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Abstract

Food security, which USDA has measured and tracked since 1995, has become a key national measure of well-being; therefore, it is important that the measure is accurate. Since the food security measure was developed, USDA, Economic Research Service (ERS) has conducted ongoing research on the statistical properties of the measure. ERS researchers have developed an alternative "experimental" classification method for classifying food security status in households with children. This alternative approach reduces statistical biases inherent in the current classification approach and improves fit to the Rasch measurement model and its assumptions. Here, ERS evaluates how well the food-security-status categories correlate with other food inadequacy and nutritional indicators. The researchers examine whether the experimental classification or the current classification is more consistent with indicators of "food inadequacy," defined here as food insufficiency, unmet food needs, and use of a food pantry. ERS also examines the association between each of the two food-security-classification methods and dietary quality. Results show that the current classification is more consistent with indicators of food inadequacy. The report includes guidance for researchers using USDA's food security measure.

Keywords: Food security, food insecurity, food security measurement, Rasch model, item response theory, food sufficiency, food pantry, dietary quality

About the Authors

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Examining an "Experimental" Food-Security-Status Classification Method for Households With Children

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What Is the Issue?

USDA has measured food security in U.S. households since 1995, and USDA's Economic Research Service continues to refine food security measurement. An accurate food security measure is important for monitoring trends in food insecurity and for conducting policy-relevant research, including understanding the relationship between nutrition assistance and food insecurity. As such, ERS conducts ongoing research on the food security measure.

A review of USDA's food-security-measurement methods by the National Academies Committee on National Statistics indicated that some long-known statistical biases in the measure should be addressed to make estimates of food insecurity between households with and without children more comparable. Nord and Coleman-Jensen (2014) presented an alternative ("experimental") approach for classifying food security status based on the food security measure that addresses these statistical biases.

In this report, we examine which food-security-status classification approach (current or experimental) performs better by comparing how well the approaches relate to other indicators of food inadequacy, including food insufficiency, unmet food needs, and food pantry use. We also examine differences in demographic characteristics, dietary quality scores, and self-assessed dietary quality between households classified using the current versus experimental food security approach.

What Did the Study Find?

In this report, we refer to the largest group of households with a different food security status on the experimental and current classification approaches as "discordant households." These are households with two affirmative responses to the adult food security questions and one affirmative response to the child questions. With the current approach, these households are classified as food insecure because they meet the standard threshold of three affirmative responses to all 18 items. With the experimental approach, these households are classified as food secure because neither adults nor children, independently, are food insecure. We focus on this group of discordant households as a window into which classification approach more consistently represents the characteristics and reported needs of these households.

- In discordant households, we find that reports of food insufficiency, unmet food needs, and use of a food pantry are more consistent with the results of the current food-security-status classification approach than the experimental classification approach.
  - A larger share of *discordant* households indicate food insufficiency, unmet food needs, or use of a food pantry than do households classified as food secure with both classifications. For example, 8.8 percent of *discordant* households indicate they are food insufficient (sometimes or often not enough to eat), while 4.7 percent of households classified as food secure by both approaches indicate food insufficiency—a statistically significantly smaller percentage.
- Household characteristics of discordant households resemble those of households classified as low food secure with both approaches, and they significantly differ from households classified as food secure on both. This finding suggests the current classification approach more closely represents the characteristics of discordant households than the experimental approach does.
- No meaningful differences in dietary quality are apparent between the current and experimental food-security-classification approaches when differences in scores on the Healthy Eating Index (HEI) are examined along with self-reported dietary quality. HEI measures diet quality by its conformance to USDA's Dietary Guidelines for Americans—a report updated every 5 years that contains nutritional and dietary information for the public.
- The evidence so far is not strong enough to favor one classification approach over the other. There are advantages to each approach, and researchers have several options they can use in empirical analyses to ensure the food security statuses of households with and without children are directly comparable.

How Was the Study Conducted?

Two data sources are used in the analysis. The first is the Current Population Survey Food Security Supplement (CPS-FSS), an annual, nationally representative survey of U.S. civilian households sponsored by ERS and conducted by the U.S. Census Bureau. The CPS-FSS is the source for USDA food security statistics, and data are used for the years 2008-15. We use cross-tabulations to examine whether the experimental or current food security classification is more consistent with other indicators of food inadequacy and conduct t-tests to determine if differences are statistically significant. We also estimate logistic regression models to examine the characteristics related to being in the discordant household group. The second data source is the National Health and Nutrition Examination Survey (NHANES), from which we use waves from 2005-06, 2007-08, 2009-10, and 2011-12 to examine the associations between the food-security-status classifications and dietary outcomes.

Examining an "Experimental" Food-Security-Status Classification Method for Households With Children

Introduction

USDA assesses the extent and severity of food insecurity in U.S. households with an annual survey. Food-insecure households had difficulty at some time during the year providing adequate food for all their members due to a lack of resources. Households in the severe range of food insecurity, described as having very low food security, report that some household members' food intake fell below levels they considered sufficient, and normal eating patterns were disrupted at times during the year due to limited resources. USDA's annual report on food insecurity in U.S. households includes statistics on the incidence and severity of food insecurity by selected characteristics. A key component of annual food security monitoring is making comparisons of the extent and severity of food insecurity across different households. Over the years, USDA's food security measure has become a key national indicator of well-being, so it is important to ensure that the measure is accurate. ERS conducts ongoing research to ensure that food security measurement is valid and reliable.

Prior research, including an assessment of USDA's food-security-measurement methods by the Committee on National Statistics, identified statistical biases in the current measurement methods that affect comparisons between households without children and those with children (National Research Council, 2006).[1] Some of these statistical biases were known when the food security measure was developed. Nord and Coleman-Jensen (2014) discuss the statistical biases in the current food-security-status classification method based on the food security measure and present an alternative classification[2] approach, described here as the "experimental" classification approach. The article examines the extent to which current classification procedures distort comparisons of the extent and severity of food insecurity between households with and without children and among households with children in different age ranges. The authors consider only theoretical and statistical underpinnings of the current and experimental food-security-status classification methods, and conclude that the experimental or cross-classification approach improves internal validity and reduces statistical bias when comparing households with and without children. The article includes this caveat:

> "It will also be important to assess which of the 2 classification methods is more consistent with alternative indicators of food insecurity and with expected outcomes of food insecurity. That assessment is beyond the scope of this article but will be crucial, along with the evidence provided in this article, for informing a decision on how best to classify the food security status of households with children" (p. 320).

[1]The bias is explained in the "Background" chapter.

[2]In Nord and Coleman-Jensen (2014), the alternative food-security-status classification approach is referred to as the "cross-classification method." In this report, we refer to the alternative classification method as the "experimental" classification method or approach.

A comprehensive assessment to support the current or experimental food-security-classification systems requires strong and consistent evidence of both superior internal and external validity.[3] Our current report, TB-1945, takes up the recommended assessment of alternative indicators of food insecurity and their relationship to the current food-security-status classification approach and the experimental approach. Specifically, we examine how closely three indicators of food inadequacy—(1) food sufficiency, (2) unmet food needs, and (3) food pantry use—relate to each of the two approaches. We compare the percentage of food-insecure households reporting each of these other indicators of food inadequacy using the current and experimental classification approaches to assess external validity. We expect the prevalence of other reported food inadequacy indicators to be higher among food-insecure households as classified by the method that more closely resembles "true" food insecurity.

We find that a greater share of households classified as food insecure by the current approach report other types of food inadequacy than households classified as food insecure by the experimental method. We also compare the characteristics of the largest group of discordant households[4] that differ on the two classification approaches (food insecure on current, food secure on experimental) using logistic regression models. We find their characteristics to be more like households that are food insecure on both classifications than to those that are food secure on both approaches. There are no observable differences between the two classification methods in dietary quality. Although the experimental classification method is preferred for its internal validity on statistical and theoretical grounds, we find that the current method performs somewhat better on external validity when examining the consistency of empirical associations with alternative indicators of food inadequacy and characteristics of households.

[3]The classical definition of "validity" refers to how well a study was conducted and if the conclusions reached are valid and free of error and can be applied beyond the study sample. "Internal validity" generally refers to the study sample and research methods and whether they are sound and free of bias. "External validity" refers to the extent to which conclusions from a study sample can be generalized to the population of interest. We use "internal validity" here to refer to the conformity of the food security measure to the Rasch measurement model assumptions and the presence or lack of bias or measurement error. We use "external validity" here to refer to consistency of the food security measure with other indicators of food inadequacy.

