Associations Between Participation in the National School Lunch Program, Food Insecurity, and Child Well-Being

Rachel Dunifon, Assistant Professor
Cornell University
Department of Policy Analysis and Management
295 MVR Hall
Ithaca, NY 14853
red26@cornell.edu
FAX: 607-255-4071
PHONE: 607-255-6535

Lori Kowaleski-Jones, Assistant Professor
University of Utah
Department of Family and Consumer Studies
225 South, 1400 East, Alfred Emery Building, Room 228
Salt Lake City, UT 84112-0080
lk2700@fcs.utah.edu
FAX: 801-581-5156
PHONE: 801-585-0074

December, 2001

- We gratefully acknowledge support from the USDA Small Grants program, administered through the Institute for Research on Poverty at the University of Wisconsin. We also appreciate helpful comments from J.S. Butler, John Cawley, Mary Corcoran, Sheldon Danziger, Edward Frongillo, Craig Gunderson, Nader Kabbani, Mark Nord, John Karl Scholz, Ken Smith, Scott Winship, Cathleen Zick and seminar participants in the Department of Policy Analysis and Management at Cornell University, the Economic Research Service Small Grants Conference, and the 2001 Annual Meetings of the Association of Policy Analysis and Management.

Associations Between Participation in the National School Lunch Program, Food Insecurity, and Child Well-Being

Abstract

This paper examines the associations between food insecurity, National School Lunch Program (NSLP) participation, and children's well-being. We address problems of selection by restricting our sample to children in families in which at least one child participates in the NSLP. Results suggest that food insecurity is associated with behavioral problems, but not health or cognitive difficulties, among children. Additionally, after adjusting for selection, participation in the NSLP does not significantly impact child outcomes; the exception is for children in families experiencing child hunger, for whom participation is associated with reduced behavior problems.

Associations Between Participation in the National School Lunch Program, Food Insecurity, and Child Well-Being

Introduction

Recently a direct measure of food insecurity has become available in the United States, leading to a growing body of research on the determinants and consequences of food insecurity. Federal food assistance programs, such as the National School Lunch Program (NSLP), are believed to have the potential to reduce food insecurity among children and have direct effects on children's well-being. Because food insecure children are likely to participate in food assistance programs, and because of the potential for such programs to influence both food insecurity and child well-being, it is important to consider the relative effects of both program participation and food insecurity on children's well-being. This paper examines these effects for a nationally-representative sample of U.S. children.

Using data from the 1997 Child Development Supplement to the Panel Study of Income Dynamics (CDS-PSID), this paper examines two specific questions. First, what child and family-specific factors predict food insecurity and participation in the National School Lunch program? Second, what are the relative associations between food insecurity, participating in the NSLP, and the well-being of school-aged children? The results from this analysis provide much-needed insight into the role of a widely-used food assistance program in influencing the well-being of U.S. children.

In this paper, we first describe research on the associations between food insecurity and child development. Next, we describe the existing body of research on the NSLP. We then present information on our sample and methods, and then present and discuss our results.

Food Insecurity and Child Development

Food security is defined by the United States Department of Agriculture (USDA) as "access…to enough food for an active, healthy life" (USDA Guide, 2000). Food insecurity for the entire population was measured directly for the first time with an 18-item measure included in the April 1995 Current Population Survey (CPS), creating four categories of security: food secure, food insecure without hunger, food insecure with moderate hunger (meaning that an adult in the family has gone hungry) and food insecure with severe hunger (meaning that at least one child in the family has gone hungry; USDA, 1997). In 1999, 10% of U.S. households were food insecure, with 3% (3.1 million) experiencing hunger (USDA, 2001). Food insecurity is highly correlated with poverty. In the April 1997 CPS, 33% of poor households were food insecure (USDA, 1997).

Measures of food insecurity are associated with deficits in nutritional consumption. Using a 24-hour diet recall, as well as a survey of household food supplies, Kendall, Olson, and Frongillo (1996) found that food insecure households have lower rates of consumption of fruits and vegetables and less food on-hand that food secure households, providing validation that the USDA measure of food insecurity is associated with actual food intake.

The effects of the USDA measure of food insecurity on the development of U.S. children has not been widely researched, although rates of food insecurity are twice as high in households with children than in those without (Bickel, Carlson, and Nord, 1999). Research in developing countries finds that poor nutrition is related to cognitive delays and temperamental difficulties, among other long-term problems (see Gardner et al., 1999; Aboud and Alemu, 1995; Grantham-McGregor et al., 1994). Additionally, using the CDS-PSID, Reid (2000) found links between

food insecurity and increased behavior problems, as well as lower cognitive test scores. Food insecurity was not related to children's health.

While research examining the effects of food insecurity on children is relatively rare, a larger body of research examines the influence of food insufficiency on child and family well-being. Food insufficiency is assessed in surveys with a single item indicating that a family "often or sometimes does not have enough food to eat". In a series of studies, Alaimo, Olson and Frongillo (2001) and Alaimo, Olson, Frongillo, and Briefel (2001) found food insufficiency to be associated with adverse outcomes among children, including lower math scores, greater problems getting along with others, poor health status, and more frequent illness. Among low-income women, food insufficiency is correlated with depression, lack of a high school degree, alcohol or drug dependence, and experiences of domestic violence (Corcoran et al., 1999).

Recent research by Gundersen and Oliveria (2001) investigates the relationship between food insufficiency and the food stamp program, observing that food stamp participants have higher food insufficiency rates than eligible non-participants, even after controlling for other factors. Gundersen and Oliveria argue that this is due to the self-selection of food insufficient households into the food stamp program. Using simultaneous equation models, they show that when selection is controlled, food stamp recipients have the same probability of food insufficiency as non-recipients. These results underscore the importance of addressing the issue of potential selection bias in estimating the relationship between food insecurity, food assistance programs and child outcomes.

