crawford, 2005; Weir, Etelson, & Brand, 2006). In general, research on the built environment and children's activities shows similar impacts as for adults (Gordon-Larsen, Nelson, Page, & Popkin, 2006; Sallis & Glanz, 2006), although very few studies focus on young children (Papas et al., 2007). Residents of disadvantaged communities may actually walk more, perhaps due to greater density of destinations and pedestrian routes in urban environments (Romero et al., 2001; Ross, 2000). Collective efficacy, or the degree to which neighbors trust and look out for one another (Sampson, Raudenbush, & Earls, 1997), is positively associated with physical activity (Echeverría, Diez-Roux, Shea, Borrell, & Jackson, 2008; Evenson, Sarmiento, Tawney, Macon, & Ammerman, 2003). Parents who perceive higher degrees of collective efficacy (CE) may be more likely to allow their children to play outside. One study found an effect on television viewing but not outdoor play, although it was unable to account for neighborhood SES (Burdette & Whitaker, 2005). A recent analysis (Cradock et al., 2009), with rich and detailed neighborhood data for Chicago, found that adolescents in neighborhoods with high levels of cohesion had higher physical activity levels. Another comprehensive study of ten-year-old children in three U.S. cities found that neighborhood social factors were stronger predictors of physical activity than were the physical characteristics of neighborhoods (Franzini et al., 2009).

In the second part of our analysis, we assess how multiple measures of residential context may influence young children's physical activity -- neighborhood socioeconomic disadvantage, type of living environment (dwelling type, number of residents in the household, and public housing), maternal perceptions of collective efficacy and fears about the child playing outdoors, as well as interviewer-assessed physical disorder of the immediate environment outside the home, while simultaneously controlling for multiple individual-level determinants of children's activities. We believe a major advantage of the study is its ability to incorporate both subjective (from the mother's perceptions) and objective (demographic and interviewer observations) data about the neighborhoods. The causal direction for associations between maternal perceptions of neighborhoods and children's physical activity is unclear. In other words, rather than neighborhood perceptions driving children's outdoor time, perceptions may be formed by spending time with children outdoors. In addition, perceived neighborhood disorder may stem more from social factors than from actual observed disorder (Franzini, Caughy, Nettles, & O'Campo, 2008; Sampson & Raudenbush, 2004), making it critical to account for multiple perspectives when assessing neighborhood conditions (Franzini et al., 2009). Thus, we test associations between subjective and objective measures of neighborhoods and children's activities. In other words, we do not have to rely only on mothers' perceptions of their neighborhoods, which may be influenced by how often her child plays outside, or by other unobserved individual factors. Instead, we can incorporate her perceptions along with Census demographic data and interviewer observations. Thus, we expect that mothers who perceive high levels of CE will have children who play outdoors more, and watch television less. We also hypothesize that children in areas of high physical disorder will play outside less, and watch more television, than children in neighborhoods of lower physical disorder.

Research methods

Data

The Fragile Families and Child Wellbeing Study (FFCWS) follows a birth cohort of urban parents and their children (N=4898), and when weighted it is representative of all births in large U.S. cities in 1998–1999. The study oversampled unmarried mothers, who make up about three-quarters of the sample, with the remaining one quarter of mothers married at the time of the child's birth. Follow up interviews were conducted when the child was one, three, and five years old. Data for this paper are from a sub-sample of FFCWS respondents at wave IV, who also took part in the In-Home Longitudinal Study of PreSchool Aged Children, an in-depth survey administered when the children were five years old (about 76% of the Wave IV respondents participated). U.S. Census 2000 data for Census tracts were merged with the FFCWS data file. In addition to sociodemographic and attitudinal information for both mothers and fathers in the Wave IV survey, the In-Home Survey includes interview responses, parent and child activities, parent and child anthropometric measures, and an observation of both parent -child interaction and the home environment (including the exterior of the home). The data for the first analysis include the 1975 children with valid BMIs and non-missing data on the family background characteristics measures. The data for the second analysis include the 1822 mothers and children who completed all components of the In-Home and Core Five-Year Surveys, and who had valid geocoded data and interviewer home observation data. Respondents we exclude include those missing information on their Census tract (N=155) and those missing the observation of the exterior of their home (N=233). Both sets of respondents missing data on these measures are slightly more likely to be Hispanic, but otherwise are very similar to respondents who completed all portions of the study. For further information about the Fragile Families Study, please visit http://crcw.princeton.edu/ff.asp. These data are ideal for our research questions because they are, as far as we know, the only longitudinal data from multiple large U.S. cities on young children which incorporate both mother-reported and objectively measured neighborhood characteristics. In addition, the data include a large proportion of low SES families, so a wide range of neighborhood conditions and experiences are represented. Research ethical approval for this study was provided by the Rice University Institutional Review Board.

Measures

The first outcome of interest is the child's body mass index percentile (BMI) at age five. Children were weighed and measured during the in-home visit using standard procedures and digital scales. Physical and sedentary activities were measured by three variables (all reported by the mother): 1) child's average number of hours per weekday of outdoor play; 2) child's average number of hours per weekday of television viewing; and 3) the average number of days per week the mother takes the child out to play at a park or playground. For the first two outcomes, outdoor play and hours of television, responses were totals across one full day; we do not know when during the day these activities took place. Less than 0.5% of cases were missing any of the activity measures, and those children were dropped from the sample for that particular analysis. We also created a ratio of outdoor play time to television time, suspecting that it might be a meaningful predictor of BMI.