[4]These are households with two affirmative responses to the adult food security questions and one affirmative response to the child questions. With the current approach, these households are classified as food insecure because they meet the standard threshold of three affirmative responses to all 18 items. With the experimental approach, these households are classified as food secure, because neither adults nor children, independently, are food insecure.

Background

Since 1995, USDA has monitored U.S. food security using the annual, nationally representative Current Population Survey Food Security Supplement (CPS-FSS). Household survey respondents are asked a series of questions about conditions and behaviors that characterize households when they are having difficulty meeting basic food needs. (See box 1, "Questions Used To Assess the Food Security of Households in the Current Population Survey Food Security Supplement.") USDA has relied on a household food security scale with 10 items for adult-only households and 18 items for households with children. In households with children, responses to both adult and child items in the food security scale are combined to determine household food security status. Responses are combined to indicate the severity of food insecurity in households using statistical methods based on a latent trait item response theory (IRT) statistical model, specifically the Rasch model (Rasch, 1960). This report does not describe the technical details of the Rasch model or food security measurement methods; that information is available elsewhere (Bickel et al., 2000; Hamilton et al., 1997; National Research Council, 2006; Nord, 2012; Nord and Bickel, 2002; Nord and Coleman-Jensen, 2014). In this report, we consider an alternative food-security-status classification approach, referred to as "experimental," which would address statistical biases in the current food-security-classification method.

Box 1

Questions Used To Assess the Food Security of Households in the Current Population Survey Food Security Supplement

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. (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?
6. 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)
7. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)
8. In the last 12 months, did you lose weight because there wasn't 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?

(Questions 11-18 were asked only if the household included children age 0-17)

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?

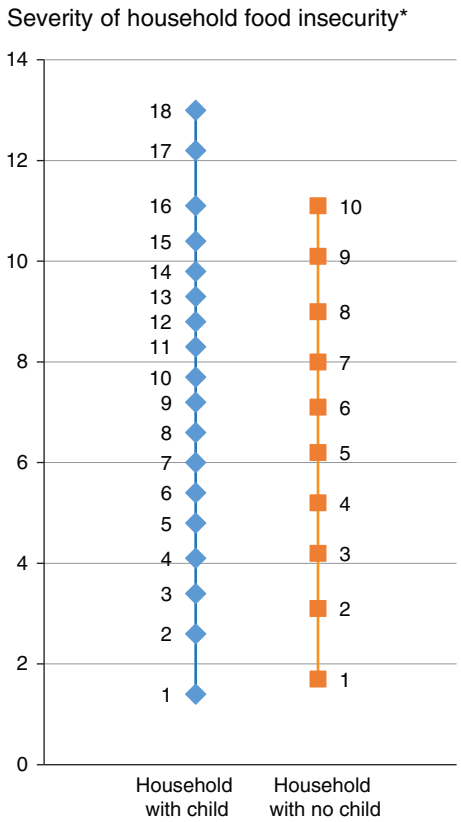
18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

As explained in Nord and Coleman-Jensen (2014), the current methods of food security measurement and classification have two factors that cause statistical biases large enough to affect comparisons of food-insecurity prevalence rates for households with and without children. The first source of statistical bias is that responses to the 18 items administered to households with children represent two latent characteristics—the food security of adults and that of children—while the Rasch model assumes that a single latent trait is being measured. These two latent characteristics correspond to the severity of food insecurity among adults and the severity of food insecurity among children. Age of children is the key factor contributing to these two latent characteristics. Given a level of food insecurity among adults, younger children are generally shielded by their parents from effects of food insecurity to a greater extent than older children. The distortion that results from these two latent traits is that the food insecurity of households with only very young children is understated relative to that of households with older children or households without children. This distortion is most noticeable for very low food security. For overall food insecurity, this statistical bias is more than offset by the second source of statistical bias.

The second source of statistical bias is that the threshold for food insecurity applied to households without children differs in severity from the threshold applied to households with children. This statistical bias is not due to any violation of assumptions or problem with the measurement model, but results because there is no raw-score-based threshold on the 10-item adult scale that is

exactly equivalent to the food insecurity threshold on the 18-item household scale for households with children (fig. 1). Three or more affirmative responses are taken to indicate food insecurity for both households with and without children, but that threshold corresponds to a more severe level of food insecurity on the 10-item adult scale than the 18-item scale. Thus, comparisons of food insecurity prevalence rates between households with and without children are biased (Nord and Coleman-Jensen, 2014). Since the food security measure was first developed, researchers have been aware that the food-insecurity-status thresholds for households with and without children were not equivalent. However, the current classification approach enabled a single scale to be used with all households and incorporated information about both adults and children. USDA has been well aware of this difference in severity of the food insecurity thresholds for households with and without children, and the agency's annual food security report explains that about one-third of the difference in food insecurity between households with and without children is an artifact of the measurement methods (see footnote 14 on p. 13 in Coleman-Jensen et al. (2016)).

Figure 1
Severity of food insecurity (latent trait measure), by raw score for households with and without children



*The vertical axis represents the Rasch-model estimate of the household parameter for the indicated raw score. This is the estimated mean measure on the latent trait (severity of food insecurity) for households with that raw score. The parameter for households with maximum scores—those that affirmed all 18 items (all 10 items for households with no child)—are technically undefined. The values shown are approximations based on raw scores a half-unit below maximum.
Source: USDA, Economic Research Service. Bickel et al. 2000. Guide To Measuring Household Food Security (revised 2000), USDA, Food and Nutrition Service, Exhibit C-2.

To address these statistical biases, ERS is further investigating the alternative food-security-status classification method described in Nord and Coleman-Jensen (2014) and refers to it as the experimental food-security-status classification method. The experimental food-security-classification approach would address the weakness in the current classification method by assessing food security among adults and children separately. This experimental cross-classification method uses the same survey items but—instead of combining adult and child items to determine household food security status based on the total of all items—determines the food security status of adults and of children separately. If there is either food insecurity among adults or food insecurity among children, the household is classified as food insecure. With this method, food insecurity among adults is statistically comparable between households with and without children. The experimental classification method is simply an alternative way of summing responses to the food security scale for households with children. There are no changes in data collection, and there is no change in food security status classification for households without children. Both the current and experimental classification methods can be estimated from all prior (and future) CPS-FSS data.

To be clear, the current methods that USDA uses to measure food security and classify household food security status are statistically sound and consistent with the underlying measurement theory. The panel of experts convened by the Committee on National Statistics (CNSTAT) to review the food security measure at USDA's request affirmed that the methodology was appropriate (National Research Council, 2006). The panel recommended some changes that USDA has already adopted and suggested that USDA explore additional technical enhancements to the food-security-measurement methods.[5] The experimental classification approach discussed here improves on the internal validity or consistency of the current method and straightforwardly addresses the weakness identified by the CNSTAT panel and other researchers.

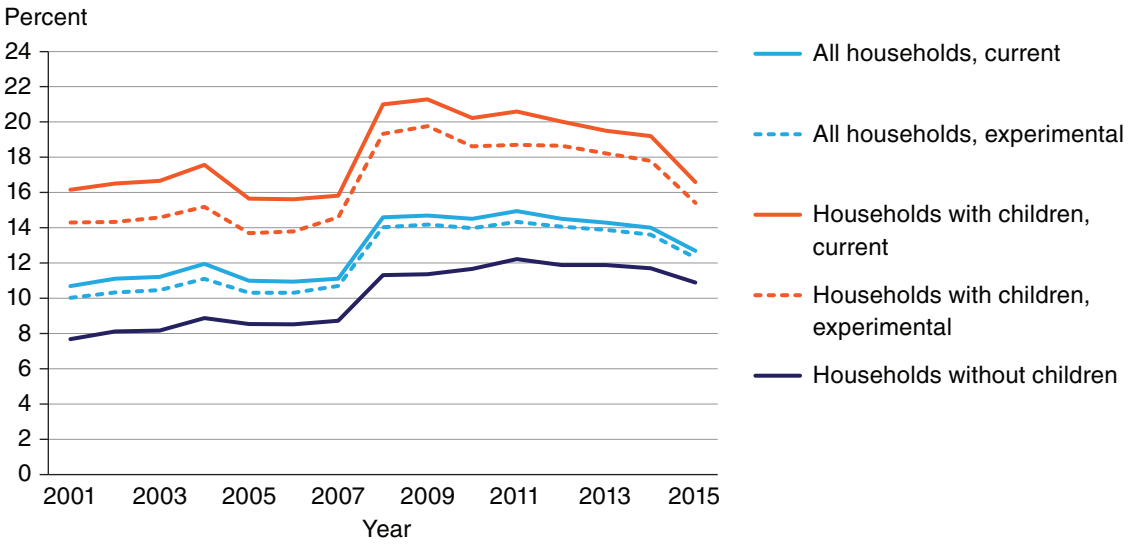
Previously published research using the current food-security-status classification approach remains valid. The "tweaking" of the classification system described in this technical bulletin is a minor difference that would be unlikely to change the substantive conclusions of earlier studies that used the current household classification method, as it only affects the food security classification of 3.48 percent of all households with children from 2008 to 2015, and does not affect the classification of households without children. Moreover, most previously published food security studies have controlled for the presence and age of children or have used the adult scale so they would not be affected by the statistical bias of the current classification. The main effect of the statistical bias would be in annual food security monitoring and comparisons of food security prevalence estimates between households with and without children.

