Helping Out to Get By: The Poverty Paradox in Children's Food Insecurity*

Justin T. Denney

Rachel Tolbert Kimbro

Rice University

* Department of Sociology, MS-28, 6100 Main Street, Houston, TX 77005-1892 (jtdenney@rice.edu). This project was supported with a grant from the University of Kentucky Center for Poverty Research through funding by the U.S. Department of Agriculture, Food and Nutrition Service, contract number AG-3198-S-12-0044. The opinions and conclusions expressed herein are solely those of the author(s) and should not be construed as representing the opinions or policies of the UKCPR or any agency of the Federal Government. We thank Laura Cenegy for comments and the Kinder Institute Urban Health Program at Rice University for administrative support.

ABSTRACT

In the U.S., one of the most developed nations in the world, more than 1 in 5 households with children are unable to access and provide adequate food for a healthy, active lifestyle. Prior work has established important individual and family predictors of food insecurity but largely failed to account for local context. We examine the relevance of neighborhood contributors to food insecurity among children, utilizing geocoded, nationally-representative data from the ECLS-K. We propose and test hypotheses suggesting 1) an accumulation of family and neighborhood risks and 2) a poverty paradox, whereby the most disadvantaged families in the most disadvantaged neighborhoods may have better access to helpful resources or collaborate to alleviate food insecurity. We find that neighborhood environments matter over and above characteristics of individual families and that family and neighborhood traits combine in ways consistent with the poverty paradox.

Helping Out to Get By: The Poverty Paradox in Children's Food Insecurity

Researchers, policy makers, and citizens alike agree that all children deserve the opportunity to develop and thrive. The most recent Census data shows that 1 in 5 children in the U.S. is poor, including 24% of all children under the age of 6 (CLASP 2013). Child poverty has immediate and long term consequences for health, educational achievement, and employment and earnings prospects. Many children growing up in poverty experience these deficits as a result of simply not having enough food to eat. Household food insecurity, a household's collective inability to access adequate food for a healthy, active lifestyle, impacts over 14% of all households in the United States (Nord et al. 2010), one of the most developed and powerful economies in the world. More troubling in this era of economic recession, food insecurity in the U.S. today is at its highest level of severity in history and has increased over 30% since 2007 in spite of Federal food and nutrition assistance programs aimed at its elimination (Nord et al. 2010). More than one in five households with children in the U.S. experience food insecurity, and half of those households report food insecurity among children living in the household (Wight, Thampi and Briggs 2010).

The issue of food insecurity and its solutions have proved complex. For example, over 50% of households with incomes below the official poverty line remain food secure (Gundersen, Kreider and Pepper 2011; Nord et al. 2010). Strategies and implemented policies to address food insecurity among children have largely focused on individual and household attributes. While these policies help individual families, to date they have struggled to curtail this enduring problem. Evidence from the social sciences suggests that one reason behind stalled progress may be failing to consider the community characteristics that might influence food security. Thus,

existing knowledge of *who* and especially *where* food insecure children are remains quite limited.

We have two primary aims in this paper. First, we document what kinds of neighborhoods food insecure children live in. And second, we investigate whether and how neighborhood characteristics influence children's odds of food insecurity by simultaneously considering the influence of family and neighborhood level characteristics influencing risk.

Food Insecurity Among Children

The consequences of food insecurity for children's health and well-being are clearly established (Alaimo et al. 2001; Cook et al. 2004; Gundersen, Kreider and Pepper 2011). The number of episodes of hunger that children experience is related to their health as they grow (Kirkpatrick, McIntyre and Potestio 2010). These findings indicate that children's health levels are associated with not just the presence, but also the severity of food insecurity. The costs of food insecurity in children extend beyond physical to mental health and academic performance. 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 households (Alaimo, Olson and Frongillo 2002; Alaimo, Olson and Frongillo 2001; Jyoti, Frongillo and Jones 2005; Kleinman et al. 1998; Murphy et al. 1998; Whitaker, Phillips and Orzol 2006).

Rates of food insecurity tend to be higher than the national average among households headed by single women, and also among black and Hispanic households (Nord et al. 2010). A number of additional individual characteristics such as low socio-economic status (SES), particularly maternal education, and participation in food assistance programs such as Food

Stamps, WIC, or free/reduced breakfast and lunch are known to be associated with household food insecurity, even after accounting for issues of selection (Alaimo et al. 1998; Casey et al. 2001; Jones et al. 2003; Kalil and Chen 2008; Rose and Richards 2004). Maternal factors, including maternal mental health and citizenship status (Van Hook and Balistreri 2006), also affect children's risk of food insecurity. And children who have noncitizen mothers have levels of food insecurity nearly twice as high as those with native born mothers (Kalil and Chen 2008).

Neighborhoods and Healthy Development

Though characteristics of children and their families motivate most research and policy strategies to curb food insecurity to date, there is ample evidence that neighborhood factors influence child health and wellbeing (Leventhal and Brooks-Gunn 2000). Neighborhoods matter, and they matter because of the resources immediately available (or unavailable) within them.