Food assistance programs, such as the NSLP, have the potential to reduce levels of food insecurity among U.S. children. Thus, when examining the associations between food insecurity and child well-being, it is important to also examine the role of participation in such programs in determining child outcomes. We next describe and summarize the relevant research on the National School Lunch Program.

The National School Lunch Program

The National School Lunch Program (NSLP) is a federally sponsored nutrition program serving approximately 26 million children a day with estimated expenditures of $5.8 billion in 1998 (Oliveira, 1999). Recent estimates indicate that the NSLP is available to 92% of U.S. students, and that 56% of these students participate in the program (Burghardt and Devaney, 1995). The aim of the program is to provide nutritious foods to school-age children at no, or reduced, cost. Eligibility for free NSLP lunches is limited to families whose incomes are at or below 135% of the poverty line. Reduced price lunches are available to families whose incomes are between 135% and 185% of the poverty line. Approximately 47% of all school lunches are served to children whose family incomes are less than 185% of the poverty level. The NSLP also subsidizes full priced lunches in most schools, so virtually all school children may benefit from the NSLP (Devaney et al., 1997).

Lunches provided by this program are expected to enable students to consume at least one-third of the Recommended Daily Allowance (RDA) of specific nutrients and to have the following core items: meat or meat alternative, two or more vegetables and fruits, whole-grain or enriched breads, and milk.

Many of the available evaluations of the NSLP document the relationship between participating in the program and increased nutrient intake (Burghardt and Devaney, 1995). There is some concern, however, that while the NSLP is effective in delivering on the promise of achieving RDA goals, the lunches are likely to be higher in fat and saturated fat than

recommended by *the Dietary Guidelines for Americans* (Meyers et al, 1989). For example, Gleason and Suitor (2001) find that NSLP participation leads to increased intake of six vitamins and minerals and reduced intake of sugars over 24 hours but is also associated with an increased intake of fats.

Other research has examined the effects of NSLP on child anthropometry (Vermeersch et al, 1984), and finds that among children younger than ten, participation in NSLP was linked to a lower likelihood of falling below the 25th percentile of weight-for-height. One of the few studies examining the links between participation in food assistance programs and performance outcomes for children studied the effects of the school breakfast program (SBP) on the school performance of children in Massachusetts (Meyers et al., 1988). This research compared children's achievement test scores before and after SBP was implemented in the schools, finding evidence of higher scores among those children who received the SBP. Meyers et al. also found beneficial effects of the SBP on school tardiness and absences. Although this study evaluated the effects of the SBP, not the NSLP, it does suggest some potential linkages between food assistance programs and child performance outcomes.

Sample

We study the associations between NSLP participation, food insecurity and child outcomes using the 1997 Child Development Supplement to the Panel Study of Income Dynamics (CDS-PSID). The Panel Study of Income Dynamics began in 1968 and is a longitudinal study of a representative sample of U.S. families. Since 1968 the PSID has followed and interviewed annually a nationally representative sample of about 5,000 families. Split-off families are followed when children leave home, when couples divorce, and when more complicated changes break families apart. Except for problems of immigration, this procedure produces an unbiased population sample each year (Fitzgerald et al., 1998).

In 1997, the PSID supplemented its core data collection with data on parents and a maximum of two of their children aged 12 or younger, a project known as the Child Development Supplement. The aim was to produce a comprehensive, nationally representative, and longitudinal database of children and their families that researchers could use to study the dynamic process of early human capital formation (only the 1997 wave of data is currently available). The supplement includes reliable assessments of the cognitive, behavioral, and health status of 3,500 children obtained from the primary caregiver (usually the mother), an absent parent, teachers and school administrators, and the child. One of the strengths of the CDS-PSID is its link to multiple years of data on the children's parents.

Our analyses focus on children aged 6-12 in 1997, for whom we have measures of participation in the NSLP in 1997.

Measurement

NSLP Participation. We measure participation in the NSLP with a dichotomous variable asking the primary caregiver if his or her 6-12 year-old child currently receives a free or reduced-price lunch at school.

Food Insecurity. Food insecurity is measured using the 18-item scale developed by the USDA. Food insecurity is assessed at the household level and captures experiences (in the last 12 months) such as running out of food, perceptions that the food in a household is of inadequate quality or quantity, and reduced food intake by adults or children, all due to financial constraints

(USDA Guide, 2000). According to the coding scheme developed by the USDA (USDA Guide, 2000), families affirming three or more of the 18 items are classified as food insecure. In our analyses, we use three different measures of food insecurity.

First, we use all 18 items in a continuous scale developed by the USDA through the use of a Rasch coding model. This is a linear scale that depends on the number of affirmative responses to a series of increasingly severe food security items (for more information on the Rasch scale, see the USDA Guide, 2000). The intervals of this scale are meaningful and an increase in the scale indicates increased severity of food insecurity. In the Rasch scale, a household that has affirmed no items is given a score of zero. However, this is problematic because it assumes that the difference between affirming zero items and affirming one item is the same as any other interval (the difference between affirming five items and affirming six, for example). To address this, we followed a procedure suggested by researchers at the USDA (Mark Nord, personal communication, 2001). Specifically, we regressed each of our outcomes of interest on the Rasch score, including a dummy for a raw score of zero. We then calculated, from the regression coefficients, the "correct" score for those households who affirm no items (for all outcomes of interest, the score was within $1/100^{th}$ of a decimal place of -3.4). We then recoded these households affirming no items to have a score of –3.4. Most of our analyses use this continuous measure of food insecurity.

