Map the Meal Gap: Child Food Insecurity 2011
Technical Brief

Craig Gundersen, University of Illinois
Julia Brown, Feeding America
Emily Engelhard, Feeding America
Elaine Waxman, Feeding America

Overview

In order to address the problem of hunger, we must first understand it. To this end, we undertook the *Map the Meal Gap* project to learn more about food insecurity among children and its distribution by income categories at the local level. By understanding the population, we can better identify strategies for reaching the children who need us most.

Research Goals

The primary goal of the *Map the Meal Gap* analysis is to more accurately assess the need for food. The methodology undertaken to make this assessment was developed to be responsive to the following questions:

- Is it directly related to the need for food?
    - Yes, it uses the USDA food insecurity measure
- Does it reflect the many determinants of the need for food?
    - Yes, along with income, our measure uses information on unemployment rates, median incomes, and other factors
- Can it be broken down by income categories?
    - Yes, we can break it down into relevant income categories
- Is it based on well-established, transparent methods?
    - Yes, the methods across the different dimensions are all well-established
- Can we provide the data without taxing the already limited resources of food banks?
    - Yes, the measures are all established by the Feeding America national office
- Can it be consistently applied to all counties in the U.S.?
    - Yes, the measure relies on publicly available data for all counties
- Can it be readily updated on an annual basis?
    - Yes, the publicly available data is released annually
- Does it allow one to see the potential effect of economic downturns?
    - Yes, by the inclusion of relevant measures of economic health in the models

The first *Map the Meal Gap* analysis (released in March 2011) was for the full population. This *Map the Meal Gap* analysis is restricted to households with children. Insofar as households with children constitute a high proportion of the U.S. population, children are a particularly vulnerable population, and the rates of food insecurity in these households are substantially higher than for the full population, this focus is warranted.

The following methodological overview will provide a description of the methods and data used to establish the county-level child food insecurity estimates. We will follow this with a brief discussion of the central results for our methods.

Technical Brief

Methods

Child Population of Counties (and Congressional Districts)
We proceed in two steps to estimate the extent of food insecurity among children in each county.

Step 1: Using state-level data from 2001-2009, we estimate a model where the food insecurity rate for children (CFI) at the state level is determined by the following equation:

$$CFI_{st} = \alpha + \beta_{UN}UN_{st} + \beta_{CPOV}CPOV_{st} + \beta_{FMI}FMI_{st} + \beta_{CHISP}CHISP_{st} + \beta_{CBLACK}CBLACK_{st} + \mu_t + \upsilon_s + \varepsilon_{st} \quad (1)$$

where s is a state, t is year, UN is the unemployment rate, CPOV is the child poverty rate, FMI is median family income, CHISP is the percent of children who are Hispanic, CBLACK is the percent of children who are African-American, μ_t is a year fixed effect, υ_s is a state fixed effect, and ε_{st} is an error term. This model is estimated using weights defined as the state population. The set of questions used to identify whether a child is living in a food insecure household are defined at the household level.

There are three measures of food insecurity among children that are found in Table 1B in *Household Food Security in the United States, 2009* (Nord et al. USDA, 2010). The first, and the one we use, is "children in food insecure households". To be in this category, a household with children must respond affirmatively to at least three of the 18 questions in the Core Food Security Module in the Current Population Survey (CPS). The complete listing of the 18 questions can be found in Table 1. The second category is "food insecure children". In this case, the children themselves experience food insecurity and a child is said to be in this category if the household responds affirmatively to two or more child-specific questions in the CFSM. The full set of eight child-specific questions in the CSFM can be found in the bottom panel of Table 1. The third category is "very low food security among children". A child is said to be in this category if the household responds affirmatively to five or more questions in the CFSM.

