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Does Household Food Security Affect Cognitive and Social Development of Kindergartners?

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Abstract

The development in the last decade of methodology for measuring and scaling household food insecurity and hunger in U.S. populations makes possible systematic examination of the ways in which hunger and food insecurity affect individuals and families. The impact on children has always been of primary concern for policy, advocacy, and science because of the vulnerability of children to long-term developmental sequelae. There is an emerging and rapidly growing literature demonstrating deletrious links between inadequate food and a variety of developmental outcomes for children, including poorer health status, school absenteeism, and emotional and behavioral dysfunction. The research presented here explores the relationship of household food insecurity to children's well-being in terms of cognitive and social development at kindergarten entry, utilizing a large and representative sample children in the United States. The timing of this evaluation, in the fall of the child's first school experience, allows a snapshot of a child's development throughout his/her preschool years relatively independent of the major influence that the school experience will have subsequently.

The data are from the Early Childhood Longitudinal Study of Kindergartners (ECLS-K), collected in 1998–99 by the National Center for Education Statistics, and comprise 20,929 children attending 1,000 private and public schools. Our results indicate that measures of reading, math, and general knowledge competence were not impacted by household food insecurity independent of other influences, but child emotional and functioning were negatively associated with household food insecurity even when many other relevant variables were controlled for. We also investigated the relationship of household food insecurity to children's attained growth and found no independent relationship of household food insecurity to height for age or weight for height.

Does Household Food Security Affect Cognitive and Social Development of Kindergartners?

BACKGROUND

The Measurement of Food Insecurity and Hunger

The Life Sciences Research Office (LSRO) of the Federation of American Societies for Experimental Biology (FASEB) has defined food insecurity as the *lack of continuous, secure access at all times to a diet adequate to support healthy life and 1) the ready availability of nutritionally adequate and safe foods and 2) the assured ability to acquire personally acceptable foods in socially acceptable ways* (Hamilton et al., 1997).

The United States Food Security Instrument, developed in the early 1990s and used since 1995 to monitor prevalence through the Current Population Survey, consists of 18 questions that deal with various aspects of household food insecurity. The questions represent a range of food insecurity conditions, beginning with questions on the inadequacy of food supplies and money available for food. Worry and concern about having adequate amounts of food are also included in the beginning of the scale. As participants respond to the questionnaire they move to questions that indicate reduced food intake for adults and finally for children (Cohen et al., 1999). The behaviors that the questions refer to generally occur in an ordered sequence as the severity of food insecurity increases. Adults in the household typically worry about having enough food, then stretch household resources and juggle other necessities such as utility bills or rent. They then tend to decrease the quality and variety of household members' diets, and then decrease the frequency and quantity of adults' food intake. Finally, a decrease in the frequency and quantity of children's food intake occurs (Nord, Jemison, and Bickel, 1999; Hamilton et al., 1997).

Cutoff points have been determined that place respondents into one of four categories:

Food Secure: Households show no or minimal evidence of food insecurity.

Food Insecurity with No Hunger Evident: Food insecurity is evident in household concern about adequacy of household supply and the adjustments made by the

household in managing their supplies, including reducing the quality of food and an increase in unusual coping patterns. There is little or no reduction in household members' intake.

Food Insecurity with Hunger Evident: Adults in the household have reduced their food intake to an extent that implies that they have repeated experiences with the physical sensation of hunger.

Food Insecurity with Severe Hunger Evident: For households with children, this level implies that the children's food intake has been reduced to an extent that implies that the children have repeated experiences with the physical sensation of hunger. For households without children and for some adults living in households with children, this level implies a more severe level of household hunger. (Cohen et al., 2000)

Food Insecurity and Poverty

Food insecurity is clearly related to income and poverty, but this relationship is not exact. Not all poor households are food insecure and only a small percentage of U.S. households with below-poverty incomes (13.1 percent in 1996) experience actual hunger (Hamilton et al., 1997). However, more than one -third of poor households are classified by the Core Food Security Module (CFSM) as food insecure while only 8 percent of households with incomes above the poverty line are ranked as food insecure (Hamilton et al., 1997).

Current data indicate that approximately 10 percent of the population living in the United States is food insecure in any given year. This means that 10.5 million households experienced some degree of food insecurity in 1998. Almost 4 million people reached a level of severity great enough that one or more household members were hungry at least sometime during the year. Altogether, 3.4 million children in any given year lived in food insecure households (Nord et al., 2000). High-risk groups tend to have much higher rates of food insecurity as well. Households headed by single women (31 percent) and Latino and African American households (21.8 percent and 20.7 percent, respectively) all have reported higher levels of food insecurity and hunger than the national average (Nord et al., 2000).

Strategies to Combat Food Insecurity in the United States

The federal government, in concert with state and local organizations has implemented a series of programs designed to provide a measure of relief to those experiencing or at risk of hunger. The largest of these is the Food Stamp Program. The Food Stamp Program is clearly targeted at the most needy among the low-income population. Female-headed households with children make up the majority of all participants, and 90 percent of recipients have gross incomes at or below the federal poverty line (Eisinger, 1998). With the exception of Medicaid, no other form of direct public assistance reaches so many poor Americans in any given year. The average monthly participation before the welfare reform legislation in 1996 was 26.6 million people, slightly more than 10 percent of the population (Eisinger, 1998). The average assistance provided by food stamps is $170 per household, or approximately 80 cents per person per meal (Kasper, 2000).

A recent study using data from the National Food Stamp Program Survey conducted by Mathematica Policy Research found that 49.6 percent of food stamp recipients report that they are food insecure. Eligible nonparticipants had a food insecurity rate of 34.2 percent. Of participants who were food insecure, 28.1 percent were insecure without hunger, 16.6 percent experienced moderate hunger, and 4.9 percent were food insecure with severe hunger. This is in contrast to the overall population in the United States below 130 percent of the poverty line; of this group 20.0 percent were food insecure without hunger, 9.3 percent were food insecure with moderate hunger, and 2.6 percent were food insecure with severe hunger (Cohen et al., 1999). The fact that those who are on food stamps have higher rates of food insecurity than the remainder of the food stamp-eligible population implies self-selection whereby those who most need the added food allowance are utilizing the program.

The School Lunch Program is the second largest federal food assistance program. The program provides cash reimbursement to schools for each meal. The program served more than 25 million children in 1996 in more than 93,600 public and private schools at a cost of more than $6 billion (Eisinger, 1998). Lunch is available free to children from families with incomes at or below 125 percent of the poverty line

and at a reduced price to those with incomes between 125–185 percent of the poverty line. Roughly half of all lunches served were free in 1996 (Eisinger, 1998). The School Lunch Program operates in approximately 95 percent of all schools and is available to 42.7 million children. Average participation is approximately 54 percent of all those eligible (Burghardt and Devaney, 1995a). Fewer schools take part in the School Breakfast Program, which operates similarly to the lunch program. Only 6.3 million children were eating breakfast in schools in 1996, despite start-up grants which increased the number of schools participating in the program from half of those with a lunch program to two-thirds (Eisinger, 1998). However, growth in the program has increased to 72 percent of all those eligible from 1995 to 1998, mostly in the free and reduced-price categories. This suggests that the School Breakfast Program is increasingly serving mostly underprivileged children (Kennedy and Davis, 1998).