In other analyses we classify families using a measure of "marginal" food insecurity, indicating families that responded affirmatively to one or two of the food insecurity scale items, but, because they did not affirm three or more items, are not classified as food insecure. Finally, other analyses use a simple indicator of whether a household is food insecure, which is indicated by an affirmative response to at least 3 of the 18 items in the overall scale (USDA Guide, 2000).

The USDA coding also allows a more refined classification of families into categories of food secure, food insecure without hunger, food insecure with moderate hunger (adults skipping meals), and food insecure with severe hunger (children skipping meals). We tested the predictive power of these four categories and did not find any additional predictive ability, compared to the simple indicator of food insecurity. Very few children in the CDS-PSID live in households that are classified as insecure with hunger. Among our sample of 6-12-year-olds, only 2% of the sample lived in households experiencing moderate hunger, and only .5% lived in households experiencing severe hunger.

Child Outcomes. We measure child outcomes in three areas: health, behavioral adjustment, and achievement. We measure child health with a variable indicating whether the child has any health limitations that affect participation in childhood activities, school attendance, or the performance of school work. A child with a limitation in any area is given a score of one, the rest are given scores of zero.

School-age children's behavioral adjustment is measured with the Behavior Problems Index (BPI), adapted from the Achenbach and Edlebrock behavioral checklist (Achenbach & Edlebrock, 1981), and measuring both externalizing behavior (20 items; examples include bullying other children or destroying things) and internalizing behavior (10 items; examples include moodiness or fearfulness). For each example of child behavior, mothers report whether it is never true (1), sometimes true (2) or often true (3), such that a higher score indicates greater behavior problems. We also use a 10-item index of Positive Behavior, in which mothers report whether a specific behavior (examples include cooperating with others and sharing) is not at all like child (1), totally like child (5), or somewhere in between.

Children's achievement is assessed with two measures from the Woodcock-Johnson Achievement Tests, Revised (Mather, 1991): math achievement (a combination of scores on applied problems and calculation tests) and reading achievement (a combination of scores on letter-word and passage comprehension tests).

Control Measures. In all analyses, we also control for an extensive set of background characteristics of the child's family. Each of these controls are theorized to be associated both with child outcomes, as well as the measures of household food insecurity and children's participation in the NSLP. The control measures are: average family income in 1996 dollars (over the years 1994 to 1997); number of siblings; the percentage of time a child's parents owned their own home between 1994 and 1997; maternal and paternal educational attainment; child gender, age, race and ethnicity; maternal age; health insurance status of the child; the percentage of time a child's family received food stamps between 1994-1997; the percentage of time in a married-couple family between 1994-1997; whether the primary caregiver smokes; whether the primary caregiver drinks; primary caregiver's score on an assessment of self-esteem (10 items); primary caregiver's score on an assessment of personal control, or efficacy (6 items); primary caregiver's score on a measure of depression (10 items); and primary caregiver's self-report of aggravation in parenting (4 items). Because of missing data on the last six of these items, all analyses include a missing data dummy for each item). It is important to note that, although only one wave of CDS-PSID data is currently available, it is possible to control for characteristics of children's families spanning several years prior to 1997 by linking children to information on their families in the PSID mainfile.

Method

First, we examine the child and family-specific factors that are associated with participation in the NSLP and with the various measures of food insecurity described above. Next, we examine the relative effects of food insecurity and NSLP participation on children's well-being in the area of health, behavioral adjustment, and test scores.

Our first set of analyses will use Logistic Regression and Ordinary Least Squares (OLS) methods to estimate Equations 1 and 2, in which various measures of household food insecurity for family *f* at time *t*, ($INSEC_{ft}$) and NLSP participation ($NSLP_{ift}$) for child *i* in family *f* at time *t* are a function of the child- (X_{ift}) and family-specific (X_{ft}) control measures detailed above. Each equation also contains a child-specific error term (e_{ift}) and a family-specific error term (e_{ft}).

$$\mathbf{INSEC_{ft} = \alpha_{ift} + \beta_2 X_{ift} + \beta_3 X_{ft} + e_{ift} + e_{ft}} \quad \mathbf{(1)}$$

$$\mathbf{NSLP_{ift} = \alpha_{ift} + \beta_2 X_{ift} + \beta_3 X_{ft} + e_{ift} + e_{ft}} \quad \mathbf{(2)}$$

In Equation 3, using OLS (or logistic regressions when predicting the indicator of health limitations), the outcomes of a child in 1997 ($CHILD_{ift}$) are a function of demographic controls at the child- and family-level (X_{ift} and X_{ft}) and an indicator for participation NSLP ($NSLP_{ift}$) as well as the continuous measure of household food insecurity in 1997($INSEC_{ft}$)[i].

$$\mathbf{CHILD_{ift} = \alpha_{ift} + \beta_1 INSEC_{ft} + \beta_2 NSLP_{ift} + \beta_3 X_{ift} + \beta_4 X_{ft} + e_{ift} + e_{ft}} \quad \mathbf{(3)}$$

We will also address issues of selection that may bias estimates of the effects of food

assistance programs on individual outcomes. This bias may be either positive or negative. Positive bias would occur if families who perform better on some unobservable measures, such as mental health or family functioning, are more likely to participate in the NSLP than families who are worse off on these measures. Negative bias would occur if families who are doing poorly in unobservable ways are more likely to participate in the NSLP. Despite the extensive set of control variables available in the PSID, we may not be able to account for all of the ways in which families using NSLP may differ from those who do not, leading to bias in the estimates of Equations 1-3. Specifically, the family-specific error-term (e_{ft}) may be correlated with the likelihood that a specific child participates in the NSLP and with the measures of child well-being.