Table 1: Food Insecurity Questions in the Core Food Security Module

ASKED OF ALL HOUSEHOLDS

1. "We worried whether our food would run out before we got money to buy more." Was that **often, sometimes**, or never true for you in the last 12 months?
2. "The food that we bought just didn't last and we didn't have money to get more." Was that **often, sometimes**, or never true for you in the last 12 months?
3. "We couldn't afford to eat balanced meals." Was that **often, sometimes**, or never true for you in the last 12 months?
4. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (**Yes**/No)
5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (**Yes**/No)
6. (If yes to Question 4) How often did this happen—**almost every month, some months but not every month**, or in only 1 or 2 months?
7. In the last 12 months, were you ever hungry, but didn't eat, because you couldn't afford enough food? (**Yes**/No)
8. In the last 12 months, did you lose weight because you didn't have enough money for food? (**Yes**/No)
9. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (**Yes**/No)
10. (If yes to Question 9) How often did this happen—**almost every month, some months but not every month**, or in only 1 or 2 months?

ONLY ASKED OF HOUSEHOLDS WITH CHILDREN

11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that **often, sometimes**, or never true for you in the last 12 months?
12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that **often, sometimes**, or never true for you in the last 12 months?
13. "The children were not eating enough because we just couldn't afford enough food." Was that **often, sometimes**, or never true for you in the last 12 months?
14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (**Yes**/No)
15. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (**Yes**/No)
16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (**Yes**/No)
17. (If yes to Question 16) How often did this happen—**almost every month, some months but not every month**, or in only 1 or 2 months?
18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (**Yes**/No)

Note: Responses in bold indicate an affirmative response.

Since our analysis is regarding children, our state-level observations are constructed based on households with children. As an example, CPOV (the poverty rate) is the poverty rate for children, not the poverty rate for all persons. The only exception is for the UN (the unemployment rate) which is based on the full labor force of states, not just the labor force of persons in households with children.

Our choice of variables was first guided by the literature on the determinants of child food insecurity insofar as we included variables that have been found to influence the probability of someone being food insecure. Next, we chose variables that are available both at the state level in the CPS and as compiled by the Bureau of Labor Statistics (BLS) and at the county level through the American Community Survey (ACS) and BLS. Variables that are not available at both the state and county level cannot be used.

Of course, these variables do not portray everything that could potentially affect food insecurity rates. In response, we include the state and year fixed effects noted above which allow us to control for all other factors that influence food insecurity.

Step 2: We use the coefficient estimates from Step 1 plus information on the same variables defined at the county level to generate estimated food insecurity rates for children defined at the county level. This can be expressed in the following equation:

$$CFI^*_{cs} = \hat{\alpha} + \widehat{\beta_{UN}} UN_{cs} + \widehat{\beta_{CPOV}} CPOV_{cs} + \widehat{\beta_{FMI}} FMI_{cs} + \widehat{\beta_{CHISP}} CHISP_{cs} + \widehat{\beta_{CBLACK}} CBLACK_{cs} + \widehat{\mu_T} + \widehat{\nu_s} \quad (2)$$

where c denotes a county and T denotes the year from which the county level variables are defined. From our estimation of (2), we calculate both child food insecurity rates and the number of food insecure children in a county. The latter is defined as $CFI^*_{cs} * N_{cs}$ where N is the number of children. Congressional district child food insecurity rates were estimated using the same methods.

The estimation of (1) gives us point estimates for food insecurity rates at the county level. In addition, we have established confidence intervals around these point estimates. These take into consideration both the variation around the estimated coefficients in (1) and the variation around the values in (2) (e.g., the unemployment rate).

