Map the Meal Gap 2017: Technical Brief

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Overview

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

Research Goals

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

- Is the methodology 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 that have been shown to be associated with food insecurity
- 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 following methodological overview will provide a description of the methods and data used to establish the congressional district and county-level food insecurity estimates, the food budget shortfall, the cost-of-food index, and the average cost of a meal. Following each section, we will provide information on the central results for our methods.

Summary of Methods

Overall and Child Food Insecurity Rate

Methodology: We begin by analyzing the relationship between food insecurity and its determinants (poverty, unemployment, median income, etc.) at the state level. We then use the coefficient estimates from this analysis combined with information on the same variables defined at the county level to generate estimated food-insecurity rates for all individuals and for children at the county and congressional district levels.

Data Sources: The Current Population Survey (CPS) survey data are used to assess the relationship between food insecurity and determinants of food insecurity at the state level. The variables used were selected because of their availability at the county, congressional district, and state level and included unemployment rates, median income, poverty rates, homeownership rates, percent of the population that is African American, and percent of the population that is Hispanic. County and congressional district level data are drawn from the American Community Survey (ACS), with the exception of the unemployment data, which are drawn from the Bureau of Labor Statistics (BLS). For the child food-insecurity estimates, we use data restricted to households with children for all variables except the unemployment rate, which is defined for the full population of the county.

Food Budget Shortfall

Methodology: Responses from food-insecure households to CPS questions about a food budget shortfall are calculated at the individual level and then averaged to arrive at a weekly food budget shortfall of $17.38. As discussed in *Household Food Security in the United States in 2015* (Coleman-Jensen et al., 2016), households experiencing food insecurity experience this condition in, on average, seven months of the year.

FI persons * $17.38 * 52 weeks * (7/12) =	$ reported needed by the food insecure to meet their food needs in 2015

Data Sources: The CPS data includes two questions relevant for this determination. First, a question asks if a household needed more, less, or the same amount of money to meet their basic food needs. Second, those that respond “more” are asked a further question about how much more money is needed. These questions are posed after questions about weekly food expenditures, but before the food security module.

Cost-of-Food Index

Methodology: To establish a relative price index that allows for comparability between counties, Nielsen assigns every sale of UPC-coded food items in a county to one of the 26 food categories in the USDA Thrifty Food Plan (TFP). These are then weighted to the TFP market basket based on pounds purchased per week by age and gender. For the current analyses, pounds purchased by males age 19-50 are examined. While other Thrifty Food Plans for different ages and/or genders may have resulted in different *total* market basket costs, *relative pricing* between counties (our goal for this analysis) is not affected. The total market basket is then translated into a multiplier that can be applied to any dollar amount. This multiplier differs by county, revealing differences in food costs at the county level.

Data Sources: Nielsen provided in-store scanning data and Homescan data.

National Average Meal Cost

Methodology: The average dollar amount spent on food per week by food-secure individuals is divided by 21 (three meals per day x seven days per week). Food expenditures for *food-secure* individuals were used to ensure that the result reflected the cost of an adequate diet. We then weight the national average cost per meal by the "cost-of-food index" to derive a localized estimate.

Data Sources: Before respondents are asked the food security questions on the CPS, they are asked how much money their household usually spends on food in a week.

Food-Insecurity Rate Estimates

Methods

Full Population of Counties (and Congressional Districts)
We proceed in two steps to estimate the extent of food insecurity in each county. In what follows, the descriptions are for counties but, except where otherwise noted, they also apply to congressional districts. Because congressional districts were redrawn in 2012, MMG estimates are available for the current congressional districts only for 2012 through 2015 (the last four years).

Step 1: Using state-level data from 2001-2015, we estimate a model where the food-insecurity rate for individuals at the state level is determined by the following equation:

$$FI_{st} = \alpha + \beta_{UN}UN_{st} + \beta_{POV}POV_{st} + \beta_{MI}MI_{st} + \beta_{HISP}HISP_{st} + \beta_{BLACK}BLACK_{st} + \beta_{own}OWN_{st} + \mu_t + \upsilon_s + \varepsilon_{st} \qquad (1)$$

where s is a state, t is year, UN is the unemployment rate, POV is the poverty rate, MI is median income, HISP is the percent Hispanic, BLACK is the percent African-American, OWN is the percent of individuals who are homeowners, 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 someone is food insecure, i.e., living in a food-insecure household, are defined at the household level. A household is said to be food insecure if the respondent answers affirmatively to three or more questions from the Core Food Security Module (CFSM). A complete list of questions in the CFSM is found in Table 1.

Our choice of variables was first guided by the literature on the determinants of food insecurity. We included variables that have been found in prior research to influence the probability of someone being food insecure. (For an overview of that literature in this context see Gundersen and Ziliak, 2014; Gundersen et al., 2012.) Next, we chose variables that are available both in the CPS and at the county level, such as those in the American Community Survey (ACS) or other sources (described below). The model does not include variables that are not available at both the state and county level.