Maternal and child background characteristics

The data provide a variety of background factors related to child weight status and to children's activities. We classified children into racial/ethnic categories: Non-Hispanic White (reference), Non- Hispanic Black, and Hispanic, and controlled for the child's age in months, child's gender (1 = male), whether the mother reported the child to be in fair or poor health, and, in the models predicting BMI, whether the child was normal birthweight (2500–5000 g), low birthweight (<2500 g), or high birthweight (5000+ g), as the influence of

birthweight on physical development reaches well into childhood. We controlled for mothers' educational attainment (when the child was born) with a set of indicators for 'did not complete high school' (reference group), 'completed high school,' and 'some college or more,' as well as mother's age. We included measures for mother's employment, with 'not employed outside the home' as the reference category, compared to 'full-time' and 'part-time' work; as well as an indicator for whether the child is enrolled in any daycare, preschool, or kindergarten program. Because children with older siblings might be more likely to play outside, we included an older sibling indicator (1 = has older sibling). Because mothers interviewed in the winter might report lower totals of outdoor activity, we included an indicator (1 = mother interviewed during the winter, and lives in a city with cold winter weather). We also included a continuous measure of the income-to-needs ratio for the household (also the income-to-needs ratio squared as indicated below), as well as family structure indicators based on the mother's current relationship with a partner (which could be the child's biological or social father) -- married, cohabiting, or single. We also included an indicator for whether the mother is likely clinically depressed, an indicator based on the CIDI-SF (Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998), as mothers who are depressed may be less likely to take their child out to play. Finally, to account for other, unobserved factors (such as genetics or general household nutrition) that may influence children's weight status as well as their outdoor activities, we also controlled in our models for whether the child's mother is overweight (BMI between 25.0 and 29.9) or obese (BMI ≥ 30.0). If the mother was pregnant at the time of the five year follow-up (N=117), we used her BMI at the time of the three year follow-up.

Residential context measures

The first set of residential context measures include (1) whether the family lived in public housing, (2) number of residents in the household, and (3) type of housing: single-family home (reference), apartment, duplex/townhome/row house, or other housing type. We also included a neighborhood poverty measure to control for tract-level differences in neighborhood poverty. The Census tract is the smallest residential area we have in our data. Given that our interviewer-assessed measure (described below) is conducted on the immediate exterior of the home, Census block data might have been preferable. Correlations for Census tract and block measures, however, are generally very high (Diez-Roux et al., 2001), and we also presume that the influence of contextual poverty on children's physical activity may extend beyond the immediate environment of the home. The measure (which was taken from the three-year survey) was coded into three categories: Low-poverty neighborhoods (% of households in poverty is less than 12%); Medium poverty neighborhoods (the reference category; 12–39% of households are in poverty); and High-poverty neighborhoods (40% or more households are in poverty). Very few tracts represented in the sample have more than two respondents who reside there (just 10%). Thus, this measure is a broad representation of the socioeconomic status of the neighborhood and is not utilized in a multilevel framework. To account for the fact that nearly half the sample has moved since the three-year survey, we included an indicator for whether the family has moved in the last two years in all the models along with the poverty measure. Unfortunately, we do not have detailed, longitudinal residential information for each family. We do ask, at each wave, how many times the family has moved since the last interview. Using this information, we also created a variable which indicated how many times the family had moved in the last four years, and included it in our models. This measure of residential instability was never significant in any of our models, so we instead used the simple measure of whether the family moved in the past two years.

To measure neighborhood collective efficacy, we used a slightly modified version of the neighborhood social environment measures in the Project on Human Development in

Chicago Neighborhoods (PHDCN) Community Survey Questionnaire (Earls, Brooks-Gunn, Raudenbush, & Sampson, 2002). Ten items assessing the mother's perception of neighborhood cohesion were summed to create the scale (Chronbach's alpha=0.86). There were two types of questions. The first five questions gauged how likely the mother thought that neighbors would intervene in certain situations, such as "If children were skipping school and hanging out on the street." Mothers chose one of four responses; from "very likely" to "very unlikely." The second five questions asked about how cohesive mothers felt their neighborhoods were, such as, "People around here are willing to help their neighbors." Mothers chose one of four responses, ranging from "strongly agree" to "strongly disagree." If mothers chose "don't know," her score on that item was coded as in the middle of the range (e.g., 2.5). We felt this was reasonable because only about 2% of mothers answered each of the 10 questions "don't know." Thus, combining the items into a scale of ten questions, having a mid-range value for a few questions should not impact the results much. As a sensitivity analysis, we reran our models including only mothers who answered 10/10 of the questions without a "don't know," and results were identical. We also tried creating a scale which was the average of all items (with missing items or "don't knows" dropped), and results were the same. Items were coded with higher scores representing more neighborhood cohesion and summed to create the full scale. We also included a dichotomous measure for whether the mother reported feeling fearful about her child playing outdoors due to violence (1 = fearful).

As part of the In-Home study, interviewers were instructed to complete a series of five questions immediately after leaving the respondent's home. The observations were a simplified version of the block physical disorder and physical decay measures created by Sampson and Raudenbush (2004) and included questions about the physical condition of the yard, street, and surrounding buildings. This interviewer observation data was summed into a physical disorder index (alpha=0.85), with higher values indicating more disorder. According to these measures, approximately 15% of households had a significant amount of litter nearby; 18% of the buildings were in poor condition or badly deteriorated; 5% had a significant amount of graffiti nearby; 21% had at least one boarded- up or abandoned building on the block; and 13% had one or more abandoned vehicles on the block.

Statistical analysis

For the first part of the analysis, which validated the association between the activity measures and body mass index (BMI) percentile, we used ordinary least squares regression. We tested several specifications of SES, and found that the income-to-needs ratio had a nonlinear association with BMI percentile, so we also included a squared income-to-needs ratio term. We also created categories for BMI percentile (underweight, normal weight, overweight, and obese), and tested whether the associations between the activity measures and weight status varied depending upon the specification of the dependent variable, using ordered logit models.

