A 30-Day Food Security Scale for Current Population Survey Food Security Supplement Data

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Abstract

This report describes and assesses a 30-day household food security scale that can be applied specifically to Current Population Survey Food Security Supplement (CPS-FSS) data. In the analysis described here, a 30-day scale was originally developed for use in the analysis of the 1995 CPS data. This report revises the scale to make it more consistent with the standard 12-month U.S. food security scale commonly used in food security household analyses. A nonlinear (Rasch-model-based) scaling method was used to statistically assess both the original and revised scales. The report specifies procedures for calculating the revised 30-day scale from CPS-FSS data and classifying households as to 30-day food security status. The report also compares prevalence rates of food insecurity with hunger based on the 30-day scale with those based on the 12-month scale for the years 1998-2000.

Keywords: Food security, food security measurement, food insecurity, hunger

Contents

Background

The Current Population Survey Food Security Supplements (CPS-FSS) have, since 1995, collected information on food security-related conditions, behaviors, and experiences that occurred in the respondents' households during the 12 months prior to the survey. For a subset of questions, respondents were also asked whether the condition occurred during the last 30 days. Initial USDA-sponsored research and analysis based on the 1995 CPS-FSS included development of scales measuring the food security of interviewed households for both 12-month and 30-day reference periods (Hamilton et al. 1997a; Hamilton et al. 1997b). The 12-month scale has been the primary monitoring tool and the focus of most of the research on food security and food security measurement to date (Hamilton et al., 1997a; Bickel et al., 1999; Andrews et al., 2000; Nord et al., 2002a). However, development work has continued on the 30-day scale, which may also have important monitoring and research uses. In this report a slightly revised 30-day food security scale for use with CPS-FSS data is described and assessed.

Households' food security, defined as "assured access by all household members at all times to enough food for an active, healthy life" (Anderson, 1990), is assessed in the CPS-FSS by a series of 18 questions about behaviors and experiences known to characterize households that are having difficulty meeting their food needs. The questions cover a wide range of severity of food insecurity. For example, questions at the least-severe level of food insecurity ask whether respondents worried that their food would run out before they got money to buy more and whether they were able to afford to eat balanced meals. Questions at the midrange ask about reductions in food intake, such as whether adults in the household cut the size of meals or skipped meals because there wasn't enough money for food. Questions tapping the more severe levels of food insecurity ask whether children skipped meals because there wasn't enough money for food, and whether adults did not eat for a whole day because there wasn't enough money for food. Each question specifies a lack of money or other resources to obtain food as the reason for the condition

or behavior. Voluntary fasting or dieting to lose weight are thereby excluded from the measure. (A complete list of the questions in the food security scale is available in Bickel et al., 2000, or at http://www.ers.usda.gov/briefing/foodsecurity/surveytools/).

Responses to the food security questions are combined into a scaled measure of the severity of food insecurity experienced by each household using statistical methods based on the Rasch measurement model (Fischer et al., 1995; Baker 1992; Hambleton et al., 1991; Wright 1983). Interviewed households are also classified into one of three categories corresponding to ranges of severity on the food security scale—food secure, food insecure without hunger, food insecure with hunger.[1]

Little use has been made of the 30-day food security scale. It has not been included on the CPS-FSS public-use files since 1995, and it has not been used in any published studies since the report on the 1995 CPS-FSS data (Hamilton et al., 1997b).[2] Two characteristics of the scale account for this paucity of use. First, while the 12-month food security scale measures food insecurity across a wide range, from mild to severe, the 30-day scale does not measure mild food insecurity at the less severe end of the range. The questions that are sensitive to that range were asked only with reference to the previous 12 months (table 1). Second, the 30-day scale was judged by Hamilton et al. to be somewhat less reliable than the 12-month scale.

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[1] The thresholds that demarcate these food security status categories were specified based on the judgment of a panel of researchers with expertise in nutrition, health, and measurement of well-being. Under the assumptions of the Rasch model, households that affirm the same number of items (i.e., that have the same raw score) are assigned the same food security scale score irrespective of which items they affirm. Therefore, classification as to food security status can also be related directly to the number of items affirmed by the household. Those that answer yes to 3 or more of the 18 food security questions are classified as food insecure. At a minimum, food-insecure households have affirmed all of the following three items or items indicating more severe conditions:
- They worried whether their food would run out before they got money to buy more;
- The food they bought didn't last, and they didn't have money to get more;
- They couldn't afford to eat balanced meals.
Households classified as food insecure with hunger have affirmed, in addition to the three items above, both of the following items or items indicating more severe conditions:
- The respondent ate less than he/she felt he/she should;
- Adults cut the size of meals or skipped meals in three or more months.

For some research purposes, however, the 30-day scale would be more appropriate than the 12-month scale. For example, in the CPS-FSS, questions about participation in some Federal food assistance programs are asked with reference to the previous 30 days. Assessing the association of food security status with participation in those programs would, most appropriately, use the 30-day food security scale. The CPS-FSS alternated between Spring and Summer during the first seven years of data collection. Analysis of the prevalence of hunger during the 30 days prior to each survey might provide information about seasonal differences in food security. The 30-day scale might also be used in combination with the 12-month scale to provide additional insight into dynamics of food security by comparing annual and monthly prevalence rates. Therefore, important research purposes could be achieved by making a standardized 30-day food security scale available for the CPS-FSS data files.

