Children and Youth Services Review 66 (2016) 85–93

Contents lists available at ScienceDirect

Children and Youth Services Review

journal homepage: www.elsevier.com/locate/childyouth

Neighborhood poverty and children's food insecurity

Taryn W. Morrissey [a,*], Don Oellerich [b], Erica Meade [b], Jeffrey Simms [b], Ann Stock [b]

[a] American University, United States
[b] U.S. Department of Health and Human Services, United States

ARTICLE INFO

Article history:
Received 16 November 2015
Received in revised form 11 May 2016
Accepted 11 May 2016
Available online 13 May 2016

Keywords:
Neighborhood poverty
Food insecurity
Children

ABSTRACT

Food insecurity among children and their families negatively affects children's health and well-being. While the link between household resources and food insecurity is well-established, family income alone does not explain food insecurity; neighborhood disadvantage, shown to affect other areas of children's development, may also play a role in food insecurity. This study examines associations between neighborhood poverty and children's food insecurity, and whether family characteristics account for identified associations. We merge data on kindergarten-age children from the Early Childhood Longitudinal Study-Kindergarten 2010–11 Cohort (ECLS-K:2011) with data on poverty rates from the American Community Survey (ACS) and on food access from the USDA's Food Environment Atlas using children's residential census tracts ($N = 12.550$ children in 3750 tracts). Using a series of multilevel models, we test for associations between neighborhood poverty, household economic, demographic, and parenting characteristics, and food insecurity at the child, adult, and household levels. Children living in higher-poverty neighborhoods are more likely to experience food insecurity than those in lower-poverty neighborhoods. Associations between neighborhood poverty and household- and adult-level food insecurity disappear when household characteristics are controlled. However, living in a very high poverty neighborhood remains predictive of child-level food insecurity, which may be an indicator of severe hardship. Findings indicate that neighborhood poverty may be a useful proxy to identify vulnerable children.

1. Introduction

In 2014, two in ten (19.9%) U.S. households with children under age six were considered to be food insecure, meaning that the food intake or eating patterns of one or more members were disrupted because the household lacked resources for food, at some point during the year (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). Although adults in food-insecure households often shield children, in nearly one in ten (9.1%) U.S. households with children under age six, children themselves experienced disrupted eating or reduced food intake (Coleman-Jensen et al., 2015). The rates of food insecurity among children and their families are alarming, as poor nutrition or disrupted eating has negative impacts for children's health and well-being (Nord, 2009). Even when children do not experience inadequate food themselves, there is evidence that their parents' food insecurity negatively affects children's physical, cognitive, and social-emotional outcomes (Johnson & Markowitz, 2015), through increased parent stress or depression (Bronte-Tinkew, Zaslow, Capps, Horowitz, & McNamara, 2007; Nord, 2009).

Although the link between household resources and food insecurity is well-established, family income alone does not explain food insecurity; neighborhood resources may also play a role (Carter, Dubois, & Tremblay, 2013; Gorton, Bullen, & Mhurchu, 2010; Nord & Parker, 2010). Living in communities of concentrated neighborhood poverty has been shown to affect the health, development, and long-term educational and economic outcomes of residents (Brooks-Gunn & Duncan, 2000; Chetty & Hendren, 2015; Chetty, Hendren, & Katz, 2015; Leventhal & Brooks-Gunn, 2000; Ludwig et al., 2011). However, the research investigating the relations between neighborhood resources, household characteristics, and food insecurity is limited (Carter, Dubois, & Tremblay, 2014).

This paper addresses these gaps in the literature on neighborhood resources and food insecurity. First, using a recent, large nationally representative dataset of children merged with census tract-level data on poverty and the community food environment, we descriptively analyze the associations between neighborhood poverty and food insecurity. Second, we investigate the extent to these associations vary between children living in rural and urban neighborhoods.

1.1. Neighborhoods and child development

Within a bioecological systems framework (Bronfenbrenner & Morris, 2006), family characteristics and circumstances, operating within children's microsystem, would be expected to be strongly predictive of children's outcomes. Indeed, research finds that a variety of child outcomes, including achievement and food security, vary with characteristics such as family income, parental employment, household

* Corresponding author.
E-mail address: morrisse@american.edu (T.W. Morrissey).

http://dx.doi.org/10.1016/j.childyouth.2016.05.006
0190-7409/

composition, and race and ethnicity (Coleman-Jensen et al., 2015; Duncan, Morris, & Rodrigues, 2011; Jacknowitz, Morrissey, & Brannegan, 2015; Morrissey, Hutchison, & Winsler, 2014; Nord & Parker, 2010). Neighborhoods, as part of children's macrosystems, represent daily, sustained environments that may also affect children's development. Disadvantaged neighborhoods, such as those with high poverty rates, average fewer and lower levels of both social and institutional supports, lower levels of collective socialization, and higher levels of social isolation, than low-poverty neighborhoods (Sampson, Morenoff, & Gannon-Rowley, 2002; Small & McDermott, 2006; Wilson, 2012), and these aspects have been found to be pathways through which neighborhood disadvantage affects children's development (Galster, 2010; Kohen, Leventhal, Dahinten, & McIntosh, 2008; Leventhal & Brooks-Gunn, 2000). A growing body of research demonstrates the importance of neighborhood resources, particularly poverty level, for a range of child and adult outcomes, including educational achievement, health, and long-term economic outcomes (Chetty et al., 2015; Chetty & Hendren, 2015; Ludwig et al., 2011; Sharkey, 2010; Wodtke, Harding, & Elwert, 2011; Wolf, Magnuson, & Kimbro, 2015).

1.2. Neighborhood poverty and food insecurity

Despite the increased research attention on the effects of neighborhoods on children's cognitive, social-emotional, or economic outcomes, studies examining the associations between neighborhood poverty and children's health and nutrition, particularly food insecurity, are few. Characteristics of the physical environment, such as the proximity of food stores, the availability of social support, access to public or private transportation, or crime levels may play an important role in linking neighborhood disadvantage with food insecurity, especially in more densely populated areas (Bader, Purciel, Yousefzadeh, & Neckerman, 2010).

Research in public health and nutrition demonstrates the importance of food insecurity, both as experienced directly by children and by their adult caregivers, for concurrent and later measures of children's health and development. Food insecurity as experienced during the earliest years of development appears particularly important to children's behavioral and socio-emotional impairments (Howard, 2011) and school readiness at kindergarten entry (Johnson & Markowitz, 2015), although food insecurity experienced during elementary school is also associated with poorer cognitive outcomes (Alaimo, Olson, & Frongillo, 2001; Jyoti, Frongillo, & Jones, 2005). Young children living in food-insecure households are more likely to experience poorer health (Bronte-Tinkew et al., 2007; Ryu & Bartfeld, 2012) and exhibit more behavioral problems (Whitaker, Phillips, & Orzol, 2006) than those in food-secure households. Similarly, other research indicates that young children living with adults who experience transient food insecurity score lower on cognitive measures than their peers living with food-secure adults (Hernandez & Jacknowitz, 2009).