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a third component of federal programs in combating the effects of food insecurity and hunger. Participation in WIC is open to pregnant and lactating women and children up to 5 years old who are certified by medical personnel to be nutritionally at risk and whose income is less than 185 percent of the federal poverty line. WIC provides a combination of services including food packages, nutrition counseling, and access to health services. The value of the average 1995 WIC package was $43.12/month and the average monthly infant package was $73.74 (Basiotis et al., 1998). WIC is not an entitlement program; participation is limited to the amount of funding provided by the federal and state governments. The number of people served nationally is approximately 7.2 million, although the number of eligible and likely to apply was estimated in 1996 to be between 7.5 and 8 million (Eisinger, 1998).

Consequences of Food Insecurity

Adverse consequences resulting from food insecurity include not only compromised dietary quality and nutritional status but also detrimental outcomes not mediated through nutritional status (UNICEF, 1992). It has been demonstrated in several U.S. subpopulations that hunger or risk of hunger is directly linked to poor physical, social, and mental well-being and to a decreased quality of life (Frongillo

et al., 1999; Rose, 2000). Food insecurity has also been shown to be related to poorer disease management, poorer health status, and increased health care utilization for low-income persons with chronic illnesses (Nelson et al., 1998, 2001).

It is well established that chronic and acute malnutrition, even of mild degrees, adversely affects children's cognitive and social development. In nonindustrialized countries, chronic undernutrition has been associated with increased anxiety, attention deficits, increased prevalence of school absence and tardiness, lower levels of social responsiveness, and higher levels of aggression in school-age children (Grantham-McGregor, 2000; Simeon, 1990). Among school-age children in the US, undernutrition manifested as short stature and thinness have been shown to affect short-term memory and other measures of cognitive function, even after poverty levels have been taken into consideration (Korenman et al., 1995; Geltman et al., 1996). Even at levels of hunger that are not severe enough to result in clinical symptoms, adverse cognitive and behavioral development have been demonstrated. Fatigue, irritability, dizziness, frequent headaches, frequent colds and infections, and difficulty concentrating have all been shown to be associated with childhood hunger in the United States (Lewit et al., 1997).

Food Insecurity and Cognitive Development in Children

The only study available in the literature focusing on effects of food insecurity on cognitive and social development of children in the United States is the analysis of Kleinman et al. (1998), in which the relationship of dysfunctional behavior to risk of hunger was investigated in a sample of several hundred children less than 12 years old in Pennsylvania. The data were drawn from one of the Community Childhood Hunger Identification Project studies, using a set of questions that were among the precursors for the current U.S. instrument to measure risk of hunger. Children who were hungry were categorized as more socially dysfunctional than those at risk for hunger, who in turn were ranked as more dysfunctional than those who were not hungry. Additionally, children who were hungry or at risk for hunger were more likely to be receiving special-education services, more likely to have a past or current history of mental health counseling, and more likely to have had to repeat a grade. Furthermore, hungry and at-risk children

scored higher on aggression and irritability scales and were more likely to engage in fighting and stealing behavior than other children.

METHODS

Data Source

This investigation utilizes data collected from the Early Childhood Longitudinal Study of Kindergartners (ECLS-K), a nationally representative sample of more than 20,929 children attending 1,000 public and private schools in the United States. Data were collected in fall 1998 and spring 1999 by the National Center for Education Statistics (NCES). Children were selected from both public and private kindergartens, offering both full- and half-day programs. The sample was designed to support separate estimates of public and private school kindergartners; African American, white, and Asian children; and children by socioeconomic status. This report examines data from the fall measures only, with the exception of the food security variables, which were asked only in the spring but designed to cover the previous 12 months.

Sampling Design

The sample design was a dual-frame, multistage cluster sample. Primary Sampling Units (PSUs) consisted of 100 counties which were selected first. Schools within the PSUs were then randomly selected from within these 100 counties, with public and private schools selected from separate sampling frames. Approximately 23 kindergartners were then randomly chosen from each school. Approximately 55 percent of the sample was enrolled in full-day kindergarten and 45 percent in part-day kindergarten.

Data Collection Methods

In fall 1998—i.e., entry into kindergarten—data were collected using several different mechanisms including direct observation, face to face interviews, phone interviews, and self-administered questionnaires. Trained project staff were sent to the schools attended by the sampled children. Children

were asked to participate in activities designed to measure important cognitive and noncognitive (e.g., social skills) outcomes. All of these measures were obtained through untimed one-on-one assessment of the child.

Concurrently, parents of the children were interviewed by phone at home, and a wealth of sociodemographic information was collected relating to the children's home and school environment. If a family did not have a phone, they were interviewed in person. A series of questionnaires were mailed to the children's teachers and to school administrators of the schools that sampled children attended. Teachers were asked about their own backgrounds, teaching practices, and experience. They were also asked to evaluate each child in comparison to other children in their classrooms in terms of social and cognitive ability. They were also asked questions relating to the classroom environment. School administrators were asked to provide information on the physical, organizational, and fiscal characteristics of their schools and on the school's programs and learning environment. All of these data collection methods were repeated in spring 1999.

Height and weight were also measured at both fall and spring surveys. Fine and gross motor skills were observed as well. Food insecurity was measured in the spring of the kindergarten year only. Assessments and surveys were administered in English and Spanish.

The items used in the direct child assessment were developed by the ECLS-K staff with input from early childhood development experts, curriculum specialists, elementary school teachers, and psychometricians. Other items were adapted from existing instruments such as the Child's Cognitive Battery, the Peabody Individual Achievement Test, the Peabody Picture Vocabulary Test, the Primary Test of Cognitive Skills, and the Woodcock-Johnson Psycho-Educational Battery-Revised. NCES conducted several field and pilot tests to assure that the instruments used were sound.

The social and emotional development assessment was provided by the children's parents and by teachers to obtain information on both home and school life. Aspects of social skills include cooperation, assertion, responsibility, and self-control. The main instrument for measuring children's social

development was an adaptation of Gresham and Elliott's Social Skills Rating System (SSRS), which was used for both the teacher and parent questionnaires.

The variety of different assessment types was designed to measure children in the home and school environment. Parents, teachers, and independent observers evaluated children's abilities, and thus while there are several different measures of cognitive and social ability, these are not the same concepts measured by different people, but rather a complete picture of children's abilities. The cognitive ability score as determined by the trained independent observer (direct assessment) differs from other measures of cognitive and social ability in that it is the only measure not dependent upon ranking. All teacher measures involve a ranking system that compares children to other children, and parent scores ask parents to rank how their child performs relative to other children. Only the direct assessment measure is based upon performance on tests of math, literacy, and general knowledge.

Both the direct assessment and teacher-ranked cognitive ability consisted of three separate variables measuring math, literacy, and general knowledge. Parent-rated social ability was designed to evaluate children's social behavior outside of school and consisted of five variables measuring self-control, sadness/loneliness, impulsive/overactive behavior, approaches to learning, and social interaction. Teacher-rated social ability was intended to measure children's social ability within the school environment and contained some, but not all, of the same measures included in the parents' measure. Teacher-rated social ability variables include approaches to learning, self-control, interpersonal skills, internalizing behavior, and externalizing behavior.

The U.S. Food Security Instrument was used to determine household food security. Demographic and socioeconomic variables were collected from the parent interview in both fall and spring. Information regarding the family structure, respondent parents' marital status, household income, child's birthweight, and other variables were collected at these interviews.