In the years since the initial development of the food security scales, understanding of the phenomenon of food insecurity and of both conceptual and statistical issues relevant to its measurement have increased. In light of this increased understanding, it is appropriate to review the conceptual and statistical underpinnings of the original 30-day scale proposed by Hamilton et al. (1997b), to reassess the validity of those foundational assumptions, and to revise the scale if appropriate. The purpose of this paper is to carry out that assessment and to propose a revised 30-day food security scale based on the findings.

In this paper, the original scale as described in Hamilton et al. (1997b) is examined. On theoretical grounds a somewhat simplified scale is proposed that includes only items that correspond to items in the 12-month scale. Both the original and simplified 30-day scales are then calculated using data from the 1998 and 1999 CPS-FSS. The scale items are assessed in terms of their goodness-of-fit to the statistical measurement model; the effects of the inclusion of a large number of frequency follow-up items in the

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[2] The 30-day items were, however, used to assess the frequency and duration of food insecurity and hunger by Nord et al. (2000; 2002).

original scale are assessed; and the appropriate number of days of occurrence for identifying frequent recurrence of conditions is investigated. Based on these findings, a revised 30-day scale is proposed, and household scores and categorical assignments are calculated. The metric of the proposed 30-day scale is adjusted to the metric of the 12-month scale so that equal scores on the two scales describe equivalent conditions and behaviors occurring during the previous 30 days and during the previous 12 months.

The 30-day scale proposed here was developed specifically for the set of questions asked in the CPS-FSS. It is only applicable to surveys that ask the same subset of 30-day-referenced food security questions that are asked by the CPS-FSS.[3] It is distinct from the standard, or "full range" 30-day scale (described in Bickel et al., 2000, p. 58) that includes all 18 questions in the U.S. Food Security Survey Module, modified to refer to the previous 30 days rather than to the previous 12 months. For surveys that collect all 18 items referenced to the previous 30 days, food security scale values and categorical assignments for the standard 30-day scale should be based on the same methods and specifications that are used for the 12-month scale (Bickel et al., 2000, p. 34), not on the methods described in the present paper.[4] The need for the CPS-FSS 30-day scale, and the analytic problems addressed in this paper, arise because the standard full-range 30-day scale cannot be calculated from CPS-FSS data since only 12 of the 18 questions comprising the standard scale are asked with reference to the previous 30 days.

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[3] At present, only the CPS-FSS collects this limited subset of 30-day referenced food security items. Typically, a survey either asks all of the food security questions referenced to the previous 12 months or asks all of the questions referenced to the previous 30 days. The CPS is unique in that it asks all questions with reference to the previous 12 months, then, for a subset of the questions, follows up affirmative responses by asking whether the condition or behavior occurred during the previous 30 days. The less severe questions in the scale are, however, asked only with reference to the previous 12 months because the form in which they are asked does not accommodate the 30-day follow-up. The Fourth National Health and Nutrition Examination Survey (NHANES IV) is asking a set of 30-day, individually referenced questions for which the methods described in this paper may also be appropriate.

[4] The findings described in the present paper, do, however, provide guidance as to the appropriate coding of the "How many days did that occur?" follow-up questions that is applicable also to the standard full-range 30-day scale. This amends slightly a technical detail that was only provisionally specified in Bickel et al. (2000). That is, responses of three or more days should be coded as indicating recurring conditions.

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The Revised 30-Day Scale

The 30-day scale developed by Hamilton et al. (1997b) included 17 items—9 items indicating occurrence of conditions at any time during the previous 30 days and 8 items indicating recurrence of selected conditions on 5 or more days. In the CPS-FSS, affirmative responses to the 30-day questions are followed up with a question that asks, "In the last 30 days, how many days did…..[the experience or behavior occur]?" Among the 30-day questions, only the question about losing weight did not include such a follow-up. (Beginning in 1998 the follow-up to the question about children not eating for a whole day, was also dropped; see table 1.) Hamilton et al. dichotomized responses to the "how many days" follow-up questions, categorizing responses of 5 or more days as indicating recurrence of the conditions. These items were then included in the scale along with the 9 base items that indicate occurrence at any time during the previous 30 days. Goodness-of-fit statistics for all items were within an acceptable range, so all of the items, including the frequency-of-occurrence follow-ups, were retained in the scale.

Two issues are explored with regard to construction of the 30-day scale. The first is whether to include all of the items that Hamilton et al. included. The second is whether the "5+ days" cutoff is optimal, in terms of consistency with the 12-month measure, for identifying multiple recurrence of conditions. Based on resolution of these issues, a specific 30-day scale is proposed, with a metric that is consistent with that of the 12-month measure.

Which Items Should Be Included in the 30-Day Scale?