The experimental food-security-status classification approach addresses theoretical concerns about the current classification approach and is preferred based purely on measurement and statistical grounds. However, there are additional points to consider regarding preference for one classification approach over another. Nord and Coleman-Jensen (2014) show that the prevalence of overall household food insecurity in households with children is *lower* with the experimental approach than with the current approach (fig. 2). However, the prevalence of very low food security in households with children is *higher* with the experimental approach than with the current approach (fig. 3). In 2001-15, the prevalence of overall food insecurity in households with children was an average of 1.7 percentage points lower, with a maximum difference of 2.4 percentage points, when classified by the experimental classification approach than when classified by the current approach. The average difference between the two classifications in the prevalence of food insecurity for all households (with and without children) was 0.6 percentage points. In 2001-15, the prevalence of very low food

[5]For a review of the recommended changes and how some have been implemented, see Nord (2012).

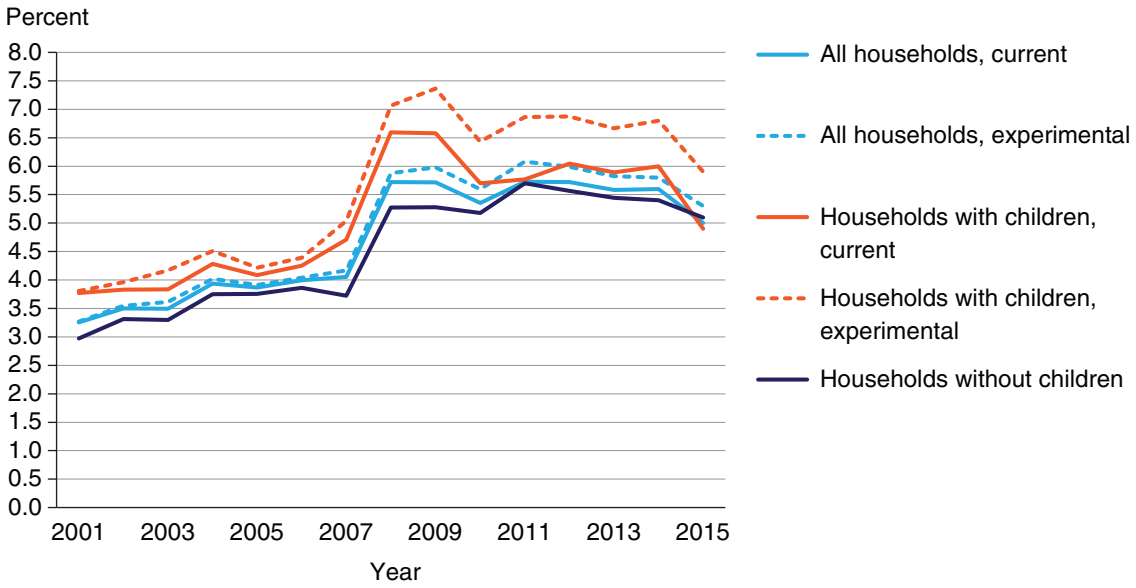
security in households with children was an average of 0.5 percentage points higher, with a maximum difference of 1.1 percentage points, when classified by the experimental approach than when classified by the current approach. The average difference between the two classifications in the prevalence of very low food security for all households (with and without children) was 0.2 percentage points.[6]

Figure 2
Prevalence of food insecurity based on current and experimental classification methods



Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2001-2015.

Figure 3
Prevalence of very low food security based on current and experimental classification methods



Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2001-2015.

[6]The overall prevalence of food insecurity is lower with the experimental approach because households with marginal food security among adults and children are no longer considered food insecure. Meanwhile, the prevalence of very low food security is higher with the experimental approach because households with relatively severe food insecurity among adults, but food security among children, are classified as having very low food security rather than only low food security.

Another factor to consider is whether the classification of food insecurity overall is more important or whether the classification of very low food security is more important. As discussed previously, the experimental food security status classification approach has different effects on prevalence depending on the severity of food insecurity. Low food security affects a larger segment of the population, while very low food security is a more severe condition for those affected. It is worth noting that research has found detrimental effects of food insecurity across severity levels. (See Coleman-Jensen et al. (2013) for a review of food security and children's outcomes and Gregory and Coleman-Jensen (2017) for an analysis of food security at varying levels of severity and chronic disease among adults.) Therefore, even less severe food insecurity can affect individuals and families. In this report, we do not determine whether the classification of food insecurity overall or very low food security is more important. That determination likely depends on the purpose for which the food security measure is being used.

For much of the analysis, we focus on households whose food security status is different in the current and the experimental classification approaches: the "discordant" households. In particular, the focus is on households with raw score two on the adult food security measure and raw score one on the child food security measure. These households are classified as food insecure on the current approach and food secure on the experimental approach. Of all the raw score combinations that differ on the two classification approaches, this is the largest group. Because many comparisons here show very small percentage point differences, the larger sample size for this group is helpful. Although we focus on discordant households, we also show results for other groups of households that differ on the two approaches.

Data and Methods

The goal of this analysis is to assess whether the current or experimental food-security-status classification method is more closely and consistently associated with indicators of food inadequacy and dietary quality. For this purpose, we use questions about food inadequacy from the 2008-15 CPS-FSS. This annual, nationally representative survey is conducted by the U.S. Census Bureau and sponsored by ERS. It is the source of USDA's annual food security statistics and includes about 40,000-45,000 households each year.

Food security is measured with a scale. One adult in each household responds to a series of questions about behaviors and conditions that characterize households when they are having difficulty meeting their food needs. Referring to the previous 12 months, the questions specify a lack of money as the reason for not having enough food and exclude voluntary fasting or dieting. As previously noted, all households respond to 10 questions, and households with children are asked an additional 8 questions about children's experiences. (See box 1, "Questions Used To Assess …."[7])

Standard USDA measurement procedures for *household food security status* classify households as food insecure if they affirm three or more items indicating food insecurity, regardless of whether there are children in the household. Adult-only food-insecure households are further classified as having very low food security if they report six or more food-insecure behaviors or conditions. Food-insecure households with children are classified as having very low food security if they report eight or more food-insecure behaviors or conditions, counting responses to both adult and child items.

With the experimental food-security-status classification method, there is no change to how food insecurity is classified for households without children. However, in households with children, food security status is determined separately for adults and children and then combined or cross-classified to assign household food security status.

Adult food security status is determined by responses to the 10 items on the adult scale (questions 1-10 in the box "Questions Used To Assess.…"), regardless of the presence of children. Three or more affirmative responses to the adult items indicate food insecurity, with six or more affirmative responses being classified as very low food secure. *Child food security status* is determined by the child food security scale consisting of the eight child-referenced food security items (questions 11-18 in the box, "Questions Used To Assess …"). Households reporting two or more food-insecure conditions among children are classified as having food insecurity among children. Five or more affirmative responses to child-referenced items indicate very low food security among children (Coleman-Jensen et al., 2013).

[7] To reduce the burden on higher income respondents, households with incomes above 185 percent of the Federal poverty line that give no indication of food-access problems on either of two preliminary screening questions are deemed to be food secure and are not asked the questions in the food security assessment series. The preliminary screening questions asked of all households are as follows:

- People do different things when they are running out of money for food in order to make their food or their food money go further. In the last 12 months, since December of last year, did you ever run short of money and try to make your food or your food money go further?
- Which of these statements best describes the food eaten in your household—enough of the kinds of food we want to eat, enough but not always the kinds of food we want to eat, sometimes not enough to eat, or often not enough to eat?

The experimental food-security-status classification approach is based on cross-classification of *adult food security status* and *child food security status* in households with children. Households are classified as food insecure if they have adults or children who are food insecure by the adult or child scale, respectively. Likewise, if a household has adults or children with very low food security according to either the adult or child scale, the household is classified as having very low food security. The experimental approach addresses the weaknesses identified above by explicitly allowing for the two latent characteristics corresponding to adult and child food security and using a comparable measure of adult food security status in households with and without children.