If associated with food insecurity, the neighborhood poverty rate could be a useful indicator for identifying at-risk children and communities, particularly given the regularly gathered geographic data available on poverty. Existing research in this area is limited, however, although several studies have found associations between the neighborhood characteristics linked with poverty and food insecurity. Using nationally representative data from the 1998 Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) linked with census data, Kimbro, Denney, and Panchang (2012) found that children living in the poorest and racially segregated neighborhoods were likely to persist in food insecurity (Kimbro et al., 2012). Likewise, research in the United Kingdom and Canada have found positive associations between measures of disadvantage such as disorder and social deprivation and food insecurity (Carter, Dubois, Tremblay, & Taljaard, 2012; Pilgrim et al., 2012). Other work using a sample of households in Wisconsin with elementary-age children found no associations between neighborhood poverty per se and food security, but other community factors such as access to transportation, housing costs, and grocery store availability were predictive of food security (Bartfeld, Ryu, & Wang, 2010). Likewise, in a sample in Iowa, Garasky, Morton, and Greder (2006) found that inadequate numbers of food stores, together with high food prices, were viewed by families as barriers to meeting their food needs. This research also suggests a protective effect of living in rural areas compared to urban or micro-urban areas (Bartfeld et al., 2010; Carter et al., 2014; Garasky et al., 2006).

An important challenge to neighborhood research is selection into neighborhoods. Indeed, some quasi-experimental research finds that family characteristics account for much of the association between neighborhood poverty and children's outcomes (Page & Solon, 2003a, 2003b; Solon, Page, & Duncan, 2000). To address the selection issue, the Moving to Opportunity (MTO) Study randomly assigned a sample of families living in high-poverty census tracts to one of three groups: to have housing vouchers that could only be used in low-poverty neighborhoods (poverty rates less than 10%); to have traditional vouchers with no location requirements; or to have no vouchers at all. While the random-assignment in the MTO study partially addressed the issue of neighborhood selection, it confounds neighborhood characteristics and residential moves, the latter of which has been shown to predict food insecurity in households with young children (Jacknowitz et al., 2015). Further, it only provides for an estimate of the average effect of neighborhood, which is problematic when generalizing to families who would not be willing to move.

1.3. The current study

Although estimating the causal pathways of neighborhoods on children and families is important, descriptive associations between neighborhood disadvantage, family poverty, and food security can be useful in a policy context to identify potentially vulnerable children in order to use resources most efficiently and effectively. To date, although much is known about the micro-level (e.g., household income) factors that predict food insecurity, we know less about the contextual factors, particularly neighborhood disadvantage, that are associated with food insecurity among families with children. Children facing disadvantage at either, or both, the household and neighborhood levels may be at risk for food insecurity. Given the increase in the concentration of poverty in recent years (Bishaw, 2014; Jargowsky, 2014; Kneebone, 2014) and the negative effects of food insecurity on children's short- and long-term outcomes (e.g., Hernandez & Jacknowitz, 2009; Johnson & Markowitz, 2015; Nord, 2009), examining the associations between neighborhood poverty and food insecurity among households with young children warrants greater attention. This study addresses this gap in the literature using the 2010–2011 Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K:2011), a recent, large, nationally representative dataset, linked with contextual data on neighborhood poverty, to descriptively examine associations between neighborhood poverty, family poverty, and food insecurity among households with children. Specifically, we address two research questions:

1. Does food insecurity among kindergarten children vary by neighborhood poverty? We hypothesize the likelihood of food insecurity will increase with the neighborhood poverty.
2. Do the (expected) associations between neighborhood poverty and food insecurity vary between rural and urban or suburban areas? We expect that associations between neighborhood poverty and food insecurity will be weaker among rural communities.

2. Methods

2.1. Data and sample

This study uses data from three sources. First, the Early Childhood Longitudinal Study-Kindergarten 2010–11 Cohort (ECLS-K:2011),

collected by the National Center for Education Statistics (NCES), is a nationally representative longitudinal dataset of approximately 18,200 children who attended kindergarten in the United States in the 2010–2011 academic year.[1] This study focuses on the first two waves of data, collected in the fall and spring of kindergarten. Information about child and family characteristics and their residential census tract were collected through interviews with parents (85% of whom were children's biological mothers and 10% biological fathers).

Using children's residential census tracts, we merged in tract-level information on poverty rates gathered from the U.S. Census Bureau's 2008–2012 American Community Survey (ACS) Five Year estimates[2] and the USDA's Food Environment Atlas 2010 data.[3] The multiyear ACS data offer the advantage of increased statistical reliability for less populated areas and small population subgroups, and the five-year ACS is the only source for poverty rates at the census tract level. The midpoint of the 2008–2012 ACS corresponds to the year in which child-level data were collected (the fall of kindergarten during the 2010–11 academic year).

We limit our analysis sample to the 12,550 children living in 3750 census tracts with nonmissing data on food security or household poverty level. As reported by NCES, the weighted parent response rate for both the fall and spring of kindergarten interviews was 55% (80% for either the fall or the spring). The vast majority of missing data resulted from a lack of response to the food security questions at the spring of kindergarten (5000 children). Children missing food security information were less likely to have household incomes above 200% FPL or to have married mothers, and more likely to live in tracts with higher poverty rates. Of children in our subsample, covariates with missing information included parental employment (2400), educational expectations for their children (2250), number of children or adults in the home (2300), number of books in the home (2300), or mothers' marital status (2450). Multiple imputations (with 20 imputations) were used to impute missing information on child and household covariates.[4] This research received exemption from the American University Institutional Review Board.

2.2. Measures

2.2.1. Dependent variables

The severity of food insecurity is measured at three levels: household, adult, and child. During the spring of kindergarten, participating households were asked about their experiences over the past 12 months using the 18-question Core Food Security Module (CFSM), created and validated by the USDA (Nord & Bickel, 2002). Ten questions correspond to the experiences of the household and adults, while the remaining questions focus on the children. Questions ask respondents about their experiences regarding their food purchases, consumption, and concerns (e.g., whether they were worried their food would run out before they had money to buy more, whether they cut the size of or skip their own or their children's meals because there wasn't enough money to buy food). From these questions, a raw score, a scale score, and a categorical measure of the severity of food security at the following three levels are generated: household food security, adult food security, and child food security.[5] For each level of food security, a household, adult, or child is classified as being food secure or having low or very low food security.