Neighborhood deprivation has been linked with low birth weight (Morenoff 2003; Pearl, Braveman and Abrams 2001) and infant mortality (Hearst, Oakes and Johnson 2008), suggesting a key, early mechanism connecting residential context with the healthy development of children. Recent studies have documented a link between neighborhood SES and obesity in children (Grow et al. 2010; Kimbro and Denney 2013; Singh, Siahpush and Kogan 2010), and a new stream of research focuses on social and built environment factors which influence young children's nutrition, outdoor play, and physical activity (Carver et al. 2010; Franzini et al. 2009; Kimbro, Brooks-Gunn and McLanahan 2011; Kimbro and Schachter 2011). To date, sociologists have paid little attention to correlates of child food insecurity and especially the consequences of neighborhood environments. This is a critical gap in the literature that impedes the identification and assistance of food insecure families.

As a notable exception to this gap, Kirkpatrick and Tarasuk's (2010; 2011) research evaluates the importance of area characteristics on families' food insecurity risks in a large urban area in Canada. The authors calculate distance from residence to food outlets and aggregate individual survey responses to create their area measures and conclude that the causes of food insecurity lie with characteristics of households and not necessarily neighborhoods. While informative, their analyses are inconclusive in several ways and cannot distinguish between compositional and contextual predictors of food insecurity (Cummins et al. 2007; Duncan, Jones and Moon 1996). Structural factors such as aggregate levels of poverty may in fact impact food insecurity above and beyond household-level factors (Kimbro, Denney and Panchang 2012). The neighborhood effects literature suggests a first hypothesis:

H1: Neighborhood social and economic disadvantages associate with increased risk of food insecurity after accounting for characteristics of individual families.

Social and economic characteristics of neighborhoods, such as the proportion in poverty, may also be a mechanism connecting place to children's risk of food insecurity. Beyond addressing whether or not neighborhood traits matter for individual risks, we seek to understand *how* characteristics of place may be important. Decades of neighborhood disadvantage research on health and well-being stipulate that disadvantage across individuals and the places they live possess the capability to accumulate. That is, is it a double disadvantage to be poor and live in a poor community, devoid of resources used to leverage better health? In the context of food insecurity, this might include places with few jobs, little transportation, and/or few supermarkets that provide foods at lower costs and which accept assistance programs such as SNAP.

Conceptualizing food insecurity, especially for children, as an outcome with collective or community implications reveals the possibility of a unique interaction between neighborhoods and families. Not all poor communities are alike (Small, Harding and Lamont 2010). Structurally, some poor neighborhoods possess resources such as community centers or food pantries specifically aimed at alleviating disadvantage. These community resources provide the potential to help all residents, regardless of individual SES (Carpiano, Lloyd and Hertzman 2009). Further, neighborhood characteristics comprise indicators of social networks and connectivity that come with links to resources or information (Carpiano 2008; Kawachi 2010). Given that healthy foods are not equally accessible across all communities (Hung 1999; Jetter and Cassady 2006; Morland, Diez Roux and Wing 2006), community resources and support that can be leveraged to avoid food insecurity may also fluctuate. Recent qualitative research concludes that insufficient food supplies are likely not the result of some deficiency at the household level but rather extend to wider social networks and the social and economic characteristics of the communities in which families live (Ahluwalia, Dodds and Baligh 1998). There is evidence to suggest that greater civic structure within communities can reduce the chance of food insecurity (De Marco and Thorburn 2009; Morton et al. 2005; Vozoris and Tarasuk 2003). A small study in Connecticut found that social capital at the household and community level was associated with a reduced risk of food insecurity (Martin et al. 2004).

A body of work describes how disadvantaged persons and families pool resources with each other in order to endure difficult circumstances (Morton et al. 2008; Stack 1974), showing more prosocial resource allocation and a greater tendency toward egalitarian social values than more advantaged persons and families (Piff et al. 2010). In a landmark study of daily life in poor communities, Stack (1974) showed that strong kin networks are leveraged to help protect child

health and well-being in poor communities. Indeed, establishing strong networks is an adaptive strategy used to deal with the consequences of poverty. This perspective makes clear that perceptions of (as well as actual) inequality in the distribution of resources can have both positive and negative effects on inhabitants. That is, deprivation can serve as both a source of hopelessness as well as a source of social action (Cattell 2001). Existing work on neighborhoods and their influence on individuals, as well as, this stream of research that suggests a collective will among disadvantaged communities to protect the well-being of children provides competing hypotheses for the combined effects of individual/family and neighborhood characteristics on children's food insecurity. The first hypothesis suggests that these two areas combine and create an accumulation of risk:

H2: Neighborhood disadvantage and family disadvantage accumulate to place children at heightened risk. For example, children in poor families living in the poorest neighborhoods will have greater odds of food insecurity than children living in poor families in less poor neighborhoods.

A second hypothesis suggests a poverty paradox wherein families and neighborhoods survive extreme disadvantage by pooling resources to protect children:

H3: Neighborhood traits of disadvantage combine with disadvantaged family level traits to reduce food insecurity risk. For example, children in poor families living in the poorest neighborhoods will have lesser odds of food insecurity than children in poor families living in less poor neighborhoods.

