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# Individual, Family, and Neighborhood Characteristics and Children's Food Insecurity

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## Introduction

Household food insecurity, a household's collective inability to access adequate food for a healthy, active lifestyle, impacts 14.7% of all households in the United States.[1] Among households with children, estimates of the prevalence of food insecurity range from about 8%-21%,[2-6] depending upon the exact measure of food insecurity which is utilized and the composition of the sample. Although research that explores the individual and family predictors of food insecurity is robust, much less work attempts to connect contextual factors such as neighborhood or community features to the likelihood of households being food insecure. Given that contextual characteristics like the scarcity of food stores in poor neighborhoods and limited access to public transportation may impact a household's access to food, the utility of research linking neighborhood features to food insecurity seems clear. A better understanding of which neighborhood characteristics are associated with an increased risk of food insecurity could help policy makers target neighborhoods where children are most at risk. Thus, in this paper we utilize the geocoded Early Childhood Longitudinal Study (ECLS-K), a nationally representative and longitudinal dataset of over 20,000 kindergarteners in 1998-1999, to examine individual, family, and neighborhood characteristics of food secure and food insecure children. We also examine the traits of children who are persistently food insecure at both kindergarten and third grade, those who move into food insecurity, those who move out, and those who are food secure at both survey waves. It is important to note that the US food security landscape of today likely differs substantially from that in 1998-1999 (when the kindergarten wave of the data was collected) and 2001-2002 (when the third grade wave of the data was collected). For example, Supplemental Nutrition Assistance Program (SNAP, formerly called Food Stamps) receipt reached an all-time high of 46 million Americans in mid-2011,[7] indicating that the impact of the Great Recession is being felt on families' food budgets. From 2000 to 2007, household food insecurity rates were closer to 11%, undergoing a spike from 2007 to 2008[8] to roughly 14% in 2009 and 2010, which was the highest level since the USDA surveys began in 1995.[1] Thus, it is likely that our estimates, from data before the increase in food insecurity began, are conservative and reflect a better food environment for households with children in the US than can be expected today.

## Food Insecurity

Rates of food insecurity tend to be higher than the national average among households headed by single women or men and also among black and Hispanic households.[1] A number of additional individual characteristics such as low socioeconomic status (SES), particularly maternal education, and participation in food assistance programs such as SNAP, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), or free/reduced breakfast and lunch are known to be associated with household food insecurity.[3,4,9-11] The consequences of food insecurity for children's health and well-being are clearly established. Food insufficient children may be more likely to suffer from stomachaches, headaches, and colds than those classified as food sufficient.[5] Among lower income families, infants and toddlers from food insecure households also have a higher chance of fair or poor health and incidents of hospitalization since birth compared to their food secure counterparts; this gap increases for families who are classified as food insecure on household as well as child levels.[2] Among low-income and homeless families headed by mothers, children with hunger are more likely to have been low birthweight babies than those without hunger.[12] In addition, the number of episodes of hunger that children experience is related to their health as they grow.[13] These findings indicate that children's health levels are associated with not just the presence but also the severity of food insecurity.

The outcomes of food insecurity in children may extend beyond physical health to academic performance as well as mental health. Detrimental performance in math and reading, loss of school days and repeated grades, behavior or attention problems, special education or mental health counseling, and suicidal or depressive tendencies among adolescents have all been linked to living in food insecure or insufficient households.[6,14-18] In one study, food insufficient adolescents were five times as likely to have attempted suicide as those who were food sufficient; notably, they were also more likely to have lost or gained weight without intending to.[15] This supports the hypotheses of some authors that poorer youths' well-being may not just be a result of lower net availability of food at home but also of unpredictable changes in availability—a supposition consistent with the finding that food insecurity is more of a recurrent than chronic phenomenon.[1]

Maternal factors, especially maternal mental health, may be a direct correlate of food insecurity as well as a mediator. Depressed mothers in low-income families are more likely to be food insecure and also to report lower child health status and recent losses or reductions in financial

assistance programs.[3,19] Maternal stressors relate to a host of other poor health outcomes for children in food insecure households.[20] Household food insecurity can also predict significantly higher levels of maternal depression, making it difficult to sort out the causal ordering of depression and food insecurity.[16]

Maternal citizenship status may also affect food insecurity for children, but this relationship is complex as well. For instance, children who have not just foreign-born but specifically *noncitizen* mothers may have levels of food insecurity nearly twice as high as those with native-born mothers.[3] The reasons for this are unclear, but navigating social services and securing information or tangible resources such as SNAP or health care often proves difficult for immigrants.[21] Similarly, immigrant families who have been in the United States for less than 10 years are more likely to be food insecure than those who have been here longer, but children of immigrant mothers are at a greater risk of food insecurity and poor health than native families overall—despite the fact that many maternal and child health indicators such as breastfeeding and prevalence of low birthweight may actually be better among immigrant families.[22]

The contradictory relationship between overweight and food insecurity in low-income children is well documented but largely inconclusive, as both cross-sectional and longitudinal studies have yielded conflicting results.[9,23-25] While some studies suggest a correlation between the two among whites, Mexican-Americans, or girls, others have found no link or even a negative relation.[4,6,25-27] SNAP and certain food assistance programs have been shown with some consistency to attenuate the chance of overweight and other poor health outcomes among food insecure children in some cases, however.[2,10,27,28]