The Rasch model assumes that all items are mutually independent except for their relationship with the common underlying phenomenon being measured (Fischer and Molenaar, 1995; Baker, 1992; Hambleton et al., 1991; Wright, 1983). This assumption is clearly violated by the pairs of items consisting of a base item and its frequency-of-occurrence follow-up. The pervasive item dependencies created by the large

number of such pairs of items in the original 30-day scale may, therefore, be problematic. However, previous analysis has found that the item dependencies in the 12-month scale—three sets of dependent items similar to those in the 30-day scale—have negligible effects on item severity scores, although the dependencies bias fit statistics downward for the dependent pair and slightly upward for all other items (Nord and Fogarty, 2000). That analysis consisted of calculating three separate scales. The first included all 18 items. The second omitted the three frequency follow-up items. The third included the frequency follow-up items but omitted their base items. The three scales were then placed on the same metric based on the scores of the 12 items that do not have frequency follow-ups. Item scores and fit statistics for the sets of dependent items were then compared across the three scaling scenarios.

The dependent items in the 30-day scale were tested using a similar methodology and here, too, the effect on item severity estimates was found to be negligible (analysis not shown). Further, in the case of the 30-day scale as proposed by Hamilton et al. (1997b), because almost every item has a dependent partner, fit statistics are also not much affected by the item dependencies. Or, more precisely, the fit of all items is artifactually improved by the item dependencies, and this shows up as improved discrimination of the model overall. Since almost all items are similarly affected by item dependencies, their fit statistics, which compare fit of the item to overall discrimination of all the items in the model, are all near unity.

Thus, on statistical grounds, there is no compelling reason not to include all of the items originally suggested by Hamilton et al. However, the wholesale inclusion of frequency-of-occurrence follow-ups may not be justified on theoretical grounds. The three frequency-of-occurrence follow-ups that are included in the 12-month scale all have theoretical links to adult or child hunger. But more frequent occurrence does not, for all items, necessarily correspond to greater severity.[5] For this reason, and to

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[5] On the other hand, the empirical results from the present analysis provide fairly strong evidence for the correspondence between greater frequency of occurrence and greater severity within a specific range. For all items with 30-day frequency-of-occurrence follow-ups the difference between very occasional occurrence and repeated

facilitate description and discussion of the 30-day scale *vis-à-vis* the 12-month scale in future reports and research, the revised scale proposed here includes only items corresponding to those in the 12-month scale.[6]

Data from the 1998 and 1999 CPS-FSS were fit to the Rasch model for both the original and revised item sets for the 30-day scale using joint maximum likelihood methods (Fischer and Molenaar, 1995; Wright, 1983). The items are presented along with their severity scores in table 2. The items that are excluded from the revised scale (those shaded in table 1) are mostly in the severe range of the scale. Additional items generally increase the precision of a Rasch-based scale. However, comparison of the measurement error of household scores on the two 30-day scales (not shown) indicates that the gain in precision achieved by including the additional 4 frequency-of-occurrence items is modest (about 10 percent) near the hunger threshold. The gain in precision is greater in the higher-severity range (15 to 20 percent), but added precision in this range does not seem to be important enough for research purposes to justify including the additional items.

Frequency-of-Occurrence Threshold To Indicate Recurring Conditions

The second issue is where to place the cutoff for repeated or recurring conditions for the three frequency-of-occurrence items that are retained in the 30-day scale. In the standard 12-month scale, the three "How often did this happen?" follow-up questions are scored as indicating recurring conditions or behaviors if the response indicated that it occurred in 3 or more months. The corresponding follow-up questions for the 30-day-referenced questions ask, "In the last 30 days, how many days did this happen?" The response is a number of days from 1 to 30. Hamilton et al. placed the cutoff for these items between 4 and 5 days.

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occurrence of at least 3 or 4 times per month does, in fact, correspond to greater severity. That is, the Rasch fit-statistics of these "frequency" items are consistent with a good fit to the Rasch model.

However, this cutoff results in higher severity of the frequency-of-occurrence items compared with their corresponding items in the 12-month scale (figure 1). In this analysis, the metric of the 30-day scale was adjusted to that of the 12-month scale by a linear transformation that equated the mean and standard deviation of the 30-day base items only to the mean and standard deviation of the corresponding items in the 12-month scale. The calibrations of the base items are very nearly linear with respect to their corresponding items in the 12-month scale. However, each of the three frequency-of-occurrence items is about one-half logistic unit more severe than its corresponding 12-month item.

The scale was recalculated with the "recurrence" threshold set at 4+ days and at 3+ days (in two separate scale estimations; figure 2). The 3+ days cutoff was adopted for the revised scale because it results in relative severities of the frequency-of-occurrence items that are most nearly identical to those of their counterparts in the 12-month scale.