DATA and METHOD

This study uses restricted, geo-coded data from the spring kindergarten wave of the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), which is a nationally-representative sample of U.S. children who were in kindergarten in 1998-1999. Although the data are longitudinal, to preserve our sample size and to take advantage of the clustering of children in neighborhoods, we utilize data only from the fall kindergarten wave. The restricted version of the data provides Census tract numbers which may be linked with a Census 2000 data file provided by ECLS-K to create neighborhood-level measures (Beveridge et al. 2004). Children are sampled from within schools and restricted use data provide home location information.

The ECLS-K sample includes 21,400 children (in accordance with our restricted data agreement we round all sample sizes to the nearest 10). We drop 18% of the original sample because they are missing information sufficient to match the geocoded census information at the tract level. This leaves us with an analytic sample of 17,530 children. Roughly 12% of the sample represents the sole observation in their census tract and the average number of children per census tract is 3.7, although this does not create estimation problems (Bell, Ferron and Kromrey 2008). We conduct sensitivity analyses by comparing our results before and after dropping the singleton neighborhood cases and find no differences in results so they are included in the final models.

Variables

Our outcome measure is a dichotomous measure of household food insecurity derived from the USDA's 18-item food insecurity scale (Bickel et al. 2000). 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 given that 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 (Nord et al. 2010). Following Bickel and colleagues (2000), we code the households of parents answering in the affirmative to three or more of the items as food insecure.

Individual-level variables include the child’s age in months, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic Asian, and non-Hispanic other), and gender (1=male), the mother’s age, level of education (Less than high school, high school degree, or college degree or more), employment status (Works full-time, Works part-time, and Does not work) and nativity status (1=foreign born), the federal poverty threshold level of the household (under 100% of the Federal Poverty Line (FPL) in 1999, 100-200% FPL, 200-300% FPL, and 400%+ FPL), whether the households receives food stamps (1=yes), the number of siblings in the household, and family structure (two-parent family, single-mother family, and other family type).

To capture the neighborhood characteristics that influence child food insecurity risk we control for neighborhood population density in order to account for neighborhood differences which may arise between dense urban and less dense suburban environments. We also present

individual neighborhood measures rather than combining census measures, to better evaluate which measures of disadvantage matter for food insecurity. Neighborhood-level measures include the percent of households in the Census tract living below the poverty line, the percent of households receiving public assistance, and the percent of female-headed households with children. We estimated numerous models with continuous and categorical indicators for the neighborhood variables. Substantively, results do not vary but for clarity we present terciles for neighborhood poverty and female-headed households allowing us to compare neighborhoods with low poverty, for example, to neighborhoods with medium and high poverty. For public assistance, we compare neighborhoods with highest proportions of participants (top 10% of all neighborhoods) on public assistance to all other neighborhoods.

Missing Data

Approximately 16% of children remaining in our analytic sample are missing data on one or more measures of interest. Children missing data were more often non-Hispanic black or Hispanic, poorer, lived with single mothers, and had less-educated mothers. Given the evidence that our missing data are not missing completely at random and may be conditioned by other observed covariates, standard procedures such as listwise deletion would be inappropriate (Allison 2001). Instead, we use multiple imputation procedures in Stata 12 (Royston 2005) to estimate values for our multivariate analyses. During imputation, a diverse set of predictors estimate twenty sets of probable values for each missing value. The resulting twenty data sets include a random component based on draws from the posterior predictive distribution of the missing data under a posited Bayesian model and, under the missing-at-random assumption, provide unbiased estimates of variance (Allison 2001). Models estimated without imputation provide results very similar to the imputation results (available upon request).

Estimation

To test the effects of neighborhood conditions on individual odds for food insecurity among children we estimate random-intercept logistic multi-level models (Guo and Zhao 2000; Rabe-Hesketh and Skrondal 2008) using the MIM command within STATA 12 software (StataCorp 2010). Multilevel models treat level-1 individuals as nested within level-2 census tracts.

All models utilize maximum likelihood estimation with adaptive quadrature (Rabe-Hesketh and Skrondal 2008), adjusting for clustering by neighborhood, different sample sizes for level-1 and level-2 units, heteroscedastic error terms, and varying numbers of cases within level-2 units – all problems that otherwise downwardly bias estimated standard errors (Raudenbush and Bryk 2002). The multilevel model for binary outcomes adds to a traditional logit model with the inclusion of a neighborhood-level error component (u_j). The following equation represents the probability of child food insecurity, allowing risk to vary across neighborhoods and includes individual-level (x_{ij}) and neighborhood-level (z_j) explanatory variables:

$$\log [P_{ij} / (1 - P_{ij})] = \beta_0 + \beta_1 x_{ij} + \beta_2 z_j + u_j \qquad (1)$$

The probability (P_{ij}) that the *i*th child in the *j*th neighborhood is food insecure is determined in equation 1, where β_0 is the model intercept, $\beta_1 x_{ij}$ is a level 1 (individual) predictor, $\beta_2 z_j$ is a level 2 (neighborhood) predictor, and u_j is the random effect of neighborhoods on obesity risk. Error across neighborhoods is captured by a level-2 residual term with a mean of zero and an unknown variance, σ_u^2 (McCulloch and Searle 2001). This level-2 residual can be used to estimate the extent to which residual variation in the log-odds of obesity is situated within or between neighborhoods. To address hypothesis 1, we assess the independent effects of the neighborhood

conditions on the odds of food insecurity while holding other measures of the child's family constant. To address hypotheses 2 and 2a we estimate models with cross-level interactions between individual and neighborhood characteristics. We report all regression results as odds ratios.