Research focusing on weight status for women rather than children in food insecure households has found more conclusive results, such that food insecurity is highly correlated with overweight as well as lower consumption from key food groups among women.[29,30] In addition, adults from food insecure households may consume less in energy and key nutrients than those from food secure families; this is especially the case for older adults.[24,31,32] These and other findings suggest that women or elders in food insecure households may be denying themselves adequate nutrition so their children may eat normally; as such, children in these households may not have a poorer quality nutrient intake.[4,9,24,33-35] Indeed, authors have pointed out the limitations of measuring proximate factors such as home diets and child body mass index (BMI) due to the inherent variability of food availability, food intakes at home as opposed to school and other places, and weight status.[24,36] Nevertheless, it is clear that the

condition of food insecurity is detrimental to children's physical and mental health.

Qualitative research that taps into the dynamics of food insecurity not readily measured by quantitative methods has suggested that the "burden of food insufficiency is not only borne by individual households but also by the members of extended social networks," concluding that "Existing community programs need to be strengthened to decrease the effect of economic stress on families and their networks."[37] This suggests that social characteristics of communities may play an important role in protecting against food insecurity. In fact, few quantitative studies have investigated social support as an influence on food insecurity; although there are conflicting results depending on how support is measured, there is also some evidence that greater civic structure in a community can actually reduce the chance of being food insecure.[38-40] These and other studies have suggested that a multilevel analysis could shed light on the sometimes contradictory connection between food insecurity and child outcomes.[36,37,41] It seems likely that a downstream factor such as material deprivation in general—linked to food insecurity—may be what drives the relationship between food insecurity and child outcomes. Nonetheless, the existing body of work on food insecurity is incomplete as it focuses on the individual level traits of children and their families (mainly their mothers), ignoring other possible structural influences such as those present in a child's place of residence. It is important to discern which family, household, and neighborhood factors may be linked to food insecurity because it is linked to so many detrimental outcomes for mothers and children.

**Neighborhoods and Healthy Development**

Though indicators of children and their families have served as the motivating mechanisms behind child health research and policy strategies to curb health disparities to date, characteristics of children's neighborhoods have become important foci for public health and social science scholarship focused on health outcomes. Neighborhoods matter, and they matter because of the resources immediately available (or unavailable) within them. There is ample evidence that neighborhood factors influence child health and well-being,[42] and it seems likely that some features of neighborhoods related to physical and social disadvantage, particularly the availability of healthy foods and the social cohesion of neighbors, are linked to food insecurity. Housing affordability has been identified as one factor which is related to food insecurity; families in more affordable housing situations are less likely to be food

insecure.[43] To date, however, very little attention has been paid to describing the ways that characteristics of neighborhoods impact household food insecurity. Kirkpatrick and Tarasuk[44] find, using careful measurement of the proximity to food access sources, that food insecurity is attributable much more to household factors such as income than to neighborhood factors like the distance to a grocery store. They also aggregate individual survey responses to create what they refer to as neighborhood social capital, finding that the positive relationship between low perceived neighborhood social capital and food insecurity was attenuated by accounting for household factors. Although the authors conclude that there is limited utility to investigating the impact of neighborhood factors on food insecurity, their analyses are not suitable to determine whether aggregate levels of disadvantage impact food insecurity above and beyond household-level factors.[45] Several studies have demonstrated a link between neighborhood deprivation measures and low birth weight[46,47] and infant mortality,[48] suggesting a key, early mechanism connecting residential context with the healthy development of children. Two recent studies documented a link between neighborhood SES and obesity in older children,[49,50] and a new stream of research focuses on social and built environment factors which influence young children's nutrition, outdoor play, and physical activity.[51-54] These links may be due to safety concerns, the built environment (e.g., lack of parks, playgrounds, and walkable destinations such as churches, restaurants, and grocery stores),[55] access to and affordability of healthy foods,[56,57] or to differences in neighborhood social processes such as social cohesion.[58-61]

Given the strong links between neighborhood factors and child development, it seems likely that neighborhoods may influence food insecurity either through access and availability of food or via social factors such as social cohesion or social support. Both of these potential mechanisms are strongly related to the socioeconomic status and racial/ethnic composition of neighborhoods. The food desert is a general concept which may refer to a sheer lack of food retailers in a certain area, but it also extends to accessibility and affordability of healthy foods in the context of relative neighborhood disadvantage.[62] A systematic review of the recent food desert literature found that availability and quality of healthy foods is relatively poor for disadvantaged areas, as well as areas with a high proportion of African-Americans.[62] It is now generally accepted that chain supermarkets, rather than other food businesses such as liquor stores, smaller grocery stores, and specialty stores, offer the widest range of foods and, therefore, healthy options at the cheapest price—but this

amenity is not equally accessible across all communities.[63-66] Accessibility of supermarkets in urban, middle to lower income areas is strongly associated with race as well as income. Primarily black neighborhoods may be significantly further away from supermarkets than white neighborhoods; in one study, the only areas exceptional to this trend were historically white neighborhoods which had recently undergone a demographic shift toward black residents.[67-69] White neighborhoods tend to have more supermarkets and fewer liquor stores, grocery stores, and convenience stores than poorer or minority areas.[63,67,69] Income may also affect consumer shopping choices and, indirectly, perceptions of selection and quality within particular stores.[57,70]