The associations between the activity measures and a four-category weight outcome were uniformly weaker than for the linear model, but the effects were in the same direction. For the second part of the analysis, each of the three activity measures (average hours per day spent playing outdoors; average hours per day spent watching television; and average times per week mother takes the child to a playground) was a count measure and each was marked by over-dispersion, so OLS regression was not appropriate. Thus, negative binomial regression models were used. These models are increasingly common in physical activity research and they allow for responses of zero hours and also adjust standard errors for over-dispersion in the outcome measure (Slymen, Ayala, Arredondo, & Elder, 2006).

Results

Table 1 presents descriptive statistics for the sample, consisting of the mean and standard deviation for each variable. The mean BMI percentile in the sample was 66.2, and in categorical terms (not shown) approximately 19% of the sample was overweight (between the 85th and 95th percentiles), and 16% were obese (≥95th percentile). On average, children played outside about 2 h per day, and watched more than two and a half hours of television per day. Mothers took their children to the playground or the park nearly four times per week. The background characteristics show that the FFCWS sample was relatively disadvantaged (reflecting the urban nature of the sample) with more than one-third of mothers having not completed high school, and the mean income-to-needs ratio was 1.76. In addition, just 32% of mothers were married to the child's father (or a social father), and 38% were working full-time. Fully 27% of mothers were overweight, and 42% were obese, meaning that nearly three-quarters of the mothers were overweight or obese. Nearly one in five families (19%) lived in public housing, and the mean number of residents per household was 4.63.

Table 2 presents results of the OLS analysis designed to validate the association between the physical activity outcomes and children's BMI. As expected, hours of outdoor play were negatively associated with BMI, and hours of television were positively associated with BMI. For each hour of outdoor play, children, on average, scored about half a percentile point lower on BMI. The corresponding increase for each hour of television was similar, about half a percentile point. Model 3 shows the results when the ratio of outdoor time to television time was included in the model, and results indicate that the higher the ratio of outdoor time to television time on an average weekday, the lower the child's BMI. In fact, for each additional hour they play outside each day -over and above television watching- children scored 1.5 percentile points lower on BMI. Contrary to expectations, we found that the number of playground trips with the mother per week was not a statistically significant predictor of BMI at age five (although the distribution of this variable was skewed toward the high end). We also found that the income-to-needs ratio was associated in a nonlinear way with BMI percentile, such that it was lowest for the poorest and wealthiest children. Maternal weight status, a very strong predictor of child BMI, captures many of the unobserved factors that correlate with children's BMI percentiles, and our ability to control for maternal weight is a strength of our study.

Our second question focused on the association between neighborhood characteristics and children's activities. Table 3 presents results of the negative binomial regression models for hours of outdoor play. In the basic model (Model 1), Black children had an estimated count of outdoor hours of play 18% lower than White children, similar to the result for Hispanic children. Working mothers, and those families interviewed in the winter, reported less time outside. In Model 2 we controlled for residential context, and see that children living in public housing had an estimated outdoor play count 13% higher than other children. Neighborhood poverty was not significantly related to children's outdoor time, nor was maternal fear about her child playing outdoors.

In Model 3, higher levels of collective efficacy were associated with more outdoor play time, even after accounting for differences between neighborhoods in poverty level and other residential context measures. The effect was significant but small; for a standard deviation increase in CE, children's estimated hours of play increased by 5%. In Model 4, we tested the association between children's outdoor play and physical disorder in the immediate area around the home, and found that, counter-intuitively, higher physical disorder was associated with more time outdoors for children. This effect was somewhat stronger than the CE effect; a standard deviation increase in physical disorder was associated

with a 10% increase in estimated hours of play for children. In a model (not shown) which included both CE and physical disorder (which were correlated _0.19), results were virtually unchanged.

Table 4 presents results for models examining children's television time. In Model 1, Black and Hispanic children watched more weekday television, on average, than white children (29% and 16% more, respectively). Similarly, higher-SES children watched less television; each standard deviation increase in the income-to-needs ratio resulted in about 7% less television time. Children of mothers who worked full-time and children enrolled in kindergarten or a daycare program watched less television. Model 2 added the residential context measures, and again we found a significant difference between children who lived in public housing and those who did not -children living in public housing had an 12% increase in the estimated number of hours of television per day. In Model 3, we tested the association between maternal perceptions of collective efficacy and children's television time, and found that the children of mothers who perceived better collective efficacy in their neighborhoods watched less television. Each standard deviation increase in CE was associated with a 1% decrease in the estimated count of television time for children. We also see that maternal fear of the child playing outside is associated with more television time. Model 4 shows that children living in areas of higher physical disorder watched more television, about 5% more for each standard deviation increase in physical disorder.

Results for the number of times per week the mothers took the children to a park or playground were virtually identical to those for hours of outdoor play, so results are not presented here (available upon request).

Discussion

Our analysis, one of the first to incorporate objective and subjective neighborhood characteristics when examining young children's physical and sedentary activities, revealed some surprising findings. Despite most recent research documenting a negative association between SES and the likelihood of overweight for children (e.g. Danielzik, Czerwinski-Mast, Langnase, Dilba, & Muller, 2004), we found a nonlinear effect - the poorest and wealthiest children in our sample had the lowest BMIs, while the children in the middle of the SES distribution had the highest BMIs. In addition, we found that hours of outdoor play and television watching were both associated with BMI at age five, as was the ratio of outdoor play to television watching time. The magnitude of the associations was similar to those of earlier studies of older children (e.g. Dennison, Erb, & Jenkins, 2002; Gable et al., 2007), showing small but statistically significant associations between physical and sedentary activities and BMI for children.