Finalizing the Revised 30-Day Scale

The final step in specifying the 30-day scale is to finalize its metric and calculate household scores for each raw score for households with complete responses. The objective of this process is to adjust the metric of the 30-day scale to that of the standard 12-month scale so that equal scores on the two scales represent (probabilistically) identical arrays of conditions and behaviors, except that they refer to different periods of time. That is, if a specific household score on the 12-month scale indicates a .75 probability that an adult in the household went a whole day without eating in the previous 12 months, the same score

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[6] The follow-up to the most severe question, asking about children going a whole day without eating, has to be dropped from the scale in any case, as it is no longer asked in the CPS-FSS. The question was dropped because multi-day occurrence was reported by so few households that the data were not usable.

for another household on the 30-day scale will indicate a .75 probability that an adult in that household went a whole day without eating in the previous 30 days.[7]

This objective is accomplished by a linear transformation of the 30-day scale so that the mean and standard deviation of the scores of all items in the scale are equal to the mean and standard deviation of the scores of the corresponding items in the 12-month scale. Since the frequency-of-occurrence items have now been aligned with the base items in a way that is consistent with the 12-month scale, all items in the scale (rather than just the base items) are now used to adjust the metric to that of the 12-month scale (table 3). This adjustment makes it appropriate to use the same thresholds for food insecurity (Rasch scale score of 3.25) and for hunger (Rasch scale score of 6.38) as are used for the 12-month scale. Using these item scores and the discrimination parameter required to equate the standard deviation of the item scores to that of the corresponding items in the 12-month scale, household food security scores and status categories were calculated for each raw score for households with complete responses (table 4). Households that affirm 1 or 2 items are classified as food insecure without hunger, those that affirm 3 or more items are classified as food insecure with hunger.[8]

It is appropriate to consider households that affirmed 1 or 2 items in the 30-day scale to be food insecure without hunger. However, it is not appropriate to describe all households with raw scores of zero as food

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[7] Note that this does *not* mean that two households, H12 with a score of 4.0 on the 12-month scale and H30 with a score of 4.0 on the 30-day scale, were equally food insecure during either period. H30 was at least as food insecure as H12 during the previous 12 months, but may have been more insecure. H30 experienced, during the previous 30 days, the same array of conditions and experiences that H12 experienced during their worst spell of food insecurity in the previous 12 months. But the last 30 days may not have included the most severe spell of food insecurity experienced by H30. By the same reasoning, during the previous 30 days, H12 could not have been more insecure than H30, but may have been less insecure—even fully food secure—because their worst spell of insecurity may have occurred several months earlier.

[8] The revised scale specifications were based on theoretical and statistical considerations. The overall effects of the revisions on the performance of the scale were small. Cross-tabulation of the revised scale with the original scale based on Hamilton et al. (1997b) found a high level of agreement between the two. The revised scale classified a total of 2.57 percent of households in the April 1995 CPS Food Security Supplement as food insecure with hunger during the previous 30 days compared with 2.40 percent by the original scale. Of all households in the Supplement, 2.29 percent were classified by both scales as food insecure with hunger; the revised scale classified an additional

secure. The lowest score that can be measured by this 30-day scale is well above the food insecurity threshold because the scale lacks the less severe items that are needed to reliably identify food insecurity. Therefore, a substantial proportion of households that were food insecure during the 30-day period are not identified as food insecure by this scale. Comparison of similar scores on the 12-month measure suggests that about 40 percent of all households that would be classified as food insecure (with or without hunger) by a full-range 30-day scale will be incorrectly classified as food secure by this truncated 30-day scale. This 30-day scale should, therefore, only be used to monitor the prevalence of hunger, not of food insecurity. The lower threshold (1 or more affirmatives) may be useful for analytic purposes, but if it is to be used for monitoring, appropriate language will need to be developed to describe the ranges of severity below and above that threshold so that the meaning of the threshold is not confused with that of the food-insecure threshold.

The 30-day food security scale is somewhat less reliable than the 12-month scale, but the difference is not great and affects only households with children. Near the hunger threshold, the measurement standard error of the 30-day scale is around 0.9 logistic units for households with children and 0.94 units for households without children (table 4).[9] The corresponding standard errors for the 12-month scale (not shown) are 0.77 units for households with children and 0.96 units for households without children. The lower reliability of the 30-day scale is almost completely due to the smaller number of items in the scale. The discrimination of the individual items is nearly identical in the 30-day and 12-month scales. The main limitation of the 30-day scale is that it does not cover the less severe range of the food insecurity continuum. In the range that it does cover, however, it is sufficiently reliable for routine monitoring and

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0.28 percent as food insecure with hunger that were not so classified by the original scale; and the reverse was true for 0.11 percent of households.

[9] All statistics are subject to measurement error (distinct from sampling error) in surveys. An advantage of multiple-indicator measures such as the food security measure is that it is possible to estimate the size of the measurement error. The standard error of measurement of a Rasch-based measure is based on the assumed logistic relationship between the "true" food security of the household and the probability of affirming each item. It is the inverse of the square root of the sum of the information function ($p*(1-p)$) across items.

research applications. The measurable range of the scale extends almost 7 logistic units (from 4.90 to 11.77), and the measurement standard error is less than 1 unit across most of the measurable range.