In order to deal with issues of selection on the basis of family-level unobservables, we perform analyses in which the sample is restricted to children in families in which at least one child is participating in the NSLP. In our sample of 1854 children aged 6-12, 928 children lived in families in which at least one child was participating in the NSLP. Of these children, 73 did not participate in NSLP themselves. This is the strategy used by Oliveira & Gunderson (2000) when estimating the impact of WIC participation on children's nutrient intake. This method attempts to control for the self-selection of certain families into NSLP participation on the basis of unobservable family-level characteristics.

One concern with this method is that, although family-level unobservable characteristics are controlled, it is still possible that child-level unobservable characteristics may differ between children participating in the NSLP and children who do not participate and that these differences may influence the child outcomes examined here. To test this, we examined the measures in our model that differ between siblings: child age, child sex, and whether a child has health insurance. A Chow test was used to examine whether the associations between these measures and child outcomes differ between children in the NSLP-receiving families who are not receiving the NSLP themselves and children in NSLP-receiving families who do receive the NSLP. The associations between the child-specific variables and the child outcomes did not differ significantly for children in these different groups. Thus, among children in families participating in the NSLP, the impact of observable child-specific variables on the child outcomes do not differ between children who participate in the NSLP and those who do not. These results give us some confidence that the impact of unobservable characteristics on our dependent variables will not differ for children in this sample either.

Results

First, we examine the characteristics of our sample. Weighted means for all variables used are presented in Table 1 and indicate that about 13% of our CDS-PSID sample of children aged 6-12 lived in food insecure households in 1997. Seven percent of children are in marginally food insecure households, meaning that 20% of 6-12 year-old children in the CDS-PSID households live in families which affirmed at least one of the items on the food insecurity scale. 38% of children receive a free or reduced-price lunch through the National School Lunch Program. Analyses not shown here indicate that twenty percent of children participating in the NSLP are food insecure, compared to 5% of those not participating in NSLP. Additionally, food insecure children are more likely to be African-American or Hispanic, to live in a household with an unemployed head, and to live in poverty.

We next examine the multivariate relationships between food insecurity, participation in the NSLP, and children's developmental outcomes. All analyses control for the covariates

described above. Because our data consist of some children with the same family of origin, all analyses were estimating with Huber-White robust standard errors, clustered by the family of origin (in1968).

In Table 2, we first examine the association between child and family-specific factors and three different measures of food insecurity (the continuous Rasch food insecurity scale, the indicator of marginally food insecure, and the food insecure dummy) as well as the indicator for participation in the NSLP. The associations operate in the expected direction. Family income is significantly and negatively associated with the continuous food insecurity measure, as is the % time a child's parents owned their own home, paternal education, and whether the child is insured. The percent of time a child received food stamps is significantly and positively associated with the continuous food insecurity measure. Similar associations are found when predicting the food insecurity indicator. Considering the indicator of marginal food insecurity, results indicate that black children are more likely to be marginally food insecure and that paternal education is associated with a reduced likelihood of marginal food insecurity.

Turning to the determinants of participation in the NSLP, family income, parental home ownership, paternal education, and whether the caregiver drinks are all significantly and negatively associated with participation. The number of siblings a child has, whether the child is black, percent time received food stamps, and % time in a married-parent family are all positively and significantly associated with participation in the NSLP. Noteworthy is the large odds ratio on the indicator that a child is black; black children are almost five times more likely to participate in the NSLP than other children, controlling for the other factors in the model.

In Table 3, we examine the associations between both food insecurity and participation in NSLP with the developmental outcomes of 6-12 old children. Here, we use the continuous food insecurity scale as the preferred measure of food insecurity (see Endnote i). The results show that participating in the NSLP is associated with increased externalizing behavior, increased odds of health limitations, and lower math test scores among children. Additionally, an increase in the food insecurity scale is associated with decreased levels of positive behavior and increased odds of health limitations. The other variables in the model operate in the expected direction; male children have greater behavior problems, parental education is highly associated with test scores, and parental aggravation in parenting is associated with increased reports of children's behavior problems.

It is unlikely that participating in the NSLP is actually detrimental for children. Thus, the pattern of negative associations between NSLP participation and children's outcomes suggests that omitted variables may be biasing the results presented in Table 3. Specifically, children participating in the NSLP may be different from those not participating in unmeasured ways, and these unmeasured variables may be associated with detrimental outcomes observed among children participating in NSLP.

To address this, Table 4 presents the results of analyses using the restricted sample of children aged 6-12 who live in a family in which at least one child is participating in the NSLP. Here, the NSLP indicator is not a significant predictor of any of the child outcomes. Additionally, in most cases, the sign on the NSLP coefficient has reversed compared to the coefficients in Table 3. In the restricted sample, an increase in the food insecurity scale is associated with decreased levels of positive behavior, as in Table 3. The remaining variables in the model operate in the expected direction and their coefficients are consistent with those in Table 3.

The restricted sample and full-sample results do not support the hypothesis that that

participation in the NSLP is associated with improvements in child well-being. However, it is possible that the NSLP may benefit sub-groups of especially disadvantaged children. To test this, we examined whether the impact of participation in the NSLP on children differs for children living in a single parent family and children whose family income-to-needs ratio in 1996 was below the Federal Poverty Line. The impact of participation in the NSLP did not differ for these sub-groups.

We also examined whether participation in the NSLP benefits children in households reporting child hunger. There are eight items in the USDA food insecurity scale that refer specifically to children. These items range in severity from "we relied on only a few kinds of low cost food to feed the children" to "did any of the children ever not eat for a whole day because there wasn't enough money for food?" Consistent with coding developed by the USDA (Nord and Bickel, 2001), families affirming at least five of these eight items were classified as experiencing child hunger. In our sample, 0.3% of the children were in families classified as experiencing child hunger.