RESULTS (in brief)

First, Table 1 provides weighted means and proportions for the dependent and independent variables at both the individual/family level and at the neighborhood level. Roughly 9% of children in the ECLS-K Spring sample lived in households that met the criteria for food insecurity. The remainder of Table 1 provides descriptive statistics associated with the sample used in our analysis after employing multiple imputation procedures.

(Table 1 about here)

Table 2 provides odds ratios for food insecurity first for the individual covariates (Model 1) then sequentially for the three neighborhood-level predictors (Models 2-4). Model 1 shows that Hispanic children, relative to whites, have higher odds of food insecurity and that children of foreign born mothers have higher odds than children of native born mothers. In addition, children with higher educated mothers are less likely to live in food insecure households. The odds of food insecurity are higher for households in poverty, households receiving food stamps, and households with more children. And children in single mother households have nearly 1.6 times the odds of food insecurity compared to children in two parent families.

Model 2 shows that neighborhood poverty is an important contributor to household food insecurity even after accounting for family poverty status and other individual-level covariates. Indeed, after accounting for family socioeconomic status, children who live in households in the

highest poverty neighborhoods have 1.4 times the odds of food insecurity than children who live in the lowest poverty neighborhoods. Living in a neighborhood with the highest proportion of residents on public assistance does not associate with food insecurity after accounting for the individual and family covariates (Model 3). However, living in neighborhoods with medium and high levels of female headed households associates with higher odds of food insecurity after accounting for the specific family structure of children (Model 4).

(Table 2 about here)

Table 3 examines the combined effects of individual/family characteristics and neighborhood characteristics on food insecurity. The models account for all covariates from Table 2 but for simplicity, present only the odds ratios for the 1-way and 2-way terms in the cross-level interactions. All three models show that the individual and family covariates combine with the neighborhood characteristics to shape food insecurity risk in a similar fashion. There are two substantial findings across neighborhood measures. First, children in less disadvantaged families (not poor, not receiving food stamps, in a two parent family) but who live in the most disadvantaged neighborhoods (high poverty, high public assistance, high female headed households) face higher odds of food insecurity than do children in less disadvantaged neighborhoods. For example, for poverty (Model1), children who do not live in poor households but do live in high poverty neighborhoods have 1.78 times the odds of food insecurity compared to similar children who live in low poverty neighborhoods. Second, contrary to the accumulation of risk hypothesis and consistent with the poverty paradox hypothesis, children in more disadvantaged households (living below poverty, receive food stamps, live in single mother family) who also live in the most disadvantaged neighborhoods (high poverty, high public assistance, high female headed households) face lower odds of food insecurity than do similar

children in less disadvantaged neighborhoods. Using poverty as an example again (Model 1), children in families who live in poverty and who live in the most impoverished neighborhoods face lower odds of food insecurity than do children in similar families but who live in less disadvantaged neighborhoods. Figure 1 provides an illustration of these points by using the coefficients from the models in Table 3 and calculating the family and neighborhood specific odds for food insecurity. Looking at Figure 1, we see that children in poor households also living in high poverty neighborhoods have 3.5 times the odds of food insecurity and children in poor households but who do not live in high poverty neighborhoods have 3.9 times the odds of food insecurity, compared to children who are not in poverty and who live in low poverty neighborhoods.

(Table 3 and Figure 1 about here)

DISCUSSION (in brief)

Sociologists should be concerned with and contributing to understanding the contributors to food insecurity. With over 20% of households with children in the U.S. struggling to consume enough food for a healthy and active lifestyle and signs that this problem is on the rise rather than receding, researchers, child advocates, policy makers, and the nation as a whole have a responsibility to better understand and provide solutions to ultimately eliminate food insecurity. With a focus on individual families, past research and solutions have fallen short.

Using nationally representative data, we find that neighborhood characteristics are important for understanding food insecurity. Even if children do not live in households living below poverty, if they live in a high poverty neighborhood their odds of experiencing food insecurity are elevated. Perhaps more illuminating, the traits of individual families and the traits

of neighborhoods combine in unique ways to place children at risk. We find support for a poverty paradox, whereby children in the most disadvantaged families and living in the most disadvantaged neighborhoods have lower odds of food insecurity than similar children in less disadvantaged neighborhoods. This may be a result of the pooling of limited resources and enhanced sense of social egalitarianism among poor families in the most destitute communities (Morton et al. 2005; Piff et al. 2010; Stack 1974). Gaining a better understanding of the mechanisms underlying this finding will aid in our understanding of how community resources in disadvantaged areas can be leveraged to alleviate food insecurity and thus improve the health and achievement of children.

References

Ahluwalia, Indu B., Janice M. Dodds, and Magda Baligh. 1998. "Social support and coping behaviors of low-income families experiencing food insufficiency in North Carolina." *Health Education & Behavior* 25:599-612.

Alaimo, K., R. R. Briefel, E. A. Frongillo, and C. M. Olson. 1998. "Food insufficiency exists in the United States: Results from the third National Health and Nutrition Examination Survey (NHANES III)." *American Journal of Public Health* 88:419-426.