During the period 1998 to 2000, prevalence rates of food insecurity with hunger during the 30 days prior to the CPS-FSS ranged from 2.0 to 2.7 percent (table 5). The 30-day prevalence rates were in the range of two-thirds to three-fourths of the prevalence rates during the 12 months prior to the surveys. For both measures, the prevalence rates of hunger in 1999 were lower than the corresponding averages of 1998 and 2000, and this pattern was substantially more pronounced for the 30-day scale than for the 12-month scale. This is consistent with the hypothesis advanced by Andrews et al. (2000) and Nord et al. (2002) of a seasonal effect on the measurement of food insecurity and hunger. The measured (12-month) prevalence rates of food insecurity and hunger in 1995, 1997, and 1999, when the food security surveys were conducted in April, were lower than would have been expected based on rates in the alternate years, when the surveys were conducted in August or September. Such a seasonal effect on the 12-month measure would result from measurement error—due to respondents remembering recent events more reliably than events that occurred nearly a year ago. It was expected that a 30-day measure would show a larger seasonal effect since it would be sensitive to the actual seasonal prevalence rates. The prevalence rates for 1998-2000 provide at least a preliminary confirmation of this hypothesis.

Summary and Conclusions

The revised 30-day food security scale proposed here—specifically for the limited set of 30-day referenced items collected by the CPS-FSS—is conceptually consistent with that developed by Hamilton et al. (1997b) and differs only in two technical details. The changes result in a scale that is conceptually and operationally more consistent with the 12-month scale. The metric of the proposed scale is also specified more precisely than had been done by Hamilton et al. in order to make it consistent in meaning with the 12-month scale across the entire range that the 30-day scale measures. That is to say, equal

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scores on the two scales represent (probabilistically) the same array of conditions and behaviors, differing only with regard to the time period (30 days versus 12 months) during which those conditions and behaviors may have occurred.

The revised 30-day scale is suitable for monitoring and research purposes within the range of food insecurity and hunger that it measures. It is only slightly less reliable than the 12-month scale, a result of its being based on a smaller number of items. The main limitation of the revised 30-day scale, as of its predecessor, is that it lacks coverage of the less severe range of insecurity. If it is feasible to do so, adding 30-day follow-up questions to some or all of the less severe food security questions in the CPS-FSS could overcome this limitation.

The 30-day food security scale is expected to complement, not replace, the 12-month scale. Assuming that food security at the national level continues to be assessed annually, the 12-month scale—which registers insecurity at any time during the annual cycle—is a logical monitoring tool. However, prevalence statistics based on the 30-day scale could provide additional perspective on the persistence and prevalence of food insecurity and hunger. Perhaps the greatest contribution of the 30-day scale will be in research applications, where its greater temporal specificity can help overcome temporal mismatch problems that complicate and obscure associations between the 12-month scale and variables measuring determinants and outcomes of food insecurity and hunger.

References

Anderson, S.A. (ed.). 1990. "Core Indicators of Nutritional State for Difficult-To-Sample Populations," *Journal of Nutrition* 120(11S):1557-1600. A report prepared by the Life Sciences Research Office, Federation of American Societies for Experimental Biology, for the American Institute of Nutrition.

Andrews, Margaret, Mark Nord, Gary Bickel, and Steven Carlson (2000). *Household Food Security in the United States, 1999.* Food Assistance and Nutrition Research Report No. 8. U.S. Dept. Agr., Economic Research Service.

Baker, Frank B. (1992). *Item Response Theory: Parameter Estimation Techniques.* New York: Marcel Dekker, Inc.

Bickel, G., M. Nord, C. Price, W.L. Hamilton, and J.T. Cook (2000). *Guide to Measuring Household Food Security, Revised 2000.* U.S. Dept. Agr., Food and Nutrition Service, Alexandria, VA.

Bickel, G., S. Carlson, and M. Nord (1999). *Household Food Security in the United States 1995-1998: Advance Report.* U.S. Dept. Agr., Food and Nutrition Service, Alexandria, VA. (available: www.fns.usda.gov/oane/MENU/Published/FSP/FSP.htm).

Fischer, Gerhard H., and Ivo W. Molenaar, eds. (1995). *Rasch Models: Foundations, Recent Developments, and Applications.* New York: Springer-Verlag.

Hambleton, Ronald K., H. Swaminathan, and H. Jane Rogers (1991). *Fundamentals of Item Response Theory.* Newbury Park, CA: Sage Publications, Inc.

Hamilton, W.L., J.T. Cook, W.W. Thompson, L.F. Buron, E.A. Frongillo, Jr., C.M. Olson, and C.A. Wehler (1997a). *Household Food Security in the United States in 1995: Summary Report of the Food Security Measurement Project.* Report prepared for USDA., Food and Consumer Service, Alexandria, VA. (summary available: www.fns.usda.gov/oane/MENU/ Published/FSP/FSP.htm).

Hamilton, W.L., J.T. Cook, W.W. Thompson, L.F. Buron, E.A. Frongillo, Jr., C.M. Olson, and C.A. Wehler (1997b). *Household Food Security in the United States in 1995: Technical Report.* Report prepared for USDA, Food and Consumer Service, Alexandria, VA. (available: www.fns.usda.gov/oane/MENU/Published/FSP/FSP.htm).

Nord, Mark, Nader Kabbani, Laura Tiehen, Margaret Andrews, Gary Bickel, and Steven Carlson (2002a). *Household Food Security in the United States, 2000.* Food Assistance and Nutrition Research Report No. 21. U.S. Dept. Agr., Economic Research Service.