While most recent studies examining food insecurity have had reasonably large sample sizes, often drawing from nationally representative data,[3,9,22,24] others have been limited by smaller sample sizes.[12,18] By far the largest methodological problem with comparing food insecurity studies is the variety of ways in which this outcome has been measured. Though the relatively recent introduction of the USDA Core Food Security Module has precluded a standard assessment of food security in earlier studies, especially those that drew from NHANES III,[5,15] the current module provides for a measurement of insecurity that is dichotomous or categorical, and some studies apply its recommendations in varying ways.[4,6,27] In addition, a major limitation of prior work on child food insecurity has been a limited focus on structural factors, such as neighborhood poverty, outside the family household which might influence food insecurity. Thus, in this paper, we present nationally representative, weighted estimates of a dichotomous measure of food insecurity, modeled off Nord et al[1] in their annual report on food security in the United States as well as a dynamic measure of change in food insecurity status over time, and we link neighborhood census data to those estimates to ascertain in which types of neighborhoods children are most likely to live in food insecure households.

## Data and Methods

This study uses restricted, geocoded data from the fall and spring kindergarten waves, as well as the third grave wave, of the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), which is a nationally representative sample of approximately 22,000 US children who were in kindergarten in 1998-1999. Because children were sampled from within schools, many children are therefore also clustered in census tracts based on their home addresses. The restricted version of the data provides census tract numbers which may be linked with Census 2000

data to create neighborhood-level variables. We thus merged the ECLS household data with Census 2000 contextual data at the tract level to create the data for our analysis. Children were matched with their neighborhood data at both kindergarten and the third grade waves. Food insecurity information is not collected until the second wave of the study (in the spring of the kindergarten year), so we lose 11% of the sample who did not complete a parent interview for the second wave and another 28% of the sample who did not complete a survey for the fifth wave (third grade). We lose an additional 9% of the sample who did not have complete geocoded addresses. Our analytic sample size is thus 11,610. We use longitudinal survey weights provided by the ECLS-K to ensure that the sample remains nationally representative of all children who were in kindergarten in the U.S. in 1998-1999.

**Variables**

We use two measures of food insecurity, one static and one dynamic. The static measure, assessed in both kindergarten and third grade, is a dichotomous measure of household food insecurity derived from the USDA's 18-item food insecurity scale.[71] For our analysis, we utilize the full 18-item Core Food Security Module as endorsed by the USDA. For example, the questions include, "In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?" and "In the last 12 months, was [child] ever hungry but you just couldn't afford more food?" We focus on household food insecurity rather than child food insecurity because every household in the initial sample has a kindergarten-aged child and because the rates of child food insecurity (a more severe measure) are quite low compared to household food insecurity among households with children. Additionally, child food insecurity does not assess the extent to which all children are actually affected by food insecurity, and because it is likely to be a recurring condition, assessing insecurity at the household level may capture the outcomes associated with it on a more holistic level.[1] Parents were asked a series of 18 questions relating to the access to and availability of food in the household. Following Bickel et al,[71] we code the households of parents answering in the affirmative to 3 or more of the items as "food insecure"; this matches the USDA's classification of households with low and very low food security.[72] The second, dynamic food insecurity measure is created by looking at change between kindergarten and third grade for a household's food insecurity status. Children are categorized into one of the following: 1) persistently food insecure—food insecure at kindergarten and in third grade; 2) never food insecure—food secure at kindergarten

and third grade; 3) enters food insecurity—food secure at kindergarten but food insecure at third grade; and 4) exits food insecurity—food insecure at kindergarten but food secure at third grade. As for the static measure, the "food insecure" designation corresponds with households with low and very low food security.

Independent variables for our study include the child's sex, race/ethnicity (white, black, Hispanic, Asian, or other), the mother's nativity (foreign-born or US-born), the child's age in months, the mother's age, whether the child was low birthweight (<2500 grams), the federal poverty threshold level of the household (under 100% FPL, 100-200% FPL, 200-300% FPL, and 400%+ FPL), the mother's level of education (less than high school, high school degree to some college, or college degree or more), family structure (two-parent family, single-mother family, and other family type), the number of siblings in the household, whether the family is currently receiving SNAP benefits, the household's employment status (full-time worker or no full-time worker in the household), and whether the parent reports it is safe for the child to play outside. With the exception of race/ethnicity and the mother's nativity, all measures are taken from both the kindergarten and the third grade waves of the data so we can account for the ways that the family environment may have changed between kindergarten and third grades.

Neighborhood-level measures capture the racial/ethnic make-up of the census tract in which one resides as the percentage of non-Hispanic white, non-Hispanic black, and Hispanic. A measure of the percentage of female-headed households living with children under age 18 provides a sense of family structure in neighborhoods, and the percentage of foreign-born mothers and the percentage of linguistic isolation capture other important social characteristics of neighborhoods that might relate to food insecurity. If one is linguistically isolated and poor, accessing assistance programs may be difficult, if not impossible. The percentage of the population aged 65 and older is also included. Finally, measures of disadvantage at the neighborhood level include the percentage of persons living below poverty, the percentage of unemployed persons, and the percentage of the population with less than a high school education. We assess neighborhood characteristics at both the kindergarten and third grade waves.