A second surprising finding was that children living in public housing, and those living in the neighborhoods with higher levels of physical disorder, were playing outdoors more often than other children. These same characteristics were also associated with more television viewing, indicating that these activities were not substitutes for one another, at least in this study population. Qualitative research on children's leisure activities provides a rich picture of children's time management differences by class. Children in lower class households have much more unstructured time than do those in middle-class households, reflecting class differences not just in resources but also in child-raising philosophies (Lareau, 2003). The social environments surrounding families may also influence children's time regulation. Disadvantaged families, particularly African-Americans, often rely on in-home strategies for childrearing, given the uncertainties of the surrounding social environments (Furstenberg, Cook, & Eccles, 2000). Thus, it seems likely that the poorest children in our sample (who were less likely to be enrolled, especially full-time, in a preschool or daycare) had more

unstructured time to fill with outdoor play and sedentary activities, such as television watching. These findings give rise to the idea that SES may differentially influence children's activities, which has implications for interpretations of the associations between activities and weight status.

The negative influences of social and physical environments on children's physical activity are often construed as a result of mothers' decisions to keep their children indoors for safety reasons. Instead, we demonstrated that in poor communities, specific social conditions may give rise to higher rates of physical activity. In public housing projects where parents (especially mothers) are likely to be home during the day, and thus potentially more available to supervise play, children may have higher rates of outdoor physical activity. Moreover, these children of mostly non-working mothers may be less likely to be enrolled in preschool or daycare programs, and thus may have more unstructured time at home in which to play outdoors. It also is likely that public housing projects provide relatively safe and accessible places to play (e.g. courtyards or playgrounds) which may not be available to poor children not living in public housing. Although one strength of our study was the ability to control for maternal BMI in all our models, when we tested the physical activity models without this measure results were virtually identical.

Our findings also dovetail with recent studies which find a positive effect of perceived collective efficacy on physical activity for adolescents and adults (Cradock et al., 2009; Echeverría et al., 2008). The children of mothers who perceived higher levels of collective efficacy in their neighborhoods -net of neighborhood SES - were playing outside for longer periods each day, watching less television, and also visiting the park or playground more often each week. Surprisingly, neighborhood poverty status was not significant in any of the models presented here, a finding at odds with other recent work which focused on child obesity rather than physical activity (Lumeng et al., 2006). This may be because our sample was disproportionately poor and urban, which may reduce variability in neighborhood poverty and thus our ability to discern differences in the influence of this measure. We also tested models including neighborhood poverty without our other residential context measures and this measure was only a significant predictor of hours of weekday television, such that children in low-poverty neighborhoods watched less television. We suspect that, contrary to studies with child obesity as an outcome, maternal perceptions may matter more than objective measures of disadvantage for neighborhood influences on children's outdoor play. Since this measure was from the three-year data, it is conceivable that, although we control for whether the family has moved between years three and five, we are not adequately capturing the socioeconomic environment; or that we are limited in explanatory power by utilizing Census tracts instead of smaller geographic areas. It seems likely, however, that maternal perceptions of neighborhood environments -both positive and negative- truly override objective measures like neighborhood poverty status when considering children's activities. Another limitation of our study was that all our outcome measures are mother-reported, and our findings may not be generalizable to younger preschool children in the U.S. since our sample is only five-year-olds. We were also unable to disaggregate between time children may be spending outside alone vs. time they are spending outdoors with their parents (or other adults); similarly, we cannot be sure that our television viewing measure was a full capture of the amount of time children enrolled in daycare spend watching television, as their mothers may not know how much television they watch when away from home. Ideally, future analyses of this sort would have more detailed measures of outdoor time and sedentary activities. In addition, despite being well-suited for our research questions, our sample was limited, and thus our findings relate only to young, urban children in the U.S. Despite these limitations, we believe our paper adds to the emerging literature on the influence of young children's social and physical environments on their physical activity -and suggests several implications for public policy. For example,

our findings point to the need for safe, open spaces near homes in urban areas for poor children who may not have access to preschool programs or to housing with its own play facilities. In addition, given the importance of perceived collective efficacy on children's outdoor activities, community-based programs which seek to facilitate trust and neighborhood social networks may be a key piece of public health policy in urban areas.

Acknowledgments

Preparation of this article was funded by the Robert Wood Johnson Foundation through its national program Active Living Research (ALR). The authors thank the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) through grants R01HD36916, R01HD39135, and R01HD40421, as well as a consortium of private foundations for their support of the Fragile Families and Child Wellbeing Study.

References

Boardman JD, Saint Onge JM, Rogers RG, Denney JT. Race differentials in obesity: the impact of place. Journal of Health and Social Behaviour. 2005; 46:229–243.

Burdette HL, Whitaker RC. Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children. Preventive Medicine. 2004; 38:57–63. [PubMed: 14672642]

Burdette HL, Whitaker RC. A national study of neighborhood safety, outdoor play, television viewing, and obesity in preschool children. Pediatrics. 2005; 116:657–662. [PubMed: 16140705]

Carver A, Timperio A, Crawford D. Playing it safe: the influence of neighbourhood safety on children's physical activityda review. Health and Place. 2008; 14:217–227. [PubMed: 17662638]

Cradock AL, Kawachi I, Colditz GA, Gortmaker SL, Buka SL. Neighborhood social cohesion and youth participation in physical activity in Chicago. Social Science & Medicine. 2009; 68:427–435. [PubMed: 19036490]

Danielzik S, Czerwinski-Mast M, Langnase K, Dilba B, Muller MJ. Parental overweight, socioeconomic status and high birth weight are the major determinants of overweight and obesity in 5e7 y-old children: baseline data of the Kiel Obesity Prevention Study. International Journal of Obesity. 2004; 28:1494–1502. [PubMed: 15326465]

Davison KK, Lawson CT. Do attributes in the physical environment influence children's physical activity? A review of the literature. International Journal of Behavioural Nutrition and Physical Activity. 2006; 3:19.

Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. Pediatrics. 2002; 109:1028–1035. [PubMed: 12042539]

Diez-Roux AV, Kiefe CI, Jacobs DR Jr, Haan M, Jackson SA, Nieto FJ, et al. Area characteristics and individual-level socioeconomic position indicators in three population-based epidemiologic studies. Annals of Epidemiology. 2001; 11(6):395–405. [PubMed: 11454499]

Earls, FJ.; Brooks-Gunn, J.; Raudenbush, SW.; Sampson, RJ. Project on human development in Chicago neighborhoods (PHDCN). Boston, MA/Ann Arbor, MI: Harvard Medical School/Inter-University Consortium for Political and Social Research; 2002.

Echeverría S, Diez-Roux AV, Shea S, Borrell LN, Jackson S. Associations of neighborhood problems and neighborhood social cohesion with mental health and health behaviors: the multi-ethnic study of atherosclerosis. Health and Place. 2008

Escobar-Chaves SL, Anderson CA. Media and risky behaviors. Future of Children. 2008; 18:147–180. [PubMed: 21338009]

Evenson KR, Sarmiento OL, Tawney KW, Macon ML, Ammerman AS. Personal, social, and environmental correlates of physical activity in North Carolina Latina immigrants. American Journal of Preventive Medicine. 2003; 25(3SI):77–85. [PubMed: 14499813]

Fisher KJ, Li F, Michael Y, Cleveland M. Neighborhood-level influences on physical activity among older adults: a multilevel analysis. Journal of Aging and Physical Activity. 2004; 12:45–63. [PubMed: 15211020]

Foster S, Giles-Corti B. The built environment, neighborhood crime and constrained physical activity: an exploration of inconsistent findings. Preventive Medicine. 2008; 47:241–251. [PubMed: 18499242]

Franzini L, Caughy MOB, Nettles SM, O'Campo P. Perceptions of disorder: contributions of neighborhood characteristics to subjective perceptions of disorder. Journal of Environmental Psychology. 2008; 28:83–93.

Franzini L, Elliott MN, Cuccaro P, Schuster M, Gilliland MJ, Grunbaum JA, et al. Influences of physical and social neighborhood environments on children's physical activity and obesity. American Journal of Public Health. 2009; 99:271. [PubMed: 19059864]

Furstenberg, FF., Jr; Cook, TD.; Eccles, J. Managing to make it: Urban families and adolescent success. University of Chicago Press; 2000.

Gable S, Chang Y, Krull JL. Television watching and frequency of family meals are predictive of overweight onset and persistence in a national sample of school-aged children. Journal of the American Dietetic Association. 2007; 107:53–61. [PubMed: 17197271]

Giles-Corti B, Donovan RJ. Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. Preventive Medicine. 2002; 35:601–611. [PubMed: 12460528]

Goran MI, Reynolds KD, Lindquist CH. Role of physical activity in the prevention of obesity in children. International Journal of Obesity. 1999; 23:S18–S33. [PubMed: 10367999]

Gordon-Larsen P, Nelson MC, Page P, Popkin BM. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006; 117:417–424. [PubMed: 16452361]

Grow HMG, Cook AJ, Arterburn DE, Saelens BE, Drewnowski A, Lozano P. Child obesity associated with social disadvantage of children's neighborhoods. Social Science & Medicine. 2010; 71:584–591. [PubMed: 20541306]

Humpel N, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity: a review. American Journal of Preventive Medicine. 2002; 22:188–199. [PubMed: 11897464]

Kawachi, I.; Berkman, L. Social cohesion, social capital, and health. In: Berkman, L.; Kawachi, I., editors. Social epidemiology. New York: Oxford University Press; 2000. p. 174e-190e.

Kessler RC, Andrews G, Mroczek D, Ustun TB, Wittchen HU. The world health organization composite international diagnostic interview shortform (CIDI-SF). International Journal of Methods in Psychiatric Research. 1998; 7:171–185.

Lang T, Caraher M. Access to healthy foods: part II. Food poverty and shopping deserts: what are the implications for health promotion policy and practice? Health Education Journal. 1998; 57:202.

Lareau, A. Unequal childhoods: Class, race, and family life. University of California Press; 2003.

Lumeng JC, Appugliese D, Cabral HJ, Bradley RH, Zuckerman B. Neighborhood safety and overweight status in children. Archives of Pediatrics and Adolescent Medicine. 2006; 160:25–31. [PubMed: 16389207]

Molnar BE, Gortmaker SL, Bull FC, Buka SL. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. American Journal of Health Promotion. 2004; 18:378–386. [PubMed: 15163139]

Moore LV, Diez Roux AV, Evenson KR, McGinn AP, Brines SJ. Availability of recreational resources in minority and low socioeconomic status areas. American Journal of Preventive Medicine. 2008; 34:16–22. [PubMed: 18083446]

Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2003–2006. Journal of the American Medical Association. 2008; 299:2401. [PubMed: 18505949]

Papas MA, Alberg AJ, Ewing R, Helzlsouer KJ, Gary TL, Klassen AC. The built environment and obesity. Epidemiologic Reviews. 2007

Romero AJ, Robinson TN, Kraemer HC, Erickson SJ, Haydel KF, Mendoza F, et al. Are perceived neighborhood hazards a barrier to physical activity in children? Archives of Pediatrics and Adolescent Medicine. 2001; 155:1143–1148. [PubMed: 11576010]

Rose D, Richards R. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. Public Health Nutrition. 2007; 7:1081–1088. [PubMed: 15548347]

Ross CE. Walking, exercising, and smoking: does neighborhood matter? Social Science & Medicine. 2000; 51:265–274. [PubMed: 10832573]

Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. The Future of Children. 2006; 89:108.