ANALYSIS

Construction of Dependent Variables

Cognitive and Social Abilities: Factor analyses were conducted on the entire set of cognitive and social variables to elucidate the underlying structure. A priori, Eigenvalues greater than 1.0 were the criterion for retention of a factor (Kim and Mueller, 1978); in fact, on analysis all were greater than 2.0. Scree plots were examined. The analysis revealed that for both the teacher and the independent observer, scores of math, reading, and general knowledge, a single factor represented cognitive ability. This was true for both fall and spring data. Mean values of the three measures were combined to form one measure each of cognitive ability for independent observer and teacher-reported scores. For the social skills variables, the five parent variables loaded onto two factors. This was true for both the fall and spring data and the same variables loaded together at both time points. Approaches to learning and social interaction formed one factor, while self-control, sad/lonely, and impulsive/overactive loaded onto another factor. The first social variable appears to reflect children's interaction abilities while the second represents emotional state. For the teacher measures, all of the social interaction variables loaded onto one factor. As with the cognitive variables, means scores across the items were used.

Table 1 demonstrates means and standard deviations for the cognitive and social ability ratings from independent observers, parents, and teachers. The cognitive teacher measure is a 0–5 scale; all other measures except for the independent observer score are a four-point scale. Scores for the independent observer measure are out of a possible 72. The tests were designed for use in both kindergarten and first grade, so none of the children was expected to achieve a perfect score.

Anthropometric variables: Weight-for-age, weight-for-height, and height-for-age Z scores relative to the standard reference population of healthy children used both in the United States and internationally were calculated using EpiInfo 2000's NutStat program. Accepted cutoffs for over- and undernutrition are greater than +2.0 Z scores and –2.0 Z scores, respectively (WHO, 1995). Body Mass Index (BMI) was calculated using the formula (weight in kilograms)/height in meters^2. BMI for age

TABLE 1
Social and Cognitive Variables

	N	Mean and Standard Deviation
Cognitive ability, independent observer	21,042	21.12 ± 6.23 (8.39-55.39)
Cognitive ability, teacher rating	21,042	2.59 ± .68 (1.00-5.00)
Social ability I, parent rated (self-control, sad/lonely, impulsive/overactive)	21,042	2.12 ± .26 (1.00-3.45)
Interaction abilities, parent (approaches to learning, social interaction)	21,042	3.21 ± .45 (1.00-4.00)
Social ability, teacher rating	21,042	2.44 ± .25 (1.20-3.53)

Note: Figures in parentheses indicate range of scores.

percentiles were calculated using the Centers for Disease Control and Prevention's newly released growth charts. These charts were created using anthropometric data from several national data sets such as HES I and II and NHANES I,II,III . They can be used from ages 2 to 20 years and allow for a comparison of children from both racially and ethnically diverse backgrounds. Those over the 95th percentile for BMI-for-age are considered overweight. Those below the 5th percentile are considered underweight (CDC, 2001).

Analysis

Descriptive statistics were computed and examined for each variable. All variables were examined for outliers. Appropriate sampling weights provided by the ECLS-K staff were used for all analyses so that results would be representative of the U.S. population.

Bivariate correlations were computed to detect associations between the dependent variables and continuous independent variables. Those variables that correlated at .100 or higher with the cognitive variables and .075 for the social variables (in general, correlates with the social outcome measures were smaller than those of the cognitive) were considered for multivariate modeling. One-way ANOVA tests were computed to identify differences in means between continuous and categorical variables. Because the large sample size of this study had the potential to have statistically significant, but meaningless differences, variables that were not significant at the .001 level were considered for elimination.

Stepwise regression analyses were also conducted to eliminate redundant variables. Variables were grouped according to topic, and those that were considered to be overlapping concepts were forced into a model together using the stepwise regression technique. Those that were the greatest contributors to the variance in the dependent variables were kept for further analyses. Significance, due to the large sample size, was limited to $p<.001$.

Those variables that proved to be significant in the bivariate analyses were further investigated using multivariate linear regression analyses in which control variables that were associated with the dependent variable and had a theoretically justifiable basis for inclusion were added to the regression

model consisting of cognitive and social ability scores and food security level. Logistic regression analyses were used to explore predictors of dichotomous anthropometric variables (overweight, underweight, short stature). Regressions were carried out in SPSS version 11.0 using forward selection. Selection criteria were .01 for variable entry and .05 for variable removal.

RESULTS

Demographic characteristics of the study population are presented in Tables 2 and 3. The average age of children in the study was between 5 and 6 years with a range from 4.5 to 6.6 years. Mothers' average age was slightly lower than fathers' age, although both had a wide range of values from teenagers to octogenarians. Mothers' average age at first birth was 23 years, with a wide range from teenagers to women in their late 40s. Household income also had a wide distribution, with some households reporting no income and others reporting over $200,000 . Mean household size was around 4.5 members, with approximately half of those being less than 18 years old (Table 2).

Table 3 displays the distribution of several important demographic variables. The sample was 55 percent white, 18 percent Latino, and 15 percent African American, with small representations of other ethnic groups. Slightly more than 13 percent of mothers had completed less than a high school education; more than 29 percent of mothers had completed a university education or more. Nearly 80 percent of the sample was urban-dwelling.

The distributions of other potential demographic and control variables are shown below (Tables 4 and 5). These variables are divided between current and previous time periods in order to differentiate between events that could be concurrently affecting cognitive and social ability and those that predate the measures used in this study.

As can be seen from Table 4, the majority of parents in the study were married, although 13.5 percent had never married. Respondents lived throughout the nation, with the South more highly represented than other regions. The vast majority of households spoke English (although not necessarily as a first language). Spanish was the language spoken by the majority of non-English speakers (data not

TABLE 2
Demographic Profile of the Sample
(N=21,042)

	N	Mean and Standard Deviation
Age of child (months)	18,780	68.44 ± 4.30 (54.00-79.00)*
Age of mother (years)	17,384	32.89 ± 6.66 (18-83)
Age of father (years)	13,800	35.88 ± 7.01 (16-85)
Mother's age at first birth (years)	16,803	23.47 ± 5.41 (12-49)
Household income ($/year)	19,784	46,656.75 ± 35,893.57 (0-200,050)
Household size (# of persons)	17,762	4.52 ± 1.02 (2-17)
Number in the household less than 18 years old	17,762	2.50 ± 1.18 (1-11)

Note: Figures in parentheses indicate minimum and maximum values.