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 unobserved state-specific and year-specific influences on 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 individuals defined at the county level. This can be expressed in the following equation:

$$FI^*_c = \hat{\alpha} + \widehat{\beta_{UN}} UN_c + \widehat{\beta_{POV}} POV_c + \widehat{\beta_{MI}} MI_c + \widehat{\beta_{HISP}} HISP_c + \widehat{\beta_{BLACK}} BLACK_c + \widehat{\beta_{OWN}} OWN_C + \widehat{\mu_{2015}} + \widehat{v_s} \qquad (2)$$

where c denotes a county. The variables POV, MI, HISP, BLACK, and OWN are all based on averages taken from the ACS for 2011 to 2015 in the county-level models and from 2015 in the congressional district-level models. The variable UN is based on the 2015 values from BLS for the county-level estimates and 2015 from the ACS for the congressional district models. From our estimation of (2), we calculate both food-insecurity rates and the number of food-insecure persons in a county. The latter is defined as $FI^*_c * N_c$ where N is the number of persons. The estimation of (1) gives us point estimates for food-insecurity rates at the county level.

Income Bands within Counties (and Congressional Districts)

Food-insecurity rates are also estimated for those above or below each state's Supplemental Nutrition Assistance Program (SNAP) and National School Lunch Program (NSLP) income eligibility threshold (see Appendix A for a list of SNAP and NSLP thresholds for each state). 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:

$$FIC_{st} = \alpha + \beta_{UN} UN_{st} + \beta_{HISP} HISP_{st} + \beta_{BLACK} BLACK_{st} + \beta_{OWN} OWN_{st} + \mu_t + \upsilon_s + \varepsilon_{st} \qquad (1')$$

and equation (2) is specified as:

$$FIC^*_c = \hat{\alpha} + \widehat{\beta_{UN}} UN_c + \widehat{\beta_{HISP}} HISP_c + \widehat{\beta_{BLACK}} BLACK_c + \widehat{\beta_{OWN}} OWN_C + \widehat{\mu_{2015}} + \widehat{v_s} \qquad (2')$$

In this case, (1') is estimated on the following sample: We limit the estimation to those with incomes within a particular income range (e.g., below 130 percent of the poverty line) but UN, BLACK, HISPANIC, and OWN are defined for all individuals. We do so since these variables are only available in the ACS for all income levels.

Based on our estimation of (2'), we are interested in three main things. First, directly from (2'), we have the food-insecurity rate within a county for those within a particular income band. Second, using (2'), we can derive the percentage of food-insecure persons within a county with incomes within a particular band. This is calculated as $(FIC^*_{cs} * NC_{cs})/(FI^*_{cs} * N_{cs})$ where NC_{cs} is the number of people below a certain income threshold. Third, the percentage of food-insecure persons within a county above a particular threshold is then calculated as $1-(FIC_{cs} * NC_{cs})/(FI_{cs} * N_{cs})$. Estimated food-insecurity rates by income bands within congressional districts were estimated using the same methods.

Child Population of Counties (and Congressional Districts)

To estimate child food-insecurity rates at the county and congressional district levels, we proceed in essentially the same manner as for the full population. However, a few notes are needed regarding the specific procedures used for child food insecurity.

First, we define the variables for households with children rather than for all households. For example, the poverty rate is defined only for households with children. The only exception is for the unemployment rate variable, which is defined for all households. We made this decision because the sub-state unemployment rates as constructed by BLS are not broken down by whether or not an adult lives in a household where children are present.

Second, we define child food insecurity in the following manner. There are three measures of food insecurity related to children (Coleman-Jensen et al. 2016, Table 1B). The first, and the one we use, is "children in food-insecure households," which includes children residing in households experiencing low or very low food security among children, adults, or both. 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 (CFSM) in the CPS. The count of children who are food insecure is based on the number of children in food-insecure households, and the food-insecurity rate is the ratio of the number of children in food-insecure households to the total number of children in the relevant geographic area. (This measure is distinct from two other measures found in Coleman-Jensen et al. (2016) – households with food insecure children and households with very low food secure children, albeit all children falling into either of these two categories would also be categorized as being in a food insecure household.)

Third, in light of the smaller sample sizes for children, we do not break things down in the same income bands as with the full population. Instead, we break the analyses down in accordance with the threshold for free or reduced price lunches in the NSLP. Unlike for SNAP thresholds, this cutoff is the same for all states.

Data

The information at the state level (i.e., the information used to estimate equations (1) and (1')) is derived from the CFSM in the December Supplement of the CPS for the years 2001-2015. 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 persons in the CPS for which we had information on (a) income and (b) food insecurity status, we aggregated information up to the state level for each year to estimate equation (1). We aggregated in a similar manner for equation (1'); however, only those below a defined income threshold were used in the aggregation. As noted above, the values for the full sample for the other variables outside of income are used.

For information at the county level (i.e., the information used to estimate equations (2) and (2')), we used information from the 2011-2015 five-year ACS estimates and unemployment data from the BLS. The ACS is a

sample survey of three million addresses administered by the Census Bureau. In order to provide estimates for areas with small populations, this sample was defined over a five-year period. Information about unemployment at the county level was taken from information from the BLS's labor force data by county, 2015 annual averages. For information at the congressional district level, including unemployment data (i.e., the information used to estimate equation (2)), we used information from the 2015 one-year ACS estimates. For both county and congressional districts, ACS data were drawn from tables S1701 (poverty rate), C17002 (ratio of income to poverty level), B19013 (median income), DP04 (homeownership rate), and DP05 (percent African-American and percent Hispanic). For congressional districts, unemployment data were drawn from S2301. All 3,142 counties provided by the Census Bureau were included in the analysis.

