

The Consequences of Food Insecurity for Child Well-Being:
An Analysis of Children's School Achievement,
Psychological Well-Being, and Health¹

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Does food insecurity in the United States affect child well-being? Specifically, is the amount or quality

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of food that U.S. children lack sufficient to affect their health, school achievement, or psychological well-being in observable ways. Do children who do not have enough to eat or who eat less balanced meals experience more health problems than other children? Do undernourished children perform more poorly in school than other children? Similarly, do children who do not eat as well as other children experience more emotional and psychological distress than other children?

The effect of food insecurity on child well-being has been the subject of much research in the context of developing countries. However, very little research has attempted to analyze the effect of food insecurity on child well-being in the United States. With a few exceptions, research on U.S. food insecurity has focused more on examining the causes of food insecurity, potential solutions, and more recently, on assessing the incidence of food insecurity. Given this focus, we know very little of the actual effects of food insecurity on the well-being of children in the United States. Interested parties have disagreed about the potential consequences of domestic food insecurity. Some have suggested that the level of food insecurity in the United States is not severe or prolonged enough to have measurable effects on the well-being of children or adults, while others have speculated about potentially negative effects of food insecurity on the emotional, cognitive, and behavioral functioning of children. However, we have little direct evidence to support a conclusion in either direction. Using the 1997 Child Development Supplement to the PSID, I examine the effects of food insecurity on the school achievement, psychological well-being, and health of children. This analysis will provide direct evidence about the effect of food insecurity on the well-being of children in the United States.

Most researchers, whether working within the context of the United States or developing countries, have concluded that poverty, in conjunction with inadequate state action mitigating the effects of poverty, is the primary cause of hunger and food insecurity (Brown 1987, 1989; Cohen 1990; Martorell 1996; Nestle and Guttmacher 1992; Physicians Task Force on Hunger 1985; Poppendieck 1997). Given this emphasis on poverty as the primary cause of food insecurity, policy proposals have focused on addressing poverty and economic issues such as unemployment, underemployment, and housing, in addition to food assistance programs (Brown 1989; Cohen 1990; Nestle and Guttmacher 1992; Physician Task force on Hunger 1985; Poppendieck 1997).

Despite widespread agreement about the strong relationship between poverty and food insecurity, Mayer and Jencks (1988) argue that poverty statistics cannot provide accurate information about the distribution of material hardship, such as food insecurity. Many of the early estimates of the incidence of U.S. food insecurity were based on poverty statistics. Based on a study of Chicago, Mayer and Jencks report that direct measures of material hardship are better indicators of hardship than estimates based on income or poverty.

While many are skeptical of the validity of self-reports of material hardship, Rose and Oliveira (1997) conducted an analysis comparing self-report measures of food insecurity with nutrient intake data. The researchers found that, on average, households reporting food insecurity had significantly lower intakes of energy than other households, as well as a significantly decreased intake of thirteen other nutrients. Thus, there is evidence to support the accuracy of self-report measures of food insecurity.

In 1985, the Physicians Task Force reported that some 20 million people in the United States were going hungry at least part of each month (Physicians Task Force on Hunger in America 1985).

The task force also reported that hunger in America was growing worse, rather than improving. The task force had collected its own data and conducted field investigations to reach this conclusion. In addition, the task force utilized reports from a large number of local programs and pointed out that local food banks and soup kitchens across the country experienced a tremendous growth in the number of individuals and families who seeking food assistance beginning in the early 1980's. Thus, many activists and a few researchers began to piece together information derived from local food assistance programs and determined that hunger was becoming a worsening problem throughout the 1980's. However, much disagreement remained about the extent and severity of the hunger problem in the United States.