## Analysis

The analysis provides primarily a descriptive account of food insecurity incorporating two levels of influence: individual and/or family level characteristics and neighborhood traits. Given that the food insecurity

literature has largely neglected to consider structural indicators of risk, this represents one of the first systematic investigations of neighborhood risk factors for child food insecurity. We provide weighted means and proportions and t-tests of significance to examine differences across characteristics for food secure and food insecure children, including their neighborhood characteristics at both kindergarten and at third grade (see Table 1). Consistent with the neighborhood focus, we used cluster analysis[74] (kmeans) to discern a sensible grouping of respondents into neighborhood types to assess the relative risk of food insecurity for children living in different types of neighborhoods (see Figure 1 and Table 2). Because we are interested in showing how neighborhoods may influence changes in food insecurity over time, we utilize the kindergarten neighborhood data for this part of the analysis. We decided on a 3-class solution, described below, based on the results of the Caliński and Harabasz index.[74] The results showed that certain neighborhood measures characterized an area in ways that produced 3 distinct types of neighborhoods: white/high SES; black/low SES; and Hispanic/foreign-born. Finally, we use the results from the cluster analysis to estimate the odds of food insecurity at both waves by neighborhood type and by the individual characteristics.[75] These multivariate logistic regressions incorporate appropriate weights available in the ECLS and estimate robust standard errors accounting for clustering within schools. All analyses were conducted using Stata software.[76]

## Results

Table 1 provides weighted proportions and means at kindergarten and third grade for individual and neighborhood characteristics of children and makes comparisons across variable categories and food insecurity statuses. Panel A provides proportions for the individual categorical variables and provides t tests of differences within categories, for example, race/ethnic group or maternal education categories. At kindergarten and third grade, 8% of children in the ECLS-K sample were classified as food insecure. This estimate is similar to those obtained from slightly different subsamples of ECLS-K respondents.[3,4,6] At both kindergarten and third grade, significant differences in the likelihood of food insecurity exist by race, poverty status, mother's education, family structure, SNAP receipt, parent's employment status, immigrant status, and perceptions of community safety.

**Table 1.** Weighted Proportions and t Tests of Significant Differences Between Groups, ECLS-K Kindergarten and Third Grade Data

| | Panel A. Categorical Variables | | | |
|---|---|---|---|---|
| | Kindergarten | | Third Grade | |
| | Full | Food insecure[a] | Full | Food insecure[a] |
| | | 0.08 | | 0.08 |
| **Individual characteristics** | | | | |
| Sex | | | | |
| female | 0.49 | 0.08 | 0.49 | 0.08 |
| male | 0.51 | 0.08 | 0.51 | 0.07+ |
| Race/ethnicity | | | | |
| non-Hispanic white (ref) | 0.62 | 0.05 | 0.58 | 0.05 |
| non-Hispanic black | 0.13 | 0.12*** | 0.16 | 0.13*** |
| Hispanic | 0.19 | 0.15*** | 0.20 | 0.11*** |
| Asian | 0.03 | 0.08** | 0.03 | 0.07 |
| Other | 0.03 | 0.08+ | 0.03 | 0.08 |
| Mother is foreign-born | | | | |
| yes | 0.18 | 0.15 | 0.17 | 0.10 |
| no | 0.82 | 0.07*** | 0.83 | 0.07*** |
| Birth weight | | | | |
| low (<2500 grams) | 0.08 | 0.12 | 0.08 | 0.09 |
| not low (>=2500 grams) | 0.92 | 0.08*** | 0.92 | 0.08 |
| Poverty thresholds | | | | |
| Household Income <100% Federal Poverty Level (ref) | 0.18 | 0.22 | 0.20 | 0.21 |
| 100%-200% Federal Poverty Level | 0.23 | 0.13*** | 0.24 | 0.10*** |
| 200%-300% Federal Poverty Level | 0.20 | 0.04*** | 0.19 | 0.04*** |
| > 300% Federal Poverty Level | 0.40 | 0.01*** | 0.37 | 0.01*** |

| | | | | |
|---|---|---|---|---|
| Mother's education | | | | |
| less than high school (ref) | 0.12 | 0.21 | 0.14 | 0.16 |
| high school to some college | 0.61 | 0.08*** | 0.63 | 0.08*** |
| bachelor's degree or more | 0.26 | 0.01*** | 0.23 | 0.02*** |
| Family Structure | | | | |
| two parents, married or cohabiting (ref) | 0.78 | 0.06 | 0.72 | 0.05 |
| single mother family | 0.17 | 0.16*** | 0.22 | 0.16*** |
| other family type | 0.05 | 0.07 | 0.06 | 0.07 |
| SNAP (Food Stamps) Receipt | | | | |
| household receives SNAP | 0.15 | 0.22 | 0.13 | 0.24 |
| household does not receive SNAP | 0.85 | 0.06*** | 0.87 | 0.05*** |
| Parents' employment status | | | | |
| at least one parent works full-time | 0.88 | 0.07 | 0.86 | 0.06 |
| no parent works full-time | 0.12 | 0.16*** | 0.14 | 0.17*** |
| Neighborhood safety (parent reported) | | | | |
| very safe to play outside | 0.71 | 0.05 | 0.75 | 0.06 |
| not safe or somewhat safe | 0.29 | 0.14*** | 0.25 | 0.14*** |