For information at the child level, ACS data were drawn from tables S1701 (poverty), B17024 (ratio of income to poverty level), B19125 (household median income), B09001I (number of Hispanic children), B09001B (number of African-American children), and B25115 (homeownership). For congressional districts, child data tables are the same as those used for the county-level data with the exception of percent Hispanic and African-American children, which were pulled from S1901.

Results

We now turn to a brief discussion of the results from the estimation of equation (1) and (1'). These results for the full population are presented in 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.

Concentrating on column (1), there are several points worth emphasizing from these results. First, as expected, the effects of unemployment and poverty are especially strong. A one percentage point increase in the unemployment rate leads to a 0.51 percentage point increase in food insecurity, while a one percentage point increase in the poverty rate leads to 0.23 percentage point increase. Second, median income and the proportion of a state's population that is African American have no statistically significant effect on the food-insecurity rate. The proportion of a state's population that is Hispanic, however, is statistically significant; a one percentage point increase in the share of a state's population that is Hispanic leads to a 0.20 percentage point decrease in food insecurity. Third, states with higher proportions of homeowners have lower rates of food insecurity. A one percentage point increase in the proportion of a state's population that are homeowners leads to a 0.10 percentage point decrease in food insecurity. Fourth, at least as reflected in the variables used to predict food insecurity in our models, the continued high level of food insecurity in 2015 is unexpected. This can be seen in the positive and statistically significant coefficient on the year fixed effect for 2015.

The results for the various income categories (i.e., columns (2) through (6)) are broadly similar to those found for the full population, with a few differences. For example, the effect of homeownership is statistically insignificant for all but two of the income categories and the effect of the proportion of a state that is Hispanic is statistically insignificant for all income categories.

In Table 3, we present the results for children. Overall, the results are similar to those for the full population, so here we emphasize two areas where they differ. First, the effect of homeownership is statistically

insignificant for both all incomes (column (1)) and when incomes are restricted to under 185 percent of the poverty line (column (2)). Second, with the exception of 2008 and 2009 for all incomes, and 2005 for those under 185 percent of the poverty line, the year fixed effects are statistically insignificant. One interpretation is that the observed factors, including state fixed effects, explain more of the variation in the child food-insecurity rates in comparison to those for the full population.

We conducted a series of tests of the *Map the Meal Gap* results to see how well the models performed. Our tests included, among other tests, the following: we compared county results aggregated to metropolitan areas with food-insecurity values for these metro areas taken from the CPS; we compared county results averaged over several years for counties that are observed in the CPS; we compared results with and without state fixed effects; we compared county results aggregated to the state level with food insecurity values for states taken from the CPS; and we compared predicted results from our model at the national level with actual food-insecurity rates per year. (For a broader discussion of *Map the Meal Gap* along with information on some further analyses of the robustness of the *Map the Meal Gap* results, see Gundersen et al., 2014.)

Trends in County Food Insecurity Rates between 2011 and 2015

This report reviews findings from the seventh year that Feeding America has conducted the *Map the Meal Gap* analysis. Here, we consider how food-insecurity rates and numbers in 2015 compare to those in the previous four years to identify any notable shifts. (We made a similar comparison for 2011 to 2014 in last year's MMG Technical Brief for the full population and for children.) Food-insecurity estimates at the county level may be less stable from year to year than those at the state or national level due to smaller geographies, particularly in counties with small populations. Efforts are taken to guard against unexpected fluctuations that can occur in these populations by using the five-year averages from the ACS for key variables, including poverty, median income, homeownership, and the percent of the population that is African American or Hispanic. However, the other key variable in the model—unemployment—is based on a one-year estimate for each county as reported by the BLS. The model looks at the relationship between all of these variables and the rate of food insecurity as reported by USDA in order to generate the estimates.

Nationally, the food-insecurity rate declined significantly in 2015 at 13.4 percent compared to 15.4 percent in 2014 (Coleman-Jensen et al., 2016). The national child food-insecurity rate saw a similar decline from 2014 to 2015 (20.9 percent to 17.9 percent).

In contrast, only a handful of counties saw a statistically significant change in their food insecurity rates. Less than one percent (18) of all 3,142 counties experienced a statistically significant change between 2014 and 2015, all but one of which were decreases. The number of counties with statistically significant changes is substantially higher at nine percent (271) since 2014, ten percent (312) since 2012, and 17 percent (542) since 2011.

Those counties that experienced a three-percentage point or greater change in their food-insecurity estimates were flagged for further examination (see Appendix B). Out of 3,142 counties analyzed, only 13 experienced changes in food-insecurity rates equal to or beyond the threshold of three percentage points, all of which were decreases. The list of these counties can be found in Appendix B. All of these counties have populations

of less than 75,000. Moreover, out of these, only two— Maverick County, Texas and Starr County, Texas— have populations greater than 50,000.

Child food-insecurity rates are, as covered above, on average higher than overall food insecurity rates. As such, we only list counties with more than four percentage point changes in child food-insecurity rates. As seen in Appendix C, there are 58 counties with a child population of at least 1,000 that fell into this category. These are similar to the changes seen for the full population in that all of them are decreases. However, the counties seeing changes in child food insecurity of at least four percentage points differ from the changes seen for the full population in that all of them have an estimated child population of under 15,000.

Food Budget Shortfall

Methods

In an effort to understand the food needs of the food-insecure population, we sought to estimate the shortfall in their food budgets. To do so, we use the following question taken from the CPS Food Security Supplement:

In order to buy just enough food to meet (your needs/the needs of your household), would you need to spend more than you do now, or could you spend less?