More recently, researchers have begun to develop indicators of food insecurity in an attempt to more accurately gauge the scope of food insecurity in the United States. The Food Security Measurement Project, a supplement to the CPS, reports that 11.9 percent of U.S. households are food insecure (Hamilton, et al., 1995). This overall prevalence rate can be broken down into three more detailed categories. The prevalence among U.S. households of food insecurity with no hunger is 7.8 percent, the prevalence of food insecurity with moderate hunger is 3.3 percent, while that for food insecurity with severe hunger is .8 percent. Combining the two most severe levels of food insecurity provides an estimate of the prevalence of food insecurity that involves reducing the amount of food eaten, 4.1 percent of U.S. households experience a level of food insecurity that involves adults or children who are hungry because they do not have enough to eat.

Despite our knowledge about food insecurity in the United States, it remains unclear what consequences we should expect as a result of these levels of food insecurity. Research on the effects of malnutrition in developing countries has clarified the devastating effects of hunger and malnutrition on the health of children (Boivin, et al., 1996; Martorell, 1993 and 1996; Schroeder and Martorell, 1997). Hunger and nutrient malnutrition in developing countries have been linked to growth failure, delayed maturation, mental retardation, child mortality, increased severity of infections, impaired learning, low birth weight, and increased maternal mortality (Boivin, et al., 1996; Martorell, 1993 and 1996).

While the consequences of hunger in developing countries are clear, the extent and severity of hunger in the United States are significantly less than that in developing countries making the link between food insecurity and health more difficult to pinpoint. Brown (1987) lists a number of potential outcomes of hunger and malnutrition including premature births, low birth weight, impaired cognitive functioning, decreased energy levels, reduced productivity, increased vulnerability to environmental toxins, and weakened resistance to infection and other illnesses. However, the question remains as to whether the food insecurity experienced in the United States is severe or prolonged enough to effect outcomes. The Physician Task Force on Hunger in America (1985) concludes that food insecurity in the United States has negative consequences for child, maternal, and adult health. However, the organization is forced to rely on indirect evidence in drawing such conclusions. Rather than looking directly at health outcomes for individuals who experience food insecurity, they are forced to use indirect measures of the health status of low-income groups relative to high-income groups. Thus, the evidence we have to date linking food insecurity in the United States to detrimental health outcomes is indirect.

Theoretical Model and Hypotheses

I hypothesize that food insecurity will have a negative impact on child health, utilizing two measures of child health. I also hypothesize that food insecurity will have a negative impact on children's school achievement and psychological health, utilizing a variety of measures of school achievement and two measures of psychological health to determine the validity of such an assumption. Figure 1 presents the theoretical model that provides the basis for the current analyses. We see that a set of social, economic, and demographic factors such as the child's race, sex, and age; the family's structure, size, and home ownership; as well as the mother's education affect a family's income. Income effects food insecurity directly as well as indirectly through its influence on public transfers such as food stamps. There are a number of potential mechanisms for explaining why food insecurity affects child well-being.

The mechanism for the effect of food insecurity on child health seems straightforward. Children who experience food insecurity to an extent that they are lacking in particular nutritional substances (such as protein or iron), or who simply are not getting enough food to provide them with an adequate level of food energy may experience a variety of health problems as a result of these deficiencies. Health problems may be provoked by food insecurity of a severe nature, or by food insecurity of a mild or moderate nature that occurs for such a prolonged period of time that it leads to health problems. The important question for this analysis is whether food insecurity is severe enough or prolonged enough in the United States to affect child health, and, if so, what sorts of health problems arise as a result of food insecurity.

The mechanism for the effect of food insecurity on school achievement is less straightforward. Certainly, food insecurity that affects child health is also likely to affect school achievement. Children who are experiencing health problems are likely to miss more schooling, and may also find it more difficult to fully participate in the learning process while at school, depending on the nature of the health problem. For instance, children suffering an iron deficiency are likely to be tired at school and may consequently not learn as much as other students. Another possibility is that food insecurity may affect the level of energy that children have, even though they have no health problems. Again, if these children have less energy than other children they may not learn as much at school. A third possibility is that, regardless of whether children who experience food insecurity have less energy than other children, the feelings of hunger that result from food insecurity may distract these children from learning in school. A fourth possibility is that children who experience food insecurity also experience a significant amount of psychological and emotional distress in their household surrounding the concerns of the caregivers to provide adequate food. This level of emotional distress and worry may affect the emotional well-being of the child to an extent that interferes with cognitive and behavioral functioning. Any of these mechanisms alone, or some combination of them, could explain an effect of food security on the school achievement of children.