Sampson RJ, Raudenbush SW. Seeing Disorder: neighborhood stigma and the social construction of "broken windows". Social Psychology Quarterly. 2004; 67:319.

Sampson RJ, Raudenbush SW, Earls F. Neighborhood and violent crime: a multilevel study of collective efficacy. Science. 1997; 277:918. [PubMed: 9252316]

Singh GK, Siahpush M, Kogan MD. Neighborhood socioeconomic conditions, built environments, and childhood obesity. Health Affairs. 2010; 29:503–512. [PubMed: 20194993]

Slymen DJ, Ayala GX, Arredondo EM, Elder JP. A demonstration of modeling count data with an application to physical activity. Epidemiologic Perspectives & Innovations. 2006; 3:3. [PubMed: 16551368]

Timperio A, Salmon J, Telford A, Crawford D. Perceptions of local neighbourhood environments and their relationship to childhood overweight and obesity. International Journal of Obesity. 2005; 29:170–175. [PubMed: 15583699]

Weir LA, Etelson D, Brand DA. Parents' perceptions of neighborhood safety and children's physical activity. Preventive Medicine. 2006; 43:212–217. [PubMed: 16712912]

Whitaker KL, Jarvis MJ, Beeken RJ, Boniface D, Wardle J. Comparing maternal and paternal intergenerational transmission of obesity risk in a large population-based sample. American Journal of Clinical Nutrition. 2010; 91:1560–1567. [PubMed: 20375189]

Table 1

Descriptive Statistics for Five-Year Core and In-Home FFCWS Samples

	M (SD)
Activity/Outcome Measures	
Mean BMI Percentile	66.2 (28.64)
Weekday Hours of Outdoor Play	2.05 (1.87)
Weekday Hours of Television	2.62 (1.86)
Days Per Week Mother Takes Child Outside to Play	3.78 (2.18)
Family Background Characteristics	
(White)	0.20
Black	0.54
Hispanic	0.26
Child's age in months (In-Home)	63.5 (2.99)
Child is male	0.51
Child has older sibling	0.61
(Child normal birthweight)	0.88
Child was low birthweight (<2500 grams)	0.11
Child was high birthweight (>5000 grams)	0.01
Child in fair or poor health	0.02
(Mother did not complete high school)	0.35
Mother completed high school	0.32
Mother completed at least some college	0.33
Household Income/Needs Ratio	1.76 (2.02)
Mother's age	29.9 (5.96)
Child Has Older Sibling	0.61
(Mother married to child's father/social father)	0.32
Mother cohabiting with child's father/social father	0.27
Mother is no longer with child's father/social father	0.41
(Mother does not work)	0.41
Mother works full-time	0.38
Mother works part-time	0.22
Child enrolled in kindergarten or other program	0.76
(Mother is normal weight)	0.31
Mother is overweight (BMI ≥ 25.0 and BMI ≤ 30.0)	0.27
Mother is obese (BMI ≥ 30)	0.42
Mother is likely depressed	0.17
Mother interviewed in winter, cold city	0.22
Residential Context	
Family lives in public housing	0.19
(Medium-poverty neighborhood)	0.47
High-poverty neighborhood (>40%)	0.16
Low-poverty neighborhood (<12%)	0.37

	M (SD)
Family moved since three-year survey	0.49
(Family lives in house)	0.43
Apartment	0.28
Duplex/Townhouse/Row House	0.26
Other Housing Type	0.03
Number of Residents in Household	4.63 (1.66)
Mother fearful to let child play outside	0.18
Collective Efficacy (CE) Scale	21.9 (6.26)
Physical disorder scale (outside home)	7.00 (2.54)
N	1822

Table 2

OLS Regression of child's BMI Percentile, Testing Association with Play Outcomes

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	Coef. (Std. Err.)		***Coef. (Std. Err.)***		***Coef. (Std. Err.)***		***Coef. (Std. Err.)***	
Number of Hours of Weekday Play	**−0.62***	**(0.28)**						
Number of Hours of Weekday TV			**0.49***	**(0.23)**				
Ratio of Play to Television Time					**−1.52***	**(0.70)**		
Days per Week Mother Takes Child Outside to Play							**0.50**	**(0.29)**
Family Background Characteristics								
(White)								
Black	−1.26	(2.50)	−0.80	(2.57)	−1.45	(2.53)	−0.35	(2.50)
Hispanic	6.73**	(2.27)	7.03**	(2.40)	6.52*	(2.34)	7.61**	(2.38)
Child's age in months (In-Home)	−0.11	(0.21)	−0.03	(0.22)	−0.09	(0.21)	−0.07	(0.20)
Child is male	−0.47	(1.57)	−0.36	(1.56)	−0.27	(1.57)	−0.30	(1.45)
Child has older sibling	0.80	(0.88)	0.62	(0.86)	0.89	(0.87)	0.96	(0.84)
(Child normal birthweight)								
Low Birthweight	−7.54**	(2.09)	−7.25**	(2.21)	−7.65**	(2.14)	−7.57**	(2.05)
High Birthweight	11.82***	(2.96)	11.56***	(2.71)	11.55***	(2.78)	11.64***	(2.77)
Child in fair or poor health	−0.17	(5.19)	−0.39	(5.27)	−1.02	(5.40)	0.73	(5.07)
(Mother did not complete high school)								
Mother completed high school	−0.29	(1.70)	−0.14	(1.74)	−0.24	(1.70)	0.01	(1.80)
Mother completed at least some college	−1.86	(1.40)	−1.58	(1.41)	−1.70	(1.41)	−1.36	(1.42)
Household Income/Needs Ratio	1.94***	(0.52)	2.05***	(0.54)	2.02***	(0.54)	1.94**	(0.59)
Household Income/Needs Ratio ^{2}	−0.09**	(0.03)	−0.10*	(0.03)	−0.09*	(0.03)	−0.08*	(0.03)
Mother's age	−0.06	(0.15)	−0.04	(0.14)	−0.06	(0.15)	−0.05	(0.14)
(Mother is married to father/social father)								
Mother is cohabiting with father/social father	1.25	(2.14)	1.15	(2.16)	1.20	(2.19)	1.09	(2.11)
Mother is no longer with father/social father	5.31*	(1.99)	4.91*	(1.94)	5.26*	(1.98)	5.21*	(1.96)
(Mother does not work)								
Mother works full-time	0.79	(1.45)	0.94	(1.45)	0.79	(1.46)	1.17	(1.43)