Alaimo, K., C. M. Olson, and E. A. Frongillo. 2002. "Family food insufficiency, but not low family income, is positively associated with dysthymia and suicide symptoms in adolescents." *J Nutr* 132:719-25.

Alaimo, K., C. M. Olson, and E. A. Frongillo, Jr. 2001. "Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development." *Pediatrics* 108:44-53.

Alaimo, K., C. M. Olson, E. A. Frongillo, Jr., and R. R. Briefel. 2001. "Food insufficiency, family income, and health in US preschool and school-aged children." *Am J Public Health* 91:781-6.

Allison, P.D. 2001. *Missing Data*: London: Sage University.

Bell, Bethany A., John M. Ferron, and Jeffrey D. Kromrey. 2008. "Cluster Size in Multilevel Models: The Impact of Sparse Data Structures on Point and Interval Estimates in Two-Level Models." in *Proceedings of the American Statistical Association, Section on Survey Research Methods*. Alexandria, VA: American Statistical Association.

Beveridge, A.A., S. Catsambis, S.R. Wever, Michalowski S., and C. Ng. 2004. "Census data and geocoded locations for the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K) user's guide." edited by U.S. Department of Education. Washington, D.C: National Center for Education Statistics.

Bickel, Gary, Mark Nord, Cristofer Price, William Hamilton, and John Cook. 2000. "Guide to Measuring Household food security, revised 2000." Alexandria, VA: United States Department of Agriculture, Food and Nutrition Service.

Carpiano, R.M., J.E.V. Lloyd, and C. Hertzman. 2009. "Concentrated affluence, concentrated disadvantage, and children's readiness for school: A population-based, multi-level investigation." *Social Science & Medicine* 69:420-432.

Carpiano, Richard M. 2008. "Actual or potential neighborhood resources and access to them: Testing hypotheses of social capital for the health of female caregivers." *Social Science & Medicine* 67:568-582.

Carver, A., A. Timperio, K. Hesketh, and D. Crawford. 2010. "Are children and adolescents less active if parents restrict their physical activity and active transport due to perceived risk?" *Soc Sci Med* 70:1799-805.

Casey, P. H., K. Szeto, S. Lensing, M. Bogle, and J. Weber. 2001. "Children in food-insufficient, low-income families: prevalence, health, and nutrition status." *Arch Pediatr Adolesc Med* 155:508-14.

Cattell, V. 2001. "Poor people, poor places, and poor health: the mediating role of social networks and social capital." *Social Science & Medicine* 52:1501-1516.

Center for Law and Public Policy (CLASP). 2013. "Child Poverty in the U.S.: What New Census Data Tell Us About Our Youngest Children." Washington DC.

Cook, J. T., D. A. Frank, C. Berkowitz, M. M. Black, P. H. Casey, D. B. Cutts, A. F. Meyers, N. Zaldivar, A. Skalicky, S. Levenson, T. Heeren, and M. Nord. 2004. "Food insecurity is associated with adverse health outcomes among human infants and toddlers." *J Nutr* 134:1432-8.

Cummins, Steven, Sarah Curtis, Ana V. Diez-Roux, and Sally Macintyre. 2007. "Understanding and Representing 'Place' in Health Research: A Relational Approach." *Social Science & Medicine* 65:1825-1838.

De Marco, M., and S. Thorburn. 2009. "The relationship between income and food insecurity among Oregon residents: does social support matter?" *Public Health Nutr* 12:2104-12.

Duncan, Craig, Kelvyn Jones, and Graham Moon. 1996. "Health-Related Behaviour in Context: A Multilevel Modelling Approach." *Social Science & Medicine* 42:817-830.

Franzini, L., M. N. Elliott, P. Cuccaro, M. Schuster, M. J. Gilliland, J. A. Grunbaum, F. Franklin, and S. R. Tortolero. 2009. "Influences of physical and social neighborhood environments on children's physical activity and obesity." *Am J Public Health* 99:271-8.

Grow, H. M., A. J. Cook, D. E. Arterburn, B. E. Saelens, A. Drewnowski, and P. Lozano. 2010. "Child obesity associated with social disadvantage of children's neighborhoods." *Soc Sci Med* 71:584-91.

Gundersen, C., B. Kreider, and J. Pepper. 2011. "The Economics of Food Insecurity in the United States." *Applied Economic Perspectives and Policy* 33:281-303.

Guo, Guang, and Hongxin Zhao. 2000. "Multilevel Modeling for Binary Data." *Annual Review of Sociology* 26:441-462.

Hearst, M. O., J. M. Oakes, and P. J. Johnson. 2008. "The effect of racial residential segregation on black infant mortality." *Am J Epidemiol* 168:1247-54.

Hung, Chanjin, Samuel L. Myers. 1999. "Do the poor pay more for food? An analysis of grocery store availability and food price disparities." *The Journal of Consumer Affairs* 33:276-296.

Jetter, Karen M., and Diana L. Cassady. 2006. "The availability and cost of healthier food alternatives." *American Journal of Preventive Medicine* 30:38-44.

Jones, S. J., L. Jahns, B. A. Laraia, and B. Haughton. 2003. "Lower risk of overweight in school-aged food insecure girls who participate in food assistance: results from the panel study of income dynamics child development supplement." *Arch Pediatr Adolesc Med* 157:780-4.