Income Bands within Counties (and Congressional Districts)
Child food insecurity rates are also estimated for those at or below the National School Lunch Program (NSLP) income eligibility threshold of 185% of the poverty line (CFIC). In this case, we continue to proceed with a two-step estimation method. The structure of the equations is slightly different than above. Equation (1) is instead specified as follows:

$$CFIC_{st} = \alpha + \beta_{UN} UN_{st} + \beta_{HISP} CHISP_{st} + \beta_{BLACK} CBLACK_{st} + \mu_t + \upsilon_s + \varepsilon_{st} \quad (1')$$

and equation (2) is specified as:

$$CFIC^*_{cs} = \hat{\alpha} + \widehat{\beta_{UN}} UN_{cs} + \widehat{\beta_{HISP}} HISP_{cs} + \widehat{\beta_{BLACK}} BLACK_{cs} + \widehat{\mu_T} + \widehat{\nu_s} \quad (2')$$

In this case, (1') is specified on a sample composed of those at or below 185% of the poverty line and, as a consequence, BLACK and HISP are defined with the sample restricted to that income range. UN continues to be the unemployment rate for all households, not just within income categories.

Based on our estimation of (2'), we are interested in three main things. First, directly from (2'), we have the child food insecurity rate within a county for those below 185% of the poverty line. Second, using (2'), we

can derive the percentage of food insecure children within a county with incomes below 185% of the poverty line. This is calculated as $(CFIC^{*}_{cs}*NC_{cs})/(CFI^{*}_{cs}*N_{cs})$ where NC_{cs} is the number of children below 185% of the poverty line. Third, the percentage of food insecure children within a county above 185% of the poverty line is then calculated as $1-(FIC_{cs}*NC_{cs})/(FI_{cs}*N_{cs})$. Food insecurity rates by income bands within congressional districts were estimated using the same methods.

In a few cases (N=52 or 1.6% of counties), the results of the calculation $(FIC^{*}_{cs}*NC_{cs})/(FI^{*}_{cs}*N_{cs})$ were slightly greater than 1. The set of counties for which this was the case had some combination of higher than average poverty rates, higher proportions of African-Americans, and lower median incomes. In addition, four counties did not have information on the proportion of children in households with incomes less than 185% of the poverty line. In these cases, the results were set to 1. A full listing of counties for which either of the above indicated corrections was made can be found in Appendix B.

Data

The information at the state level (i.e., the information used to estimate equations (1) and (1')) is derived from the Core Food Security Module (CFSM) in the December Supplement of the CPS for the years 2001-2009. While the CFSM has been on the CPS since 1996, it was previously on months other than December. To avoid issues of seasonality and changes in various other aspects of survey design, e.g., the screening questions, only the post-2001 years are used.

The CPS is a nationally representative survey conducted by the Census Bureau for the Bureau of Labor Statistics, providing employment, income and poverty statistics. In December of each year, 50,000 households respond to a series of questions on the CFSM in addition to questions about food spending and the use of government and community food assistance programs. Households are selected to be representative of civilian households at the state and national levels, and thus do not include information on individuals living in group quarters including nursing homes or assisted living facilities. Using information on all children in the CPS from which we had information on (a) household income and (b) whether a child is in a food insecure household, we aggregated information up to the state-level for each year to estimate equation (1). We aggregated in a similar manner for equation (1'), but restricted to those with household incomes below a 185% of the poverty line.

For information at the county and congressional district level (i.e., the information used to estimate equations (2) and (2')), we used information from the 2005-2009 five-year ACS estimates. The ACS is a sample survey of 3 million addresses administered by the Census Bureau. In order to provide estimates for areas with small populations, this sample was accumulated over a 5-year period. Data was drawn from tables B17024 (ratio of income to poverty level by age), B19125 (median income, families with own children), B01001B (percent of children African-American) and B01001I (percent of children Hispanic). Information about unemployment at the county level was taken from information from the Bureau of Labor Statistics' labor force data by county, 2009 annual averages. Information about unemployment in congressional districts was taken from data produced by Proximity and made available publicly on their website (http://proximityone.com/cd_employment.htm.) Their data are based on 2007-2009 American Community Survey estimates from the economic characteristics profile (items E001-E009).