	Model 1		Model 2		Model 3		Model 4	
	Coef. (Std. Err.)		*Coef. (Std. Err.)*		*Coef. (Std. Err.)*		*Coef. (Std. Err.)*	
Mother works part-time	0.54	(1.41)	0.48	(1.35)	0.35	(1.41)	0.81	(1.42)
Family lives in public housing	−0.24	(1.39)	−0.39	(1.35)	−0.32	(1.36)	−0.52	(1.27)
(Mother is normal weight)								
Mother is overweight	4.27*	(1.58)	4.21*	(1.57)	4.37*	(1.62)	3.91*	(1.58)
Mother is obese	14.08***	(1.55)	13.92***	(1.51)	14.11***	(1.49)	13.72***	(1.73)
Child enrolled in kindergarten/program	1.45	(1.47)	1.76	(1.50)	1.44	(1.43)	1.77	(1.64)
Mother likely depressed	−1.68#	(0.92)	−1.33	(0.89)	−1.50	(0.93)	−1.26	(0.73)
Constant	63.2		54.4		62.2		55.8	
N	1,970		1,974		1,960		1,970	

Note: Standard errors were adjusted for clustering at the city-level.

# $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Soc Sci Med. Author manuscript; available in PMC 2011 September 1.

Table 3

Negative Binomial Regression Models for Hours of Weekday Outdoor Play

	Model 1		**Model 2**		**Model 3**		**Model 4**	
Residential Context	***Coef. (Exp. Coef.)***		***Coef. (Exp. Coef.)***		***Coef. (Exp. Coef.)***		***Coef. (Exp. Coef.)***	
Family lives in public housing			0.12*	(1.13)	0.12*	(1.13)	0.12*	0.12*
(Medium-poverty neighborhood)								
High-poverty neighborhood (>40%)			−0.01	(0.99)	−0.02	(0.98)	−0.02	(0.98)
Low-poverty neighborhood (<12%)			0.02	(1.02)	0.01	(1.01)	0.05	(1.05)
Family moved since three-year survey			−0.03	(0.97)	−0.04	(0.97)	−0.03	(0.97)
(Family Lives in House)								
Apartment			−0.13*	(0.88)	−0.12*	(0.89)	−0.13*	(0.88)
Duplex/Townhome/Row House			−0.07	(0.93)	−0.06	(0.94)	−0.11#	(0.90)
Other Housing Type			0.10	(1.10)	0.10	(1.11)	0.06	(1.06)
Number of Residents in Household			0.02	(1.02)	0.03#	(1.03)	0.02	(1.02)
Mother fearful to let child play outside			0.05	(1.05)	0.09	(1.09)	0.02	(1.02)
Collective Efficacy (CE) Scale					−0.01*	(1.01)		
Physical disorder scale (outside home)							0.04**	(1.04)
Family background characteristics								
(White)								
Black	−0.20**	(0.82)	−0.19**	(0.83)	−0.18**	(0.84)	−0.21***	(0.81)
Hispanic	−0.20*	(0.83)	−0.19	(0.83)	−0.18	(0.84)	−0.18	(0.84)
Child's age in months	−0.01	(0.99)	−0.01	(0.99)	−0.01	(0.99)	−0.01	(0.99)
Child is male	−0.00	(1.00)	0.00	(1.00)	0.00	(1.00)	−0.00	(1.00)
Child has older sibling	0.06	(1.06)	0.02	(1.02)	0.01	(1.01)	0.03	(1.03)
Child in fair or poor health	−0.07	(0.93)	−0.04	(0.96)	−0.04	(0.96)	−0.06	(0.94)
(Mother did not complete high school)								
Mother completed high school	−0.00	(1.00)	0.00	(1.00)	0.00	(1.00)	0.01	(1.01)
Mother completed at least some college	−0.07	(0.93)	−0.05	(0.95)	−0.06	(0.95)	−0.02	(0.98)
Household Income/Needs Ratio	−0.02	(0.98)	−0.01	(0.99)	−0.01	(0.99)	−0.01	(0.99)
Mother's age	−0.01	(0.99)	−0.01	(0.99)	−0.01	(0.99)	−0.01	(0.99)