2.2.2. Child-level variables

Because the types of neighborhoods in which families live are based on characteristics that are often associated with outcomes including food insecurity, we take advantage of the rich measures of child and household characteristics in the ECLS-K data to control for potential confounding factors. ECLS-K respondents' reports of household size and income for the prior year were used to generate the household poverty levels using the federal poverty threshold (*below 100% FPL*, *between 100 and 200% FPL*, *and above 200% FPL*). These assessments were gathered at the fall of kindergarten, and thus represent family poverty level during the year before school entry (e.g., at preschool age). Other covariates include child age (in months), gender, race/ethnicity (*non-Hispanic Black*, *Hispanic*, *non-Hispanic White/other*), the number of adults and children in the household, and whether the child lived in a two-parent household (married/cohabiting). We use respondent-reported maternal and paternal education at the fall of kindergarten to generate four levels of parental education (*neither parent graduated high school*, *at least one parent has a high school degree*, *at least one parent has some college*, *and at least one parent graduated from college*). Also at the fall of kindergarten, respondents (mostly mothers) reported their employment status and weekly work hours (*worked 35 or more hours per week*, *worked fewer than 35 h per week*, *not employed/not in the labor force*). To account for parenting characteristics that may be associated with both neighborhood selection and child development, we control for respondents' educational expectations for the child (*expects the child to complete college or attain a higher degree*) and their reports of the number of books in the home.

2.2.3. Tract-level variables

Children's residential census tracts collected in the fall of kindergarten were merged with tract-level information from the ACS on the percent of residents living below the federal poverty threshold (FPL) from the five-year ACS (2008–2012). Thus, measures represent the poverty level of the census tracts in which children lived when they entered kindergarten. Although U.S. Census tracts may not correspond with neighborhoods as defined by residents, tracts represent small, relatively permanent subdivisions of a county or city containing a population size of 1200 to 8000 people, with an optimum size of 4000, that are updated prior to each decennial census,[6] and are widely used as proxies for neighborhoods in research (Jargowsky, 1997). The multiyear ACS data offers the advantage of increased statistical reliability for less populated areas and small population subgroups, and it is the only source for poverty rates at the tract level.

Following previous research (Bishaw, 2011; Wolf et al., 2015), we classified tracts into one of four categories: *low poverty neighborhoods*, census tracts with less than 14% of residents living below the FPL (i.e., representing a neighborhood with a poverty rate below the national average); *moderate-low poverty neighborhoods*, tracts in which 14–19% of residents live below the FPL; *moderate-high poverty neighborhoods*, in which 20–39% of residents live below the FPL; and *high-poverty neighborhoods*, in which 40% of more residents live below the FPL. In our analysis sample of 12,550, 64.7% of children lived in low-poverty neighborhoods, 13.5% in moderate-low poverty neighborhoods, 21.9% in moderate-high poverty neighborhoods, and 4.0% in high-poverty

[1] The reported sample sizes are rounded to the nearest 50, per NCES regulations regarding disclosure of restricted-use data. For more information on the dataset, see: http://nces.ed.gov/ecls/kindergarten2011.asp.

[2] For more information on the ACS, see: https://www.census.gov/programs-surveys/acs/.

[3] For more information on USDA's Food Atlas, see: http://www.ers.usda.gov/data-products/food-environment-atlas.aspx.

[4] Unlike single imputation in which the imputed values are treated as though they were observed, multiple imputation provides increased variation in the parameter estimates across imputations. Analyses with multiple imputation involves three steps: 1) an imputation model is formulated and a series of imputed datasets are created (in this case, 20); 2) the analysis of each imputed dataset is carried out separately; and 3) the estimates from the imputed datasets are pooled to generate a single set of estimate using the "mi" command. For more information about multiple imputation with Stata, see: http://www.ats.ucla.edu/stat/stata/seminars/missing_data/mi_in_stata_pt1.htm.

[5] The raw scores are the number of questions answered affirmatively (i.e., yes; often or sometimes; almost every month or some months but not every month). The household-level variables are calculated according to Bickel, Nord, Price, Hamilton, & Cook (2000), and the child-level variables are calculated according to Nord and Bickel (2002).

[6] For more information on census tracts, see: https://www.census.gov/geo/reference/gtc/gtc_ct.html

neighborhoods. The Census Bureau uses these categories because 13.8% (the first cut-off) represents the overall poverty rate in the United States; 20% is the threshold used to term a tract a "poverty area"; and 40% is considered very high poverty. These thresholds are also policy-relevant, as the requirements for applying for the federal Promise Zones initiative include having 20% or more residents living under the poverty line (and containing one or more tracts above 30% poverty).

In addition, we merged data from the USDA's Food Environment Atlas with children's residential census tracts at the fall of kindergarten. We used USDA's binary indicator for whether a census tract had at least 500 people or 33% of the population living more than 1 mile (in urban areas) or more than 10 miles (in rural areas) from the nearest supermarket, supercenter, or large grocery store. Finally, the urbanicity (*urban/suburban* or *rural*) of the child's residential census tract using Census Bureau's Urban Area definition was included in the model.

2.3. Statistical methods

A series of linear multilevel probability models[7] using xtmixed in Stata v. 12 were used to predict the binary measures of low or very low food security (at the household, adult, and child levels). Multilevel models account for the nonindependence of clustered data (Rabe-Hesketh & Skrondal, 2008): in this study, our sample of 12,550 children nested within 3750 census tracts. All models utilize maximum likelihood estimation and assume linear associations between neighborhood poverty category and the probability of being food insecure; coefficients can be interpreted as percentage point changes in the likelihood of being food insecure. Associations were modeled at the child level (Level 1) and neighborhood level (Level 2). Eq. (1) below is used to predict measures of food security for child *i* in census-tract *j* (FS_{ij}), allowing for variation across neighborhoods and including child-level (X_{ij}) and tract-level (Z_j) explanatory variables:

$$FS_{ij} = \beta_0 + \beta_1 X_{ij} + \beta_2 Z_j + u_j. \quad (1)$$

Here, β_0 is the model intercept, β_1 represents the level 1 (child) predictor, β_2 represents the level 2 (neighborhood) predictor, and u_j is the random effect of neighborhoods.

In presenting regression results, we first test Model 1 that examines the main associations between neighborhood poverty (level 2) and food security. In Model 2, we add child, parent, and household (level 1) and food access (level 2) characteristics to test whether they account for the expected associations identified in the Model 1. A *p* value of 0.05 was used to indicate statistically significant differences.