TABLE 3
Distribution of Demographic Variables

Demographic Variable	N	Percent
Child ethnicity		
White	11,476	55.1
African American	3,196	15.3
Latino	3,729	17.9
Asian/Pacific Islander	1,553	7.5
Native American	376	1.8
Other	504	2.4
Total	**20,834**	**100.0**
Mother's education		
Less than high school diploma	2,133	13.3
High school diploma	5,044	31.4
Some college/voc.tech	4,184	26.0
Bachelor's/some graduate	3,014	18.7
Graduate school degree	1,703	10.6
Total	**16,078**	**100.0**
Residence		
Urban	16,652	79.7
Rural	4,251	20.3
Total	**20,903**	**100.0**
Child sex		
Male	10,667	51.1
Female	10,223	48.9
Total	**20,890**	**100.0**

TABLE 4
Current Situation

	N	Percent
Marital status		
Married	12,908	69.5
Separated	875	4.7
Divorced	1,676	9.0
Widowed	151	0.8
Never married	2,505	13.5
No biological/adoptive parent	471	2.5
Total	**18,586**	**100.0**
Region		
Northeast	3,830	18.3
Midwest	5,189	24.8
South	6,993	33.5
West	4,891	23.4
Total	**20,903**	**100.0**
Home language		
English	16,905	86.0
Non-English	2,745	14.0
Total	**21,399**	**100.0**
Current type of nonparental care		
No nonparental care	9,172	52.2
Relative care	3,250	18.5
Nonrelative care	1,746	9.9
Head Start	3,031	17.2
Center-based program	146	0.8
Two or more types of programs	237	1.3
Total	**17,582**	**99.9**
Mother's current employment status		
35 hours or more	7,917	45.8
Less than 35 hours	3,722	21.5
Looking for work	685	4.0
Not in labor force	4,978	28.8
Total	**17,302**	**100.1**

(table continues)

TABLE 4, continued

	N	Percent
Parent rating of child health		
Excellent	8,964	50.6
Very good	5,721	32.3
Good	2,501	14.1
Fair	495	2.8
Poor	39	0.2
Total	**17,720**	**100.0**
Child's last visit for routine health care		
Never	74	0.4
Less than 6 months ago	10,360	56.1
6 months to 1 year ago	7,087	38.3
1–2 years ago	889	4.8
More than 2 years ago	70	0.4
Total	**18,480**	**100.0**

Note: Percentages may not add to 100 due to rounding.

shown). The majority of parents did not have their children in nonparental care—this differs markedly from the data obtained regarding nonparental care prekindergarten, where the majority of parents had their children placed in some form of day-care—predominantly center-based care (see Table 5). Relative care edged out Head Start for second most utilized type of current day care. Mothers' current employment status reflects the need for children to be in day care or school since 46 percent of participants work 35 hours or more a week. It would appear that children entering kindergarten reduces the need most families have for nonparental care for their children. An additional 21 percent of the sample work less than 35 hours such that almost 70 percent of the sample is composed of mothers who work outside of the home for some period of time each week. Overall, parents rated the vast majority of children as having either good or excellent health, and most children had been to the doctor for within the last 6 months. An additional third of the children had been to the doctor for routine care within the last year.

A quarter of the sample had experienced some form of money problems since the birth of the child in this study while three-quarters of mothers had worked at some time between the birth of the child and the start of kindergarten (Table 5). The majority of mothers were married at birth, although nearly 30 percent were not. This is comparable to other nationally representative studies where unmarried mothers at birth were approximately 33 percent from 1998 to 2000. (Federal Interagency Forum on Child and Family Statistics, 2002) Almost 20 percent of the sample was reported to have been born more than 2 weeks early, higher than the national average of 11.6 percent reported by the National Center for Health Statistics (CDC, 2002). The overwhelming majority of kindergarteners began school on time. As reported previously, center-based care was the predominant nonparental care choice before kindergarten.

Table 6 shows data relative to public program participation. A smaller percentage of those surveyed participated in AFDC/TANF than in food stamps in the last 12 months. Interestingly, over 45 percent of survey respondents had children enrolled in the WIC program at some point since birth. About one-third of those children surveyed participated in the School Lunch and School Breakfast programs and one-sixth had been in Head Start.

TABLE 5
Previous Conditions

	N	Percentage
Money problems from birth		
Yes	4,283	24.4
No	13,292	75.6
Total	**17,575**	**100.0**
Mom worked between birth and kindergarten		
Yes	13,873	73.6
No	4,972	26.4
Total	**18,845**	**100.0**
Mom married at birth		
Yes	12,898	70.6
No	5,361	29.4
Total	**18,259**	**100.0**
Was child born more than 2 weeks early		
Yes	3,929	19.6
No	16,149	80.4
Total	**19,388**	**100.0**
Enrollment into kindergarten		
Early	409	2.3
When old enough	16,024	90.4
Waited	1,298	7.3
Total	**17,731**	**100.0**
Type of nonparental care prekindergarten		
No nonparental care	3,332	19.3
Relative care	2,418	14.0
Nonrelative care	1,707	9.9
Head Start	1,697	9.8
Center-based program	7,428	43.0
Two or more types of programs	691	4.0
Total	**17,273**	**100.0**

TABLE 6
Public Program Participation

	N	Percent
Participation in AFDC/TANF in the last 12 months		
Yes	2,041	11.6
No	15,585	88.4
Total	**17,626**	**100.0**
Participation in the Food Stamp Program in the last 12 months		
Yes	3,320	18.8
No	14,317	81.2
Total	**17,637**	**100.0**
Participation in the WIC Program		
Yes	7,981	45.5
No	9,541	54.5
Total	**17,522**	**100.0**
Does child receive free or reduced price school lunch?		
Yes	5,748	27.3
No	15,294	72.7
Total	**21,042**	**100.0**
Does child receive school breakfast		
Yes	4,296	36.7
No	7,406	63.3
Total	**11,702**	**100.0**
Was child ever in Head Start		
Yes	2,963	16.4
No	15,076	83.6
Total	**18,039**	**100.0**

Table 7 displays school and teacher variables that could be related to children's cognitive or social abilities. Eighty percent of children sampled attended public schools. The majority of students attended full-day kindergarten although almost as many attended for a half day. Most children's teachers were white and had at least 1 year of graduate school or more. Most students attended schools that had over 300 students.

Food insecurity levels in this population were over 9 percent, with those without hunger at 7.2 percent and those experiencing hunger at 1.9 percent (Table 8). This is lower than the national average for households with children in 1998 when 17.6 percent of families reported being insecure (Nord, 2000). The percentage of ECLS-K households experiencing hunger is higher than those with children that were reported in the Current Population Survey for the same year. It is similar to the rates reported by the CPS for all households experiencing food insecurity in the United States.

Tables 9 and 10 summarize the anthropometric status of the sampled children. More than 80 percent of children were categorized as normal by both the BMI for age and the weight-for-height Z scores. Similar percentages of overweight children are estimated by both measures. The two methods differ in their depiction of underweight, with weight-for-height Z scores categorizing fewer children as underweight compared to the BMI for age measures. A large percentage of children were listed in the normal height Z score range, with almost 3 percent categorized as stunted or low height for age (Table 9). Table 10 illustrates that the prevalences of overweight and underweight among the ECLS-K sample are similar to other national data, with about 10–12 percent of children classified as overweight and very few underweight.

MULTIVARIATE ANALYSES

The following results reflect analyses of the fall observation (start of kindergarten) only. The multivariate models will be presented for each dependent variable in turn.