| | Panel B. Continuous Variables | | | | | |
|---|---|---|---|---|---|---|
| | Kindergarten | | | Third Grade | | |
| | Full | Not food insecure | Food insecure[b] | Full | Not food insecure | Food insecure[b] |
| **Individual characteristics** | | | | | | |
| Mother's age | 33.77 | 33.92 | 32.11*** | 37.34 | 37.47 | 35.83*** |
| Child's age in months | 74.69 | 74.69 | 74.73 | 108.82 | 108.81 | 108.84 |
| Number of siblings in the household | 1.44 | 1.40 | 1.91*** | 1.55 | 1.52 | 1.87*** |
| **Neighborhood characteristics** | | | | | | |
| % white | 67.66 | 69.02 | 52.13*** | 67.33 | 68.39 | 54.78*** |
| % black | 12.13 | 11.82 | 15.82*** | 13.02 | 12.59 | 17.95*** |
| % Hispanic | 14.35 | 13.41 | 24.98*** | 13.88 | 13.31 | 20.83*** |
| % female-headed household | 20.07 | 19.58 | 25.72*** | 20.08 | 19.65 | 24.85*** |
| % linguistic isolation | 4.93 | 4.60 | 8.67*** | 4.57 | 4.37 | 6.82*** |
| % foreign-born | 11.29 | 10.87 | 15.93*** | 10.76 | 10.54 | 13.26*** |
| % persons below poverty | 12.13 | 11.61 | 18.17*** | 11.93 | 11.59 | 15.92*** |
| % age 65 and older | 11.88 | 11.99 | 10.68*** | 11.68 | 11.74 | 10.97** |
| % unemployed | 6.06 | 5.85 | 8.46*** | 6.04 | 5.88 | 7.88*** |
| % < high school education | 20.74 | 19.96 | 29.63*** | 20.55 | 20.06 | 26.38*** |

Source: ECLS Kindergarten (N = 11,610) and Third Grade (N = 11,520) Samples; 2000 US Census Data at the Tract Level
[a] p-value for a t-test of significance by row (e.g., female vs. male) for food insecurity; *** ≤ 0.001 ** ≤ 0.01 * ≤ 0.05 + ≤ 0.10
[b] p-value for a t-test of significance by column (i.e., not food insecure vs. food insecure); *** ≤ 0.001 ** ≤ 0.01 * ≤ 0.05 + ≤ 0.10

Specifically, compared to whites, children of all other racial and ethnic groups are significantly more likely to be food insecure at kindergarten. Only 5% of white children are food insecure, for example, while 12% and 15% of black and Hispanic children are food insecure, respectively. This trend carries forward to third grade, where 13% of black and 11% of Hispanic children are food insecure compared to 5% of white children. The poverty status of the household and mother's education show similar results. At kindergarten and third grade, over 20% of children whose families are less than 100% of the federal poverty line reported food insecurity. That is nearly twice as many children as those in the next poorest category and over 20 times as many children as those at greater than 300% the federal poverty line. Similar disadvantages exist for mother's education. Over 20% of children of mothers with less than a high school education were food insecure at kindergarten, significantly more than children of mothers with a high school degree (8%) and 20 times as many children as those whose mother's had attained a college degree. These disadvantages persist into third grade as well.

Individual characteristics show further disadvantages for children by family structure, SNAP receipt, parent's employment status, immigration status, and safety in the neighborhood. Compared to children with 2 parents, children with single mothers are nearly 3 times more likely to be food insecure at kindergarten and third grade. Children whose families receive SNAP are nearly 4 times more likely, whose parents do not work are over 2 times more likely, whose parent is an immigrant are over 2 times more likely, and whose community is not safe to play in are over 2 times more likely to be food insecure at kindergarten, compared to their counterparts who do not receive SNAP, whose parents do work full-time, whose parents are not immigrants, and whose community is safe to play in, respectively. Finally, significantly more children who were low birth weight were food insecure at kindergarten, but that birth weight disadvantage is overcome by third grade.

Panel B of Table 1 provides weighted means and proportions for the continuous individual variables and the neighborhood characteristics compiled from 2000 US Census data and matched to the child's census tract. The t tests in Panel B compare food insecure to food secure children on each of the variables. The individual characteristics show that children with younger mothers and children with more siblings are, on average, significantly more likely to be food insecure at both kindergarten and third grade. In addition, there are consistent themes at the neighborhood level across kindergarten and third grade. Children in neighborhoods that were less white, more black, and more Hispanic are more likely to be food

insecure. In other words, the average food insecure child lives in a neighborhood that is approximately 25% Hispanic and 16% black. In addition, the average food insecure child lives in a neighborhood where more than a quarter of families are female-headed households. Food insecure children also live in neighborhoods with higher proportions of linguistically isolated residents, as well as nearly 16% of residents who are foreign-born, on average. Food insecure children are also more likely to live in neighborhoods with a higher proportion of unemployed residents as well as neighborhoods where nearly 30% of adults lack a high school degree.