This question is asked prior to the 18 questions used to derive the food-insecurity measure and, as a consequence, is not influenced by their responses about food insecurity. Out of those responding "more," the following question is posed:

About how much MORE would you need to spend each week to buy just enough food to meet the needs of your household?

Restricting the sample to households experiencing food insecurity over the previous 12 months, and assigning a value of "0" to households that report needing zero dollars (i.e. those who could spend "the same" each week), as well as to those that report needing "less money", we divide by the number of people in the household to arrive at a per-person figure of $17.38 per week. This value is denoted as PPC.

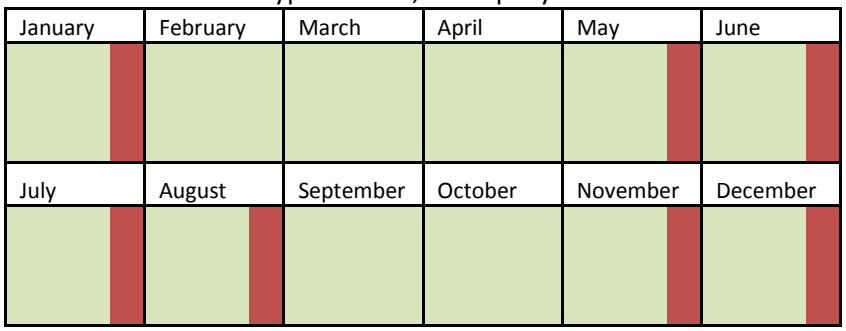
Not all food-insecure households reported needing additional food every day of the week. The phrasing of the questions above, however, suggests that responses are given with respect to a week during which the household needed to "spend more." We have assumed that these responses therefore incorporate days of the week in question during which the household was able to meet its food needs and days during which it needed more money. This assumption is supported by the dollar amount reported, which amounts to approximately 5.9 meals per week (or fewer than two days per week, assuming three meals per day), and the inclusion of food-insecure households which reported needing $0 more per week. These respondents were assumed to be responding from the perspective of a recent week, one in which they did not require additional money.

Visually, this theoretical week would then look like this:

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
With enough food	With enough food	With enough food	With enough food	With enough food	In need of food	In need of food

In addition to being food insecure only some days of any month in which they experience food insecurity, not all food-insecure households experience food insecurity every month. As reported by the USDA, in the annual report *Household Food Security in the United States*, "the average household that was food insecure at some time during the year experienced this condition in 7 months of the year." (Coleman-Jensen et al., 2016)

Visually, using the above illustration as a typical week, a sample year would look like this:



With this information, we are then able to calculate the dollar figure needed per county, per year as follows: $PPC*52*(7/12)*FI^{*}_{cs}*N_{cs}$. This calculation incorporates the number of weeks in a year (52) and the average number of months of the year in which someone experiences food insecurity (7 out of 12).

Data

To calculate the dollars needed for a food-insecure person to meet his/her food needs, we used information from the 2015 CPS.

Results

In developing the results for the amount of money needed by a food-insecure person to meet weekly food needs, we examined additional possible values, including those for (a) households experiencing food insecurity any time over the prior 12 months and (b) households experiencing food insecurity any time over the prior 30 days. We further broke this analysis down for (a) a sample of those responding "more" or "the same" to the first question above and (b) a sample of those responding "more" to the first question. Households responding "less" were included in these analyses and coded as "zero".

The value of $17.38 was selected both because it was the most conservative result and because it was the result most similar to the difference in per-person weekly food expenditures between food-secure and food-insecure households. We note that the growth of the food budget shortfall from 2014 to 2015 ($16. 82 to

$17.38) is slightly greater than the growth between 2013 and 2014 (from $16.28). For the fourth year in a row, this change in the shortfall has outpaced inflation.

In Table 4, we present some descriptive statistics about reports of dollars needed to be food secure from the CPS. As done above, we restrict the sample to those reporting food insecurity and that they need to spend more on food. In the first column, we present results on individuals and in the second column, we present results for households. The average cost to be food secure in 2015 was $17.38 per-person, per week. When we break things down further by household size, income levels, and food-insecurity levels, the results are consistent with expectations. Namely, larger households report needing more money to be food secure than smaller households; individuals with lower incomes report needing more money to be food secure than better-off individuals; and individuals in households with higher levels of food insecurity need more money to be food secure than households with lower levels of food insecurity.

Cost-of-Food Index

Methods

Because the amount of money needed to be food secure is established as a national average, it does not reflect the range of that figure's food-purchasing power at the local level. In order to estimate the *local* food budget shortfall, therefore, we worked with Nielsen to incorporate differences in the price of food that exist across counties in the continental U.S. To do so, Nielsen designed custom product characteristics so that UPC codes for all food items could be mapped to one of the 26 categories described in the USDA's Thrifty Food Plan (TFP). This is based on 26 categories of food items (examples include "all potato products", "fruit juices", and "whole fruits.") Each UPC-coded food item (non-food items, such as vitamins, were excluded) was assigned to one of the categories. Random-weight food items (such as loose produce or bulk grains) were not included but packaged fresh produce, such as bagged fruits and vegetables, were included. Prepared meals were categorized as a whole (rather than broken down by ingredients) and were coded to "frozen or refrigerated entrees." Processed foods, such as granola bars, cookies, etc. were coded to "sugars, sweets, and candies" or "non-whole grain breads, cereal, rice, pasta, pies, pastries, snacks, and flours," as appropriate.