3. Results

3.1. Descriptive results

Unadjusted weight descriptive statistics for the dependent variable, food security, are shown in Fig. 1. As expected, food insecurity rates at all levels increased as neighborhood poverty increased. Across all types of neighborhoods, the majority of households, adults, and children were considered food-secure. More than one in five (22.1%) of households living in neighborhoods with 40% or greater poverty had low or very low food security, and the rate in moderately-high poverty neighborhoods was similar (19.4%). Although food insecurity rates in low-poverty neighborhoods were half that of high-poverty neighborhoods, nearly 9% of households, and 7.2% of adults in these low-poverty neighborhoods were food-insecure. As expected, reported child-level food insecurity rates were substantially lower than household or adult insecurity rates, with 2.1% of children in high-poverty neighborhoods and 0.2% of children in low-poverty neighborhoods considered as having low or very low food security.

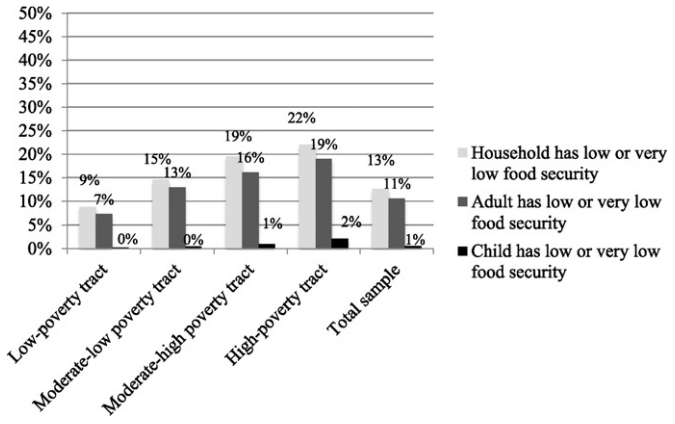

Fig. 1. Household, adult, and child food insecurity by neighborhood poverty concentration.

Weighted descriptive statistics by categories of neighborhood poverty are presented in Table 1. Children in the sample averaged 5.5 years of age at the fall of kindergarten, and about half were females. Children living in low-poverty neighborhoods tended to be more advantaged than their counterparts in high-poverty neighborhoods in terms of parent education, the number of books in the home, public assistance receipt, and family structure. Two-thirds of children living in high-poverty tracts lived in households below the poverty line, compared to only 14% of those in low-poverty tracts. In terms of income (not shown in table, one-fifth (21.7%) of children living in high-poverty tracts had annual household incomes below $10,000, compared to only 3.2% of those in low-poverty tracts. Three percent of children in households in high-poverty tracts had high incomes (above $100,000 per year), whereas this was true for nearly three in ten (28.8%) children in low-poverty tracts.

There was considerable racial and ethnic segregation by neighborhood poverty level. High-poverty neighborhoods averaged higher proportions of Black and Hispanic children and fewer White children than lower-poverty neighborhoods: 84% of children in tracts with 40% or greater poverty were Black or Hispanic, compared to 20% in tracts with less than 14% poverty. Across all sample tracts, 46% met the USDA's definition of having low access to food. Low-poverty tracts were more likely to have low food access than high-poverty tracts, potentially because low-poverty tracts were more likely to be rural.

3.2. Regression results

Our first research question sought to investigate whether food insecurity among kindergarten children varies by neighborhood poverty. Table 2 shows the results from multilevel regressions predicting household-, adult-, and child-level low or very low food security. Model 1 includes the neighborhood poverty categories only; in Model 2, child, parent, and food access characteristics are controlled.

Looking at the results from Model 1 in Table 2, there is a strong association between neighborhood poverty and food insecurity. Consistent with hyp, the likelihood of food insecurity increases as neighborhood poverty level increases. Children in high-poverty tracts were 13 percentage points more likely to live in households with low or very low food security, and 11 and 2 percentage points more likely to live with a food-insecure adult or experience food insecurity themselves, respectively. Notably, even children in moderate-low poverty neighborhoods (with poverty rates of 14–19%) were 6 and 5 percentage points more likely to live in food-insecure households or with a food-insecure adult, respectively.

However, results from Model 2, which controlled for a number of child, parent, and household characteristics and tract-level food access,

[7] Analogous logistic regression models, using robust clusters to account for nested data, were also tested. The general pattern of results did not change.

Table 1
Child and family characteristics by neighborhood poverty concentration.

	Low-poverty tract	Moderate-low poverty tract	Moderate-high poverty tract	High-poverty tract	Total sample
	% or M (SD)	% or M (SD)	% or M (SD)	% or M (SD)	% or M (SD)
Child age in months	67.46 (0.06)	67.66 (0.12)	67.38 (0.10)	67.41 (0.21)	67.46 (0.04)
Child is female	49.26%	46.60%	47.95%	49.77%	48.66%
Child race/ethnicity					
Non-Hispanic Black	6.11%	12.69%	20.25%	31.19%	11.01%
Hispanic	13.83%	20.39%	36.62%	52.75%	21.14%
Non-Hispanic White or other race	80.06%	66.92%	43.12%	16.06%	67.85%
Household FPL					
Less than 100%	13.72%	27.54%	45.53%	66.72%	25.23%
Between 100 and 200%	19.07%	26.28%	28.05%	18.94%	22.09%
Over 200%	67.21%	46.18%	26.42%	14.34%	52.68%
Parent education					
Neither parent completed high school	3.29%	8.17%	16.71%	25.34%	8.01%
One or both parents has a high school diploma	13.75%	23.76%	28.09%	37.01%	19.40%
One or both parents has some college	28.84%	36.35%	35.17%	29.17%	31.32%
One or both parents has a college degree or more	54.12%	31.72%	20.02%	8.48%	41.28%
Number of children in the household	2.44 (0.01)	2.44 (0.03)	2.57 (0.03)	2.87 (0.07)	2.49 (0.01)
Number of adults in the household	2.08 (0.01)	2.06 (0.02)	2.05 (0.02)	2.03 (0.04)	2.07 (0.01)
Mother is married	82.73%	71.68%	62.70%	46.33%	75.53%
Number of books in the home	103.92 (1.93)	83.11 (3.08)	63.02 (2.22)	39.08 (2.60)	89.86 (1.36)
Expects child to complete college or more	84.49%	79.15%	78.75%	79.82%	82.39%
Maternal employment					
Mother is employed full-time	43.05%	41.92%	39.00%	31.82%	41.57%
Mother is employed part-time	23.17%	19.51%	18.07%	18.32%	21.41%
Household is located in a rural tract	27.30%	33.84%	19.41%	7.57%	25.64%
Household is located in a low food access tract	50.03%	42.63%	37.86%	32.63%	45.66%
n	7600	1650	2750	500	12,550

Note: sample sizes are rounded to the nearest 50 in accordance with NCES regulations. Statistics include imputed values. Low-poverty neighborhoods are census tracts that have poverty rates lower than 14%; moderate-low poverty neighborhoods have poverty rates of 14–19%; moderate-high poverty neighborhoods have poverty rates of 20–39% and high-poverty neighborhoods have poverty rates of 40% or greater.

indicate that the associations between neighborhood poverty and food insecurity largely disappear with background characteristics added, with one exception; living in a high-poverty tract (40% or greater) is associated with a 1 percentage point increase in the likelihood of child food insecurity.