While researchers and policy makers have begun to measure the incidence of food insecurity in

the United States, we cannot know the full implications of this information until we know the consequences of food insecurity for individuals' physical, emotional, and cognitive well-being.

Evidence about the effect of food insecurity on the physical health, school achievement, and psychological health of children is of particular importance among child well-being indicators. The status of a child's physical and psychological health indicates not only something about the quality of the child's life, but also the degree to which that child will ultimately be able to contribute productively to his or her community. Assessments of school achievement will indicate how the child is faring in the very early stages of accumulating human capital. Anything that hinders children from taking full advantage of opportunities to acquire human capital will also ultimately hinder those children in the labor market. Research has shown human capital to be an important determinant of earnings (Corcoran and Duncan 1979). If food insecurity negatively affects a child's physical and psychological health and school achievement, it will also affect future earnings potential and limit what those individuals are able to contribute to the economy as productive workers.

Data and Methods

I use the 1997 Child Development Supplement to the Panel Study of Income Dynamics to address my hypotheses. The Panel Study of Income Dynamics (PSID) was begun in 1968, and is a longitudinal study of a representative sample of U.S. men, women, and children. It emphasizes a range of economic and demographic behavior, but also includes sociological and psychological measures. In 1997, the PSID supplemented its core data collection with data on parents and their 0- to 12-year-old children, a project known as the Child Development Supplement. The objective 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. The supplement includes reliable, age-graded assessments of the cognitive, behavioral, and health status of 3,500 children (including about 550 immigrant children) obtained from the mother, a second caregiver, an absent parent, the teacher, the school administrator, and the child. Four basic types of outcomes linked to children's well-being and future success are measured. These are (1) school progress, academic achievement and cognitive ability, including grade failure/progression, highest grade completed, verbal and math ability and literacy; (2) social well-being; (3) emotional well-being; and (4) health.

I will look at the effect of food insecurity on children's health, school achievement and psychological well-being by employing ordinary least squares and logistic regression techniques to test my hypotheses. I estimate a number of models that test the relationship between food security and child health by regressing indicators of child health on food security and a number of relevant control variables. Similarly, indicators of school achievement are regressed on food security and a number of relevant controls to test the relationship between food security and school achievement. In addition, indicators of psychological and emotional well-being are regressed on food security and a set of variables to test the effect of food insecurity on psychological well-being.

Two indicators of child health will be employed: whether a child's height falls below the 10th percentile of height for children of the same sex and age, and whether the child's weight falls below the

10th percentile of weight for children of the same sex and age. Because the health measures are binary indicators, logistic regression techniques will be used to test the relationship between child health and food insecurity. Four indicators of school achievement and two indicators of psychological and emotional well-being will be used. The indicators of school achievement include four subtests of the Woodcock-Johnson Revised Tests of Achievement: the Letter-Word Identification, Applied Problems, Passage Comprehension, and Calculation tests. Psychological and emotional well-being will be measured using two scales from the Behavior Problems Index. Ordinary least squares regression techniques will be used to test the relationship between food insecurity and both school achievement and psychological well-being.