Jyoti, D. F., E. A. Frongillo, and S. J. Jones. 2005. "Food insecurity affects school children's academic performance, weight gain, and social skills." *Journal of Nutrition* 135:2831-2839.

Kalil, A., and J. H. Chen. 2008. "Mothers' citizenship status and household food insecurity among low-income children of immigrants." *New Dir Child Adolesc Dev* 2008:43-62.

Kawachi, Ichiro. 2010. "Social Capital and Health." Pp. 18-32 in *Handbook of Medical Sociology*, edited by C.E. Bird, P. Conrad, A.M. Fremont, and Stefan Timmermans. Nashville, TN: Vanderbilt University Press.

Kimbro, R. T., J. Brooks-Gunn, and S. McLanahan. 2011. "Young children in urban areas: links among neighborhood characteristics, weight status, outdoor play, and television watching." *Soc Sci Med* 72:668-76.

Kimbro, Rachel Tolbert, and Justin T. Denney. 2013. "Neighborhood context and racial/ethnic differences in young children's obesity: Structural barriers to interventions." *Social Science & Medicine* 95:97-105.

Kimbro, Rachel Tolbert, Justin T. Denney, and Sarita Panchang. 2012. "Individual, Family, and Neighborhood Characteristics and Children's Food Insecurity." *Journal of Applied Research on Children* 3:Article 8.
Kimbro, Rachel Tolbert, and Ariela Schachter. 2011. "Neighborhood poverty and maternal fears of children's outdoor play." *Family Relations* 60:461-475.
Kirkpatrick, S.I., L. McIntyre, and M.L. Potestio. 2010. "Child hunger and long-term adverse consequences for health." *Archives of Pediatrics and Adolescent Medicine* 164:754.
Kirkpatrick, Sharon I., and Valerie Tarasuk. 2010. "Assessing the Relevance of Neighbourhood Characteristics to the Household Food Security of Low-Income Toronto Families." *Public Health Nutrition* 13:1139-1148.
—. 2011. "Housing Circumstances are Associated with Household Food Access Among Low-Income Urban Families." *Journal of Urban Health* 88:284-296.
Kleinman, R. E., J. M. Murphy, M. Little, M. Pagano, C. A. Wehler, K. Regal, and M. S. Jellinek. 1998. "Hunger in children in the United States: potential behavioral and emotional correlates." *Pediatrics* 101:E3.
Leventhal, T., and J. Brooks-Gunn. 2000. "The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes." *Psychological Bulletin* 126:309-337.
Martin, Katie S., Beatrice L. Rogers, John T. Cook, and Hugh M. Joseph. 2004. "Social capital is associated with decreased risk of hunger." *Social Science & Medicine* 58:2645-2654.
McCulloch, Charles E., and Shayle R. Searle. 2001. *Generalized, Linear, and Mixed Models*. New York: Wiley.
Morenoff, J. D. 2003. "Neighborhood mechanisms and the spatial dynamics of birth weight." *AJS* 108:976-1017.
Morland, Kimberly, Ana V. Diez Roux, and Steve Wing. 2006. "Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study." *American Journal of Preventive Medicine* 30:333-339.
Morton, Lois Wright, Ella Annette Bitto, Mary Jane Oakland, and Mary Sand. 2005. "Solving the Problems of Iowa Food Deserts: Food Insecurity and Civic Structure." *Rural Sociology* 70:94-112.
—. 2008. "Accessing food resources: Rural and urban patterns of giving and getting food." *Agriculture and Human Values* 25:107-119.
Murphy, J. M., C. A. Wehler, M. E. Pagano, M. Little, R. E. Kleinman, and M. S. Jellinek. 1998. "Relationship between hunger and psychosocial functioning in low-income American children." *J Am Acad Child Adolesc Psychiatry* 37:163-70.
Nord, Mark, Alisha Coleman-Jensen, Margaret Andrews, and Steven Carlson. 2010. "Household food security in the United States, 2009." in *Economic Research Report*. Washington D.C.: US Department of Agriculture.
Pearl, M., P. Braveman, and B. Abrams. 2001. "The relationship of neighborhood socioeconomic characteristics to birthweight among 5 ethnic groups in California." *Am J Public Health* 91:1808-14.
Piff, P.K., M.W. Kraus, S. Côté, B.H. Cheng, and D. Keltner. 2010. "Having less, giving more: The influence of social class on prosocial behavior." *Journal of Personality and Social Psychology* 99:771.
Rabe-Hesketh, Sophia, and Anders Skrondal. 2008. *Multilevel and Longitudinal Modeling Using Stata*. College Station, TX: StataCorp.