Indicators of food inadequacy come from the CPS-FSS data as well. None of these items is a scale. The questions and response options are shown in the box, "Indicators of Food Inadequacy." Respondents to the CPS-FSS are first asked about food spending and then about food sufficiency before they respond to the food security module. Households are asked about using a food pantry after they are asked the food security items.

Preceding the food security measure, "food insufficiency" is an indicator of food inadequacy that is still in use and is measured with one survey item. Food insufficiency is a more severe condition than food insecurity and measures whether a household generally has enough food to eat. The food insufficiency indicator does not have a specific time reference period, but instead refers to "not always," "sometimes," or "often."

Box 2

Indicators of Food Inadequacy

Food Insufficiency

Question: "Which of these statements best describes the food eaten in your household – enough of the kinds of food I or we want to eat, enough but not always the kinds of food I or we want to eat, sometimes not enough to eat, or often not enough to eat?"

Coding of responses: Response 1 (Enough of the kinds of food we want to eat) indicates food sufficiency. Responses 3 (Sometimes not enough to eat) and 4 (Often not enough to eat) are combined to indicate *food insufficiency.*

Unmet Food Needs

After a series of questions to determine how much the household usually spends on food, the respondent is asked: "In order to buy just enough food to meet your needs or the needs of your household, would you need to spend more than you do now, or could you spend less?" (More/Less/Same)

Coding of Responses: Responses of "more" were coded as having *unmet food needs*. Responses of "less" were coded as could spend less to meet their food needs.

Using a Food Pantry

Question: "In the last 12 months, did you or other adults in your household ever get emergency food from a church, a food pantry, or food bank? (Yes/No)

Coding of Responses: Households that responded "yes" were coded *using a food pantry.*

"Unmet food needs" is measured by asking respondents how much they actually spend on food. In the CPS-FSS, households are asked a series of questions to determine how much they spent on food in the week prior to the survey and then what their *usual* food spending is. They are then asked if they would need to spend more than they currently do or if they could spend less each week to just meet their food needs.

Households may use community-based food assistance resources when they are having difficulty meeting their household food needs. "Using a food pantry" is self-reported by the respondent. The CPS-FSS collects information on whether households have accessed food from food pantries or food banks in the past 12 months. Analyses of food pantry use are limited to households with incomes below 185 percent of the Federal poverty threshold. Most households with incomes above that range were not asked about food pantry use.

We compare the current and experimental food-security-status classification approaches by examining household responses to the other indicators of food inadequacy. Households reporting food insufficiency, unmet food needs, or food pantry use are experiencing some degree of food inadequacy. These items should be highly correlated with food security status. We conduct t-tests to determine whether the differences observed in the tables are statistically significant and mark differences that are statistically significant at the 90-percent confidence level or higher.

We first examine differences in reported food inadequacy indicators by food security status (food secure, low food secure, very low food secure) between the current and experimental classification approaches. We then use t-tests to examine differences in reported food inadequacy by raw score. Raw score is more finely disaggregated than food security status. The examination across raw score facilitates examinations of the households that differ on the current and experimental classification approaches. When the differences in the percent of households reporting food inadequacy are statistically significant, we assume that there is a substantive difference in how food insecurity is experienced across the raw score categories. When reported food inadequacy is not statistically different between raw score categories, we cannot conclude that there is a measureable difference in how food insecurity is experienced in those different raw score groups.[8]

We use logistic regression models to jointly examine the economic and demographic characteristics of the discordant households to determine whether their characteristics more closely align with households classified as food secure on both approaches or food insecure on both.

The second source of data used here is the National Health and Nutrition Examination Survey (NHANES), waves 2005-06, 2007-08, 2009-10, and 2011-12. The NHANES survey provides information about the non-institutionalized U.S. population and has a complex, multistage design that allows for nationally representative estimates of studied outcomes. NHANES is analyzed here because it includes data on dietary quality that are not available in the CPS-FSS. We examine self-reported dietary quality and the Healthy Eating Index (HEI) score. Respondents report their dietary quality on a 5-point scale as excellent, very good, good, fair, or poor. Food security status in NHANES is determined the same way as in the CPS-FSS, as previously described.

[8]There are multiple tests for statistical significance presented in the ensuing tables. As such, there is an increased risk of finding some statistically significant differences just by chance. The authors have elected not to use a Bonferroni adjustment for the multiple comparisons because the adjustment is somewhat conservative and can result in the opposite error of deeming differences not significant when they are. It is most appropriate to interpret the findings as a whole, rather than making conclusions based on an individual statistically significant comparison.

The HEI measures how closely an adult adheres to the 2010 *Dietary Guidelines for Americans*, which form the basis of Federal nutrition policy in the United States. Forming the basis of USDA's food patterns, the *Dietary Guidelines* translate the guidance into recommendations for specific types and amounts of foods to be consumed in proportion to one's total dietary intake. The food patterns are the basis of the HEI score and are generally composed of 12 components, including 9 adequacy components (foods to increase in order to boost HEI score) and 3 moderation components (foods to decrease to boost HEI score). Adequacy components include whole fruit, total fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant protein, and total fatty acids. All but total fatty acids are scored on a per-1,000-calorie basis.[9] Moderation components include refined grains, sodium, and empty calories. Total HEI score is on a 100-point scale.[10] For all components and the score as a whole, higher scores indicate more healthful diets. For more detail on the construction of the HEI scores, see Guenther et al. (2013).

NHANES respondents were assigned an HEI score based on their 24-hour, day-one dietary recall data. Each of the foods reported in the dietary recall is matched to nutrient and food group equivalents through the My Pyramid Equivalents Database (MPED), and HEI scores are constructed from that information. We assign HEI scores only to adults in households with children.

We compare self-reported dietary quality and HEI score by food security status in the current and experimental classification methods. We expect that as food insecurity worsens, dietary quality will be poorer.

[9]Fatty acids are scored based on the ratio of the sum of monounsaturated and polyunsaturated fatty acids to saturated fatty acids.

[10]Component scores for total fruit, whole fruit, total vegetables, greens, and beans, total protein foods, and seafood and plant protein foods have a maximum of 5; whole grains, dairy, fatty acids, refined grains, and sodium have a maximum of 10; empty calories has a maximum score of 20.

Findings

Percent of Households With Children by Current and Experimental Food-Security-Classification Method–Approach and Raw Score

We first show the percentage of households with children that are affected by differences in the current and experimental food-security-status classification approaches. A cross-tabulation of adult and child raw score is helpful to illustrate which cells are assigned to a different food security status in the current and experimental classification methods (table 1). Most households are classified in the same food security status by the two approaches. In table 1, cells with a value are those that are classified differently on the two approaches, and the values indicate the percent of households with children in that cell using CPS-FSS data from 2008 to 2015. A total of 3.48 percent of households with children are classified differently by the current versus the experimental food-security-status classification methods. In terms of percent of households, the biggest difference in assignment of food-security-status for the two classification approaches is for those with two affirmative adult items and one affirmative child item. This 1.61 percent of households with children are deemed low food secure by the current classification, but food secure by the experimental approach because neither adults alone nor children alone meet the threshold for food insecurity. A small percentage of households (0.19 percent) are classified as food secure by the current method but classified as low food secure by the experimental method because they have a child raw score of 2 and a 0 adult raw score. A total of 1.21 percent of households with children are low food secure by the current classification method and very low food secure by the experimental method (sum of cells in the bottom left of table 1). Nearly 0.5 percent of households are classified as very low food secure by the current classification method but as low food secure by the experimental method (sum of cells in the middle of table 1). (A similar version of table 1 appears in Nord and Coleman-Jensen (2014), using CPS-FSS data from 2001-11.)

Testing External Validity With Other Indicators of Food Inadequacy

Table 2 *(food insufficiency)*, table 3 *(unmet food needs)*, table 4 *(food pantry use)*, and figure 4 show differences in the share of households affirming indicators of food inadequacy by the current or experimental classification method. The next three paragraphs describe these tables in turn, beginning first with differences for overall food insecurity, which are not shown in the tables. The results shown in the tables are summarized graphically in figure 4.

An estimated 26.1 percent of households with children that are food insecure on the current classification method reported *food insufficiency,* and 27.5 percent of households that are food insecure on the experimental classification method reported food insufficiency—statistically significant differences (not shown). A nearly equal percentage of low-food-secure households by the current and experimental classification approaches report food insufficiency (about 16.5 percent, table 2). A statistically significantly larger percentage of households that were classified as very low food secure on the current method reported food insufficiency (49.3 percent) than households classified as very low food secure on the experimental approach (46.7 percent).