All counties provided by the Census Bureau (geographic summary level 050) were included in the analysis with a very small number of exceptions. For three counties (two in Alaska and one in Hawaii), the Bureau of Labor Statistics did not provide 2009 unemployment data. For three additional counties (all in Alaska), the county-defined area changed between 2008 and 2009. Because the model relies on data over time, we elected to exclude them from our analysis. Therefore, 3,137 counties were analyzed out of the 3,143 for

which data is provided by the Census Bureau. In four states (Maryland, Missouri, Nevada, and Virginia), one or more cities are independent of any county organization and thus constitute primary divisions of their states. Food insecurity estimates were created for these cities, as they are included in the Census Bureau's geographic summary level 050.

For confidentiality reasons, the ACS does not list the proportion of African-Americans and proportion of Hispanics for some counties (549 and 148 counties, respectively). Insofar as this occurs due to the small numbers of each of these groups within the county, we assume the proportion of each group is equal to zero percent. Given the statistical insignificance of the effect of these variables on food insecurity (discussed below) and the fact that the actual percentages would be very small, this does not influence our estimates. In addition, 10 counties did not have poverty rates due to confidentiality reasons. For these counties, we assigned the counties the average poverty rate or, if it was lower, the proportion of households with incomes below 185% of the poverty line.

Results

We now turn to a brief discussion of the results from the estimation of equations (1) and (1'). These results can be found in columns (1) and (2) of Table 2. In this table, we present coefficient estimates for selected variables and the corresponding standard errors for the full population and for various income categories.

There are several points worth emphasizing from these results. First, the effect of unemployment is strong for both the full population of children (column (1)) and for children in households with incomes less than 185% of the poverty line (column (2)). As seen in column (1), a one percentage point increase in the unemployment rate leads to a 0.93 percentage point increase in food insecurity among all children and a 1.15 percentage point increase for the NSLP eligible group of children (column (2)). (The latter is larger in part due to the non-inclusion of the poverty rate for reasons discussed above.)

Second, the effect of the poverty rate is statistically significant and strong. Per column (1), a one percentage point in the poverty rate leads to a 0.37 percentage point increase in the food insecurity rate. Its magnitude is smaller than the unemployment rate but this is partly due to the lower average value of the unemployment rate in comparison to the poverty rate. If one compares the elasticities of the two factors (i.e., the effect of a one percent increase in each of the variables) the effect of the poverty rate is actually higher; the elasticity of the food insecurity rate (evaluated at the mean levels) with respect to the poverty rate is 0.31 and the elasticity with respect to the unemployment rate is 0.27. If the elasticities are instead evaluated at the average values for 2008 and 2009 (i.e., when the unemployment rate was substantially higher), the elasticity with respect to the poverty rate is 0.28 and the elasticity with respect to the unemployment rate is 0.29.

Third, the results also demonstrate that the proportion of the population that is Hispanic or African-American in a county has no statistically significant effect on the child food insecurity rate in our models. This is, on the surface, surprising insofar as both of these groups have higher than average rates of food insecurity. In these models, however, the limited impact is due to the small changes that occur over time in the distribution of race/ethnicity in a state over time. These models rely on changes over time to identify the impact of different variables. Consequently, the impacts of relatively static variables like these are instead portrayed by the state fixed effects.

Table 2: Estimates of the Impact of Various Factors on Child Food Insecurity at the State Level, 2001-2009