Nord, Mark, Margaret Andrews, and F. Joshua Winicki (2002b). "Frequency and Duration of Food Insecurity and Hunger in U.S. Households." Forthcoming in *Journal of Nutrition Education and Behavior.*

Nord, Mark, Margaret Andrews, and F. Joshua Winicki (2000). "Frequency and Duration of Food Insecurity and Hunger in U.S. Households." Paper presented at the Fourth International Conference on Dietary Assessment Methods, Tucson, AZ, September 17-20, 2000.

Nord, Mark and Debra A. Fogarty (2000). "Comparing Prevalence Rates of Food Insecurity and Hunger Based on Non-Standard Question Sets to the National Benchmark," Paper/poster at the Fourth International Conference on Dietary Assessment Methods, Tucson AZ, September 17-20.

Wright, B.D. (1983). *Fundamental Measurement in Social Science and Education.* Mesa Psychometric Laboratory, The University of Chicago, College of Education, Chicago, IL. (available: www.rasch.org/memos.htm)

Table 1. Food security items referenced to past 12 months and to past 30 days in the Current Population Survey Food Security Supplements of 1998 and later

Item[1]	Past 12 months		Past 30 days	
	Ever?	How many months?	Ever?	How many days?
Worried food would run out before (I/we) got money to buy more	X			
Food bought didn't last and (I/we) didn't have money to get more	X			
Couldn't afford to eat balanced meals	X			
Relied on few kinds of low-cost food to feed child(ren)	X			
Couldn't feed child(ren) balanced meals	X			
Child(ren) were not eating enough	X			
Adult(s) cut size of meals or skipped meals	X	X	X	X
Respondent ate less than felt he/she should	X	X[2]	X	X
Respondent hungry but didn't eat because couldn't afford	X	X[2]	X	X
Respondent lost weight	X		X	
Adult(s) did not eat for whole day	X	X	X	X
Cut size of child(ren)'s meals	X	X[2]	X	X
Child(ren) were hungry	X		X	X
Child(ren) skipped meals	X	X	X	X
Child(ren) did not eat for whole day	X		X	[3]

[1]The actual wording of each item included explicit reference to resource limitation, e.g., "…because (I was/we were) running out of money to buy food," or "…because there wasn't enough money for food," as well as to the reference period (past 12 months or past 30 days).

[2]Respondents reporting that these behaviors and experiences occurred at any time in the previous 12 months are asked in how many months they occurred, but responses are not included in the 12-month scale.

[3]In the 1995, 1996, and 1997 CPS-FSS, respondents who reported that, at some time during the previous 30 days, children did not eat for a whole day because there wasn't enough money for food were asked how many days this occurred. This follow-up item was included in the original 30-day scale developed by Hamilton et al. (1997). However, beginning in the 1998 CPS-FSS, this follow-up was dropped from the questionnaire because it was affirmed only very rarely and was reported to be emotionally difficult for some respondents to answer.

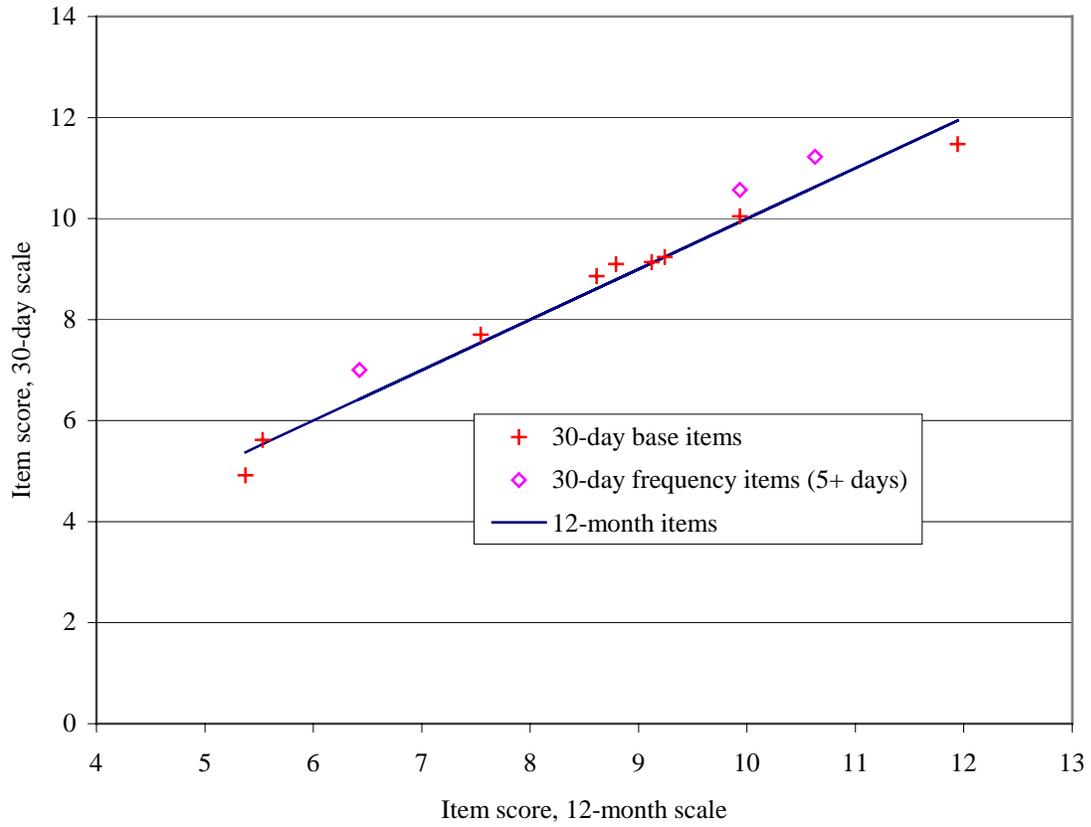Source: Current Population Survey Food Security Supplement, August 1998.