Table 1

Percentage of households with children, by raw score on the adult and child food security scales, average 2008-15

			Child food secure		Child food insecure						
					Child low food security			Child very low food security			
			Raw score on child food security scale								
			0	1	2	3	4	5	6	7	8
Adult food secure	Raw score on adult food security scale	0			0.19			*	*	*	
		1						*	*		
		2		1.61				*			
Adult food insecure	Adult low food security	3									
		4					0.08				
		5				0.30	0.09				
	Adult very low food security	6	0.45	0.50							
		7	0.26								
		8									
		9									
		10									

Shading indicates the current method of classifying households with children, based on the combined sum of adult and child raw scores:

Food secure, combined raw score 0-2
Low food security, combined raw score 3-7
Very low food security, combined raw score 8-18

Note: Percentages are displayed only for cells for which food security status based on experimental cross-classifications differs from that based on the current standard method. *Households in these cells would be classified as having very low food security by the experimental method but not by the current method. However, each of the cells had either no observed households or less than five and the total in the six cells was less than 0.0001 percent. Total N = 107,041.

Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Table 2

Percent of households with children reporting food insufficiency, by food security status, 2008-15

	Current classification method	Experimental classification method
Food secure	0.7	0.8**
Low food security	16.5	16.7
Very low food security	49.3	46.7*

Asterisks show statistically significant difference as follows: * = p < 0.05 and ** = p < .01.
Estimates are weighted to represent the U.S. population. N=106,997
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Table 3

Percent of households with children reporting unmet food needs, by food security status, 2008-15

	Current classification method	Experimental classification method
Food secure	10.1	10.7**
Low food security	49.0	49.7
Very low food security	70.7	68.3*

Asterisks show statistically significant difference as follows: * = p < 0.05 and ** = p < .01.
Estimates are weighted to represent the U.S. population. N=101,913
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Table 4

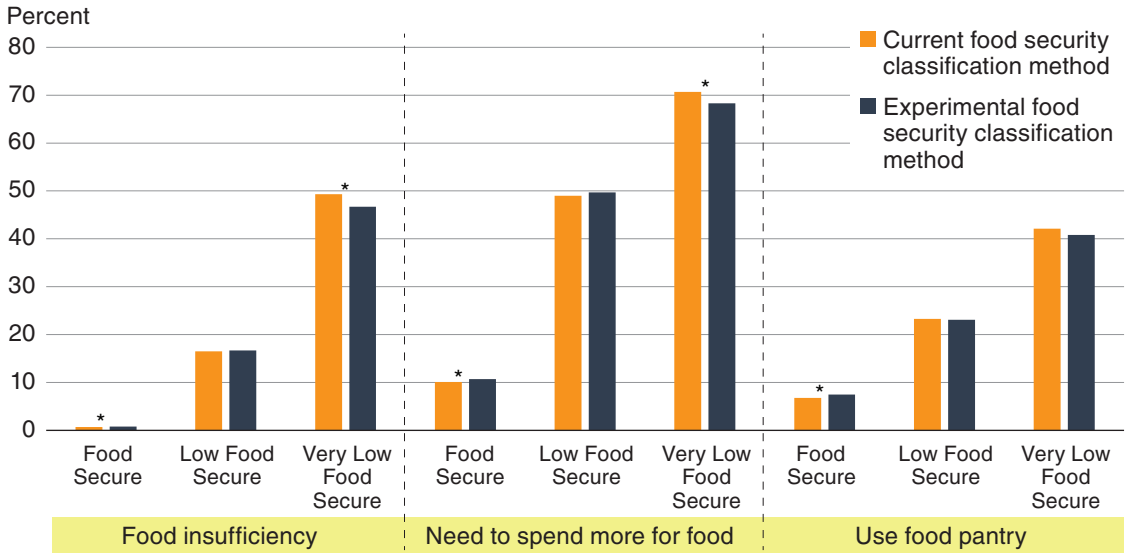
Percent of households with children and income less than 185 percent of the Federal poverty line that used a food pantry, by food security status, 2008-15

	Current classification method	Experimental classification method
Food secure	6.8	7.5*
Low food security	23.3	23.1
Very low food security	42.1	40.8

Asterisks show statistically significant difference as follows: * = p < 0.05.
Estimates are weighted to represent the U.S. population. N=34,249
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Figure 4

By food security status, percent of households with children reporting food insufficiency, unmet food needs, or food pantry use, 2008-15



* Indicates difference between current and experimental classification is statistically significant (p < .10).
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

An estimated 55.4 percent of households that are food insecure by the current classification method and 56.4 percent of households that are food insecure by the experimental method reported *unmet food needs* (not a significant difference, not shown). When a three-category food-security-status indicator (secure, low, and very low food security) is used, there is not a statistically significant difference—between the current and experimental classification—in the share of low-food-secure households reporting unmet food needs (table 3). A statistically significantly larger percentage of households that are very low food secure on the current classification method report unmet food needs (70.7 percent) than on the experimental method (68.3 percent). Comparing responses to questions of both food insufficiency and unmet food needs by food security status (between the current and experimental classification approaches), a greater share of food-secure households indicate food inadequacy with the experimental approach while a greater share of very low-food-secure households indicate food inadequacy with the current approach.

Similar percentages of food-insecure households report *using a food pantry*—29.4 percent of those that are food insecure by the current classification method and 30.0 percent of households that are food insecure by the experimental classification method (no significant difference, not shown). About the same percentage of households classified as low food secure or very low food secure by each method reported using a food pantry (table 4).

Tables 5, 6, and 7 include more detail by showing the share of households affirming each indicator of food inadequacy by raw score. Using t-tests, we examine whether the percentage of households affirming each of the food-inadequacy indicators by raw score is statistically significantly different across the raw score categories. Panel A within each table focuses on discordant households (raw score 2 on adult items and raw score 1 on child items, low food secure current, food secure experimental). Panel B shows households that are food insecure by the child scale only (raw score 0 on adult items and raw score 2 on child items; low food secure). Panel C compares differences in reported food inadequacy by households that differ on very low food security across the two classification methods.

In table 5, panel A, discordant households are significantly different from all other raw score categories on food insufficiency. The pattern of increasing food insufficiency as raw score increases is consistent with the underlying measurement theory that increasing raw score translates to increasing severity of food insecurity. The discordant households fit as expected along this continuum but do not provide conclusive evidence as to whether the category fits more appropriately with secure or low food secure households. The conclusion based on reported food sufficiency is similar. The statistics in panel B suggest that households that are food insecure by the child scale only are not experiencing food insufficiency to the same extent as other food insecure households. Panel C shows higher reported food insufficiency among households that are very low food secure on the current classification approach but low food secure on the experimental approach compared to households that are low food secure on the current approach but very low on the experimental approach. The findings from this table suggest that the current food-security-status categories are somewhat more consistent with reported food insufficiency than the experimental approach's categories.

Table 6 shows detailed comparisons by raw score for unmet food needs. In table 6, the pattern of findings is similar to those in table 5. As shown in Panel A, discordant households are more similar to households that are low food secure on the current classification approach; the share of discordant households that indicates unmet food needs is not distinguishable from the share classified as low food secure (with either approach) that indicates unmet food needs. Findings for very low food security in Panel C also support the current classification method.

The share of respondents who report using a food pantry to obtain food is shown in table 7 by food security status and raw score. The findings in Panel A suggest that the current classification of discordant households is more appropriate than their classification on the experimental approach, given that the percentage of households reporting using a pantry is similar to reported pantry users among households that are low food secure on both classification approaches. There is no statistically significant difference for using a pantry by very low food security status on the two classification approaches.