TABLE 7
School and Teacher Variables

	N	Percent
Type of school		
Public	16,507	80.0
Catholic	2,302	11.0
Other private	1,291	6.1
Other religious	803	3.8
Total	**21,399**	**99.9**
Enrolled in half- or full-day kindergarten		
Half-day	8,649	44.5
Full-day	10,808	55.5
Total	**19,457**	**100.0**
Teacher ethnicity*		
Teacher is Latino	1,226	6.4
Teacher is Native American or Pacific Islander	243	1.3
Teacher is Asian	453	2.3
Teacher is African American	1,265	6.6
Teacher is white	16,099	83.5
Total	**19,286**	**100.1**
Teacher's highest level of education		
High school/associate/bachelor's degree	5,098	30.1
At least 1 year of graduate school	5,987	35.3
Master's degree	5,003	29.5
Education specialist/professional diploma	829	4.9
Doctorate	24	0.1
Total	**16,941**	**99.9**
Total school enrollment		
0–149	832	5.1
150–299	2,950	18.0
300–499	4,852	29.6
500–749	4,262	27.0
750 and above	3,519	21.4
Total	**16,415**	**100.1**

***Teachers could report being both Latino and another ethnicity.
Note: Percentages may not add to 100 due to rounding.

TABLE 8
Food Security

	N	Percent ECLS-K	Percent **CPS, 1998** ***Households with Children***	Percent **CPS, 1998** ***All Households***
Food security status				
Food secure	16,831	90.8	82.4	88.2
Food insecure without hunger	1,337	7.2	16.7	8.1
Food insecure with hunger	360	1.9	0.9	3.7
Total	**18,528**	**100.0**	**100.0**	**100.0**

TABLE 9
Anthropometric Measures

	N	Percent
Weight-for-height Z scores		
Overweight (above +2.0 standard deviations)	1,986	10.6
Normal weight (between –2 and +2)	16,460	88.1
Underweight (below –2.0)	239	1.3
Total	**18,685**	**100.0**
Height-for-age Z scores		
Normal height (between –2 and +2)	17,562	94.0
Stunted (less than –2.0)	518	2.8
Tall (above +2.0)	609	3.3
Total	**18,689**	**100.1**
Body mass index (based on BMI for age)		
Overweight	2,070	11.0
Normal weight	15,828	84.3
Underweight	882	4.7
Total	**18,780**	**100.0**

Note: Percentages may not add to 100 due to rounding.

TABLE 10
Comparison of Overweight and Underweight with National Data

	ECLS-K (4–7 years old) BMI for Age		NHANES III (6–11 years old) BMI for Age	
	Males	Females	Males	Females
Overweight	10.0	12.1	11.8[1]	11.0[1]
Underweight	2.4	6.6	3.3[2]	4.7[2]

[1]Source: NHANES, 2002.
[2]Source: Wang et al., 2002.

Cognitive Ability, Direct Assessment (Table 11)

Results from the cognitive ability analyses demonstrate that food insecurity does not have a significant impact on cognitive scores. Significant predictors included child language skills and fine motor skills, household income as a percentage of poverty, child's age, mother's age at first birth, and parental education. Another significant variable was the number of books the child owns, independent of other variables. Negative predictors of cognitive performance were participation in reduced-price school lunch (perhaps a surrogate for low income) and parental belief that the child is not as good as other children. The R^2 for the model was .535, indicating that as a whole it contributes 54 percent of the variance in cognitive ability as measured by direct assessment by an independent observer.

Cognitive Ability as Rated by Teachers (Table 12)

Some of the same variables that appear in the model predicting independently measured cognitive performance also predict teacher-rated cognitive ability. These include child's age, fine motor skills and language skills, free or reduced-price school lunch participation (negative), and parents' belief that the child is not as good as other children (negative). Other significant variables in predicting teachers' ratings were private school (as opposed to public), geographical region (Northeastern children being rated higher), and nonparental child care prior to kindergarten entry. The R^2 for the model was .243, indicating that the model accounts for 24 percent of the variance in cognitive ability as evaluated by the teacher in the fall of kindergarten.

Emotional State, Evaluated by Parent (Table 13)

As previously mentioned, factor analyses ranked the social ability variables into two groups. The first domain to be evaluated is the Self Control/Sadness/Loneliness/Impulsive and Overactive variable (Emotional State). Food insecurity was statistically significant and negatively associated with Emotional State. In this model most variables were in the expected direction, but fine motor skills was statistically significant but negatively associated. Families with no siblings in the household were positively

TABLE 11
Model Predicting Cognitive Ability, Direct Assessment by Independent Observer

Variable	B	SE B	Beta	T	Significance	Adjusted R Square
Child's language skills[1]						.261
Average language skills	1.82	.104	.136	17.60	.000	
Above average language skills	5.56	.111	.422	50.34	.000	
Percent of poverty line	.003	.000	.097	13.30	.000	.357
Fine motor skills	.482	.020	.153	24.71	.000	.415
Child age in months	.281	.009	.189	32.74	.000	.445
Mother's age at first birth	.142	.008	.120	17.60	.000	.469
Parents' belief that child is not as good as other children	-2.26	.105	-.129	-21.49	.000	.487
How many books child owns	.010	.001	.095	15.43	.000	.504
Highest education of either parent[2]						.520
Bachelor's degree/some grad school	-.402	.155	-.030	-2.959	.003	
Graduate school degree	1.10	.101	.070	10.855	.038	
Reduced or free school lunch	-.932	.094	-.065	-9.940	.000	**.535**

[1] Reference case is below average language skills.
[2] Reference case is high school education or below.

Variables tested that did not reach statistical significance also include: family structure, happiness of marital relationship, marital status, if mother was married at birth, if child was enrolled in kindergarten on time, race of mother, father, and child, gender of child, region of the country, urban or rural residence, parental ratings of their child and their own health, length of time since child's last visit to the doctor, if the child was born more than two weeks early, language of the interview, language used at home, month of assessment, if the family had experienced money problems since the birth of the child, use of food stamps in the last 12 months, use of AFDC/TANF, food stamps in the last 12 months, WIC participation, receipt of the school breakfast program, if the child was enrolled in Title 1 reading or math programs, if the child had attended a half- or a full-day of kindergarten, mother and father's current age, days breakfast was consumed together, number in the household under 18 years, total days absent from school, hours of television watched on the weekend, age at kindergarten entry, Head Start participation, and the number of days child was born premature.

TABLE 12
Model Predicting Teacher-Evaluated Cognitive Ability

Variable	B	SE B	Beta	T	Significance	Adjusted R Square
Child's language skills[1]						.163
Average	.232	.013	.166	17.63	.000	
Above average	.522	.014	.375	37.24	.000	
Private school	.197	.012	.120	16.98	.000	.188
Fine motor skills	.031	.002	.095	12.53	.000	.204
Free or reduced school lunch	-.142	.013	-.094	-10.97	.000	.217
Region of the country[2]						
Other than Northeast	-.117	.012	-.068	-9.83	.000	.223
Child age in months	.016	.001	.103	14.58	.000	.230
Parents' belief that child is not as good as other children	-.181	.013	-.101	-13.79	.000	.237
Nonparental care pre-k[3]						**.243**
Other than center based care	.028	.013	.020	2.16	.000	
Center based care	.146	.013	.108	11.20	.000	

[1]Reference case is less than average language skills.
[2]Reference case is northeast region.
[3]Reference case is no nonparental care.