Table 2. Items in the original and revised 30-day scale

Item (Shaded items are dropped from the revised scale.)	Item score (original scale)*	Item score (first revision)*
Adult cut size of meal or skipped meal	4.92	4.92
Respondent ate less than they felt they should	5.60	5.62
---------------- hunger threshold -------------------	-------------------	-------------------
Adult cut size of meal or skipped meal, 5+ days	6.98	7.01
Respondent ate less than they felt they should, 5+ days	7.16	
Respondent hungry but didn't eat	7.69	7.70
Respondent hungry but didn't eat, 5+ days	8.80	
Respondent lost weight	8.87	8.86
Cut size of child's meal	9.11	9.10
Adult did not eat for whole day	9.16	9.14
Child was hungry	9.24	9.24
Cut size of child's meal, 5+ days	10.00	
Child skipped meal	10.05	10.05
Child was hungry, 5+ days	10.36	
Adult did not eat for whole day, 5+ days	10.56	10.56
Child skipped meal, 5+ days	11.20	11.22
Child did not eat for whole day	11.45	11.47

*Scales were adjusted to mean and standard deviation of corresponding items in the 12-month scale (base items only, not including frequency items) so that thresholds are directly comparable among the three scales.
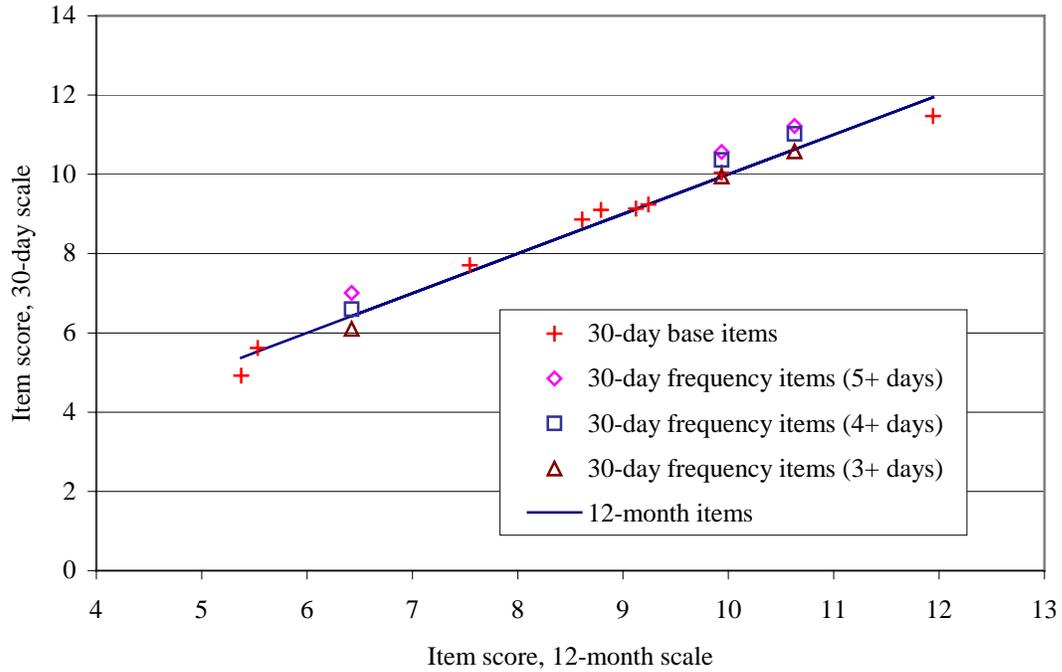
Source: Prepared by ERS using data from Current Population Survey Food Security Supplements, August 1998 and April 1999.

Figure 1. Comparison of item scores in 30-day scale to corresponding items in 12-month scale (metric adjusted by base items only)

Source: Prepared by ERS using data from Current Population Survey Food Security Supplements, August 1998 and April 1999.

Figure 2. Effect on relative severity of item scores in 30-day scale of setting "recurrence" threshold at 5+, 4+, or 3+ days (metric adjusted by base items only)

Note: The three scales were estimated separately. The differences in scores of the base items among the three scales were negligible.

Source: Prepared by ERS using data from Current Population Survey Food Security Supplements, August 1998 and April 1999.