Measures

Table 1 presents descriptive statistics for all of the measures included in the models. The Child Development Supplement to the PSID contains a number of items that assess food security and are available for use in creating a measure of food security. Each item assesses the degree to which a respondent's household experiences a shortage of food, worries about a shortage of food, or alters the food management of the household in some manner because the money available to the household is insufficient. These items will be used to create a scale of food insecurity ranging from 0 to 10 in which increasing scale values indicate more severe levels of food insecurity. Households can be classified in of the following categories: food secure, food insecure without hunger, food insecure with moderate hunger, or food insecure with severe hunger. Those classified as food secure are those who report no concerns about having enough food to eat. Those classified as food insecure without hunger are those who report concerns about having enough food to eat or make adjustments to their food intake (for instance, by eating lower quality food), but do not reduce the amount of food eaten. Those classified as food insecure with moderate hunger are those households in which adults reduce the amount of food they eat. This would include adults skipping or cutting the size of meals as well as going without eating for an entire day. Those classified as food insecure with severe hunger are households in which the amount of food that children eat is reduced. This also may include an assortment of food reduction experiences ranging from children who experience reductions in meal size or skip meals to children who go without eating for an entire day.

In addition to the scale value for food insecurity in 1997, the PSID will be used to provide information about food insecurity in 1995 and 1996. These survey waves of the PSID contain a single item that asks respondents, "In the last twelve months, did you ever run out of the foods that you needed to make a meal and didn't have the money to get more?". These items will be used to construct additional measures of food insecurity. Since the 1997 scale item does not contain information about a child's food insecurity prior to the time at which the outcome variables are measured, it is not the ideal measure of food insecurity. While the 1995 and 1996 items contain much less detailed information than the 1997 item, they do have the advantage of measuring food insecurity during the time period immediately preceding that in which the outcome variables are measured. Two additional measures of food insecurity are constructed. The first measures the number of years from 1995 to 1997 during

which a child's family experienced (any) food insecurity. This allows us to utilize the information on food insecurity over the longest period of time for which we have information. However, it also includes information about food insecurity in 1997, the year in which the outcome variables are also measured. Therefore, an additional measure is constructed which measures the number of years from 1995 to 1996 that a child's family experienced (any) food insecurity. This provides a measure of food insecurity that immediately precedes the time at which the outcome variables are measured. Each of these measures of food insecurity will be used to assess the effect of food insecurity on children's schooling and health outcomes. When discrepancies in results arise between the three measures, I give preference to the results associated with the latter measure given that it is not "contaminated" with information about food insecurity in the same year in which the outcome variables are measured.

The Child Development Supplement also contains a large number of items that assess child physical and psychological health and school performance outcomes. The current paper uses two indicators of child health, four indicators of school performance, and two indicators of psychological well-being. Following Korenman and Miller (1997), I use measures of low height-for age and low weight-for-age as indicators of child health. Low height-for-age and low weight-for-age are both considered risk factors for poor health (Martorell and Ho, 1984). Low height-for-age is evident when a child's height falls below the 10th percentile for children of the same age and sex, and low weight-for-age is indicated by whether a child's weight falls below the 10th percentile for children of the same age and sex. Percentiles are determined using standards provided by the National Center for Health Statistics (Betz and Sowden, 1996). Both low height-for-age and low weight-for-age are coded 0 for children who do not fall below the 10th percentile height or weight for their age and sex, and 1 for children who do fall below the 10th percentile.

The indicators of school performance include four subtests from the Woodcock Johnson Revised Tests of Achievement. These tests are normed to average 100. The potential range of scores for each test is 0 to 200. The subtests are the Letter Word test, which requires children aged 3 to 12 to match pictures with words and identify letters and words; the Applied Problems test, which requires children aged 3 to 12 to solve practical problems in mathematics; the Passage Comprehension test, which tests comprehension and vocabulary skills using multiple-choice and fill-in-the-blank forms in children aged 6 to 12; and the Calculation test, which measures ability to complete mathematical calculations and quantitative ability in children aged 6 to 12. Higher scores on each subtest indicate better performance.