	Model 1		Model 2		Model 3		Model 4	
Residential Context	***Coef.***	***(Exp. Coef.)***	***Coef.***	***(Exp. Coef.)***	***Coef.***	***(Exp. Coef.)***	***Coef.***	***(Exp. Coef.)***
(Mother is married to father/social father)								
Mother is cohabiting with father/social father	0.03	(1.03)	0.05	(1.05)	0.04	(1.05)	0.03	(1.03)
Mother is no longer with father/social father	0.07	(1.08)	0.11#	(1.11)	0.11#	(1.11)	0.10#	(1.10)
(Mother does not work)								
Mother works full-time	−0.14***	(0.87)	−0.12*	(0.88)	−0.12*	(0.88)	−0.12*	(0.89)
Mother works part-time	−0.15***	(0.86)	−0.15**	(0.86)	−0.12**	(0.88)	−0.14*	(0.87)
(Mother is normal weight)								
Mother is overweight	−0.01	(0.99)	0.00	(1.00)	0.00	(1.00)	0.00	1.00)
Mother is obese	0.02	(1.02)	0.02	(1.02)	0.02	(1.02)	0.01	1.01)
Mother interviewed in cold winter	−0.77***	(0.46)	−0.75***	(0.47)	−0.76***	(0.47)	−0.75***	(0.47)
Child enrolled in kindergarten/program	−0.08	(0.92)	−0.08	(0.92)	−0.08	(0.92)	−0.07	(0.93)
Mother likely depressed	−0.06	(0.94)	−0.07	(0.93)	−0.05	(0.95)	−0.07	(0.93)
Constant	2.13		2.12		1.96		1.87	
N	1,776		1,765		1,765		1,765	

Note: Standard errors were adjusted for clustering at the city-level.;

# $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Table 4

Negative Binomial Regression Models for Hours of Weekday Television

	Model 1		**Model 2**		**Model 3**		**Model 4**	
	Coef. (Exp. Coef.)		***Coef. (Exp. Coef.)***		***Coef. (Exp. Coef.)***		***Coef. (Exp. Coef.)***	
Residential Context								
Family lives in public housing			0.11**	(1.12)	0.11**	(1.12)	0.11***	(1.12)
(Medium-poverty neighborhood)								
High-poverty neighborhood (>40%)			0.04	(1.04)	0.04	(1.04)	0.04	(1.04)
Low-poverty neighborhood (<12%)			−0.02	(0.98)	−0.02	(0.98)	−0.01	(0.99)
Family moved since three-year survey			0.02	(1.02)	0.02	(1.02)	0.02	(1.02)
(Family Lives in House)								
Apartment			−0.02	(0.98)	−0.02	(0.98)	−0.02	(0.98)
Duplex/Townhome/Row House			−0.08*	(0.92)	−0.08#	(0.92)	−0.10*	(0.91)
Other Housing Type			−0.14*	(0.87)	−0.14	(0.87)	−0.16**	(0.86)
Number of Residents in Household			0.01	(1.01)	0.01	(1.01)	0.01	(1.01)
Mother fearful to let child play outside			0.09***	(1.09)	0.08**	(1.09)	0.07**	(1.08)
Collective Efficacy (CE) Scale					**0.01****	**(0.99)**		
Physical disorder scale (outside home)							**0.02****	**(1.02)**
Family background characteristics								
(White)								
Black	0.26***	(1.29)	0.23***	(1.26)	0.23***	(1.26)	0.23***	(1.25)
Hispanic	0.15**	(1.16)	0.13*	(1.14)	0.13*	(1.14)	0.13*	(1.14)
Child's age in months (in-home)	−0.03**	(0.97)	−0.03**	(0.97)	−0.03**	(0.97)	−0.03**	(0.97)
Child is male	0.04	(1.04)	0.04	(1.04)	0.04	(1.04)	0.03	(1.03)
Child in fair or poor health	−0.12	(0.88)	−0.11	(0.89)	−0.11	(0.89)	−0.12	(0.89)
(Mother did not complete high school)								
Mother completed high school	−0.01	(1.01)	0.02	(1.02)	0.02	(1.02)	0.02	(1.02)
Mother completed at least some college	−0.04	(0.96)	−0.02	(0.98)	−0.02	(0.98)	−0.01	(0.99)
Household Income/Needs Ratio	−0.04	(0.96)	−0.03*	(0.97)	−0.03*	(0.97)	−0.03*	(0.97)
Mother's age	−0.01**	(0.99)	−0.01*	(0.99)	−0.01*	(0.99)	−0.01**	(0.99)

	Model 1		Model 2		Model 3		Model 4	
	Coef. (Exp. Coef.)		*Coef. (Exp. Coef.)*		*Coef. (Exp. Coef.)*		*Coef. (Exp. Coef.)*	
(Mother is married to father/social father)								
Mother is cohabiting with father/social father	0.04	(1.04)	0.04	(1.04)	0.04	(1.04)	0.03	(1.03)
Mother is no longer with father/social father	0.05	(1.05)	0.04	(1.04)	0.04	(1.04)	0.03	(1.04)
(Mother does not work)								
Mother works full-time	−0.06#	(0.94)	−0.03	(0.97)	−0.04	(0.97)	−0.03	(0.97)
Mother works part-time	−0.04	(0.96)	−0.03	(0.97)	−0.03	(0.97)	−0.03	(0.97)
(Mother is normal weight)								
Mother is overweight	0.01	(1.01)	0.00	(1.00)	0.00	(1.00)	0.00	(1.00)
Mother is obese	0.03	(1.03)	0.03	(1.03)	0.03	(1.03)	0.02	(1.02)
Mother interviewed in cold winter	−0.02	(0.98)	−0.02	(0.98)	−0.01	(0.99)	−0.01	(0.99)
Child enrolled in kindergarten/program	−0.19***	(0.83)	−0.20***	(0.82)	−0.20***	(0.82)	−0.20***	(0.82)
Mother likely depressed	−0.09	(0.92)	−0.09	(0.92)	−0.09	(0.91)	−0.09	(0.92)
Constant	2.89		2.81		2.84		2.69	
N	1,781		1,770		1,770		1,770	

Note: Standard errors were adjusted for clustering at the city-level.;

# $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$