The cost to purchase a market basket of these 26 categories is then calculated for each county. Sales of all items within each category were used to develop a cost-per-pound of food items in that category. Some categories, such as milk, are sold in a volume unit of measure and not in an ounces unit of measure. Volume unit of measures were converted to ounces by using "FareShare Conversion Tables" (fareshare.net/conversions-volume-to-weight.html). Each category was priced based on the pounds purchased per week as defined by the TFP for each of 26 categories by age and gender. We used the weights in pounds for purchases by males 19-50 years for this analysis. Other age/gender weights may have resulted in different total market basket costs, but are unlikely to have impacted relative pricing between counties, which was the goal of the analysis. (The TFP does have 29 categories, but three categories are weighted as 0.0 lbs. for this age/gender grouping. These include "popcorn and other whole grain snacks," "milk drinks and milk desserts," and "soft drinks, sodas, fruit drinks, and -ades (including rice beverages.)")

The methods used by Nielsen do not, in general, include all stores selling food in a county in the annual sample they use to construct the market basket described above. In counties with sufficient population size and corresponding number of stores selling food, the non-inclusion of some stores is unlikely to bias the cost of the market basket. However, in small counties, the exclusion of some or even all stores can lead to pricing of the market basket that is not an accurate reflection of the "true cost." Along with some stores being excluded, some of the stores included may be too small to have sufficient sales of products included in the market basket. In response to these biases, for all counties with less than 20,000 persons, we ascertain the cost of a market basket that is based on the average of prices found in that county and the prices of the contiguous counties. To request a full list of counties for which cost data were imputed, please email research@feedingamerica.org.

In an effort to accurately reflect the prices paid at the register by consumers, food sales taxes are integrated into the market basket prices. County-level food taxes include all state taxes and all county taxes levied on grocery items. Within some counties, municipalities may levy additional grocery taxes. Because these taxes are not consistently applied across the county and we do not calculate food prices at the sub-county level, they are not included. Taxes on vending machine food items or prepared foods were not included, as the market baskets do not incorporate those types of foods. For state-level market basket costs, the average of the county-level food taxes was used. Twelve states levy grocery taxes. An additional six states do not levy state-level grocery taxes, but do permit counties to levy a grocery tax. Finally, an additional state does not levy state or county-level grocery taxes, but does permit municipalities to levy grocery taxes (more detail about the tax rates used can be found in Appendix D).

As suggested above, our interest is in the relative rather than the absolute price of the TFP, so using the value of the TFP (VTFP), we then calculate an index as follows: $IVTFP=VTFP_{cs}/AVTP$ where AVTP is the weighted average value of the TFP across all counties. We then create a value for the cost to alleviate food insecurity that incorporates these price differences. This is calculated for each county as $CAFI_{cs}=IVTFP_{cs}*PPC*52*(7/12)*FI_{cs}*N_{cs}$.

Data

To calculate the differences in food costs across counties, we used information from the Nielsen Scantrack service. This includes prices paid for each UPC code in over 65,000 stores across the U.S. For all these analyses we are using data for a 4-week period in October 2015.

National Average Meal Cost

Methods

With the above information, we have calculated a localized food budget shortfall for all food-insecure individuals in a county area. In many situations, however, food banks have found it useful and meaningful to be able to discuss the "meals" or "meal equivalents" represented by these dollar values. In an effort to provide the necessary information to allow for this communication tool, we calculated an approximation of the number of meal equivalents represented by the county-level food budget shortfall as follows.

On CPS there is a question that asks how much a household usually spends on food in a week:

Now think about how much (you/your household) USUALLY (spend/spends). How much (do you/does your household) USUALLY spend on food at all the different places we've been talking about IN A WEEK? (Please include any purchases made with SNAP or food stamp benefits).

Restricting the sample to households that are food secure, constructing this sample on a per-person basis, and dividing by 21 (i.e., the usual number of meals a person eats), we arrive at a per-meal cost of $2.94. We restricted the sample to food-secure households to ensure that the per-meal cost was based on the experiences of those with the ability to purchase a food-secure diet.

Using this information, the number of meals needed in a county can then be calculated as $MCAFI_{cs}=(IVTFP_{cs}*PPC*52*(7/12)*FI^{*}_{cs}*N_{cs})/(IVTFP_{cs}*2.94)$.

The *Map the Meal Gap 2017* meal-cost analysis includes all observations from the sample of CPS responses to the question regarding weekly household food expenditures in the calculations of the 2015 national average and local meal cost values as in previous years of *Map the Meal Gap*. It is important to note that the "meal gap" is descriptive of a food budget shortfall, rather than a literal number of meals.

Data

To calculate the average meal cost, we used information from the 2015 CPS.

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Appendix A: SNAP and NSLP thresholds

In order to be most useful for planning purposes, SNAP thresholds effective by January 1, 2017 were used for all states in this analysis. SNAP thresholds provided are the gross income eligibility criteria as established by the state. Applicants must meet other criteria (such as net income and asset criteria) in order to receive the SNAP benefit. Children in households receiving SNAP are categorically eligible for such programs as free National School Lunch Program (NSLP). In states with a SNAP threshold lower than 185 percent of the poverty line, persons earning between the SNAP threshold and 185 percent of the poverty line are income-eligible for other nutrition programs such as the reduced price National School Lunch Program, Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), etc.