The indicators of psychological well-being include a scale that measures "external" or aggressive behavior problems and a scale that measures "internal" or withdrawn behavior problems. The external behavior problems scale is based on the primary caregiver's responses to a 16 item scale that indicates the regularity of the child's exhibition of a series of "external" behaviors. The internal behavior problems scale is based on the primary caregiver's responses to a 13-item scale that indicates how often the child demonstrated signs of a series of "internal" behaviors. Externalizing behavior is measured by how often a child engages in behaviors such as cheating or lying, arguing, or bullying. Internalizing behavior is measured by how often a child engages in behaviors such as complaining that she or he is not loved,

showing fear or anxiety, or indicating feelings of worthlessness. Responses of “sometimes true” and “often true” were coded 1 and “never true” was coded zero. Separate scales for external and internal behavior problems were created by summing these responses. Both were created from items based on the behavior problem scale developed by James Peterson and Nicholas Zill (Peterson and Zill, 1986). Higher scores on both the external and internal scales indicate more behavior problems.

A measure indicating whether the child’s family received food stamps during the year prior to the year in which outcome variables began to be measured will be included as a control. Receipt of food stamps in 1996 is included as a control because it may act to reduce or eliminate the food insecurity experienced by some low-income families (See Figure 1). Therefore, to assess the real influence of food insecurity on the outcomes of interest, we must account for the receipt of food stamps that may lessen overall food insecurity. The measure is coded 1 if a child’s family received food stamps in 1996, and is coded 0 otherwise.

A series of sociodemographic factors that may influence food insecurity or child outcomes will be included as controls (See Figure 1). As noted above, income is one of the primary causal factors used in explaining food insecurity. Income is also an important influence on many of the child outcomes of interest. A family’s income may vary somewhat from year to year. Measures using several years of family income tend to be more stable and indicative of permanent income than those based upon one year of family income (Mayer, 1997). Therefore, I use a measure of income that indicates the average income (in thousands of dollars) of a child’s family from the time that the child was one year old through 1996. As noted above, income is not the only determinant of food insecurity. Home ownership has been found to influence a family’s level of material hardship (Mayer and Jencks, 1988). Most likely, home ownership is an indication that a family spends less of its overall available income on housing costs and is therefore able to utilize a larger share of overall income in meeting other needs such as food provision. Thus, home ownership may influence a family’s food security via its effect on income allocation. However, this may depend in part on whether the child’s family is paying a mortgage on the home. Therefore, two measures of home ownership will be included as controls. The first is coded 1 if a child’s family owns a home without a mortgage and 0 otherwise, and the second is coded 1 if a child’s family owns a home with a mortgage and 0 otherwise.

The number of individuals living in a household unit affects the amount of total household income available for each person, and whether total household income will be sufficient to meet the food requirements of all individuals in the household. Therefore, a measure indicating the number of people living in the household will be included as a control. Education level of the child’s mother is also a relevant influence on the total income available to a household, as well as being an influence on the child’s schooling outcomes. A measure of mother’s education indicating total years of schooling will also be included. A child’s sex, race, and age may also influence the outcomes of interest and will be included as controls. The current analyses are limited to children identified as Hispanic, Black Non-Hispanic, or White Non-Hispanic. The number of children in other racial and ethnic categories was extremely small and , because of this, these groups were eliminated from the analyses.

A child’s family structure has consequences for child outcomes as well as family income

(Hanson, McLanahan, and Thomson, 1997; McLanahan, 1997; Smith, Brooks-Gun, and Klebanov, 1997). Growing up in a broken family has negative consequences for a variety of child outcomes; the type of family structure, however, matters. Children who grow up with a never-married or divorced mother tend to suffer more negative consequences than children who grow up in homes with a widowed mother. Recent disruptions in family structure tend to lead to more negative outcomes for children than do disruptions that had [PC1]occurred further in the past. I include a set of family structure measures indicating the type of family structure in which a child has lived, the percentage of a child's life spent in each type of family structure, and also the length of time (in years) since the last change in family structure occurred. The measures indicating the time spent in each type of family structure include: the percentage of a child's life spent in a never-married, father-only household; the percentage of a child's life spent in a never-married, mother-only household; the percentage of a child's life spent in a divorced, father-only household; the percentage of a child's life spent in a divorced, mother-only household; the percentage of a child's life spent in a widowed, father-only household; and the percentage of child's life spent in a widowed, mother-only household. The omitted category illustrates the percentage of a child's life spent in a two-parent household. I also include a measure indicating the number of years since a child's family has experienced a change in family structure.