Variables tested that did not reach statistical significance also include: family structure, happiness of marital relationship, marital status, if mother was married at birth, if child was enrolled in kindergarten on time, highest degree expected of child, race of mother, father, and child, gender of child, urban or rural residence, parental ratings of their child and their own health, length of time since child's last visit to the doctor, if the child was born more than two weeks early, language of the interview, language used at home, month of assessment, current maternal employment, if mother worked between birth and kindergarten, if the family had experienced money problems since the birth of the child, history of enrollment in WIC, money problems since birth, use of food stamps in the last 12 months, use of AFDC/TANF in the last 12 months, receipt of the school breakfast program, if the child had attended a half- or a full-day of kindergarten, gross motor skills, mother's age at first birth, number of books owned, household income, child's age in months, mother and father's current age, number in the household, total days absent from school, hours of television watched on the weekend, days family eats breakfast together, age at kindergarten entry.

TABLE 13
Model Predicting Parent-Rated Child Emotional State

Variable	B	SE B	Beta	T	Significance	Adjusted R Square
Family structure[1]						
No siblings	.065	.006	.093	10.82	.000	.116
Mother's ethnicity[2]						
African American	.069	.006	.093	11.79	.000	.127
Asian/Pacific Islander	.063	.009	.055	7.16	.000	
Other	-.001	.005	-.002	-.265	.791	
Teacher rated structured play comparison[3]						.134
About the same activity as others	-.002	.006	-.004	-.381	.703	
More active than others	.050	.007	.082	7.63	.000	
Money problems since birth of child	.037	.005	.062	7.95	.000	.141
Fine motor skills	-.007	.001	-.053	-6.89	.000	.147
Number in the household less than 18 years	-.014	.002	-.061	-7.14	.000	.153
Food insecurity	-.056	.007	-.058	-7.46	.000	**.159**

[1] Reference case is Parent(s) plus siblings
[2] Reference case is Caucasian
[3] Reference case is lower activity level

Variables tested that did not reach statistical significance also include: happiness of marital relationship, highest education level of either parent, highest degree expected of child, race of father, urban or rural residence, length of time since child's last visit to the doctor, language of the interview, language used at home, month of assessment, current maternal employment, enrollment in WIC since birth, use of food stamps in the last 12 months, use of AFDC/TANF in the last 12 months, receipt of free or reduced-price school lunches, receipt of the school breakfast program, if child was ever enrolled in Head Start, type of nonparental care pre-k and currently, if the child had attended a half- or a full-day of kindergarten, child's language skills, Title 1 math and reading participation, type of school, parents' occupation, gross motor skills, mother's age at first birth, number of books owned, household income, number in the household, number of days family eats breakfast together, age at kindergarten entry.

associated with emotional state when compared to those with sibling in the household. Mother's ethnicity was significant and positively associated for Latinos and Asian/Pacific Islanders when compared to whites.

Teachers' ranking of structured play activity was also significant and positive for those with more activity than others when compared to those with lower activity levels. Number of children in the household was negatively and significantly associated with emotional state, while money problems since birth had a positive and significant association. The R^2 for the model was .159, indicating that the variables together accounted for almost 16 percent of the variance in Emotional State score.

Interaction Abilities, Parent-Rated (Table 14)

The second social ability variable consists of Approaches to Learning and Social Interaction Abilities (Interaction Abilities) as ranked by children's parents. Because these variables represent very different domains of social ability from the first parent-ranked social ability score (Emotional State), many of the variables that were significant in this model differ. However, food insecurity was also significantly associated with Interaction Abilities, indicating that those who are food insecure are more likely to have lower social ability scores.

All variables were in the expected direction. How many books a child owns was positively associated with Interaction Abilities. Children with less than excellent health as rated by their parents had a negative association with Interaction Abilities when compared to those children in excellent health. Spanish spoken in the home was also negatively associated with Interaction Abilities. Both average and above-average language skills were positively associated with Interaction Abilities when compared with those with below-average language skills. Parents' expectation that their child will complete undergraduate or higher education and being female were also positively associated with Interaction Abilities. Fine motor skills and education greater than high school for either parent when compared to those with below high school education were both positively associated with Interaction Abilities as well.

TABLE 14
Model Predicting Parent-Rated Social Interaction

Variable	B	SE B	Beta	T	Significance	Adjusted R Square
How many books child owns	.007	.000	.105	12.67	.000	.039
Other than excellent child health	-.102	.007	-.116	-15.53	.000	.060
Spanish spoken at home	-.147	.011	-.109	-12.91	.000	.076
Child's language skills[1]						.088
Average	.064	.009	.069	6.93	.000	
Above average	.121	.010	.133	12.52	.000	
Highest education expected of child[2]						
Undergraduate or greater	.100	.011	.068	8.79	.000	.095
Child is female	.069	.014	.039	10.58	.000	.102
Fine motor skills	.019	.002	.056	7.00	.000	.108
Highest education of either parent[3]						.114
More than high school	.093	.012	.062	7.82	.000	
Food insecurity	-.074	.012	-.046	-6.18	.000	.119

[1]Reference case is Below Average Language Skills.
[2]Reference case is High School Education.
[3]Reference case is Less than High School Education.

Variables tested that did not reach statistical significance also include: family structure, marital status, if child was enrolled in kindergarten on time, race of father and child, urban or rural residence, parental ratings of their child and their own health, length of time since child's last visit to the doctor, respondent's health status, language of the interview, month of assessment, current maternal employment, if mother worked between birth and kindergarten, if the family had experienced money problems since the birth of the child, enrollment in WIC since birth, use of food stamps in the last 12 months, use of AFDC/TANF in the last 12 months, receipt of free or reduced-price school lunch, receipt of the school breakfast program, if child ever in Head Start, type of nonparental care pre-k and currently, Title 1 reading participation, if the child had attended a half- or a full-day of kindergarten, type of school, parents' occupation, gross motor skills, mother's age at first birth, number of books owned, household income, child's age in months, number in the household, days family eats breakfast together, age at kindergarten entry.

The R^2 for the model was .119, indicating that 12 percent of the variance in social interaction abilities was accounted for by the variables included in this model.

Variables tested that did not reach statistical significance also include: family structure, marital status, if child was enrolled in kindergarten on time, race of father and child, urban or rural residence, parental ratings of their child and their own health, length of time since child's last visit to the doctor, respondent's health status, language of the interview, month of assessment, current maternal employment, if mother worked between birth and kindergarten, if the family had experienced money problems since the birth of the child, enrollment in WIC since birth, use of food stamps in the last 12 months, use of AFDC/TANF in the last 12 months, receipt of free or reduced-price school lunch, receipt of the school breakfast program, if child had ever been in Head Start, type of nonparental care pre-K and currently, Title 1 reading participation, if the child had attended a half- or a full-day of kindergarten, type of school, parents' occupation, gross motor skills, mother's age at first birth, number of books owned, household income, child's age in months, number in the household, days family eats breakfast together, and age at kindergarten entry.

Teacher-Rated Social Ability (Table 15)

Children's social ability was also rated by their teachers to provide a home and away indication of children's social skills. The domains that constitute this variable share only some similarities with the parental social ability domains. As with the parent-rated social ability measures, food insecurity was associated with teacher-rated social ability.