For all child outcomes examined, we tested whether the association between participation in the NSLP and child well-being was significantly different for children in families experiencing child hunger. When predicting both internalizing behavior and externalizing behavior, results indicate that, for children in the child hunger sample, participation in the NSLP is significantly associated with a reduction in behavior problems (total effect of –4.5, SE of 1.01 and total effect of –6.14, SE of 1.36 for internalizing and externalizing problems respectively). Because of sample size problems, these analyses were performed on the entire sample of children aged 6-12, not the restricted sample. Despite this limitation, however, the results suggest that participation in the NSLP may benefit the sub-group of children at risk for experiencing hunger.

Discussion

This study examines two research questions. First, what child and family-specific factors predict food insecurity and participation in the National School Lunch program? Second, what are the effects of food insecurity and participating in the NSLP on the well-being of school-aged children? The results from this analysis provide much-needed insight into the role of a widely-used food assistance program in influencing the well-being of U.S. children.

Results indicate that factors representing families' economic status are significantly associated with both the continuous measure of food insecurity and the dummy indicator of insecurity. When predicting marginal insecurity, however, only paternal education and whether a child is black were significant predictors. This suggests that while food insecurity itself is mostly a product of financial constraints, marginal food insecurity may be more attributable to a broader range of socio-economic and cultural factors. This provides validation for the USDA-developed measure of food insecurity, which was designed to capture food insecurity due to financial constraints, not other household factors.

Additionally, as expected, measures of families' economic status are highly associated with children's participation in the NSLP. One unique finding is the dramatically increased likelihood of participation in the NSLP among black children, compared to other children, even after controlling for a wide range of economic measures. This may represent a difference in school-level prevalence of participation in the program among children in different racial groups. For example, black children may attend schools in which a high percentage of children participate in the NSLP, thus reducing the stigma associated with participating compared to that

felt by white children and increasing the odds that a specific child is likely to participate. Future work should further examine this association.

It is also surprising that living in a married-parent family is associated with increased odds of participating in the NSLP compared to living in a single-parent family. Perhaps, after adjusting for the wide range of socio-economic factors in this data, married parents have more time or energy to devote to learning about programs such as the NSLP, or have more information about the program itself, leading to increased participation among their children.

When examining the ways in which participation in the NSLP and food insecurity may influence child outcomes, results in Table 3 indicate that participation in the NSLP is associated with increased externalizing behavior, increased odds of health limitations, and decreased math test scores among children. Additionally, increases in food insecurity are associated with lower levels of positive behavior and increased odds of health limitations. The detrimental associations between NSLP participation and child outcomes were eliminated after adjusting for family-level factors that may influence the selection of children into participating in the program. The dramatic difference between the whole-sample and restricted-sample results highlights the importance of addressing issues of selection into participation in the NSLP.

Additionally, results in Tables 3 and 4 suggest that food insecurity is associated with behavioral (and in Table 3 only, health) outcomes among children, but not cognitive outcomes. The lack of impact of food insecurity on cognitive outcomes may be due to the fact that very few children in our sample experience hunger due to food insecurity. Instead, food insecurity may represent a level of stress or strain in a household that is translated most reliably into children's behavioral adjustment, rather than their cognitive achievement.

It is noteworthy that even the restricted sample analyses do not show significant evidence that participation in the NSLP is associated with *improvements* in child outcomes. The exception to this is that, for the subgroup of children in households experiencing child hunger, participation in the NSLP is associated with reductions in internalizing and externalizing behavior. There are several possible explanations for these findings. First, since previous research has documented associations between participating in the NSLP and improvements in children's nutrient intake (Burghardt and Devaney, 1995), we believed that NSLP participation may also translate into improvements in children's behavioral, health, and cognitive well-being. However, it is possible that additional nutrients in a child's diet do not lead to overall improvements in child well-being because most children are already receiving an adequate nutritional intake. As noted by Butler and Raymond, (1996), "above some level, extra nutrients [may be] superfluous" (p. 782). Thus, because very few children in our sample experience hunger, the impact of the NSLP on child well-being may be extremely difficult to discern. This is supported by the fact that, for some outcomes, participation in the NSLP was beneficial only for children in households experiencing child hunger.

Second, the likelihood exists that families in which children participate in the NSLP may use the program to *replace* food the child would have eaten anyway, rather than to add to the child's overall diet (discussed in Besharov and Germanis, 2001, with respect to the WIC program). Thus, participation in the NSLP may not have an impact on children because it does not significantly improve their overall nutritional intake.

Overall, the NSLP represents a major federal policy effort to alleviate the problems associated from hunger and a lack of adequate nutrition among low-income children. Given this, it is important to evaluate the effectiveness of these programs in producing discernible effects on relevant child outcomes. This paper takes an important first step in this direction, and opens the

door for further research in this understudied area.

There are some limitations that are important to keep in mind when interpreting the results from this paper. First, as noted above, we measure most of our key independent and dependent variables in 1997, leading to concerns about simulteneity. Future work in this area would benefit from additional modeling using a simultaneous equation approach, similar to that used by Gunderson and Oliveria (2001). To do so, however, would require the identification of exogenous variables for both NSLP participation and for measures of food insecurity; a daunting task in our data.

The links between NSLP participation and the achievement and social development of children has been understudied in the program evaluation literature. Because of this, the results of this study yield an important first step in better understanding the linkages between food assistance programs and children's development. One of the main contributions of this study is to emphasize the need to address selection effects. We observe dramatic differences in the pattern of results once selection issues are addressed in our models. Future evaluations of the NSLP should seriously consider this issue. Additionally, our results suggest that the benefits of participation in the NSLP on the types of child outcomes examined here may be limited to sub-groups of particularly at-risk children. Overall, these results shed some light on the understudied relationships between food insecurity, participation in the NSLP program, and the development of pre-school and school-aged children and pave the way for future research in this area.