Results

Food insecurity and school performance

Does food insecurity have negative consequences for children's school performance? The results speaking to this question are presented in Tables 2 through 4. Table 2 presents the regression coefficients for the models which regress children's scores for the Woodcock Johnson subtests on the food insecurity scale for 1997 and the control variables. Table 3 presents analogous models with the exception of the food security scale, which is replaced by a measure indicating the number of years a child's family has experienced food insecurity from 1995 to 1997. Similarly, Table 4 presents the same models, only the food security measure included in the models indicates the number of years that a child's family has experienced food insecurity from 1995 to 1996.

Table 2 provides no evidence that increasing levels of severity of food insecurity negatively impact children's school performance. The food security scale does not significantly affect children's test scores in any of the four models. In contrast, Table 3 shows that food insecurity significantly lowers children's test scores for the letter-word and calculation subtests, and Table 4 demonstrates that food insecurity significantly lowers children's test scores for the letter word, passage comprehension, and calculation subtests. The tables indicate that for every year in which a child's family experiences food insecurity the child's letter-word score and passage comprehension score decline by a slightly more than one and a half points, and the child's calculation test score declines by just under two points. This suggests that food insecurity does negatively affect children's school performance and academic achievement. While we would prefer a model in which food insecurity is measured prior to the outcome variables (as in Tables 3 and 4), it is nonetheless somewhat surprising that food insecurity and children's

test scores are not significantly correlated in Table 2, given the more detailed information about severity of food insecurity contained in the scale measure. This may be an indication that experiences of food insecurity are relatively unstable from year to year such that a child's level of food insecurity in the current year is not a particularly good indication of whether the child has experienced food insecurity in prior years.

Looking at the control variables in Tables 2 through 4, we see that a child's sex and race have fairly consistent effects on children's school performance. Girls tend to outperform boys on the letter-word and passage comprehension tests, while boys outperform girls on the test for applied skills. Girls and boys' performances do not significantly differ from one another on the test for calculation skills. A child's average family income over the course of his or her life also affects the child's school performance. Children whose families have higher average incomes score significantly higher on all four subtests than do other children. Children from families with higher average incomes gain between one-half to almost a full point in test scores for every one-thousand dollars in average annual income. Mother's education level also consistently improves children's performance on all four subtests. For each additional year of mother's education, children gain slightly more than a point in test scores. Thus, more highly educated mothers are able to translate their education into improved verbal, math, and applied skills for their children. The number of people living in a child's household has consistently contributed negative effects on children's test scores across all four subtests. Children living in households with more people tend to do worse on tests of verbal, reading, calculation, and applied skills. This may indicate that other children in the household compete for parental time and attention. Children with more siblings have more people with whom to share parental time and attention that may have otherwise been directed toward learning activities. This may disadvantage them relative to their peers (who have less siblings) when it comes to performance on achievement tests. Home ownership without a mortgage lowers children's test scores on the letter-word and applied subtests. However, home ownership with a mortgage increases children's scores on the passage comprehension and calculation subtests. Children living in homes that their parents own outright score from four to four and a half points lower on test scores than their peers. Children who live in home that their parents own but pay mortgage payments score from two and one-half to four points higher on test scores than their peers.

The results in Table 4 suggest that, on average, children who have spent a greater portion of their lives with a widowed mother may benefit in performance on some achievement tests. Children who have lived with a widowed mother scored significantly higher than other children on the Letter-Word subtest, although the magnitude of the effect is not large. Children who have spent a greater percentage of their lives in homes with a never married father or mother or a divorced father do more poorly than other children on some tests. Children who have lived with a never married or divorced father score significantly lower than other children on the Applied subtest, whereas children who have lived with a never married mother score significantly lower than other children on the Passage Comprehension subtest. However, the magnitude of these effects are also quite small. There is no evidence to suggest that more recent disruptions in family structure can lower children's school

performance.