The information on neighborhood characteristics in Table 1 suggests that there are certain types of communities in which children reside that could associate with a higher likelihood of food insecurity. To check this possibility and to identify neighborhood types in the ECLS-K data, we used cluster analysis to reveal 3 distinct neighborhood types in which children resided. The first is represented by higher proportions of white persons as well as high proportions of educated and employed persons and low proportions of persons living below poverty (henceforth, the white/high SES neighborhood type). The second neighborhood type was characterized by high proportions of blacks and low proportions of persons across a number of SES characteristics such as education and employment (henceforth, the black/low SES neighborhood type). The third and final neighborhood type was characterized by high proportions of Hispanic and foreign born persons as well as low proportions of educated persons and high proportions of persons living in poverty (henceforth, the Hispanic/foreign-born neighborhood type).

Figure 1 shows the proportion of food insecure children in each of the neighborhood types at both kindergarten and third grade. Tests of significance compare the proportions of children in the black/low SES and Hispanic/foreign-born neighborhoods to children in the white/high SES neighborhoods at both waves. Roughly 6% percent of children living in neighborhoods characterized as white and high SES reported food insecurity at both kindergarten and third grade. Children in the other neighborhood types had significantly higher likelihoods of food insecurity. Roughly 11% and 12% of children in the black/low SES neighborhoods reported food insecurity at kindergarten and third grade respectively. Similarly, children in the Hispanic/foreign-born neighborhoods were far more likely to be food insecure: 16% in kindergarten and 13% at third grade.

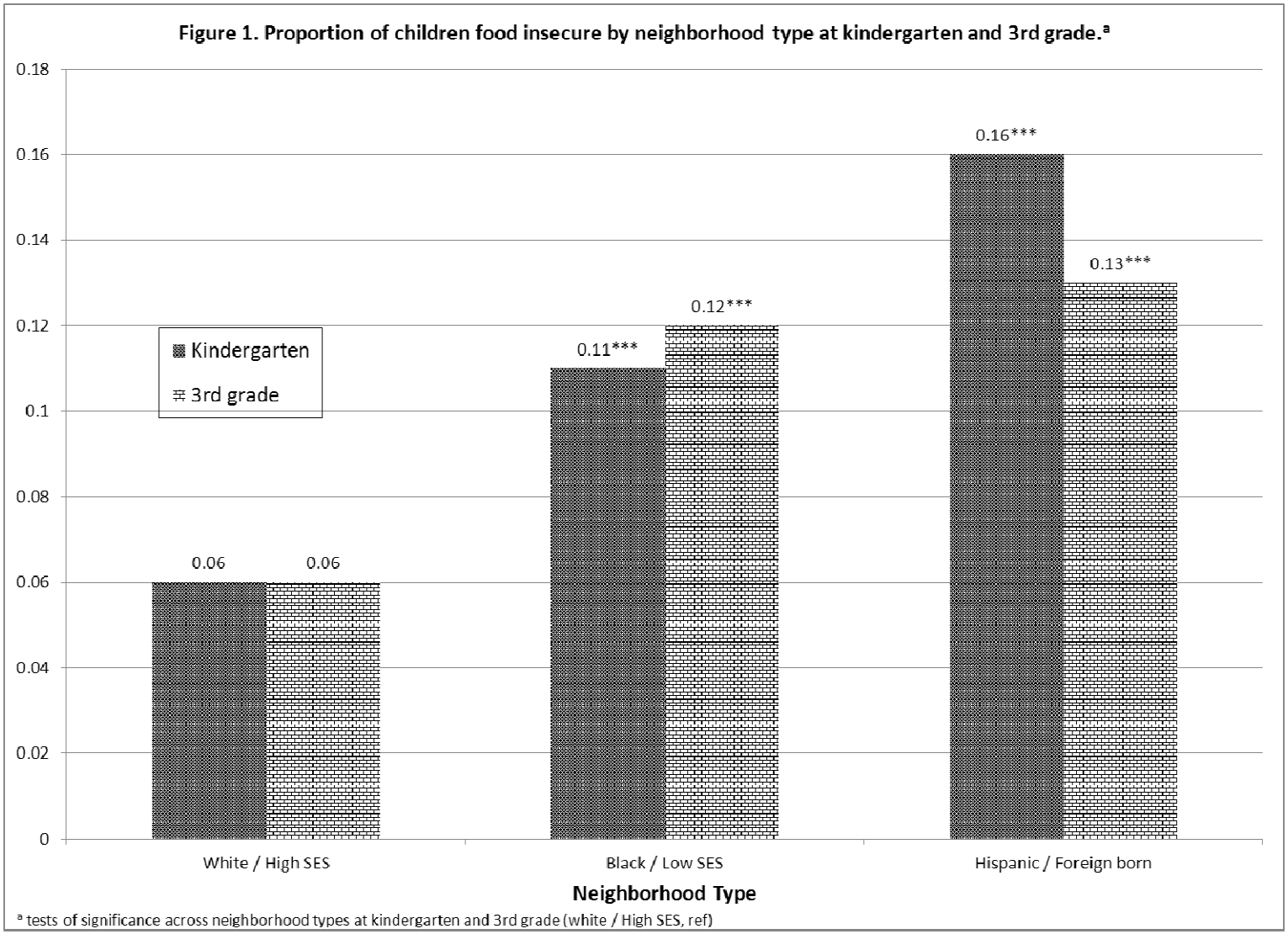
Figure 1. Proportion of children food insecure by neighborhood type at kindergarten and 3rd grade.[a]
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Kindergarten
3rd grade
0.06
0.06
0.11***
0.12***
0.16***
0.13***
White / High SES
Black / Low SES
Hispanic / Foreign born
Neighborhood Type
[a] tests of significance across neighborhood types at kindergarten and 3rd grade (white / High SES, ref)