As expected, household socioeconomic indicators were associated with food insecurity. Children in poor (less than 100% FPL) or low-income households (between 100 and 200% FPL) were more likely to live in food-insecure households or with food-insecure adults than those above 200% FPL, and children whose parents lacked a high school degree were more likely to live in food insecure households or with food-insecure adults than those with more educated parents. Hispanic children were more likely than White or other race children to experience food insecurity at all levels. Child gender, parenting characteristics (books in the home and educational expectations), maternal employment, and whether the tract was designated as having low food access were unassociated with food security.

Our second research question sought to investigate whether urban and rural areas varied in their associations between neighborhood poverty and food insecurity. Indeed, as shown in Table 2, children living in rural areas were 2 and 1 percentage points less likely to live in food insecure households or with food-insecure adults, respectively, and marginally significantly less likely to experience food insecurity themselves, compared to those in urban areas. Because of this finding and previous research that suggests a protective effect of living in a rural area (Carter et al., 2014), we explored this relationship further by adding interactions between living in a rural tract and neighborhood poverty categories to Model 2 (including all background controls) to test for a moderating effect. As shown in Table 3, we find limited evidence that associations between neighborhood poverty and food insecurity were weaker among children living in rural areas. Children in high-poverty rural tracts were 2 percentage points less likely to be food-insecure than those in high-poverty urban tracts. There was no evidence that rural tracts served a protective effect for household- or adult-level food security. That is, while food insecurity rates were lower in rural tracts, the relationships between tract-level poverty and adult- and household-level food insecurity were largely consistent across urban and rural areas.

3.3. Sensitivity analyses

A series of sensitivity analyses were conducted (results available upon request). First, the neighborhood poverty categories were replaced with a single, continuous census tract poverty rate variable. Results suggest a linear association, such that each percentage point increase in the tract poverty rate was associated with 0.45, 0.39, and 0.04 percentage point increase in the likelihood of household-, adult-, or child-level food insecurity, respectively, in the base model. However, like with the categorical independent variables, when background characteristics were controlled, neighborhood poverty rate was no longer associated with food insecurity (although the association between neighborhood poverty rate and child-level food insecurity remained marginally statistically significant, with a small association of 0.02 percentage points). In a second sensitivity analysis, the household poverty level threshold covariates were replaced with categorical income variables (representing annual incomes of: *less than $10,000*; *$10,000–$25,000*; *$25,000–$45,000*; *$45,000–$100,000*; *and greater than $100,000*) in regression models. Low household income continued to be predictive of a greater likelihood of food insecurity, and again, the general pattern of results did not change.

4. Discussion

This study examined associations between neighborhood resources, specifically census tract-level poverty rates and the food environment, and food insecurity among a nationally representative sample of kindergarteners. Consistent with previous research using earlier national and international data (Carter et al., 2012; Kimbro et al., 2012; Pilgrim et al., 2012), results indicate that neighborhood poverty is associated with food security, such that children residing in higher-poverty census

Table 2
Multilevel regression models of household adult and child level food security. ($n = 12.550$, *census tracts* $= 3750$).

	Household has low or very low food security		Adult has low or very low food security		Child has low or very low food security	
	Model 1	Model 2	Model 1	Model 1	Model 1	Model 2
	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
Low poverty tract (reference)						
Moderate-low poverty tract	0.06***	0.01	0.05***	0.01	0.00	−0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Moderate-high poverty tract	0.11***	0.01	0.09***	0.00	0.01***	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
High poverty tract	0.13***	−0.01	0.11***	−0.01	0.02**	0.01*
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.00)
Child age in months		0.00†		0.00		0.00†
		(0.00)		(0.00)		(0.00)
Child is a twin		−0.09†		−0.08†		−0.00
		(0.05)		(0.04)		(0.01)
Child is female		−0.01		−0.00		0.00
		(0.01)		(0.01)		(0.00)
Child is non-Hispanic White or other race (reference)						
Child is non-Hispanic Black		−0.01		−0.01		0.00
		(0.01)		(0.01)		(0.00)
Child is Hispanic		0.02*		0.02*		0.01***
		(0.01)		(0.01)		(0.00)
Household income above 200% FPL (reference)						
Household income <100% FPL		0.19***		0.17***		0.01***
		(0.01)		(0.01)		(0.00)
Household income between 100 and 200% FPL		0.11***		0.09***		0.00*
		(0.01)		(0.01)		(0.00)
Neither parent completed high school (reference)						
One or both parents has a high school diploma		−0.06***		−0.06***		−0.00
		(0.0)		(0.01)		(0.01)
One or both parents some college		−0.06***		−0.06***		−0.00
		(0.01)		(0.01)		(0.00)
One or both parents has a college degree		−0.09***		−0.09***		−0.00
		(0.01)		(0.01)		(0.00)
Mother is not employed (reference)						
Mother is employed full-time		0.01		0.00		0.00
		(0.01)		(0.01)		(0.00)
Mother is employed part-time		0.01		0.01		0.00
		(0.01)		(0.00)		(0.00)
Number of children in the household		0.01*		0.01†		0.00
		(0.00)		(0.00)		(0.00)
Number of adults in the household		−0.01**		−0.01†		0.00
		(0.00)		(0.00)		(0.00)
Number of books in the home		−0.00		−0.00		−0.00
		(0.00)		(0.00)		(0.00)
Expects child to complete college or more		−0.01		−0.00		−0.00
		(0.01)		(0.01)		(0.00)
Household is located in a rural area		−0.02*		−0.01*		−0.00†
		(0.01)		(0.00)		(0.00)
Tract has low food access		−0.00		−0.00		−0.00
		(0.01)		(0.01)		(0.001)
Constant	0.09***	0.05	0.07***	0.05	0.00***	−0.02
	(0.00)	(0.05)	(0.00)	(0.05)	(0.00)	(0.01)

Note: sample sizes are rounded to the nearest 50 in accordance with NCES regulations. Estimates are weighted. Robust standard errors were clustered at the census tract level.
† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

tracts are more likely to live in food-insecure households, with food-insecure adults, or be food-insecure themselves. However, when confounding background characteristics are controlled, the pattern of findings varies by the specific level of food security. We find that the associations between neighborhood poverty and household- and adult-level food insecurity are explained by child, parent, and household characteristics. By contrast, we find some evidence that neighborhood poverty is predictive of child-level food security independent of the covariates included. Children living in tracts with 40% or greater poverty levels are 1 percentage point more likely, or twice as likely, to experience food insecurity than those in tracts with poverty rates less than 14%.