Food insecurity and psychological well-being

Tables 5 through 7 show the regression coefficients for the models that regress the two behavior problem indices on food security and the other variables. Table 5 indicates that the level of severity of food insecurity is correlated with greater external and internal behavior problems in children. While the theoretical model suggests that greater severity of food insecurity effects the behavior of children, we cannot be certain of this conclusion since severity of food insecurity is measured in the same year as the behavior problems. Tables 6 and 7 also indicate that food insecurity negatively impacts child behavior. Tables 6 and 7 show that as the number of years that a child experiences food insecurity increases, the child exhibits greater levels of both external and internal behavior problems. Thus, the evidence overwhelmingly suggests that food insecurity negatively affects children's psychological well-being.

Table 7 indicates that a child's sex, race, age, household size, and mother's education also have important effects on behavior problems. Young girls are significantly less likely to exhibit external behavior problems than are young boys. However, young girls and boys do not differ significantly in the level of internal behavior problems that they exhibit. Black and Hispanic children exhibit significantly lower levels of both external and internal behavior problems than do white children. Children exhibit significantly lower levels of external behavior problems as they get older relative to when they were younger. In contrast, children exhibit significantly greater levels of internal behavior problems as they get older. Children with more highly educated mothers exhibit significantly lower levels of external behavior problems than other children, but do not differ from other children in the level of internal behavior problems exhibited. Children who live in households with a larger number of people exhibit lower levels of internal behavior problem than do other children, but do not differ from other children in the level of external behavior problems exhibited.

Food insecurity and child health

Tables 8 through 10 present the models estimating the effect of food insecurity on child health. There is no evidence in any of the models to indicate that food insecurity adversely affects child health. Children who have experienced food insecurity are no more likely than other children to experience low height-for-age or low weight-for-age. The only factors in the models that are significantly related to the likelihood of experiencing low height-for-age or low weight-for-age are race, age, and birth weight. Black and Hispanic children have a significantly greater likelihood of experiencing low height-for-age than do white children. However, they are no more likely to experience low weight-for-age than white children. As children age they are significantly less likely to experience both low height-for-age and low weight-for-age. Children who weigh more at birth are much less likely to experience low weight-for-age than other children.

Low height-for-age and low weight-for-age are measures that represent fairly severe health outcomes. The level of nutritional deprivation necessary to create health outcomes like stunting and wasting is quite severe. A range of less severe health outcomes is also possible. By analyzing the effect

of food insecurity on some of the most severe health outcomes, we have provided evidence that the level of food insecurity in the United States may not be severe enough to impact child health in such a severe manner. Were we to use measures of child health indicating less severe health problems than stunting and wasting, we might find that food insecurity affects other aspects of child health. It is also possible that children experiencing extremely prolonged food insecurity in the United States do suffer the consequences of stunting and wasting, but that because we have information on food insecurity dating back only two years prior to the year in which a child's health began to be measured, we are unable to discern this effect.

Discussion

The analyses provide evidence that food insecurity affects a child's school achievement and psychological well-being, however, there is no evidence that food insecurity negatively impacts child health. Using a child's assessment scores for the letter-word, application, passage comprehension, and calculation subtests of the Woodcock Johnson Tests as measures for school achievement, I find that food insecurity negatively affects children's scores on the letter-word, passage comprehension, and calculation subtests. Similarly, using an index of external behavior problems and an index of internal behavior problems as measures of psychological well-being, I find that food insecurity increases the number of both external and internal behavior problems that children exhibit. However, using indicators of low height-for-age and low weight-for-age as measures of child health, I find no effect of food insecurity on child health.