State	SNAP Threshold	Other Nutrition Program Threshold (if applicable)
AK	130%	185%
AL	130%	185%
AR	130%	185%
AZ	185%	
CA	200%	
CO	130%	185%
CT	185%	
DC	200%	
DE	200%	
FL	200%	
GA	130%	185%
HI	200%	
IA	160%	185%
ID	130%	185%
IL	165%	185%
IN	130%	185%
KS	130%	185%
KY	130%	185%
LA	130%	185%
MA	200%	
MD	200%	
ME	185%	
MI	200%	
MN	165%	185%
MO	130%	185%
MS	130%	185%

State	SNAP Threshold	Other Nutrition Program Threshold (if applicable)
MT	200%	
NC	200%	
ND	200%	
NE	130%	185%
NH	185%	
NJ	185%	
NM	165%	185%
NV	200%	
NY	200%	
OH	130%	185%
OK	130%	185%
OR	185%	
PA	160%	185%
RI	185%	
SC	130%	185%
SD	130%	185%
TN	130%	185%
TX	165%	185%
UT	130%	185%
VA	130%	185%
VT	185%	
WA	200%	
WI	200%	
WV	130%	185%
WY	130%	185%

Appendix B: Counties with Food-Insecurity Rate Changes of 3 Percentage Points or More

State	County	2014 Food-Insecurity Rate	2015 Food-Insecurity Rate	Change from 2014 to 2015	Total Population (2015)
Arizona	Santa Cruz	12.2%	8.6%	-3.6	47,073
Colorado	Conejos	8.9%	5.9%	-3	8,249
Colorado	Costilla	9.3%	6.1%	-3.2	3,581
Colorado	Rio Grande	12.8%	9.8%	-3	11,745
Idaho	Clark	12.7%	9.0%	-3.7	901
Kansas	Grant	6.5%	3.4%	-3.1	7,816
Mississippi	Tallahatchie	22.2%	19.0%	-3.2	14,959
Texas	Kinney	12.5%	9.3%	-3.2	3,577
Texas	Maverick	11.3%	7.9%	-3.4	56,548
Texas	Presidio	12.7%	9.7%	-3	7,304
Texas	Starr	13.6%	10.6%	-3	62,648
Texas	Sterling	13.4%	10.4%	-3	1,346
Texas	Uvalde	11.2%	7.9%	-3.3	26,952

Appendix C: Counties with Child Food-Insecurity Rate Changes of 4 Percentage Points or More and a Child Population of at Least 1,000

State	County	2014 Child Food-Insecurity Rate	2015 Child Food-Insecurity Rate	Change from 2014 to 2015	Total Child Population (2015)
Arkansas	Pike	31.4%	27.1%	-4.3	2,614
Arkansas	Van Buren	34.4%	29.3%	-5.1	3,393
Arkansas	Woodruff	30.5%	26.5%	-4	1,531
California	Modoc	30.0%	23.8%	-6.2	1,884
Colorado	Gilpin	19.4%	13.6%	-5.8	1,081
Colorado	Huerfano	23.9%	18.7%	-5.2	1,034
Florida	Calhoun	28.4%	23.8%	-4.6	3,103
Florida	Glades	30.0%	24.9%	-5.1	2,248
Georgia	Appling	29.3%	24.4%	-4.9	4,656
Georgia	Bacon	27.0%	22.9%	-4.1	2,768
Georgia	Berrien	31.5%	27.3%	-4.2	4,647
Georgia	Bleckley	32.4%	28.1%	-4.3	2,900
Georgia	Crawford	27.8%	23.6%	-4.2	2,736
Georgia	Crisp	33.9%	29.4%	-4.5	5,861
Georgia	Dawson	26.7%	22.7%	-4	4,923
Georgia	Decatur	31.5%	27.3%	-4.2	6,816
Georgia	Elbert	29.2%	24.7%	-4.5	4,359
Georgia	Hart	29.2%	25.2%	-4	5,523
Georgia	Heard	31.1%	26.9%	-4.2	2,783
Georgia	Jeff Davis	30.9%	25.8%	-5.1	4,120
Georgia	Lanier	31.4%	26.7%	-4.7	2,631
Georgia	Macon	30.8%	26.3%	-4.5	2,771
Georgia	Rabun	32.5%	27.5%	-5	2,964
Georgia	Thomas	29.3%	25.1%	-4.2	10,931
Georgia	Treutlen	30.8%	26.3%	-4.5	1,393
Georgia	Twiggs	31.0%	26.6%	-4.4	1,647
Georgia	Union	29.0%	23.9%	-5.1	3,634
Georgia	Warren	32.0%	27.9%	-4.1	1,212
Georgia	Wayne	29.2%	24.3%	-4.9	7,388
Georgia	Wilcox	30.9%	25.5%	-5.4	1,718
Georgia	Wilkinson	28.7%	24.6%	-4.1	2,201
Illinois	Alexander	36.6%	30.6%	-6	1,767
Iowa	Ringgold	21.7%	15.9%	-5.8	1,211