Fine motor skills were positively associated with social ability. Parents' belief that their child was not as good as others was negatively associated with social ability. Female gender was also related to social scores. Teacher-rated activity levels were also significant but was negatively associated for those ranked as more active compared to those who were less active than others. Perhaps teachers see these children as hyperactive and it affects their social rankings. All categories of children's language skills

TABLE 15
Model Predicting Teacher-Rated Social Ability

Variable	B	SE B	Beta	T	Significance	Adjusted R Square
Child's language skills[2]						.069
Average language skills	.066	.005	.127	12.73	.000	
Above average language skills	.143	.006	.277	25.90	.000	
Teacher rated structured play comparison[1]						.094
About the same activity level	.002	.005	.003	.283	.777	
More active activity level	-.067	.006	-.115	-10.93	.000	
Food insecurity	-.141	.007	-.016	-12.14	.000	.114
Fine motor skills	.012	.001	.097	12.45	.000	.126
Parents' belief that child is not as good as other children	-.065	.005	-.099	-12.45	.000	.135
Child is female	.033	.004	.067	8.88	.000	**.140**

[1]Reference case is Less Than Average Activity
[2]Reference case is Below Average Language Skills

Variables tested that did not reach statistical significance also include: family structure, state of partner's relationship, marital status, if mother was married at child birth, race of mother and father, respondent's health status, language of the interview, language used at home, month of assessment, current maternal employment, if the family had experienced money problems since the birth of the child, enrollment in WIC since birth, use of food stamps in the last 12 months, use of AFDC/TANF in the last 12 months, receipt of free or reduced-price school lunch, receipt of the school breakfast program, if child ever in Head Start, type of nonparental care pre-k and currently, if child watched Sesame Street pre-k, Title 1 math participation, parents' occupation, gross motor skills, mother's age at first birth, number of books owned, household income, child's age in months, number in the household, days family eats breakfast together, age at kindergarten entry, hours of television watched on weekends, child's age in months, total days absent from school, age of mother.

were significant and in the anticipated direction. Overall the R^2 for the model was.140, indicating that 14 percent of the variance in social ability according to the teachers was accounted for in this model.

In summary, food insecurity was a significant predictor of social ability in all three measurements. Given that the study was designed to measure children in both the home and school environment, it is not surprising that some of the other variables related to these outcomes are not the same.

Anthropometric Status

Overweight (Table 16): As stated previously, children were placed into normal and overweight categories based on their weight-for-height Z score. The probability of being overweight was significantly predicted by birth weight, by parental education lower than a bachelor's degree, and by physical activity variables (number of hours of television watched on weekends and teacher-rated activity level at play average or lower). A history of participation in the WIC program was positively associated with overweight. Food insecurity had no independent effect. The Hosmer and Lemeshow Chi-Square Goodness of Fit test was 6.77 with a significance of .561, demonstrating that the model fit reasonably well. The classification table for the data showed that the model classifies the data correctly 89.4 percent of the time. The area under the ROC curve encompassed 62.4 percent.

Underweight (Table 17): Food Insecurity was not significantly associated with the probability of being underweight. Lower birthweight and Asian ethnicity were positively associated with the probability of being underweight. The odds ratio of .924 for weight at birth demonstrates that the greater the weight, the lower probability that the child is currently underweight. Asians were 2.14 times more likely to be underweight than other ethnicities. The Hosmer and Lemeshow Chi-Square Goodness of Fit statistic was 6.76, $p<.562$, indicating that the model fit reasonably well. The classification table demonstrated that the model classifies the data correctly 98.8 percent of the time and the area under the ROC curve was 66.1 percent.

TABLE 16
Logistic Model Predicting Probability of Overweight

Variable	Coefficient	Odds Ratio	Significance	95% CI
Number of hours television watched on weekends	.025	1.03	.000	1.01-1.04
Weight at birth in ounces	.015	1.02	.000	1.01-1.02
Highest education of either parent[1]				
Bachelor's degree or higher	-.336	.715	.000	.629-.813
Teacher rated unstructured play comparison[2]				
Average activity as others	-.437	.646	.000	.565-.739
More activity than others	-.489	.613	.000	.524-.718
WIC participant	.358	1.43	.000	1.28-1.61
Food insecurity	.014	1.01	.876	.854-1.20

[1]Reference case is Less than an Undergraduate Diploma.
[2]Reference case is Less than Average Activity.

Variables tested that did not reach statistical significance also include: age at first birth, household income, number of days family eats breakfast together, hours spent in nonparental care, state of partner's relationship, marital status, mother being married at birth, highest education of either parent, degree expected for child, mother's occupation, father's occupation, race of mother, race of father, gender of child, region of the country, parental rating of child health, respondent's health status, child born more than two weeks early, language used at home, maternal employment, mom worked between birth and kindergarten, child on WIC, AFDC in last 12 months, food stamps in last 12 months, school lunch program, school breakfast, Head Start participation, type of day care, type of day care pre-k, structured play comparison, unstructured play comparison, language skills of child.

TABLE 17
Logistic Model Predicting Probability of Underweight

Variable	Coefficient	Odds Ratio	Significance	95% CI
Weight at birth in ounces	-.020	.924	.000	.978-.983
Child ethnicity				
Asian/Pacific Islander	.762	2.14	.000	1.73-2.66
Food insecurity	.064	1.07	.790	.667-1.70

Variables tested that did not reach statistical significance also include: age at first birth, household income, number of days family eats breakfast together, hours spent in nonparental care, state of partner's relationship, marital status, mother being married at birth, highest education of either parent, degree expected for child, mother's occupation, father's occupation, race of mother, race of father, gender of child, region of the country, parental rating of child health, respondent's health status, child born more than two weeks early, language used at home, maternal employment, mom worked between birth and kindergarten, child on WIC, AFDC in last 12 months, food stamps in last 12 months, school lunch program, school breakfast, Head Start participation, type of day care, type of day care pre-k, structured play comparison, unstructured play comparison, language skills of child.

Short Stature (Table 18): Children were categorized into stunted and normal based on their height-for-age Z score. Variables associated with the probability of stunting were few. Food insecurity was not significant. Number of children in the household under 18 was positively significant. Weight at birth was negatively associated with the probability of short stature, as was a history of premature delivery. Finally, being female was negatively associated with the probability of being short. The odds of short stature for females was .686 times that of males. The Hosmer and Lemeshow Chi-Square Goodness of Fit for the model was 6.007, P<.646, showing that the model fit. The classification table showed that the model classifies the data correctly 97.4 percent of the time. The ROC curve encompassed 69.3 percent of the data.

DISCUSSION

Cognitive and Social Ability

The assessment of cognitive and social skills is complex, since a wide variety of temperament and personality characteristics, environmental and contextual variables, and the cumulative experiences of the child interact to influence the behaviors and skills observed and tested. Children demonstrate different skills depending on the environments in which they are interacting. For this reason items that are associated with abilities at home may not predict behavior observed in the school environment and vice versa. It would also appear that many factors make small contributions to children's overall cognitive and social ability, and thus interventions geared toward improvement in ability may have to be multifaceted and interdisciplinary to have an effect.