	All children	Children in households with incomes below <185% of the poverty line	Full Population	Full population in households with incomes <185% of the poverty line
	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)
	(1)	(2)	(3)	(4)
Poverty Rate	0.368		0.266	
	(0.0893)**		(0.060)**	
Unemployment Rate	0.929	1.150	0.784	1.435
	(0.281)**	(0.456)*	(0.150)**	(0.389)**
Median Income	-0.001		-0.003	
	(0.004)		(0.003)	
Percent Hispanic	0.038	-0.056	-0.023	0.026
	(0.087)	(0.094)	(0.083)	(0.106)
Percent African-American	-0.181	-0.007	0.062	0.056
	(0.093)	(0.089)	(0.088)	(0.077)
2002 (year fixed effect)	-0.006	-0.027	-0.003	-0.002
	(0.007)	(0.014)	(0.003)	(0.011)
2003 (year fixed effect)	-0.006	-0.027	-0.002	-0.002
	(0.009)	(0.019)	(0.004)	(0.012)
2004 (year fixed effect)	0.003	-0.018	0.009	-0.006
	(0.008)	(0.015)	(0.004)*	(0.010)
2005 (year fixed effect)	-0.009	-0.038	0.006	-0.014
	(0.008)	(0.016)*	(0.004)	(0.012)
2006 (year fixed effect)	-0.003	-0.023	0.013	-0.004
	(0.008)	(0.015)	(0.004)**	(0.010)
2007 (year fixed effect)	0.004	-0.029	0.019	0.010
	(0.008)	(0.015)	(0.004)**	(0.011)
2008 (year fixed effect)	0.039	0.022	0.040	0.045
	(0.009)**	(0.014)	(0.004)**	(0.012)**
2009 (year fixed effect)	0.0101	-0.010	0.014	0.006
	(0.015)	(0.025)	(0.008)	(0.021)
Constant	0.0887	0.311	0.051	0.227
	(0.036)*	(0.042)**	(0.019)**	(0.031)**

* p<0.05 ** p<0.01. The omitted year for the year fixed effects is 2001. The data used is taken from the December Supplements of the 2001-2009 Current Population Survey.

Finally, the sharp increase in food insecurity seen in 2008 over 2007 is "unexpected" within our models for the full population of children. This can be seen by the distinctly larger coefficient on the year fixed effect in 2008 and that it is the only year fixed effect which is statistically significant. In contrast, in 2009 when the rates were similar to 2008, the coefficient on the year fixed effect is relatively smaller. This indicates that the food insecurity rates in 2009 – when unemployment rates were substantially higher than in 2008 – are more "expected." In contrast to the results for the full population, there was no "unexpected increase" from 2007 to 2008 for the under 185% of the poverty line population. In other words, conditioning on the other variables in our model, the year fixed effect for 2008 and 2009 are statistically insignificant as seen in column (2). One implication from this is that the sharp increase from 2007 to 2008 in child food insecurity

rates is primarily due to increases in food insecurity among those with incomes above 185% of the poverty line.

We now turn to a comparison of the model estimation results from *Map the Meal Gap* for all persons and the results for the child *Map the Meal Gap*. This is done through a comparison of columns (1) and (3) and columns (2) and (4) where column (3) is replicated from column (1) of Table 1 and column (4) is replicated from column (4) in Table 1, both in *Map the Meal Gap: Technical Brief* (Gundersen et al. Feeding America, 2011). There are three key differences we wish to emphasize. First, the relative effect of unemployment is stronger than poverty when the sample of all persons is considered. This can be seen in a comparison of columns (1) and (3). The ratio for children is 2.52 (i.e., 0.929/0.368) while the ratio for all persons is 2.95. Second, there is an unexpected increase in food insecurity in 2008 for households under 185% of the poverty line when all persons are considered but not, as discussed above, for children. This can be seen in a comparison of the 2008 year fixed effect in column (4) where it is statistically significant but in column (2) it is statistically insignificant. Third, the effect of the percentage of a state that is African-American is different depending on whether we consider all persons or just children. As seen in column (1), the coefficient on the percent of a state that is African-American is negative and not small but it is small and positive in column (3). This should be contrasted with when the sample is restricted to households with incomes below 185% of the poverty line – there the effect is negative and small (column (2)) and positive and small (column (4)). In all cases, though, the effect is statistically insignificant.

Appendix A: Income-band Adjustments

The following counties resulted in errors when income band data was directly calculated. The calculated and adjusted data are provided. Data presented below are rounded to the nearest tenth. In the final dataset, data are rounded to the nearest integer.