Raudenbush, Stephen W., and Anthony S. Bryk. 2002. *Hierarchical Linear Models*. Thousand Oaks, CA: Sage Publications.
Rose, D., and R. Richards. 2004. "Food store access and household fruit and vegetable use among participants in the US Food Stamp Program." *Public Health Nutrition* 7:1081-1088.
Royston, Patrick. 2005. "Multiple imputation of missing values: update." *The Stata Journal* 5:188-201.
Singh, G. K., M. Siahpush, and M. D. Kogan. 2010. "Neighborhood socioeconomic conditions, built environments, and childhood obesity." *Health Aff (Millwood)* 29:503-12.
Small, Mario Luis, David J. Harding, and Michele Lamont. 2010. "Reconsidering culture and poverty." *ANNALS, AAPSS* 629:6-26.
Stack, C.B. 1974. *All our kin: Strategies for survival in a black community*. New York: Basic Books.
StataCorp. 2010. "Stata Statistical Software: Release 12." College Station, TX: Stata Corporation.
Van Hook, J., and K.S. Balistreri. 2006. "Ineligible parents, eligible children: Food Stamps receipt, allotments, and food insecurity among children of immigrants." *Social Science Research* 35:228-251.
Vozoris, Nicholas T., and Valerie S. Tarasuk. 2003. "Household food insufficiency is associated with poorer health." *The Journal of Nutrition* 133:120-126.
Whitaker, R. C., S. M. Phillips, and S. M. Orzol. 2006. "Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children." *Pediatrics* 118:e859-68.
Wight, Vanessa R., Kalyani Thampi, and Jodie Briggs. 2010. "Who Are America's Poor Children? Examining Food Insecurity Among Children in the United States." Columbia University, Mailman School of Public Health: National Center for Children in Poverty.

Table 1. Individual- and Neighborhood-level descriptive statistics for the ECLS-K Spring kindergarten sample (N=17,530).[a]

	% or Mean
Dependent Measure	
Household food insecurity	8.9
Independent Measures	
Individual-level measures	
Child's age in months	74.6
Gender (female, ref)	49.1
male	50.9
Race / ethnicity (non-Hispanic white, ref)	57.4
Non-Hispanic Black	14.5
Hispanic	17.9
Non-Hispanic Asian	6.7
Other race	3.2
Mother's age	33.5
Mother's nativity (1=foreign born)	19.2
Mother's education (less than high school, ref)	13.2
high school or some college	61.8
college degree	24.8
Mother's employment status (Full-time Work , ref)	45.4
Part-Time Work	22.0
Unemployed	32.4
Living below poverty (1=yes)	20.4
Receives Food stamps	15.0
Number of siblings	1.5
Family Structure (Two parents, married or cohabiting, ref)	75.2
Single mother family	19.3
Other family type	5.4
Neighborhood measures	
Poverty terciles (low poverty, ref)	32.9
medium poverty	32.9
high poverty	34.1
Public assistance (% of households receiving public assistance)	
> 10% on public assistance	9.4
Female headed households terciles (low female headed households, ref)	32.9
medium female headed households	32.9
high female headed households	34.1

Source: ECLS-K 1998-1999.

[a] Sample size reflects the multiple imputation sample used in all analyses and is rounded to the nearest 10 in accordance with our restricted data agreement.

Table 2. Multilevel logistic regression odds ratios for individual and neighborhood characteristics and household food insecurity.[a]

	Model 1		Model 2		Model 3		Model 4	
Individual-level measures								
Child's age in months	1.01	+	1.01	+	1.01	+	1.01	+
Gender (female, ref)								
male	0.97		0.96		0.97		0.96	
Race / ethnicity (non-Hispanic white, ref)								
Non-Hispanic Black	0.98		0.92		0.98		0.93	
Hispanic	1.43	***	1.35	**	1.42	***	1.38	***
Non-Hispanic Asian	1.22		1.18		1.22		1.20	
Other race	1.22		1.19		1.22		1.19	
Mother's age	1.00		1.00		1.00		1.00	
Mother's nativity (1=foreign born)	1.49	***	1.48	***	1.49	***	1.50	***
Mother's education (less than high school, ref)								
high school or some college	0.78	***	0.79	**	0.78	***	0.79	**
college degree	0.21	***	0.23	***	0.21	***	0.22	***
Mother's employment status (Full-time Work , ref)								
Part-Time Work	0.88		0.89		0.88		0.89	
Unemployed	0.92		0.93		0.92		0.93	
Living below poverty (1=yes)	2.48	***	2.40	***	2.48	***	2.44	***
Receives Food stamps	1.72	***	1.67	***	1.71	***	1.70	***
Number of siblings	1.19	***	1.19	***	1.19	***	1.19	***
Family Structure (Two parents, married or cohabiting, ref)								
Single mother family	1.57	***	1.56	***	1.57	***	1.56	***
Other family type	0.95		0.92		0.95		0.94	
Neighborhood measures								
Poverty terciles (low poverty, ref)								
medium poverty			1.39	***				
high poverty			1.43	***				
Public assistance (% of households receiving public assistance)								
> 10% on public assistance					1.02			
Female headed households terciles (low female headed households, ref)								
medium female headed households							1.31	**
high female headed households							1.33	**

Source: ECLS-K 1998-1999.

[a] All models control for population density in the neighborhood.