When controlled for child age, ethnicity, type of school environment, and language and motor skills, knowledge and skills (reading, math, and general knowledge) assessed by an independent observer were significantly predicted by household income and by proxy variables for income such as participation in free and reduced-price school lunch. A number of parental and parenting variables also were significant predictors, including slightly older mother age at first birth, parents feeling about the child's worth in

TABLE 18
Logistic Model Predicting Probability of Short Stature

Variable	Coefficient	Odds Ratio	Significance	95% CI
Number in the household under 18 years	.153	1.17	.000	1.08-1.25
Weight at birth in ounces	-.033	.968	.000	.963-.973
Female	-.377	.686	.000	.564-.834
Number of days premature	-.015	.985	.000	.978-.992
Food insecurity	.175	1.19	.272	.872-1.63

Variables tested that did not reach statistical significance also include: age at first birth, father's age, number of places child has lived, age at first nonparental care, % of poverty line, state of partner's relationship, marital status, highest education of either parent, degree expected for child, mother's occupation, father's occupation, race of mother, race of father, race of child, region of country, parental rating of child health, respondent's health status, language used at home, current maternal employment, mom worked between birth and kindergarten, child on WIC, AFDC in last 12 months, food stamps in last 12 months, school lunch, school breakfast, days of day-care pre-k, language skills of child.

relation to other children, and the number of books the child owned. Household food insecurity was not an independent predictor of cognitive performance. The multivariate model predicting this variable was quite powerful, predicting 58 percent of the variance in scores.

Cognitive ability assessed by teachers was related to a rather different set of variables, with some school and teacher variables providing relevant predictors of performance. Private school was associated with higher cognitive scores and those children that teachers felt had average or above average language skills were predictors of cognitive ability. Parental belief in a child's ability remained significant. Participation in free or reduced-price school meals was negatively associated with teachers' evaluations of cognitive performance. Neither household income nor food insecurity was related to these assessments.

In contrast to cognitive measures, household food insecurity figured significantly in models predicting social interaction skills and emotional state. These observations are consistent with data from other investigators (Kleinman et al., 1998; Murphy et al., 1998; Wehler et al., 1995) on children of a wider age range (up to 12 years). Adolescents have also been shown to be particularly emotionally vulnerable in food insecure households (Alaimo et al., 2002, 2001). It is possible that the food insecurity variable serves as a proxy for the combination of absolute economic resource limitation coupled with a degree of household anxiety or disorganization (whether or not stemming from the food insecurity) that together create an environment in which children's emotional health is compromised.

Social interaction ability (learning style, interactions around learning) as rated by teachers was higher, other things being equal, for girls, and for those with average or above-average language skills. Interestingly, household food insecurity also negatively and independently predicted this variable, while household income and other proxy variables for income were not significant predictors. We may speculate that for young children, household food security indexes a combination of poverty and household disorganization or anxiety that is particularly important for emotional development and resultant social behaviors. Certainly the work of others with adolescents (Alaimo et al., 2001, 2002) that

has shown an association of depressive disorders and suicidal behaviors with household food insecurity would seem to indicate that such effects may be chronic or long-lasting.

Previous research relating to predictors of cognitive performance and social skills in children (other than household food insecurity) is consistent with our findings. A study of kindergartners in the United States found that language skills as measured by consonant-sound identification predicted cognitive ability as measured by the Peabody Picture Vocabulary Test in the first grade. Researchers conclude that children who entered school with good language skills had higher cognitive test scores (McCormick et al., 1994). Other evidence supporting this relationship is reported in research involving language-impaired children. In this study, language-impaired and non-language-impaired children were evaluated in terms of their problem-solving and cognitive ability. Children who were language-impaired had more difficulties with cognitive testing and made a greater number of errors in cognitive processing (Condino et al., 1990). Additionally, British researchers found that poor verbal and language skills among school children was related to poor performance on cognitive tests (Langdon et al., 1998). Another study involving low-birthweight children found that differences in language skill and motor skills affected cognitive ability independently of other factors (Taylor et al., 1995). Thus a variety of literature supports the relationship between language skills and cognitive ability.

Associations between parent-rated social interaction and teacher-ranked social ability and language skills have also been discovered. A recent study of Head Start preschoolers investigated the predictors of social competence of African American children. The study found that those children with above-average vocabulary development had the greatest social competence. Additionally, a relationship was described between activity levels and social skills, as found in the parent-evaluated emotional state and teacher-rated social ability analyses. Those children who were described as calm and reticent (also described as low activity) were those who were least likely to engage in disruptive play and to exhibit better social behavior.(Mendez et al, 2002).

Researchers from Italy have found a relationship between motor skills ability and cognitive performance. Those preschoolers with the best motor skills had the highest scores on cognitive tasks. This relationship was stronger than that between handedness and cognition, which has traditionally been used in cognitive testing. Motor skills were related to verbal and visuospatial skills as well (Smirni and Zappala, 1989). Both the independent observer and teacher-evaluated cognitive ability variables were significantly predicted by fine motor skills in the current analyses.

A study conducted with African American single mothers and their preschool children revealed a variety of influences on development. Children's scores on cognitive school readiness and personal maturity were highly correlated to mothers' age at first birth, mother's highest level of education, and their parenting ability (McGroder, 2000). Similarly, cognitive ability as determined by the independent observer in this study was predicted by both mother's age at first birth and the highest level of education of either parent.

As with the study of independent observer cognitive ability, poverty level has also been found to be related to cognitive ability in Britain. A study of children aged 4–18 years found that poverty had a significant association with lower test scores. Poverty appears to affect younger children more than older as the relationship was not as strong for older children. The relationship was mediated by home environment (McCulloch and Joshi, 2001).

As with the results of teacher-rated cognitive ability, nonparental care has also been found to be related to cognitive and social performance in previous studies. A study in New York found that children whose mothers stated that their children had high involvement in center-based care had better cognitive skills and less behavioral problems than those with no nonparental care (Yoshikawa et al., 2001). Conversely, researchers from Sweden have found that child care quality as measured by the number of months spent in center-based day care before kindergarten predicted cognitive ability in second grade. Children who had spent at least 36 months in out-of-home care performed worse on cognitive tests than

those who had not. Researchers also found that cognitive ability was related to paternal involvement during preschool as well (Broberg et al, 1997).

Results from these analyses have revealed relationships to cognitive and social ability that are common to other studies. Specifically, language skills, motor skills, mother's age at first birth, parents' highest level of education, poverty, and nonparental care have been shown to be related to cognitive and social functioning in both this and other studies conducted throughout the world.

Anthropometric Status: Overweight, Underweight, and Height-for-Age

Results from these analyses demonstrate that both previous and current events affect anthropometric results. Weight at birth was a common factor to all three of the anthropometric models studied. The prevalences of short stature and of underweight were very small and not in excess of what would be expected in a population of healthy children. Overweight, however, showed an excess prevalence of about 8 percent in this population. Variables relating to lack of physical activity (hours of television watched and lower activity levels in play as compared to other children) were related to the probability of overweight. Household food insecurity was not related to the anthropometric measures, consistent with data from many populations indicating relative protection of small children from direct nutritional effects of food insecurity.

STUDY LIMITATIONS

A number of limitations to this study should be mentioned. Although a wealth of cognitive and social data were collected, the interpretation of the meaning of the derived variables is a matter of judgment. The lack of dietary data in the present database makes it impossible to explore the relationships among food insecurity, dietary quality, and outcomes. The cross-sectional nature of this analysis is a major limitation in terms of interpretation of results. The clear association, however, of household food insecurity with emotional and social functioning is consistent with our hypotheses and with the limited amount of existing data exploring these relationships in children.

FUTURE RESEARCH NEEDS

Areas of future research should include reliability and validation studies of the measurements of cognitive and social ability used in this study. Additional research is needed on the effects and consequences of food insecurity on children's later development in order to make definitive policy interventions that can minimize these influences to the betterment of children in the United States.

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