These findings add further nuance to the growing body of research regarding neighborhood characteristics and children's development. Results suggest that neighborhood factors may matter more for certain developmental domains compared to others, or that neighborhood characteristics affect different domains via different mechanisms. Previous research finds neighborhood poverty to be associated with children's cognitive, social-emotional, or long-term economic outcomes (Chetty & Hendren, 2015; Chetty et al., 2015; Dupere, Leventhal,

Table 3
Testing the moderating effect of urbanicity in multilevel regression models of household adult and child level food security. (n = 12.550, *census tracts* = 3750).

	Household has low or very low food security	Adult has low or very low food security	Child has low or very low food security
	β (*SE*)	β (*SE*)	β (*SE*)
Low poverty tract (reference)			
Moderate-low poverty tract	0.002	0.005	−0.002
	(0.011)	(0.011)	(0.002)
Moderate-high poverty tract	0.012	0.007	0.002
	(0.010)	(0.009)	(0.003)
High poverty tract	−0.016	−0.013	0.010
	(0.021)	(0.019)	(0.007)
Moderate-low poverty tract X rural tract	0.020	0.021	0.005
	(0.21)	(0.020)	(004)
Moderate-high poverty tract X rural tract	−0.019	−0.018	−0.002
	(0.021)	(0.020)	(0.004)
High poverty tract X rural tract	0.064	0.061	−0.020**
	(0.073)	(0.060)	(0.007)

Note: sample sizes are rounded to the nearest 50 in accordance with NCES regulations. Estimates are weighted. All background characteristics from Model 2 in Table 2 are controlled (results not shown). Robust standard errors were clustered at the census tract level.
† $p < 0.10$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Crosnoe, &; Dion, 2010; Frech & Kimbro, 2011; Leventhal & Brooks-Gunn, 2000). Neighborhood poverty may affect achievement and economic outcomes through the quality of institutions, such schools and child care centers. The findings in this study suggest that food insecurity may be precipitated by household resources or family processes, rather than food access or other resources in the surrounding community, with the exception of child-level food insecurity. Children living in very high poverty neighborhoods (40% or more poverty) were more likely to be food insecure themselves, after controlling for a range of background characteristics. It is possible that child-level food insecurity, as a more rare and more severe indicator of hardship than food insecurity among adults in a household, is more likely in high-poverty neighborhoods because it suggests persistent hardship. For example, Kimbro et al. (2012) found that the persistence of food insecurity, not the incidence of food insecurity, was associated with neighborhood poverty. Investigations of how neighborhood disadvantage affects the persistence of hardship, or how the duration of exposure to neighborhood disadvantage affect children's health and development, remain areas for future research.

Across all models, our findings show household economic resources (e.g., income and employment) are more highly predictive of food insecurity than neighborhood poverty. These findings are consistent with much of the food security literature (Coleman-Jensen, Christian, & Singh, 2014; Coleman-Jensen, McFall, & Nord, 2013; Gorton et al., 2010; Gundersen & Ziliak, 2014) and theory indicating that the family serves as the primary proximal influence on children (Bronfenbrenner & Morris, 2006) and household characteristics, particularly the family's financial situation, are more influential on children's outcomes than the level of disadvantage in the neighborhood (Leventhal & Brooks-Gunn, 2000; Morrissey & Vinopal, 2015). That is, resources and processes within the microsystem may be most important to children's food insecurity, except for the most vulnerable. Results also demonstrate the importance of accounting for child and family characteristics when estimating the potential causal effects of neighborhoods on children's development. In particular, parental education and household income largely accounted for the associations between neighborhood poverty and food insecurity.

In this study, we also tested for differences in associations between neighborhood poverty and food insecurity by urbanicity. Like earlier studies (Bartfeld et al., 2010; Carter et al., 2014; Garasky et al., 2006; Gorton et al., 2010), results provide some evidence that living in a rural area serves as a protective factor for food insecurity, particularly from child-level food security. Recent research suggests that the experience and effects of poverty on children's academic skills may differ across urban, suburban, and rural area, based on the availability of resources (e.g., transportation, family or social networks) (Votruba-Drzal, Miller, & Coley, 2015).

Findings must be interpreted within the context of the study's limitations. First, as previously noted, the associations identified cannot be considered causal, as families' decisions about the neighborhoods in which they live are endogenous to their and the neighborhoods' resources and other characteristics (Sampson & Sharkey, 2008). The stronger links identified between neighborhood poverty level and child-level food insecurity compared to household- and adult-level food insecurity may be due to an omitted variable rather (such as household wealth or parenting practices) than a causal mechanism of neighborhood disadvantage. Although statistical techniques such as propensity score matching and within-child fixed effects using a subsample of children who move neighborhoods may increase internal validity to some degree, there are external validity considerations with each, i.e., families that move are different from those who do not, and moving may be harmful for children's food security and other outcomes (Institute of Medicine, 2010; Jacknowitz et al., 2015). Second, we examine children's residential tracts at the fall of kindergarten; we do not know whether these tracts represent where children lived prior to kindergarten entry, or how the poverty rates of these tracts changed prior to kindergarten entry. However, other research finds that point-in-time measures of neighborhood characteristics are reasonable proxies for the characteristics of their long-term neighborhoods (Kunz, Page, & Solon, 2003). Third, we use census tracts as a proxy for neighborhoods. Tracts are geographically small (smaller in urban than in rural areas) but are used for census data collection, and may not represent neighborhoods as perceived by residents. Fourth, in the ECLS-K:2011, the child-level food security questions on the CFSM were not asked of the specific focal child; a child classified as experiencing child-level food insecurity may experience food insecurity himself or herself, or have a sibling that is food insecure. Fifth, although our measure of low food access was USDA-defined, it is a general measure that may not be applicable to certain communities, such as affluent residential tracts in which people drive to grocery stores more than ten miles away. Relatedly, we did not have a measure of transportation available in the ECLS-K:2011 (e.g., whether the family owns a car), which has been found to be important in food insecurity (Bader et al., 2010; Gorton et al., 2010). Finally, due to missing data, we included a subsample of the total ECLS-K sample. Our results may underestimate associations between neighborhood poverty and food insecurity, as missing data more likely among those with lower incomes or facing food security. The use of multiple imputation helps address this issue, but missing data potentially limit the generalizability of findings.