Table 2 evaluates the effects of neighborhood type in a multivariate setting and provides odds ratios from logistic regressions estimating the odds of food insecurity by the neighborhood types and individual characteristics at both kindergarten and third grade. The estimates in Model 1 at both kindergarten and third grade show that the neighborhood types associate strongly with the odds of food insecurity. Relative to living in a white/high SES neighborhood, living in a black/low SES neighborhood puts children at over twice the odds of food insecurity, and living in a Hispanic/foreign-born neighborhood places children at roughly three times the odds of food insecurity. Controlling for individual sex and race/ethnic characteristics in Model 2 greatly reduces those increased odds. In fact, at kindergarten, the increased odds is reduced from 2.1 times more likely to a moderately significant 39% increased odds for children living in the black/low SES neighborhoods. At third grade, the increased odds of food insecurity for children living in black/low SES neighborhoods is explained away by sex and race. The increased odds of food insecurity in Model 2 for children living in Hispanic/foreign-born neighborhoods is substantially reduced but remains significant at both waves.

Model 3 in Table 2 adds additional individual level covariates, including poverty, mother's education, and food stamp receipt. The inclusion of these variables shows a strong graded relationship between food insecurity and household poverty level—the further a child gets from poverty, the less likely he or she is to be food insecure. At kindergarten, there are also increasing odds with increasing numbers of siblings and increased odds for low birthweight children, for children in single-mother families, for children whose household receives SNAP, and for children whose mother is foreign-born. The odds of food insecurity for children at kindergarten were reduced 60% in families where mother's education reaches at least a bachelor's degree and 36% for children whose parents evaluated their neighborhood as very safe to play in. At third grade, many of these individual-level effects fail to reach significance with the exception of the persistent effects of household poverty, single-mother families, and SNAP receipt.

The inclusion of individual measures in Model 3 also explains the remaining increased odds of food insecurity for children living in the black/low SES and Hispanic/foreign-born neighborhoods at kindergarten. In fact, the effect of living in a black/low SES neighborhood switches from positive to negative, suggesting a possible cross-level interaction between neighborhood conditions and individual traits. At third grade, the odds of food insecurity for children in Hispanic/foreign-born neighborhoods is greatly reduced, but a significant increased odds of food insecurity

persists. After considering individual characteristics that associate with food insecurity risk, children living in neighborhoods characterized by high proportions of Hispanic and foreign-born residents experience 39% increased odds of food insecurity. While individual covariates explain substantial amounts of the odds of food insecurity, these results provide support for considering neighborhood phenomena that may not be captured at the individual level in future analyses.

**Table 2**. Logistic Regression Odds Ratios for Neighborhood Types and Individual Characteristics on Food Insecurity Risk at Kindergarten and Third Grade

| | Kindergarten | | | Third Grade | | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 | Model 3 |
| **Neighborhood type (White/High SES, ref)** | | | | | | |
| Black/Low SES | 2.13*** | 1.39+ | 0.65* | 2.48*** | 1.25 | 0.72 |
| Hispanic/Foreign-Born | 3.17*** | 1.82*** | 0.89 | 2.87*** | 2.05*** | 1.39* |
| **Individual and Family Characteristics** | | | | | | |
| Sex (male=1) | | 0.96 | 0.99 | | 0.90 | 0.89 |
| Race/ethncity (non-Hispanic white, ref) | | | | | | |
| non-Hispanic black | | 2.01*** | 0.87 | | 2.75*** | 1.13 |
| Hispanic | | 2.50*** | 1.17 | | 1.73*** | 0.82 |
| Asian | | 1.42+ | 1.02 | | 1.08 | 0.82 |
| Other | | 1.41 | 1.06 | | 1.5+ | 0.98 |
| Mother's age | | | 1.00 | | | 1.01 |
| Child's age in months | | | 1.00 | | | 1.01 |
| Number of siblings | | | 1.18*** | | | 1.04 |
| Low birth weight (1= <2500 grams) | | | 1.35* | | | 1.00 |

**(Continued on next page)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Poverty thresholds (< 100% Federal poverty level, ref) | | | | | | |
| 100%-200% federal poverty level | | | 0.72** | | | 0.61*** |
| 200%-300% federal poverty level | | | 0.28*** | | | 0.20*** |
| > 300% federal poverty level | | | 0.06*** | | | 0.06*** |
| Mother's education (less than high school, ref) | | | | | | |
| high school to some college | | | 0.81+ | | | 0.98 |
| bachelor's degree or more | | | 0.40*** | | | 0.74 |
| Family structure (two parents, married or cohabiting, ref) | | | | | | |
| single-mother family | | | 1.65*** | | | 1.56*** |
| other family type | | | 0.92 | | | 1.02 |
| Household receives SNAP (yes=1) | | | 1.39** | | | 2.02*** |
| Parents' employment status (at least one parent works full time, ref) | | | | | | |
| at least one parent works part time | | | 0.76 | | | 0.94 |
| neither parent works | | | 0.77+ | | | 0.91 |
| Mother is foreign-born (yes=1) | | | 1.32* | | | 1.03 |
| Neighborhood is very safe to play in (yes=1) | | | 0.64*** | | | 0.82+ |
| log likelihood | -627029.2 | -618350.7 | -491429.1 | -557531.3 | -550571.4 | -479784.5 |