State	County	2014 Child Food-Insecurity Rate	2015 Child Food-Insecurity Rate	Change from 2014 to 2015	Total Child Population (2015)
Kansas	Cloud	25.3%	20.2%	-5.1	1,983
Kansas	Linn	24.7%	20.2%	-4.5	2,222
Kentucky	Lee	30.5%	24.8%	-5.7	1,449
Kentucky	Mason	24.3%	20.2%	-4.1	4,134
Kentucky	Wolfe	37.0%	32.4%	-4.6	1,728
Michigan	Alcona	23.6%	19.6%	-4	1,428
Michigan	Gogebic	27.2%	23.0%	-4.2	2,481
Mississippi	Clay	32.8%	28.3%	-4.5	5,019
Mississippi	Greene	25.3%	21.2%	-4.1	2,908
Mississippi	Humphreys	36.0%	31.9%	-4.1	2,476
Mississippi	Sharkey	30.8%	25.6%	-5.2	1,213
Mississippi	Tallahatchie	29.6%	23.7%	-5.9	2,334
Mississippi	Yalobusha	26.7%	22.2%	-4.5	2,894
Missouri	Crawford	26.5%	22.5%	-4	5,879
Missouri	Schuyler	29.0%	24.3%	-4.7	1,131
Nebraska	Box Butte	26.4%	22.1%	-4.3	2,866
Oregon	Baker	30.4%	25.8%	-4.6	3,159
Oregon	Harney	31.6%	26.8%	-4.8	1,520
South Dakota	Dewey	33.1%	29.1%	-4	1,933
Tennessee	Bedford	26.1%	21.7%	-4.4	12,045
Tennessee	Weakley	26.6%	22.4%	-4.2	6,762
Texas	Runnels	29.1%	24.6%	-4.5	2,536
Virginia	Buckingham	23.5%	19.5%	-4	3,322
Virginia	Mathews	19.5%	13.8%	-5.7	1,512
Virginia	Franklin city	23.6%	19.5%	-4.1	2,085

Appendix D: Food Tax Rates

States not listed in this appendix do not levy grocery taxes and do not permit counties or municipalities to levy grocery taxes (with the exception of Alaska and Hawaii, as noted below). In some cases, as noted below, municipalities may levy additional grocery taxes. These taxes were not included in this analysis. A full list of individual counties' rates is not provided here, but is available upon request.

Twelve states levy grocery taxes. In the following three states, no additional grocery taxes are levied at the individual county level. In some counties, additional taxes may be levied by municipalities, but those rates were not included in this analysis.

State	2015 Food Tax (state rate)
ID	6.0%
MS	7.0%
SD	4.0%

In the following nine states, additional grocery taxes are levied at the county or municipal level. Only those rates levied at the county and state level were incorporated into this analysis.

State	2015 Food Tax (state rate)	2015 Food Tax (average of all county rates)	Total Food Tax (state + county)
AL	4.00%	2.11%	6.11%
AR	1.50%	1.60%	3.10%
IL	1.00%	0.06%	1.06%
KS	6.50%	1.05%	7.55%
MO	1.23%	1.68%	2.90%
OK	4.50%	1.29%	5.79%
TN	5.00%	2.50%	7.50%
UT*	1.75%	1.25%	3.00%
VA*	1.50%	1.00%	2.50%

An additional six states do not levy state-level grocery taxes, but do permit counties and municipalities to levy a grocery tax. Municipal taxes were not included in this analysis.

State	2015 Food Tax (state rate)	2015 Food Tax (average of all county rates)
AK	0%	1.45%
CO	0%	1.08%
GA	0%	3.25%
LA	0%	0.27%
NC	0%	2.00%
SC	0%	0.86%

Finally, an additional state does not levy state or county-level grocery taxes, but does permit municipalities to levy grocery taxes. In these cases, no taxes were factored into the food-cost index, but it is worth noting that additional burden may be placed on residents of municipalities in which food taxes are in effect.

State	Food Tax (state rate)	Food Tax (county rate)
AZ	0%	0.00%

Table 1: Food Insecurity Questions in the Core Food Security Module (administered in the Current Population Survey)

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.

Table 2: Estimates of the Impact of Various Factors on Food Insecurity at the State Level, 2001-2015

	Full Population	<130% of the poverty line	<160% of the poverty line	<165% of the poverty line	<185% of the poverty line	<200% of the poverty line
	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)	coefficient (s.e.)
Poverty Rate	0.228**					
	(0.053)					
Unemployment Rate	0.513**	0.680*	0.724**	0.682**	0.700**	0.757**
	(0.101)	(0.288)	(0.254)	(0.248)	(0.231)	(0.210)
Median Income	-0.002					
	(0.002)					
Percent Hispanic	-0.195**	-0.313	-0.296	-0.299	-0.317	-0.269
	(0.059)	(0.205)	(0.174)	(0.175)	(0.167)	(0.153)
Percent African-American	0.119	0.060	0.127	0.142	0.186	0.230
	(0.061)	(0.185)	(0.163)	(0.163)	(0.148)	(0.142)
Percent Homeownership	-0.102**	-0.185	-0.185*	-0.202*	-0.170	-0.194*
	(0.037)	(0.111)	(0.094)	(0.094)	(0.088)	(0.082)
2002 (year fixed effect)	0.001	0.015	0.010	0.011	0.008	0.007
	(0.003)	(0.012)	(0.010)	(0.010)	(0.010)	(0.009)
2003 (year fixed effect)	0.005	0.020	0.019	0.020	0.019	0.016
	(0.004)	(0.015)	(0.012)	(0.012)	(0.013)	(0.010)
2004 (year fixed effect)	0.015**	0.035**	0.032**	0.031**	0.007	0.029**
	(0.004)	(0.013)	(0.011)	(0.011)	(0.010)	(0.009)
2005 (year fixed effect)	0.010**	0.030*	0.024*	0.020	-0.004	0.018*
	(0.004)	(0.012)	(0.012)	(0.012)	(0.010)	(0.009)
2006 (year fixed effect)	0.015**	0.037**	0.032**	0.032**	0.005	0.029**
	(0.003)	(0.012)	(0.010)	(0.010)	(0.009)	(0.008)
2007 (year fixed effect)	0.021**	0.028*	0.047**	0.047**	0.020*	0.043**
	(0.004)	(0.012)	(0.010)	(0.010)	(0.010)	(0.009)
2008 (year fixed effect)	0.043**	0.068**	0.072**	0.062**	0.061**	0.072**