Table 5
Percent of households with children reporting food insufficiency/sufficiency by food security status, 2008-15[1]

	Food insufficiency "sometimes or often not enough to eat"		Food sufficiency "enough of the kinds of food we want to eat"	
	Percent	Difference[2] from shaded	Percent	Difference[2] from shaded
Panel A: household food security status on current and experimental classification methods and raw score				
Food secure (raw score 1)	2.5	-6.3***	47.0	21.2***
Food secure (raw score 2 adult items or 1 adult item and 1 child item)	4.7	-4.1***	39.3	13.5***
Discordant households: low food secure current, Food secure experimental (raw score 2 adult items and 1 child item)	8.8	—	25.8	—
Low food secure (raw score 3 adult items or 1 adult item and 2 child items)	11.5	2.7*	28.7	2.9+
Low food secure (raw score 4)	11.7	2.9*	19.3	-6.5***
Low food secure (raw score 5)	17.6	8.8**	13.3	-12.5***
Panel B: households that are low food secure on experimental classification method, by child scale only				
Food secure current, low food secure experimental (raw score 0 adult item and 2 child items)	1.5	-7.3***	36.9	11.1*
Panel C: very low food security (VLFS) status on current and experimental classification methods and raw score				
VLFS current, low food secure experimental (raw score 4 or 5 adult items and 4 child items, or 5 adult items and 3 child items)	36.7	5.6+	12.9	1.7
VLFS experimental: low food secure current (raw score 6 adult items and 0 or 1 child item, or 7 adult items and 0 child item)	31.1	—	11.2	—

[1]Food sufficiency question: "Which of these statements best describes the food eaten in your household—enough of the kinds of food we want to eat, enough but not always the kinds of food (I/we) want to eat, sometimes not enough to eat, or often not enough to eat?"
[2]For Panels A and B, difference is from "discordant households." For Panel C, difference is from VLFS experimental.
Estimates are weighted to represent the U.S. population.
Asterisks show statistically significant difference as follows: * = p < 0.05, ** = p < .01, *** p < .001, and + p < .10.
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Table 6

Percent of households with children reporting unmet food needs or could spend less on food, by food security status, 2008-15[1]

	Unmet food needs (need to spend more on food just to meet food needs)		Could spend less on food just to meet food needs	
	Percent	Difference[2] from shaded	Percent	Difference[2] from shaded
Panel A: household food security status on current and experimental classification methods and raw score				
Food secure (raw score 1)	25.2	-16.0***	21.1	9.7***
Food secure (raw score 2 adult items or 1 adult item and 1 child item)	33.0	-8.2***	16.4	5.0***
Discordant households: low food secure current, food secure experimental (raw score 2 adult items and 1 child item)	41.2	—	11.4	—
Low food secure (raw score 3 adult items or 1 adult item and 2 child items)	44.2	3.0	11.5	-0.1
Low food secure (raw score 4)	47.1	5.9**	10.5	-0.9
Low food secure (raw score 5)	49.6	8.4***	10.9	-0.5
Panel B: households that are low food secure on experimental classification method, by child scale only				
Food secure current, low food secure experimental (raw score 0 adult item and 2 child items)	30.23	-11.0*	11.8	0.4
Panel C: very low food secure (VLFS) status on current and experimental classification methods and raw score				
VLFS current, low food secure experimental (raw score 4 or 5 adult items and 4 child items, or 5 adult items and 3 child items)	66.8	10.1**	9.1	0.5
VLFS experimental: low food secure current (raw score 6 adult items and 0 or 1 child item, or 7 adult items and 0 child item)	56.7	—	8.6	—

[1]Households responding "more" or "less" to the question: "In order to buy just enough food to meet the needs of your household, would you need to spend more than you do now, or could you spend less?"

[2]For Panels A and B, difference is from "discordant households." For Panel C, difference is from VLFS experimental.

Estimates are weighted to represent the U.S. population.

Asterisks show statistically significant difference as follows: * = p < 0.05, ** = p < .01, *** p < .001, and + p < .10.

Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Table 7
Percent of households with children and income less than 185 percent of the Federal poverty line that used a food pantry, by food security status, 2008-15

	Percent that used a pantry	Difference from shaded[1]
Panel A: household food security status on current and experimental classification methods and raw score		
Food secure (raw score 1)	10.4	-10.3***
Food secure (raw score 2 adult items or 1 adult item and 1 child item)	15.2	-5.5**
Discordant households: low food secure current, food secure experimental (raw score 2 adult items and 1 child item)	20.7	—
Low food secure (raw score 3 adult items or 1 adult item and 2 child items)	17.7	-3.0
Low food secure (raw score 4)	23.7	3.0
Low food secure (raw score 5)	20.9	0.2
Panel B: households that are low food secure on experimental classification method by child scale only		
Food secure current, Low food secure experimental (raw score 0 adult item and 2 child items)	14.0	-6.7
Panel C: very low food secure (VLFS) status on current and experimental classification methods and raw score		
VLFS current, Low food secure experimental (raw score 4 or 5 adult items and 4 child items, or 5 adult items and 3 child items)	30.3	0.2
VLFS experimental: low food secure current (raw score 6 adult items and 0 or 1 child item, or 7 adult items and 0 child item)	30.1	—

[1]For Panels A and B, difference is from "discordant households." For Panel C, difference is from VLFS experimental.
Estimates are weighted to represent the U.S. population.
Asterisks show statistically significant difference as follows: * = p < 0.05, ** = p < .01, *** p < .001, and + p < .10.
Source: USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Examining Differences in Household Characteristics by Food- Security-Status Classification on the Experimental and Current Food Security Classifications

Tables 8, 9, and 10 show logistic regression models that examine the social and economic characteristics of households. We estimate these models to focus attention on the characteristics of discordant households. The question examined in these analyses is whether these households are more similar in terms of their economic and demographic characteristics to other households that are food secure on both classification methods, low food secure on both, or very low food secure on both.

Table 8, Model 1 predicts membership in the discordant households group (low food secure current, secure experimental) versus households that are food secure on both approaches. A number of characteristics are statistically significant, indicating that households in the discordant households group have different characteristics from households that are food secure on both approaches. For example, household composition, race/ethnicity of the household reference person, household

income, employment and age of oldest child are all significantly related to the measured outcome. These characteristics have all been linked to household food security in the research literature. Thus, the characteristics of households that are low food secure on the current classification approach and secure on the experimental approach are significantly different from households that are food secure on both. In model 2, discordant households are compared to households that are low food secure on both classification approaches. Here almost no covariates are statistically significant, and the overall model does not reach statistical significance. There is no evidence to conclude, from this model, that there is a relationship between the economic and demographic covariates and being in the discordant household group versus being low food secure on both approaches. The lack of significant correlates in model 2 suggests that there are few, if any, variables that distinguish membership in the discordant group and the group of households that are low food secure on each classification approach. Thus, these households appear to be similar to the low-food-secure group on the current approach, and are not like the food-secure group as would be suggested by the experimental approach. Thus, models 1 and 2 in table 8 suggest that characteristics of households that differ on food security status with the two classification approaches (low food secure on current approach and food secure on experimental approach) are more similar to those households with low food security on both approaches, and supports the current classification approach.

Table 8
Logistic regression model comparing discordant households (low food secure current, food secure experimental) with households consistent on both classification methods, 2008-15

	Model 1				Model 2			
	Discordant households (low current, secure experimental; N=1,723) versus food secure (N=86,614)				Discordant households (low current, secure experimental; N=1,723) versus low food secure (N=12,484)			
	Parameter estimate	Standard error	P-value	Odds ratio	Parameter estimate	Standard error	P-value	Odds ratio
Intercept	-5.94	0.134	<.0001		-1.79	0.148	<.0001	
Household composition (reference: married couple)								
Single father	0.39	0.084	<.0001	1.48	0.18	0.089	0.0462	1.19
Single mother	0.51	0.058	<.0001	1.66	0.07	0.060	0.2548	1.07
Other household with children	0.30	0.188	0.1144	1.35	-0.02	0.199	0.9334	0.98
Race/ethnicity of household reference person (reference: White non-Hispanic)								
Black non-Hispanic	0.20	0.071	0.0047	1.22	-0.03	0.075	0.7105	0.97
Hispanic	0.30	0.064	<.0001	1.35	0.01	0.067	0.8721	1.01
Other non-Hispanic	-0.21	0.114	0.0631	0.81	-0.13	0.121	0.2805	0.88
Income-to-poverty ratio (reference: 4.0+)								
Income missing	1.51	0.140	<.0001	4.54	-0.13	0.154	0.4141	0.88
Less than .5	2.59	0.149	<.0001	13.36	-0.20	0.160	0.2095	0.82
.5 - .75	2.64	0.153	<.0001	14.04	-0.24	0.163	0.1394	0.79
.75-1.0	2.55	0.152	<.0001	12.78	-0.35	0.162	0.0325	0.71
1.0-1.5	2.54	0.139	<.0001	12.68	-0.18	0.150	0.2413	0.84
1.5-2.0	2.24	0.142	<.0001	9.42	-0.17	0.154	0.2744	0.85
2.0-3.0	1.73	0.141	<.0001	5.64	-0.12	0.154	0.4504	0.89
3.0-4.0	1.17	0.159	<.0001	3.22	-0.05	0.174	0.7605	0.95

continued

Table 8

Logistic regression model comparing discordant households (low food secure current, food secure experimental) with households consistent on both classification methods, 2008-15—continued