References

Aboud, F.E., & Alemu, T. (1995). "Nutrition, maternal responsiveness, and mental development of Ethiopian children". *Social Science and Medicine, 41*(5): 725-32.

Achenbach, T. M. and Edlebrock, C.S. (1981). Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monograph of the Society for Research in Child Development*. Serial No. 188, Vol. 46, Whole No. 1.

Alaimo, K., Olson, C., & Frongillo, E. (2001). "Food insufficiency and American School-Aged Children's Cognitive, Academic and Psychosocial Development". *Pediatrics, 108*: 44-53.

Alaimo, K., Olson, C., Frongillo, E., & Briefel, R. (2001). "Food insufficiency, poverty, and health in U.S. pre-school and school-age children". *American Journal of Public Health, 91*: 781-786.

Besharov, D.J., & Germanis, P. (2001). *Rethinking WIC: An evaluation of the Women, Infants and Children Program*. Washington, DC: AEI Press.

Bickel, G., Carlson, S., & Nord, M. (1999). "Household food security in the U.S. 1995-1998 (Advance report)". Food and Nutrition Service, U.S. Department of Agriculture.

Burghardt, J. & Devaney, B. (1995). "School Nutrition dietary assessment study." *American Journal of Clinical Nutrition 61* (1), Supplement.

Butler, J.S., & Raymond, J. (1996). "The effect of the Food Stamp Program on nutrient intake". *Economic Inquiry, 34:* 781-798.

Corcoran, M.E., Heflin, C.M., & Siefert, K. (1999). "Food insufficiency and material hardship in post-TANF welfare families". *Ohio State Law Journal, 60*: 1364-1395.

Devaney, B., Ellwood, M. R. & Love, J.M. (1997). "Programs that mitigate the effects of poverty on children." *The Future of Children 7*(2): 88-112.

Fitzgerald, J., Gottschalk, P., and Moffitt, R. (1998). "An Analysis of the Impact of Sample Attrition on the Second Generation of Respondents in the Michigan Panel Study of Income Dynamics". *Journal of Human Resources, 33*(2): 300-43.

Gardner, J.M.M., Grantham-McGregor, S., Himes, J., & Chang, S. (1999). "Behaviour and development of stunted and nonstunted Jamaican children". *Journal of Child Psychology and Psychiatry and Allied Disciplines, 40*(5): 819-827.

Gleason, P.M. & Suitor, C.W. (2001). "Eating at School: How the National School Lunch Program affects children's diets". Mathematica Policy Research Working Paper.

Grantham-McGregor, S., Powell, C., Walker, S., Chang, S., and Fletcher, P. (1994). "The long-term follow-up of severely malnourished children who participated in an intervention program". *Child Development, 65*: 428-39.

Gunderson, C., & Oliveira, V. (2001)."The Food Stamp program and food insufficiency". *American Journal of Agricultural Economics, 83*(4): 875-887.

Kendall, A., Olson, C.M., & Frongillo, E.A. (1996). "Relationship of hunger and food insecurity to food availability and consumption". *Journal of the American dietetic association, 96*(10): 1019-24.

Mather, N. (1991). *An instructional guide to the Woodcock-Johnson Psycho-Educational Battery-Revised*. New York: John Wiley and Sons.

Meyers, A., Sampson, A., Weitzman, M., & H. Kane. (1988). "School Breakfast Program and School Performance." Mimeo, Tufts University.

Nord, M., & Bickel, G. (2001). "Estimating the prevalence of children's hunger from the Current Population Survey Food Security Supplement". Paper presented at the Second Food Security Research Conference, USDA Economic Research Service, August, 2001. http://www.ers.usda.gov/publications/fanrr11-2/

Oliveira, V. (1999). "Food-assistance expenditures fall for second year." *Food Review, 22*(1): 38-44.

Oliveira, V., & Gunderson, C. (2000). "WIC and the nutrient intake of children". Economic Research Service, U.S. Department of Agriculture, Food Assistance and Nutrition Research Report No. 5.

Reid, L. (2000). "The consequences of food insecurity for child well-being: An analysis of children's school achievement, psychological well-being, and health". Northwestern University: Joint Center for Poverty Research Working Paper # 137.

United States Department of Agriculture (1997). "Household food security in the United States in 1995." Summary report of the food security measurement project. Food and Consumer Service, Office of Analysis and Evaluation, Washington, DC.

United States Department of Agriculture (2000). "Food security in the United States". http://www.ers.usda.gov/briefing/foodsecurity/

USDA Guide (2000). "Guide to Measuring Household Food Security". http://www.ers.usda.gov/briefing/foodsecurity/surveytools/index.htm

Vermeersch, J., Hanes, S., and Gale, S. (1984). "The national evaluation of school nutrition programs: programs impact on anthropometric measures." *The American Journal of Clinical Nutrition 40*: 414-424.

Table 1: Weighted Means for Children ages 6-12

Variable	*N*	*Mean*	*SD*
Participates in National School Lunch Program	1854	.38	.49
Household is Food Insecure	1870	.13	.34
Household is Marginally Food Insecure	1852	.07	.25
Recoded Rasch Food Insecurity Scale	1852	-1.94	3.13
Average family income 1994-1996 (1996 dollars)	1713	56,041	54,364
Number of siblings	1878	1.71	1.21
% years parents owned home 1994-1997	1878	.59	.44
Child is black	1878	.17	.38
Child is male	1878	.50	.50
Child is Hispanic	1878	.13	.34
Age of child	1878	9.00	2.02
Age of Primary Caregiver	1810	37.16	6.69
Child is insured	1874	.91	.29
% time received Food Stamps 1994-1997	1878	.15	.30
% years in a married-parent family 1994-1997	1878	.63	.45
Internalizing Behavior Problems	1844	16.77	4.53
Externalizing Behavior Problems	1840	22.98	5.81
Positive Behavior	1870	42.27	5.67
Whether any health limitations	1878	.09	.38
Math Test Score	1471	49.76	16.60
Reading Test Score	1478	58.35	19.32
Primary caregiver (PCG) smokes	1159	.22	.41
PCG drinks	1163	.42	.49
PCG Efficacy	1154	21.94	3.38
PCG Self-Esteem	1109	34.19	4.35
PCG Depression	1133	16.26	5.62
PCG Aggravation in Parenting	1160	9.20	2.61