Table 3. Scale scores (calibrations) and fit statistics of items in the revised 30-day scale

Item	Item score[1]	Error	Infit[2]	Outfit[3]
Adult cut size of meal or skipped meal	5.00	0.04	0.90	1.46
Respondent ate less than they felt they should	5.69	0.04	1.18	1.58
---------------- hunger threshold -------------------	---------------	--------------	--------------	--------------
Adult cut size of meal or skipped meal, 3+ days	6.17	0.04	0.85	1.12
Respondent hungry but didn't eat	7.74	0.04	0.87	0.99
Respondent lost weight	8.89	0.05	1.17	1.77
Cut size of child's meal	9.13	0.08	1.21	2.04
Adult did not eat for whole day	9.17	0.06	0.91	1.78
Child was hungry	9.26	0.09	0.90	0.68
Adult did not eat for whole day, 3+ days	9.96	0.07	0.87	0.59
Child skipped meal	10.05	0.11	0.86	2.49
Child skipped meal, 3+ days	10.58	0.13	0.91	0.37
Child did not eat for whole day	11.46	0.18	0.94	1.17

[1]Scales were adjusted to the mean and standard deviation of corresponding items in the 12-month scale (base items and frequency items) so that thresholds are directly comparable between the two scales.

[2]Item infit is an information weighted fit statistic that compares the observed responses of all households to an item to the responses expected under the assumptions of the Rasch model. It is calculated as follows:

$$INFIT_i = SUM\ [(X_{i,h} - P_{i,h})^2] / SUM[P_{i,h} - P_{i,h}^2]$$

where:

$X_{i,h}$ is the observed response of household h to item i (1 if response is yes, 0 if response is no);

$P_{i,h}$ is the probability of an affirmative response by household h to item i under Rasch assumptions, given the item calibration and the estimated level of severity of food insecurity in the household.

The expected value of each item's infit statistic is 1.0 if the data conform to Rasch model assumptions. Values above 1.0 indicate that the item discriminates less sharply than the average of all items in the scale.

[3]Item outfit is an outlier-sensitive fit statistic that compares the observed responses of all households to an item to the responses expected under the assumptions of the Rasch model. It is calculated as the average across households of the squared error divided by the expected squared error:

$$OUTFIT_i = SUM\ [(X_{i,h} - P_{i,h})^2 / (P_{i,h} - P_{i,h}^2)] / N$$

where:

$X_{i,h}$ is the observed response of household h to item i (1 if response is yes, 0 if response is no);

$P_{i,h}$ is the probability of an affirmative response by household h to item i under Rasch assumptions, given the item calibration and the estimated level of severity of food insecurity in the household;

N is the number of households.

The expected value of each item's outfit statistic is 1.0 if the data conform to Rasch model assumptions. Values above 1.0 indicate a higher than expected proportion of "erratic" responses—affirmative responses to a severe item by households that affirmed few other items or denials of a low-severity item by households that affirmed many other items.

Source: Prepared by ERS using data from Current Population Survey Food Security Supplements, August 1998 and April 1999.

Table 4. Household scale scores and food security status based on the revised 30-day scale

Number of "yes" responses (raw score)		Household scale score*	Standard error of household scale score	Food security status category
Household with child	Household with no child			
0	0	0.0**		Food secure, or low-severity level of food insecurity
		3.25		Threshold—food insecurity
1		4.90	1.03	
	1	4.92	1.04	Food insecure
2		5.96	.90	without hunger
	2	6.02	.93	
		6.38		Threshold--hunger
3		6.87	.86	
	3	7.04	.94	
4		7.68	.78	
	4	8.06	.91	
5		8.33	.70	
6		8.86	.65	
	5	9.02	.90	
7		9.35	.63	Food insecure with hunger
8		9.82	.64	
	6	10.07	1.03	
9		10.33	.67	
	7	10.85**	NA	
10		10.93	.76	
11		11.77	.97	
12		12.49**	NA	

Notes:

*Scale metric is adjusted so that mean and standard deviation of all items are equal to those of the corresponding items in the 12-month scale so that the thresholds are directly comparable to those in the 12-month scale.

**Scale scores for extreme households--i.e., those affirming no items or all items--cannot be calculated under Rasch model assumptions. Here the score of 0 for no affirmatives is arbitrary and researchers should omit the category from linear analyses or use appropriate techniques to allow the implied scale value to be estimated in the equation. Very few households affirm all items. Scores for those households are calculated at 11.5 affirmatives for households with children and 6.5 affirmatives for households without children. These values can be used in most linear models without distorting the fit of the model. Standard errors for these scores cannot be calculated.

Source: Prepared by ERS using data from Current Population Survey Food Security Supplements, August 1998 and April 1999.

Table 5. Prevalence of food security with hunger in U.S. households during the 12 months and 30 days prior to the food security survey, by year

Year	Total[1]	Food insecure with hunger				Ratio of prevalence during last 30 days to last 12 months
		During 12 months prior to survey		During 30 days prior to survey		
	1,000	*1,000*	*Percent*	*1,000*	*Percent*	*Percent*
1998	103,309	3,835	3.7	2,793	2.7	72.8
1999	104,684	3,109	3.0	2,055	2.0	66.1
2000	106,043	3,315	3.1	2,467	2.3	74.4

[1]Totals exclude households whose food security status is unknown because they did not give a valid response to any of the questions in the food security scale.

Sources: Calculated by ERS using data from the August 1998, April 1999, and September 2000 Current Population Survey Food Security Supplements.