	Model 1				Model 2			
	Discordant households (low current, secure experimental; N=1,723) versus food secure (N=86,614)				Discordant households (low current, secure experimental; N=1,723) versus low food secure (N=12,484)			
	Parameter estimate	Standard error	P-value	Odds ratio	Parameter estimate	Standard error	P-value	Odds ratio
Intercept	-5.94	0.134	<.0001		-1.79	0.148	<.0001	
Metropolitan status (reference: metro suburban)								
Metro central city	0.10	0.059	0.0868	1.11	0.05	0.063	0.4498	1.05
Metro not identified	-0.04	0.078	0.6087	0.96	-0.07	0.083	0.4244	0.94
Nonmetropolitan	-0.07	0.074	0.3468	0.93	-0.03	0.079	0.7165	0.97
Region (reference: South)								
Northeast	-0.03	0.074	0.6793	0.97	0.02	0.079	0.7712	1.02
Midwest	-0.02	0.068	0.7681	0.98	-0.01	0.072	0.9432	1.00
West	0.08	0.064	0.1888	1.09	0.12	0.068	0.088	1.12
Employment (reference: full-time)								
Retired	-0.18	0.178	0.3215	0.84	-0.11	0.190	0.5519	0.89
Part-time preferred	0.04	0.111	0.7107	1.04	-0.07	0.116	0.5244	0.93
Part-time economic reasons	0.26	0.127	0.039	1.30	-0.34	0.131	0.0096	0.71
Unemployed	0.46	0.105	<.0001	1.59	-0.17	0.106	0.1102	0.84
Disabled	0.68	0.124	<.0001	1.97	-0.19	0.127	0.138	0.83
Not in the labor force	0.12	0.120	0.3033	1.13	0.05	0.127	0.6919	1.05
Age of oldest child (reference: age 14-17)								
Age 5 and under	-0.26	0.068	0.0002	0.77	-0.18	0.072	0.0136	0.84
Age 6-9	-0.13	0.069	0.0584	0.88	-0.08	0.074	0.2955	0.93
Age 10-13	0.05	0.063	0.4313	1.05	0.08	0.067	0.2615	1.08
-2LL	15,861.784				10,494.053			
Likelihood ratio Chi-square	1,658.653				46.0397			
Df, p-value	29, p < .0001				29, p = .0233			
Number of households with children	88,337				14,207			

Estimates are weighted to represent the U.S. population.

Source: Calculated by USDA, Economic Research Service using data form the Current Population Survey Food Security Supplement, 2008-15.

Table 9 examines the group of households that differ on very-low-food-security status, being low food secure on the current classification approach and very low on the experimental approach. Model 1 compares these households to those that are low food secure on both, and model 2 compares them to households that are very-low-food-secure on both. Neither model 1 nor model 2 in table 9 shows covariates that are consistently related to the outcome measure. There is not a clear conclusion on similarities or differences between very-low-food-secure discordant households (low on current approach, very low experimental approach) and households that are low food secure on both approaches or very low food secure on both.

Table 10 also examines households that differ on very-low-food-security status but focuses on households that are very low food secure on the current classification approach and low food secure on the experimental approach. Similar to the logistic regression models in table 9, the coefficients for the characteristics in these models do not show clear patterns between the current and experimental classification approaches.

Table 9
Logistic regression model comparing very-low-food-secure discordant households (low food secure current and very low food secure experimental) with households consistent on both classification methods, 2008-15

	Model 1				Model 2			
	Very low discordant households (low current, very low experimental N=1,291) versus low food secure (N=12,916)				Very low discordant households (low current, very low experimental N=1,291) versus very low food secure (N=5,507)			
	Parameter estimate	Standard Error	P-value	Odds Ratio	Parameter estimate	Standard Error	P-value	Odds Ratio
Intercept	-2.75	0.200	<.0001		-1.31	0.227	<.0001	
Household composition (reference: married couple)								
Single father	0.24	0.098	0.0141	1.27	0.13	0.106	0.2239	1.14
Single mother	-0.01	0.069	0.8519	0.99	-0.20	0.073	0.0062	0.82
Other household with children	0.18	0.204	0.3731	1.20	-0.04	0.217	0.8555	0.96
Race/ethnicity of household reference person (reference: White non-Hispanic)								
Black non-Hispanic	-0.35	0.084	<.0001	0.70	-0.12	0.089	0.1753	0.89
Hispanic	-0.67	0.083	<.0001	0.51	-0.17	0.087	0.0455	0.84
Other non-Hispanic	-0.12	0.128	0.3626	0.89	-0.08	0.136	0.5439	0.92
Income-to-poverty ratio (reference: 4.0+)								
Income missing	0.21	0.207	0.3069	1.24	-0.30	0.234	0.2031	0.74
Less than .5	0.48	0.208	0.0219	1.61	-0.51	0.233	0.0292	0.60
.5 - .75	0.23	0.214	0.2772	1.26	-0.69	0.239	0.0038	0.50
.75-1.0	0.39	0.209	0.0602	1.48	-0.47	0.235	0.0451	0.62
1.0-1.5	0.36	0.200	0.0694	1.44	-0.41	0.227	0.0697	0.66
1.5-2.0	0.20	0.207	0.3358	1.22	-0.38	0.234	0.1077	0.69
2.0-3.0	0.27	0.206	0.1909	1.31	-0.29	0.234	0.2106	0.75
3.0-4.0	0.22	0.229	0.3278	1.25	-0.13	0.259	0.6274	0.88

continued

Table 9

Logistic regression model comparing very-low-food-secure discordant households (low food secure current and very low food secure experimental) with households consistent on both classification methods, 2008-15—continued

	Model 1				Model 2			
	Very low discordant households (low current, very low experimental N=1,291) versus low food secure (N=12,916)				Very low discordant households (low current, very low experimental N=1,291) versus very low food secure (N=5,507)			
	Parameter estimate	Standard Error	P-value	Odds Ratio	Parameter estimate	Standard Error	P-value	Odds Ratio
Intercept	-2.75	0.200	<.0001		-1.31	0.227	<.0001	
Metropolitan status (reference: metro suburban)								
Metro Central City	0.03	0.076	0.6578	1.03	0.08	0.080	0.2981	1.09
Metro not identified	0.20	0.088	0.0225	1.22	0.18	0.094	0.0607	1.19
Nonmetropolitan	-0.07	0.088	0.4199	0.93	0.10	0.094	0.3042	1.10
Region (reference: South)								
Northeast	0.00	0.090	0.9982	1.00	-0.01	0.096	0.9292	0.99
Midwest	0.04	0.079	0.6305	1.04	0.07	0.085	0.386	1.08
West	-0.05	0.082	0.5316	0.95	-0.10	0.087	0.2389	0.90
Employment (reference: full-time)								
Retired	0.18	0.209	0.3941	1.20	-0.14	0.217	0.5258	0.87
Part-time preferred	0.28	0.120	0.0201	1.32	0.12	0.128	0.3382	1.13
Part-time economic reasons	0.11	0.134	0.4114	1.12	-0.14	0.140	0.3022	0.87
Unemployed	0.37	0.106	0.0005	1.44	-0.07	0.111	0.5367	0.93
Disabled	0.38	0.125	0.0028	1.46	-0.04	0.129	0.7334	0.96
Not in the labor force	-0.11	0.155	0.4653	0.89	-0.18	0.162	0.2549	0.83
Age of oldest child (reference: age 14-17)								
Age 5 and under	0.64	0.078	<.0001	1.90	1.05	0.083	<.0001	2.86
Age 6-9	0.34	0.086	<.0001	1.41	0.53	0.090	<.0001	1.69
Age 10-13	0.07	0.086	0.3998	1.08	0.19	0.089	0.0322	1.21
-2LL	8,416.73				6,409.056			
Likelihood ratio Chi-square	231.9193				246.2908			
df, p-value	29, p < .0001				29, p < .0001			
Number of households with children	14,207				6,798			

Estimates are weighted to represent the U.S. population.

Source: Calculated by USDA, Economic Research Service using data form the Current Population Survey a Security Supplement, 2008-15.