Table 2: Factors Affecting Food Insecurity And NSLP Participation

	Continuous Food Insecurity Measure			*Food Insecure Indicator (Logistic Regression)*			*Marginal Food Insecurity Indicator (Logistic Regression)*			*NSLP Participation (Logistic Regression)*		
	Coeff.	**SE**	**Sig.**	**Odds Ratio**	**Z-score**	**Sig.**	**Odds Ratio**	**Z-score**	**Sig.**	**Odds Ratio**	**Z-score**	**Sig.**
Family Income (10,000s)	-0.03	0.01	**	1.00	-2.63	***	1.00	-1.84		1.00	-3.9	***
Number Of Siblings	0.13	0.09		1.19	2.26	**	0.99	-0.14		1.39	4.05	***
% Years Parents Owned Home	-0.71	0.27	**	0.47	-2.63	***	1.03	0.08		0.59	-2.47	**
Maternal Education	0.04	0.05		1.07	1.06		1.04	0.61		0.90	-1.77	
Paternal Education	-0.14	0.05	***	0.90	-1.65		0.81	-2.87	***	0.86	-2.74	***
Child Is Black	0.06	0.22		0.78	-0.98		1.72	2.08	**	4.80	9.06	***
Child Is Hispanic	0.46	0.81		0.77	-0.36		1.37	0.41		0.73	-0.62	
Child Is Male	0.08	0.14		1.02	0.09		1.10	0.54		0.95	-0.36	
Age Of Child	0.03	0.04		1.05	1.06		1.01	0.2		1.00	0.09	
Age Of Mother	0.00	0.01		1.00	-0.1		0.98	-1.25		0.99	-1.3	
Child Is Insured	-1.44	0.44	***	0.51	-2.14	**	0.61	-1.58		0.64	-1.31	
Avg. Years Of Food Stamps 1994-1997	1.79	0.40	***	1.81	1.79		1.29	0.71		2.87	2.76	***
% Of Years In A Married Parent Family 1994-1997	-0.38	0.40		0.87	-0.34		0.93	-0.17		2.01	2.05	**
PCG Drinks	0.12	0.20		0.92	-0.3		1.36	1.03		0.51	-2.87	***
PCG Smokes	0.14	0.25		1.44	1.36		0.82	-0.62		1.13	0.51	
PCG Self-Esteem	-0.01	0.03		0.99	-0.38		1.04	0.93		1.00	-0.09	
PCG Self-Efficacy	-0.03	0.05		0.99	-0.12		0.93	-1.34		0.98	-0.36	
PCG Aggravation In Parenting	0.04	0.04		1.08	1.88		0.90	-1.92		1.02	0.47	
PCG Depression	0.05	0.02	**	1.03	1.12		1.04	1.63		0.99	-0.6	
N	1631			1631			1631			1633		
R-square	.19			.18			.10			.47		

** indicates p<.05, *** indicates p<.01

Table 3: Associations Between NSLP Participation, Food Insecurity, and Child Outcomes

	Internalizing Behavior			*Externalizing Behavior*			*Positive Behavior*			*Health Limitations (Logistic Regression)*			*Math Test Score*			*Reading Test Score*		
	Coeff.	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Odds Ratio**	**Z-score**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**
Food Insecurity	0.05	0.05		0.07	0.06		-0.17	0.06	***	1.08	1.98	**	-0.08	0.10		-0.08	0.13	
NSLP Participation	0.45	0.27		1.05	0.41	**	-0.19	0.41		1.88	2.05	**	-1.98	0.78	**	-1.26	0.98	
Family Income (10,000s)	-0.02	0.02		-0.03	0.03		-0.01	0.04		1.00	-0.83		0.12	0.06		0.19	0.07	**
Number Of Siblings	-0.15	0.10		0.03	0.15		0.00	0.15		0.88	-1.41		-0.36	0.22		-0.93	0.30	***
% Years Parents Owned Home	-0.28	0.31		-0.81	0.44		0.62	0.46		1.13	0.38		1.30	0.73		0.52	1.03	
Maternal Education	0.08	0.08		0.02	0.10		-0.03	0.10		1.00	0.03		0.54	0.16	***	0.48	0.21	**
Paternal Education	-0.06	0.08		-0.16	0.09		-0.02	0.10		0.94	-0.81		0.56	0.17	***	0.56	0.22	**
Child Is Black	-1.21	0.26	***	-1.01	0.37	***	1.40	0.37	***	0.46	-2.9	***	-1.99	0.68	***	-1.71	0.94	
Child Is Hispanic	-0.39	1.53		-1.12	1.49		2.12	1.28		1.02	0.01		-0.81	1.40		-1.00	2.55	
Child Is Male	0.54	0.21	***	1.48	0.28	***	-1.84	0.28	***	1.45	1.88		0.88	0.49		-1.67	0.67	**
Age Of Child	0.11	0.06		0.08	0.07		-0.11	0.07		1.09	1.7		6.31	0.14	***	6.70	0.18	***
Age Of Mother	0.03	0.02		0.02	0.02		0.02	0.02		1.01	0.66		0.04	0.04		0.05	0.05	
Child Is Insured	0.65	0.42		0.44	0.61		-0.17	0.54		2.11	1.71		0.27	1.00		-0.02	1.35	
Avg. Years Of Food Stamps 1994-1997	1.36	0.52	***	0.97	0.62		0.55	0.59		1.76	1.67		-0.51	1.01		-5.11	1.36	***
% Of Years In A Married Parent Family 1994-1997	0.61	0.49		-0.19	0.67		-0.69	0.67		1.20	0.35		-1.06	1.19		-0.93	1.69	
PCG Drinks	-0.25	0.29		-0.08	0.38		0.39	0.37		0.79	-0.77		0.60	0.64		1.58	0.87	
PCG Smokes	0.16	0.37		0.12	0.48		0.19	0.43		0.87	-0.43		-0.71	0.64		-0.73	0.95	
PCG Self-Esteem	-0.04	0.04		-0.07	0.05		0.16	0.06	***	1.01	0.23		-0.06	0.10		0.06	0.12	
PCG Self-Efficacy	-0.09	0.05		-0.08	0.07		0.16	0.07	**	0.92	-1.67		0.15	0.12		0.16	0.15	
PCG Aggravation In Parenting	0.19	0.06	***	0.37	0.08	***	-0.21	0.08	***	1.09	1.63		-0.06	0.13		0.01	0.17	
PCG Depression	0.12	0.03	***	0.19	0.04	***	-0.05	0.04		0.96	-1.33		-0.10	0.06		-0.02	0.09	
N	1613			1605			1629			1631			1302			1310		
R-Square	.09			.14			.09			.07			.71			.61		