In sum, findings suggest that neighborhood poverty rates may be a useful proxy for policymakers to identify children in food-insecure households, or those experiencing the greatest severity of food insecurity. However, place-based initiatives for high-poverty neighborhoods should not be the exclusive policy focus for food insecurity, as findings also suggest that food-insecure households and adults are present even in low-poverty communities. For example, nearly one in 11 kindergarten-age children in low-poverty neighborhoods experienced household food insecurity in 2010–2011, suggesting that substantial numbers of families in more advantaged neighborhoods may benefit from greater access to food assistance, as well.

Acknowledgements

This study was supported by the Division of Human Services Policy in the Office of the Assistant Secretary for Planning and Evaluation

(ASPE), in the U.S. Department of Health and Human Services. The opinions and conclusions expressed herein are solely those of the author and should not be construed as representing the opinions or policies of the HHS or any agency of the Federal Government. Participants at the Association of Public Policy Analysis and Management Annual Conference and colloquium at American University provided helpful comments.

References

Alaimo, K., Olson, C. M., & Frongillo, E. A. (2001). Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatrics*, *108*(1), 44–53.

Bader, M. D. M., Purciel, M., Yousefzadeh, P., & Neckerman, K. M. (2010). Disparities in neighborhood food environments: Implications of measurement strategies. *Economic Geography*, *86*(4), 409–430.

Bartfeld, J. S., Ryu, J. -H., & Wang, L. (2010). Local characteristics are linked to food insecurity among households with elementary school children. *Journal of Hunger & Environmental Nutrition*, *5*(March 2015), 471–483.

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). *Guide tomeasuring household food security revised 2000.* VA: USDA, FNS.

Bishaw, A. (2011). Areas with concentrated poverty: 2006–2010. Washington, DC.: U.S. Census Bureau Retrieved from http://www.census.gov/prod/2011pubs/acsbr1017.pdf.

Bishaw, A. (2014). Changes in areas with concentrated poverty: 2000 to 2010. U.S. Washington, DC.: Census Bureau Retrieved from http://www.census.gov/content/dam/Census/library/publications/2014/acs/acs-27.pdf.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon, & R. Lerner (Eds.), *Handbook of child psychology (Sixth). Theoretical models of human development*, *Vol. 1*. (pp. 793–838). New York: John Wiley & Sons Ltd.

Bronte-Tinkew, J., Zaslow, M., Capps, R., Horowitz, A., & McNamara, M. (2007). Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. *The Journal of Nutrition*, *137*(9), 2160–2165.

Brooks-Gunn, J., & Duncan, G. J. (2000). Family poverty, welfare reform, and child development. *Child Development*, *71*, 188–196.

Carter, M. A., Dubois, L., & Tremblay, M. S. (2013). Place and food insecurity: A critical review and synthesis of the literature. *Public Health Nutrition*, *7*, 1–19.

Carter, M. A., Dubois, L., & Tremblay, M. S. (2014). Place and food insecurity: A critical review and synthesis of the literature. *Public Health Nutrition*, *17*(1), 94–112. http://dx.doi.org/10.1017/S1368980013000633.

Carter, M. A., Dubois, L., Tremblay, M. S., & Taljaard, M. (2012). Local social environmental factors are associated with household food insecurity in a longitudinal study of children. *BMC Public Health*, *12*(1), 1038. http://dx.doi.org/10.1186/1471-2458-12-1038.

Chetty, R., & Hendren, N. (2015). The impacts of neighborhoods on intergenerational mobility: Childhood exposure effects and county-level estimate. Cambridge, MA.: National Bureau of Economic Research (NBER) Retrieved from http://www.equality-of-opportunity.org/images/nbhds_paper.pdf.

Chetty, R., Hendren, N., & Katz, L. F. (2015). *The effects of exposure to better neighborhoods on children: New evidence from the moving to opportunity experiment.* Cambridge, MA.: National Bureau of Economic Research (NBER) Retrieved from http://www.equality-of-opportunity.org/images/mto_paper.pdf.

Coleman-Jensen, A., Christian, G., & Singh, A. (2014). Household food security in the United States in 2013. *Economic research report*. Washington, DC: Economic Research Service, U.S. Department of Agriculture.

Coleman-Jensen, A., McFall, W., & Nord, M. (2013). *Food insecurity in households with children: Prevalence, severity, and household characteristics, 2010–2011.* Washington, DC: Economic Research Service, U.S. Department of Agriculture.

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C., & Singh, A. (2015). *Household food security in the United States in 2014. USDA economic research report*, *Vol. 194*, Washington, DC: Economic Research Service, U.S. Department of Agriculture.

Duncan, G. J., Morris, P. A., & Rodrigues, C. (2011). Does money really matter? Estimating the impacts of family income on young children's achievement with data from random-assignment experiments. *Developmental Psychology*, *47*(5), 1263–1279.

Dupere, V., Leventhal, T., Crosnoe, R., & Dion, E. (2010). Understanding the positive role of neighborhood socioeconomic advantage in achievement: The contribution of the home, child care, and school environments. *Developmental Psychology*, *46*(5), 1227–1244.

Frech, A., & Kimbro, R. (2011). Maternal mental health, neighborhood characteristics, and time investments in children. *Journal of Marriage and Family*, *73*(3), 605–620. http://dx.doi.org/10.1186/1479-5868-3-19.

Galster, G. C. (2010). The mechanism(s) of neighborhood effects: Theory, evidence, and policy implications. *Neighborhood effects research: New perspectives* (pp. 23–56).

Garasky, S., Morton, L. W., & Greder, K. a. (2006). The effects of the local food environment and social support on rural food insecurity. *Journal of Hunger & Environmental Nutrition*, *1*(March 2015), 37–41. http://dx.doi.org/10.1300/J477v01n01.

Gorton, D., Bullen, C. R., & Mhurchu, C. N. (2010). Environmental influences on food security in high-income countries. *Nutrition Reviews*, *68*(1), 1–29. http://dx.doi.org/10.1111/j.1753-4887.2009.00258.x.

Gundersen, C. G., & Ziliak, J. P. (2014). Childhood food insecurity in the U.S.: Trends, causes, and policy options. *The future of children*.

Hernandez, D., & Jacknowitz, A. (2009). Transient, but not persistent, adult food insecurity influences toddler development. *Journal of Nutrition*, *139*(8), 1517–1524.

Howard, L. L. (2011). Does food insecurity at home affect non-cognitive performance at school? A longitudinal analysis of elementary student classroom behavior. *Economics of Education Review*, *30*(1), 157–176. http://dx.doi.org/10.1016/j.econedurev.2010.08.003.