Source: ECLS Kindergarten and Third Grade Waves *** < 0.001 ** < 0.01 * < 0.05 + < 0.10

Table 3 evaluates whether neighborhood characteristics contribute to changes in food security states from kindergarten to third grade. Tests of significance evaluate differences in the proportions on neighborhood characteristics for children who were never food insecure (88%), moved into food insecurity (4%), and moved out of food insecurity (5%) in reference to children who were persistently in food insecurity at kindergarten and third grade (3%). The most telling differences exist between persistently food insecure and never food insecure children. Persistently food insecure children live in neighborhoods with fewer whites, slightly more blacks, more Hispanics, more linguistically isolated and foreign-born persons, more persons living below poverty, and more unemployed and low-educated persons compared to children who never experienced food insecurity.

Compared to persistently food insecure children, children who moved into food insecurity—that is, those who lost ground between kindergarten and third grade—lived in neighborhoods that have higher proportions of black and lower proportions of Hispanic residents. In addition, they live in neighborhoods with lower proportions of linguistic isolation and foreign-born residents. Interestingly, the neighborhoods of children who move out of food insecurity are quite similar to the neighborhoods of children who are persistently disadvantaged. Thus, although we are able to show that the neighborhoods of persistently food insecure children are different from those who are never food insecure and different by race/ethnic and nativity composition for those who move into food insecurity, we are unable to distinguish differences in neighborhoods for children who move out of food insecurity between kindergarten and third grade.

**Table 3**. Differences in neighborhood characteristics by change in food security status from kindergarten to 3rd grade.[a]

| | Persistently food insecure (3%) | Never food insecure (88%) | Into food insecure (4%) | Out of food insecure (5%) |
|---|---|---|---|---|
| **Neighborhood characteristics** | | | | |
| % white | 53.04 | 69.82*** | 52.40 | 51.39 |
| % black | 13.74 | 11.38+ | 21.18*** | 16.89+ |
| % hispanic | 26.32 | 13.10*** | 20.04** | 24.53 |
| % Female headed household | 25.33 | 19.21*** | 26.93 | 25.87 |
| % linguistic isolation | 9.05 | 4.47*** | 6.95* | 8.55 |
| % foreign born | 16.59 | 10.76*** | 12.82** | 15.72 |
| % persons below poverty | 17.96 | 11.30*** | 18.02 | 18.27 |
| % age 65 and older | 10.52 | 12.04** | 10.99 | 10.74 |
| % unemployed | 8.14 | 5.74*** | 8.22 | 8.63 |
| % < high school education | 29.91 | 19.59*** | 27.54+ | 29.55 |

[a] All estimates weighted and t-tests of significance by food insecurity status are in reference to persistently food insecure.

*** < 0.001 ** < 0.01 * < 0.05 + < 0.10

## Discussion/Conclusion

These analyses provide evidence of individual, family, *and* neighborhood contributors to food insecurity risk for children and our findings are consistent with a growing body of work that demonstrates the relevance of neighborhood characteristics for children's health and well-being.[42] This analysis shows that differences in the risk of living in a food insecure household for children are sizeable across various sources of individual and structural disadvantage.

A few illustrations show the importance of considering both individual and neighborhood level characteristics for children's well-being. Black and Hispanic children are more likely to be food insecure than white children. In addition, children who live in neighborhoods with higher proportions of black and Hispanic residents are more likely to be food insecure than children who live in largely white neighborhoods. This suggests an additional impact on child food insecurity beyond an individual-level risk factor like race/ethnicity. In addition, poverty is associated with food insecurity both at the individual and neighborhood level. Importantly, children living in the poorest neighborhoods are likely to persist in states of food insecurity, and this may be the case regardless of whether those children are in families who are themselves poor.

Including both individual and neighborhood factors in a multivariate model showed the powerful mediation of neighborhood effects by individual characteristics. However, the persisting significance of neighborhood traits in many of the analyses conducted here and the growing body of evidence supporting the effects of community characteristics on child health and well-being[42] call for more detailed analyses. Our neighborhood measures in multivariate models were limited to indicators that include elements of both race and SES. In fact, race and SES neighborhood-level traits may act independently or in conjunction with individual characteristics to influence the odds of food insecurity status. In other words, there may be something about living in a disadvantaged neighborhood that increases the risk of food insecurity beyond a family's level of disadvantage. Advances in statistical modeling and incorporating the influence of covariates at multiple levels of analysis might help untangle these complex relationships.[45]

Our findings suggest that research and policies that focus on levels of food insecurity within neighborhoods or communities, rather than a strictly individual- or household-level focus, may have more far-reaching effects on curbing food insecurity. For example, a focus on improving access to affordable and healthy foods in poor neighborhoods could reap

dividends for decreasing household food insecurity. In addition, local policy makers could target poor neighborhoods rather than poor families for measures to increase food security. This practice would have the additional advantage of reaching families who might need, but not be eligible for, existing assistance programs such as SNAP or WIC. Finally, a focus on the contextual determinants of food insecurity highlights the need for researchers and policy makers to look beyond individuals and families to the social contexts in which they reside. Interventions that are aimed solely at the individual or family level, while well intentioned, likely miss the contribution of residential context to child and family outcomes.

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