	(0.004)	(0.012)	(0.010)	(0.011)	(0.011)	(0.009)
2009 (year fixed effect)	0.028**	0.051**	0.054**	0.046**	0.046**	0.053**
	(0.006)	(0.016)	(0.014)	(0.014)	(0.014)	(0.012)
2010 (year fixed effect)	0.023**	0.030	0.032*	0.033*	0.032*	0.040**
	(0.006)	(0.016)	(0.014)	(0.014)	(0.014)	(0.012)
2011 (year fixed effect)	0.022**	0.045**	0.047**	0.046**	0.047**	0.045**
	(0.005)	(0.015)	(0.014)	(0.014)	(0.013)	(0.012)
2012 (year fixed effect)	0.024**	0.060**	0.053**	0.053**	0.043**	0.049**
	(0.005)	(0.014)	(0.012)	(0.012)	(0.012)	(0.010)
2013 (year fixed effect)	0.027**	0.070**	0.060**	0.061**	0.051**	0.057**
	(0.005)	(0.013)	(0.012)	(0.012)	(0.011)	(0.010)
2014 (year fixed effect)	0.030**	0.064**	0.061**	0.060**	0.056**	0.059**
	(0.005)	(0.014)	(0.012)	(0.013)	(0.012)	(0.011)
2015 (year fixed effect)	0.027**	0.065**	0.062**	0.061**	0.054**	0.056**
	(0.005)	(0.014)	(0.012)	(0.012)	(0.011)	(0.010)
Constant	0.135**	0.439**	0.408**	0.422**	0.391**	0.379**
	(0.031)	(0.082)	(0.070)	(0.070)	(0.066)	(0.061)

* 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 2001-2015 Current Population Survey.

Table 3: Estimates of the Impact of Various Factors on Child Food Insecurity at the State Level, 2001-2015

	Full Population	<185% of the poverty line
	coefficient	coefficient
	(s.e.)	(s.e.)
Poverty Rate	0.267**	
	(0.062)	
Unemployment Rate	0.700**	1.070**
	(0.188)	(0.321)
Median Income	-0.002	
	(0.003)	
Percent Hispanic	-0.090	-0.208
	(0.060)	(0.121)
Percent African-American	-0.074	-0.195
	(0.071)	(0.130)
Percent Homeownership	-0.033	0.017
	(0.048)	(0.086)
2002 (year fixed effect)	-0.003	-0.026
	(0.007)	(0.014)
2003 (year fixed effect)	0.001	-0.020
	(0.009)	(0.019)
2004 (year fixed effect)	0.009	-0.014
	(0.008)	(0.017)
2005 (year fixed effect)	-0.004	-0.032*
	(0.008)	(0.016)
2006 (year fixed effect)	0.002	-0.018
	(0.008)	(0.015)
2007 (year fixed effect)	0.008	-0.021
	(0.008)	(0.016)
2008 (year fixed effect)	0.047**	0.029
	(0.008)	(0.015)
2009 (year fixed effect)	0.027*	-0.002
	(0.011)	(0.020)
2010 (year fixed effect)	0.002	-0.038
	(0.012)	(0.021)
2011 (year fixed effect)	0.001	-0.023
	(0.011)	(0.021)
2012 (year fixed effect)	0.009	-0.010
	(0.010)	(0.019)
2013 (year fixed effect)	0.016	0.012
	(0.010)	(0.019)
2014 (year fixed effect)	0.015	-0.003

	(0.010)	(0.018)
2015 (year fixed effect)	0.003	-0.012
	(0.010)	(0.017)
Constant	0.144**	0.328**
	(0.041)	(0.069)

* p<0.05 ** p<0.01. The omitted year for the year fixed effects is 2001. The data used are taken from the December Supplements of the 2001-2015 Current Population Survey.

Table 4: Breakdowns of Weekly Cost to be Food Secure (in $) in 2015

	Individuals	Households
All Food Insecure	17.38	
By Household Size		
1 person		26.70
2 person		34.39
3 person		38.16
4 person		39.32
5 person		49.06
6 person		44.33
By Income Categories		
<130% of poverty line	18.74	
>130% of poverty line	16.02	
<185% of poverty line	18.13	
>185% of poverty line	15.90	
By food security status		
Marginally food secure	7.25	
Low food secure	13.05	
Very low food secure	23.93	

The data used are taken from the December Supplement of the 2015 Current Population Survey.