+ p < 0.10 ; * p < 0.05 ; ** p < 0.01 ; *** p < 0.01

Table 3. Multilevel logistic regression odds ratios for individual x neighborhood cross-level interactions and household food insecurity.[a]

	Model 1		Model 2		Model 3	
Individual-level measures						
Living below poverty (1=yes)	3.87	***				
Receives Food stamps			1.92	***		
Family Structure (Two parents, married or cohabiting, ref)						
Single mother family					2.39	***
Other family type					1.11	
Neighborhood measures						
Poverty terciles (low poverty, ref)						
medium poverty	1.45	***				
high poverty	1.78	***				
Public assistance (% of households receiving public assistance)						
> 10% on public assistance			1.34	*		
Female headed households terciles (low female headed households, ref)						
medium female headed households					1.46	***
high female headed households					1.54	***
Interactions						
living below poverty x medium poverty	0.73					
living below poverty x high poverty	0.51	***				
receives food stamps x > 10% on public assistance			0.60	**		
single mother x medium female headed hh					0.66	*
single mother x high female headed hh					0.57	**
other family x medium female headed hh					0.62	
other family x high female headed hh					0.89	

Source: ECLS-K 1998-1999.

[a] All models control for population density in the neighborhood and all covariates presented in Table 2.

+ p < 0.10 ; * p < 0.05 ; ** p < 0.01 ; *** p < 0.01

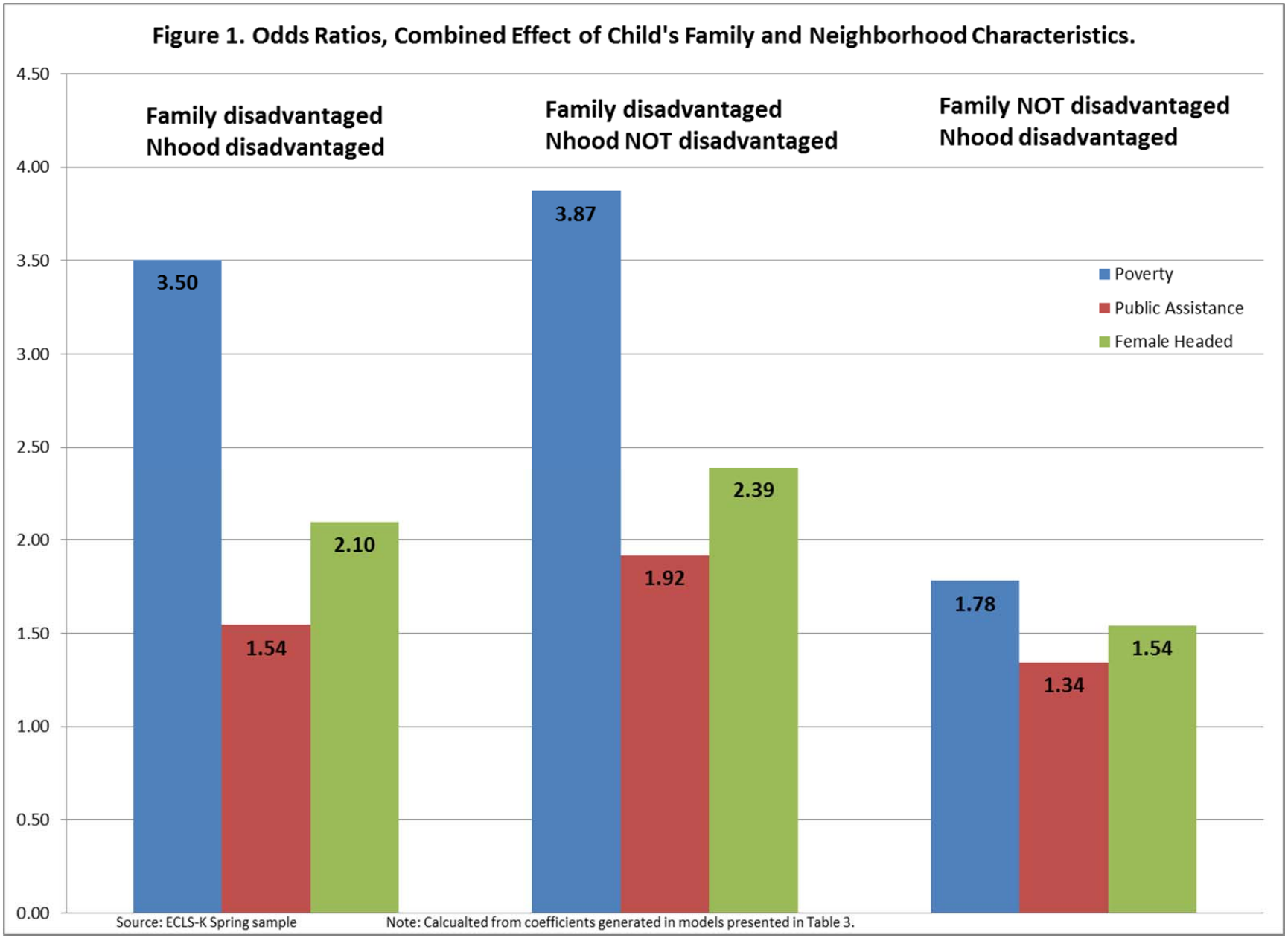
Figure 1. Odds Ratios, Combined Effect of Child's Family and Neighborhood Characteristics.
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Family disadvantaged Nhood disadvantaged
Family disadvantaged Nhood NOT disadvantaged
Family NOT disadvantaged Nhood disadvantaged
3.50
1.54
2.10
3.87
1.92
2.39
1.78
1.34
1.54
Poverty
Public Assistance
Female Headed
Source: ECLS-K Spring sample
Note: Calcualted from coefficients generated in models presented in Table 3.