In the following cases, the results of the calculation $(FIC^{*}_{cs}*NC_{cs})/(FI^{*}_{cs}*N_{cs})$ were slightly greater than 1. In these cases, the results were set to 1.

State	County	Child Population	Calculated % of food insecure children ≤185% poverty	Adjusted % of food insecure children ≤185% poverty
AL	GREENE	2,395	115.66%	100.00%
AL	MACON	4,805	112.51%	100.00%
AL	PERRY	2,914	127.17%	100.00%
AL	SUMTER	3,286	106.52%	100.00%
AR	LAFAYETTE	1,713	110.18%	100.00%
AR	MONROE	2,068	108.85%	100.00%
AR	OUACHITA	6,228	101.96%	100.00%
AR	PHILLIPS	6,642	115.79%	100.00%
AR	SAINT FRANCIS	7,117	100.66%	100.00%
FL	GADSDEN	11,198	106.38%	100.00%
GA	BAKER	1,326	107.21%	100.00%
GA	CLAY	735	112.49%	100.00%
GA	HANCOCK	2,331	118.10%	100.00%
GA	MACON	3,327	104.14%	100.00%
GA	QUITMAN	614	110.03%	100.00%
GA	STEWART	1,123	108.27%	100.00%
IL	ALEXANDER	1,986	106.85%	100.00%
KY	FULTON	1,569	108.31%	100.00%
LA	MADISON	3,282	115.30%	100.00%
LA	TENSAS	1,407	113.19%	100.00%
MD	BALTIMORE CITY	147,590	106.24%	100.00%
MS	JEFFERSON	2,095	111.33%	100.00%
MS	QUITMAN	2,511	111.42%	100.00%
MS	SHARKEY	1,325	118.50%	100.00%
MS	SUNFLOWER	7,895	100.90%	100.00%
MS	TALLAHATCHIE	3,516	106.23%	100.00%
MS	WILKINSON	2,488	109.24%	100.00%
MO	SAINT LOUIS CITY	81,973	104.53%	100.00%
NE	ARTHUR	127	148.57%	100.00%
NE	BLAINE	71	105.70%	100.00%
NE	HOOKER	123	102.69%	100.00%
NE	WHEELER	177	103.71%	100.00%

NM	UNION	1,005	112.11%	100.00%
NC	BERTIE	4,531	106.03%	100.00%
NC	HERTFORD	5,180	103.28%	100.00%
NC	NORTHAMPTON	4,505	101.03%	100.00%
ND	STEELE	457	106.67%	100.00%
SC	ALLENDALE	2,552	104.97%	100.00%
TX	BAILEY	2,208	110.19%	100.00%
TX	BAYLOR	743	102.81%	100.00%
TX	COTTLE	443	122.20%	100.00%
VA	BRUNSWICK	3,287	124.56%	100.00%
VA	CUMBERLAND	2,187	104.02%	100.00%
VA	GREENSVILLE	2,139	101.17%	100.00%
VA	NORTHAMPTON	2,799	110.64%	100.00%
VA	SURRY	1,490	100.24%	100.00%
VA	SUSSEX	2,119	108.96%	100.00%
VA	DANVILLE CITY	9,619	100.52%	100.00%
VA	EMPORIA CITY	1,221	150.63%	100.00%
VA	FRANKLIN CITY	2,225	102.61%	100.00%
VA	PETERSBURG CITY	7,947	135.02%	100.00%
WA	GARFIELD	393	105.32%	100.00%

In the following cases, the ACS did not provide information on the proportion of children in households with incomes less than 185% of the poverty line. In these cases, the results were set to 1.

State	County	Child Population	% of children ≤185% poverty	Adjusted % of food insecure children ≤185% poverty
CO	HINSDALE	62	not available	100.00%
CO	SAN JUAN	34	not available	100.00%
TX	KING	31	not available	100.00%
TX	LOVING	3	not available	100.00%