The effect of food insecurity on children's school achievement suggests that food insecurity is partially responsible for creating differences in human capital in children. To the extent that school achievement among young children is important for subsequent academic achievement as young adults, the experience of food insecurity among children plays at least a partial role in determining later access to resources for young adults. The empirical relationship between years of schooling completed and annual earnings is well-established. To the extent that poor performance in school and on achievement tests hinders opportunities for post-secondary schooling, as would be suggested by the use of SAT scores in college admission, the effect of food insecurity on children's school achievement can be expected to translate into lower earnings as adults. Thus, the effect of food insecurity on children's achievement scores is important not only for its initial effect on a child's school performance, but also for what it may indicate about the future earning potential of these children. The mechanism by which food insecurity affects school achievement is unclear. The lack of an effect of food insecurity on child health does suggest that this is an unlikely mechanism. However, as will be discussed below, it is possible that food insecurity affects child health in less extreme ways than is indicated by measures of low height-for-age and low weight-for-age. The significant effect of food insecurity on child behavior problems, however, suggests that the effect of food insecurity on school achievement may at least partly work through an effect on children's psychological and emotional well-being. It is clear that children who experience food insecurity also experience more psychological and emotional distress as evidenced by the effect of food insecurity on child behavior problems. Psychological and emotional problems

likely serve as obstacles to learning in school, and may, in part, explain the effect of food insecurity on school achievement. However, I did not test for this, nor any of the other potential mechanisms directly.

Other mechanisms may also play an important role. While it is unclear from these analyses which mechanisms explain the effect of food insecurity on school achievement, the effect does suggest that policy which reduces food insecurity among children may also help to equalize the learning process for children at school, bringing school performance outcomes such as achievement scores into more of a balance for different students, and also having important effects on a child's future earning potential.

The effect of food insecurity on the two behavior problem indices suggests that children who experience food insecurity suffer more psychological and emotional difficulties than other children. Children who have experienced food insecurity exhibit more aggressive and destructive behaviors, and more withdrawn and distressed behaviors than other children. It appears that children are experiencing a great deal of psychological and emotional distress in response to issues of food insecurity within the family, and that children respond to this distress with a range of behavioral responses. The results clearly indicate that food insecurity negatively impacts children's psychological and emotional well-being. This is important as an indicator of the well-being of children, but may also have implications for other child development outcomes. As mentioned above, children who experience higher levels of psychological and emotional distress may also experience more difficulties in other areas such as school achievement. Psychological and emotional distress have the potential to interfere with a number of other activities in which children may be involved, and thus, may be an important link between food insecurity and its effect on other outcomes. Future research investigating the mechanisms by which food insecurity affects child outcomes would contribute much to our knowledge of these processes. At the very least, the results suggest that policy that effectively reduces food insecurity among children will improve the psychological and emotional well-being of those children, if not other outcomes as well.

The lack of a significant effect of food insecurity on measures of low height- and weight-for-age suggests that food insecurity does not affect child health. It is possible that the level of food insecurity in the United States is either not severe enough or prolonged enough to appreciably affect child health. Levels of food insecurity in the United States are certainly much less severe than those encountered in many non-industrialized countries. However, it is also possible that the less extreme nature of food insecurity in the United States gives rise to less extreme health outcomes in children, outcomes that are not discernable using measures of fairly extreme physical consequence, such as stunting and wasting. It is possible that food insecurity affects child health by lowering children's level of food energy or creating deficiencies in certain vitamin or minerals that affect a child's energy. These types of effects would not necessarily affect a child's height and weight to an extent that would show up on measures of stunting and wasting, but could possibly affect the level at which a child is able to engage in daily activities. Unfortunately, such measures were not available in the current analysis. Measures of child health that directly measure aspects of child health other than height and weight, such as nutritional status in regards to levels of vitamin, minerals, or iron, would be very useful in assessing less severe outcomes for child health. While the results indicate that food insecurity does not affect child health using measures of fairly

extreme health outcomes, it is possible that food insecurity has less severe consequences for child health that went unmeasured in the present analyses. It would be useful for future research to assess the impact of food insecurity on less severe health outcomes for children.

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Figure 1: Model for Effect of Food Insecurity on Children's School Achievement, Psychological Well-Being, and Health

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[PC1]Which or that?