Table 10

Logistic regression model comparing very-low-food-secure discordant households (very low food secure current, low food secure experimental) with households consistent on both classification methods, 2008-15

	Model 1				Model 2			
	Very low discordant households (very low current, low experimental N=507) versus low food secure (N=12,916)				Very low discordant households (very low current, low experimental N=507) versus very low food secure (N=5,507)			
	Parameter estimate	Standard error	P-value	Odds ratio	Parameter estimate	Standard error	P-value	Odds ratio
Intercept	-3.86	0.342	<.0001		-2.54	0.361	<.0001	
Household composition (reference: married couple)								
Single father	0.14	0.174	0.4106	1.15	0.01	0.177	0.9705	1.01
Single mother	0.32	0.107	0.003	1.37	0.12	0.109	0.2618	1.13
Other household with children	-0.32	0.456	0.4853	0.73	-0.61	0.460	0.1847	0.54
Race/ethnicity of household reference person (reference: White non-Hispanic)								
Black non-Hispanic	0.32	0.137	0.0179	1.38	0.56	0.139	<.0001	1.75
Hispanic	0.50	0.124	<.0001	1.65	1.01	0.126	<.0001	2.74
Other non-Hispanic	0.57	0.195	0.0032	1.78	0.67	0.198	0.0007	1.95
Income-to-poverty ratio (reference: 4.0+)								
Income missing	0.11	0.354	0.7593	1.12	-0.32	0.369	0.3935	0.73
Less than .5	0.55	0.351	0.1167	1.73	-0.35	0.364	0.3433	0.71
.5 - .75	0.48	0.355	0.1721	1.62	-0.35	0.369	0.3462	0.71
.75-1.0	0.30	0.356	0.407	1.34	-0.48	0.371	0.1994	0.62
1.0-1.5	0.22	0.346	0.5251	1.25	-0.43	0.360	0.2272	0.65
1.5-2.0	0.36	0.351	0.2985	1.44	-0.19	0.367	0.6037	0.83
2.0-3.0	0.11	0.360	0.7611	1.12	-0.34	0.377	0.3628	0.71
3.0-4.0	0.04	0.414	0.9313	1.04	-0.33	0.430	0.439	0.72
Metropolitan status (reference: metro suburban)								
Metro central city	-0.02	0.112	0.8251	0.98	0.08	0.115	0.4781	1.09
Metro not identified	0.01	0.151	0.9402	1.01	0.06	0.154	0.6815	1.07
Nonmetropolitan	0.06	0.144	0.678	1.06	0.25	0.147	0.0836	1.29
Region (reference: South)								
Northeast	0.17	0.137	0.2089	1.19	0.18	0.139	0.209	1.19
Midwest	-0.15	0.142	0.2839	0.86	-0.10	0.145	0.4982	0.91
West	0.14	0.120	0.2314	1.15	0.08	0.123	0.5141	1.08

continued

Table 10
Logistic regression model comparing very-low-food-secure discordant households (very low food secure current, low food secure experimental) with households consistent on both classification methods, 2008-15—continued

	Model 1				Model 2			
	Very low discordant households (very low current, low experimental N=507) versus low food secure (N=12,916)				Very low discordant households (very low current, low experimental N=507) versus very low food secure (N=5,507)			
	Parameter estimate	Standard error	P-value	Odds ratio	Parameter estimate	Standard error	P-value	Odds ratio
Intercept	-3.86	0.342	<.0001		-2.54	0.361	<.0001	
Employment (reference: full-time)								
Retired	-0.16	0.351	0.6476	0.85	-0.53	0.354	0.1379	0.59
Part-time preferred	0.12	0.196	0.5483	1.13	-0.18	0.200	0.3644	0.83
Part-time economic reasons	0.02	0.200	0.911	1.02	-0.18	0.202	0.3637	0.83
Unemployed	0.28	0.162	0.0812	1.33	-0.12	0.165	0.469	0.89
Disabled	0.10	0.199	0.6181	1.10	-0.37	0.198	0.0658	0.69
Not in the labor force	0.06	0.211	0.7836	1.06	0.02	0.215	0.9326	1.02
Age of oldest child (reference: age 14-17)								
Age 5 and under	-0.84	0.150	<.0001	0.43	-0.43	0.153	0.0049	0.65
Age 6-9	-0.37	0.132	0.0053	0.69	-0.15	0.135	0.2767	0.86
Age 10-13	-0.10	0.113	0.389	0.91	0.02	0.115	0.8734	1.02
-2LL	4123.633				3349.373			
Likelihood ratio Chi-Square	115.9905				110.1256			
df, p-value	29, p < .0001				29, p < .0001			
Number of households with children	13,423				6,014			

Estimates are weighted to represent the U.S. population.
Source: Calculated by USDA, Economic Research Service using data from the Current Population Survey Food Security Supplement, 2008-15.

Testing external validity with dietary quality

Self-reported dietary quality by food security status is shown in table 11. The share of adults reporting excellent/very good, good, or fair/poor are shown by current and experimental food-security-status classification approaches. These estimates are from adults in households with children in NHANES. There are no statistically significant differences in dietary quality between the current or experimental classification approaches. Overall, a greater percentage of adults report their dietary quality to be excellent or very good if they are food secure (about 29 percent of adults in food-secure households by either the current or experimental approach). As food insecurity worsens, self-reported dietary quality also worsens. For both food-security-status classification approaches, the greatest share of adults in low-food-secure households report fair/poor dietary quality (each 42.7 percent). Among adults in very-low-food-secure households, about 45 percent report fair/poor dietary quality regardless of food-security-classification method. Self-reported dietary quality does

not point to the current or experimental classification approach as more closely aligned with food intake, but the expected relationship between worsening food insecurity and poorer dietary quality is evident for both classification methods.

Healthy eating scores by the current and experimental classification approaches are shown in table 12. HEI may be preferred over self-reported dietary quality because it is derived from dietary intake data and does not depend on the respondents' idea of a quality diet. However, HEI scores are very similar between the two classification approaches with no statistically significant differences and do not indicate that the current or experimental approach matches more closely with intake. For both classifications, adults in food-secure households have higher HEI scores, and adults in food-insecure households have lower HEI scores. It is worth noting that dietary quality is relatively poor across all food-security-status categories. (Scores range from a possible 0 to 100.)

Table 11
Self-reported dietary quality by food-security-status classification method for adults in households with children, NHANES 2005-2011

	Current classification method			Experimental classification method		
	Excellent/ Very good	Good	Fair/Poor	Excellent/ Very good	Good	Fair/Poor
	---Percent---					
Food secure	29.3	44.0	26.7	29.2	43.8	27.0
Low food secure	17.0	40.3	42.7	16.2	41.2	42.7
Very low food secure	16.5	38.6	45.0	16.2	39.5	44.4

Estimates are weighted to represent the U.S. population. N=10,032.
There are no statistically significant differences by current or experimental food-security-status classification method.
Source: USDA, Economic Research Service using data from 2005-2011 waves of the National Health and Nutrition Examination Survey of Centers for Disease Control and Prevention, National Center for Health Statistics.

Table 12
Healthy Eating Index score by food-security-status classification method, adults in households with children, NHANES 2005-2011

	HEI - 2010	
	Current classification method	Experimental classification method
	---Mean Score---	
Food secure	47.93	47.87
Low food secure	44.83	45.02
Very low food secure	44.78	44.65

Estimates are weighted to represent the U.S. population. N=9,134
There are no statistically significant differences by current or experimental food-security-status classification method.
Source: USDA, Economic Research Service using data from 2005-11 waves of the National Health and Nutrition Examination Survey of Centers for Disease Control and Prevention, National Center for Health Statistics.

Conclusion

ERS's program of research on food security measurement aims to ensure the food security measure is sound and improve the measure, as appropriate. The analysis examines whether an experimental classification approach—developed to address statistical bias in comparing food security statuses in households with and without children—or the current classification is more consistent with indicators of food inadequacy. While previous research indicates that the experimental food-security-status classification method conforms more closely to Rasch measurement model assumptions and overcomes certain statistical biases (Nord and Coleman-Jensen, 2014), it is also useful to examine which classification approach is more strongly supported by comparisons with other indicators of food inadequacy.

Differences between the current and experimental classification approach in reported food inadequacy are minimal but tend to favor the current approach. The logistic regression models suggest that for food insecurity status, the current approach's classification of the discordant households is appropriate given that their household characteristics more closely match the characteristics of households classified as low food secure than food-secure households. Analysis of dietary quality indicates that there are no differences between the two food-security-classification approaches on this indicator and does not point to specific conclusions regarding which classification method more closely reflects dietary intake. The results suggest that the current classification method of food insecurity status is appropriate if we assume that households truly experiencing low or very low food security should also show other indicators of food inadequacy such as food insufficiency or unmet food needs. However, even the statistically significant differences shown here are small.

To overcome the theoretical limitations of the current classification approach in research, analysts could use the adult (10-item) food security scale for all households, regardless of whether children are present. The adult food-security-status variables based on this version of the scale are available in the CPS-FSS data, and the user notes for the data indicate that the adult scale "provides a more nearly comparable measure of food security between households with and without children, or among households with children in different age ranges than does the Household Food Security Scale" (Current Population Survey, 2014). Using the adult food security scale for research purposes rectifies any potential statistical bias introduced into the research by using a different food-insecurity-severity threshold for households with and without children. Researchers could also continue to use the current household (18-item) food security scale and ensure that they include controls for presence and ages of children.

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