** indicates p<.05, *** indicates p<.01

Table 4: Associations Between NSLP Participation, Food Insecurity, and Child Outcomes—Restricted-Sample

	Internalizing Behavior			*Externalizing Behavior*			*Positive Behavior*			*Health Limitations (Logistic Regression)*			*Math Test Score*			*Reading Test Score*		
	Coeff.	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Odds Ratio**	**Z-score**	**Sig.**	**Coeff.**	**SE**	**Sig.**	**Coeff.**	**SE**	**Sig.**
Food Insecurity	0.06	0.06		0.08	0.07		-0.18	0.07	**	1.07	1.58		-0.02	0.12		0.06	0.15	
NSLP Participation	-0.20	0.62		0.20	0.96		-0.08	0.74		5.03	1.56		1.26	2.23		2.91	2.56	
Family Income (10,000s)	-0.02	0.10		-0.08	0.18		0.30	0.17		1.00	1.5		-0.22	0.40		-0.20	0.46	
Number Of Siblings	-0.15	0.15		-0.04	0.21		-0.13	0.19		0.89	-0.93		-0.38	0.28		-0.70	0.40	
% Years Parents Owned Home	-0.16	0.41		-0.65	0.63		0.93	0.64		1.47	0.96		1.51	1.02		0.96	1.38	
Maternal Education	0.19	0.15		0.21	0.17		-0.14	0.17		0.97	-0.35		0.31	0.25		0.46	0.31	
Paternal Education	-0.26	0.14		-0.30	0.19		-0.13	0.21		0.83	-1.86		0.92	0.31	***	0.96	0.36	***
Child Is Black	-0.99	0.42	**	-0.33	0.63		1.87	0.63	***	0.37	-2.91	***	-1.44	1.00		-0.26	1.43	
Child Is Hispanic	-2.75	0.87	***	-1.30	1.60		2.31	1.95		2.60	0.85		-1.11	3.06		-1.52	5.45	
Child Is Male	0.60	0.33		1.82	0.48	***	-1.96	0.45	***	1.63	1.86		-0.17	0.73		-2.11	1.04	**
Age Of Child	0.11	0.09		0.05	0.12		-0.20	0.11		1.05	0.71		5.90	0.19	***	7.01	0.24	***
Age Of Mother	0.05	0.03		0.02	0.03		0.03	0.03		0.98	-0.98		0.00	0.05		0.01	0.06	
Child Is Insured	1.14	0.49	**	1.03	0.73		-0.67	0.69		2.22	1.5		0.25	1.18		0.34	1.48	
Avg. Years Of Food Stamps 1994-1997	1.84	0.62	***	1.49	0.79		1.12	0.77		2.41	2.04	**	-0.66	1.33		-5.28	1.68	***
% Of Years In A Married Parent Family 1994-1997	1.07	0.76		0.87	0.92		-1.57	0.94		1.28	0.37		-1.51	1.60		-2.28	2.15	
PCG Drinks	0.52	3.05		-0.25	0.75		-0.84	0.72		1.11	0.22		1.73	1.15		3.61	1.61	**
PCG Smokes	0.24	0.57		0.04	0.79		0.87	0.66		0.73	-0.7		0.95	0.91		-0.22	1.37	
PCG Self-Esteem	-0.37	0.54		-0.07	0.09		0.24	0.09	***	1.08	1.46		-0.10	0.14		-0.00	0.20	
PCG Self-Efficacy	-0.03	0.06		-0.13	0.15		0.18	0.13		0.94	-0.78		0.44	0.20	**	0.60	0.27	**
PCG Aggravation In Parenting	-0.15	0.11		0.36	0.11	***	-0.11	0.10		1.06	0.95		-0.16	0.17		-0.20	0.23	
PCG Depression	0.18	0.08	**	0.17	0.06	***	-0.04	0.05		0.96	-1.03		-0.09	0.08		-0.08	0.11	
N	729			728			738			738			594			597		
R-square	.12			.11			.13			.10			.68			.63		

** indicates p<.05, *** indicates p<.01

[i] Analyses examining the other measures of food insecurity did not differ substantially from those using the continuous measure.