Institute of Medicine (2010). *Student mobility: Exploring the impacts of frequent moves on achievement: Summary of a workshop.* Washington, DC: National Academy of Sciences (Retrieved from http://nap.edu/catalog.php?record_id=12853).

Jacknowitz, A., Morrissey, T. W., & Brannegan, A. (2015). Food insecurity across the first five years: Triggers of onset and exit. *Children and Youth Services Review*, *53*, 24–33. http://dx.doi.org/10.1016/j.childyouth.2015.03.012.

Jargowsky, P. (2014). Concentration of poverty: An update. Retrieved January 27, 2015, from http://tcf.org/blog/detail/concentration-of-poverty-an-update

Jargowsky, P. (1997). *Poverty and place: Ghettos, barrios, and the American city.* New York, NY: Russell Sage Foundation.

Johnson, A. D., & Markowitz, A. J. (2015). Associations beween early childhood food insecurity and readiness for kindergarten. *Working paper*. Washington, DC: Georgetown University.

Jyoti, D. F., Frongillo, E. A., & Jones, S. J. (2005). Food insecurity affects school children's academic performance, weight gain, and social skills. *The Journal of Nutrition*, *135*(12), 2831–2839 (R).

Kimbro, R. T., Denney, J. T., & Panchang, S. (2012). Individual, family, and neighborhood characteristics and children's food insecurity. *Journal of Applied Research on Children*, *3*(1), 1–30.

Kneebone, E. (2014). *The growth and spread of concentrated poverty, 2000 to 2008–2012.* Washington, DC: The Brookings Institution doi: http://www.brookings.edu/research/interactives/2014/concentrated-poverty#/M10420.

Kohen, D. E., Leventhal, T., Dahinten, V. S., & McIntosh, C. N. (2008). Neighborhood disadvantage: Pathways of effects for young children. *Child Development*, *79*(1), 156–169. http://dx.doi.org/10.1111/j.1467-8624.2007.01117.x.

Kunz, J., Page, M. E., & Solon, G. (2003). Are point-in-time measures of neighborhood characteristics useful proxies for children's long-run neighborhood environment? *Economics Letters*, *79*(2), 231–237. http://dx.doi.org/10.1016/S0165-1765(02)00324-5.

Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, *126*(2), 309–337.

Ludwig, J., Sanbonmatsu, L., Gennetian, L. A., Adam, E. K., Duncan, G. J., Katz, L. F., ... McDade, T. W. (2011). Neighborhoods, obesity, and diabetes — A randomized social experiment. *New England Journal of Medicine*, *365*(16), 1509–1519 (Retrieved from http://www.nejm.org/doi/full/10.1056/NEJMsa1103216).

Morrissey, T. W., & Vinopal, K. (2015). Neighborhood poverty and children's school readiness. *Working paper*. Washington, DC: American University.

Morrissey, T. W., Hutchison, L., & Winsler, A. (2014). Family income, school attendance, and academic achievement in elementary school. *Developmental Psychology*, *50*(3), 741–753. http://dx.doi.org/10.1037/a0033848.

Nord, M. (2009). *Food insecurity in households with children: Prevalence, severity, and household characteristics.* Washington, DC: Economic Research Service. U.S. Department of Agriculture.

Nord, M., & Bickel, G. (2002). *Measuring children's food security in U.S. households, 1995–99.* Washington, DC: Economic Research Service. U.S. Department of Agriculture.

Nord, M., & Parker, L. (2010). How adequately are food needs of children in low-income households being met? *Children and Youth Services Review*, *32*(9), 1175–1185. http://dx.doi.org/10.1016/j.childyouth.2010.03.005.

Page, M. E., & Solon, G. (2003a). Correlations between brothers and neighboring boys in their adult earnings: The importance of being urban. *Journal of Labor Economics*, *21*(4), 831–855. http://dx.doi.org/10.1086/377021.

Page, M. E., & Solon, G. (2003b). Correlations between sisters and neighboring girls in their subsequent income as adults. *Journal of Applied Econometrics*, *18*(5), 545–562.

Pilgrim, A., Barker, M., Jackson, A., Ntani, G., Crozier, S., Inskip, H., ... Robinson, S. (2012). Does living in a food insecure household impact on the diets and body composition of young children? Findings from the Southampton Women's survey. *Journal of Epidemiology & Community Health*, *66*, 1–6. http://dx.doi.org/10.1136/jech.2010.125476.

Rabe-Hesketh, S., & Skrondal, A. (2008). *Multilevel and longitudinal modeling using Stata* (2nd ed.). College Station, TX: Stata Press.

Ryu, J. -H., & Bartfeld, J. S. (2012). Household food insecurity during childhood and subsequent health status: The early childhood longitudinal study—Kindergarten cohort. *American Journal of Public Health*, *102*(11), e50–e55. http://dx.doi.org/10.2105/AJPH.2012.300971.

Sampson, R. J., & Sharkey, P. (2008). Neighborhood selection and the social reproduction of racial inequality. *Demography*, *45*(1), 1–29.

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*(1), 443–478. http://dx.doi.org/10.1146/annurev.soc.28.110601.141114.

Sharkey, P. (2010). The acute effect of local homicides on children's cognitive performance. *Proceedings of the National Academy of Sciences of the United States of America*, *107*(26), 11733–11738. http://dx.doi.org/10.1073/pnas.1000690107.

Small, M. L., & McDermott, M. (2006). The presence of organizational resources in poor urban neighborhoods: An analysis of average and contextual effects. *Social Forces*, *84*(3), 1697–1724. http://dx.doi.org/10.1353/sof.2006.0067.

Solon, G., Page, M. E., & Duncan, G. J. (2000). Correlations between neighboring children in their subsequent educational attainment. *The Review of Economics and Statistics*, *82*(August), 383–392.

Votruba-Drzal, E., Miller, P., & Coley, R. L. (2015). Poverty, urbanicity, and children's development of early academic skills. *Child Development Perspectives*, *0*(0). http://dx.doi.org/10.1111/cdep.12152 (n/a–n/a).

Whitaker, R. C., Phillips, S. M., & Orzol, S. M. (2006). Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics*, *118*(3), e859–e868. http://dx.doi.org/10.1542/peds.2006-0239.

Wilson, W. J. (2012). *The truly disadvantaged* (2nd ed.). Chicago, IL: University of Chicago Press.

Wodtke, G. T., Harding, D. J., & Elwert, F. (2011). Neighborhood effects in temporal perspective. *American Sociological Review*, *76*(5), 713–736. http://dx.doi.org/10.1177/0003122411420816.

Wolf, S., Magnuson, K. A., & Kimbro, R. T. (2015). Family poverty and neighborhood poverty: Links with children's school readiness before and after the great recession. *Working paper*. New York: New York University.