CENTER FOR NUTRITION POLICY AND PROMOTION

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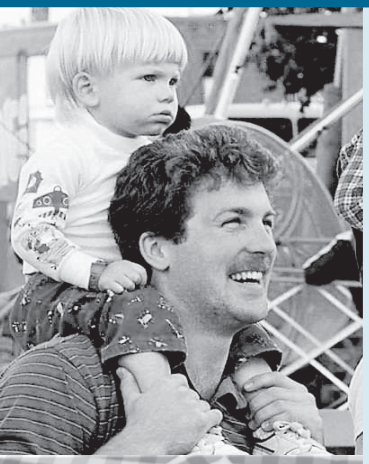

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Center for Nutrition Policy and Promotion Mission Statement

To improve the health of Americans by developing and promoting dietary guidance that links scientific research to the nutrition needs of consumers.

CENTER FOR NUTRITION POLICY AND PROMOTION

Family Economics and Nutrition Review

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Front and Center

Serving the American People: From 1943 to 2005

This issue of *Family Economics and Nutrition Review* contains three research articles and briefs that, respectively, examine variations in State hunger rates; focus on fruits and vegetables offered in school lunch salad bars; and describe the perceptions of rural, suburban, and urban residents who use food pantries.

The issue also includes reports by the Center for Nutrition Policy and Promotion: one describing the nutrient content of the U.S. food supply and the other detailing how variety—one of the 10 components of the Healthy Eating Index—was calculated. The nutrient content of the food supply provides information on nutrient availability and is often used in setting fortification policy. The Healthy Eating Index, representing a report card on the American diet, gives policymakers a picture of the overall status of the American diet and where changes need to be made. In addition to these reports, the Center for Nutrition Policy and Promotion uses a brief article to explain why cost updates of the Thrifty Food Plan, the basis for food stamp allotments, differ from price changes as measured by the Consumer Price Index for food.

Although the name of this USDA publication has changed over the years (*Wartime Family Living* in 1943, *Rural Family Living* in 1945, *Family Economics Review* in 1957, and *Family Economics and Nutrition Review* in 1995), its goal of reaching American consumers with current, science-based information has remained constant. The USDA agencies or divisions that had the privilege of producing this publication met a perennial need of linking research to the needs of consumers. These USDA agencies or divisions were the Bureau of Human Nutrition and Home Economics, Home Economics Research Branch, Institute of Home Economics, Consumer and Food Economics Research Division, Consumer and Food Economics Institute, and Family Economics Research Group. The agencies' or divisions' contributions formed the foundations upon which actionable consumer strategies were based. Similarly, we believe that the Center for Nutrition Policy and Promotion, with its *Family Economics and Nutrition Review*, has added to that substantial tradition and has thus improved the well-being of all Americans.

As Americans began using more electronic means of communications, the Center for Nutrition Policy and Promotion decided to use a variety of other information-multiplying strategies that could meet the demands of consumers who are obtaining information at the "click of the mouse." With this final issue of *Family Economics and Nutrition Review*, the Center for Nutrition Policy and Promotion concludes the chapter on this paper form of providing information to the economic and nutrition professional communities. We invite the readers of *Family Economics and Nutrition Review* to use our Web site (www.cnpp.usda.gov) to learn more about our other publications and links that provide nutrition and economic information that can be used to help Americans develop and maintain a healthful lifestyle.

Eric J. Hentges, PhD
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Fruits and Vegetables Offered in School Lunch Salad Bars Versus Traditional School Lunches

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Most U.S. school-age children do not eat enough fruits and vegetables, both in terms of the number of servings and variety. One proposed way to improve children's consumption of fruits and vegetables is to increase the number of schools that offer salad bars as part of the National School Lunch Program. This study presented the first analysis of nationally representative data on foods offered in school lunch salad bars. The data were collected during the 1998-99 school year as part of USDA's School Nutrition Dietary Assessment Study-II. The study presented here examined whether schools with salad bars offered a greater variety of fruits and vegetables than did schools without salad bars. The study also examined items other than fruits and vegetables that were commonly offered in school lunch salad bars, with a focus on dietary fat content. Results showed that salad bars were associated with a greater variety of fruit and vegetable offerings. Schools with salad bars were much more likely to serve lettuce, tomatoes, other raw vegetables, and fresh fruit than were schools without salad bars. In addition, schools with salad bars were more likely than their counterparts, to offer nutrient-dense vegetables (like carrots and broccoli).

School-age children in the United States eat fewer fruits and vegetables than are recommended by the Dietary Guidelines for Americans (U.S. Department of Agriculture [USDA] and U.S. Department of Health and Human Services [HHS], 2000). In 1994-96, only 14 percent of school-age children met the target of consuming at least two servings of fruits a day; only 17 percent met the target of consuming at least three servings of vegetables a day (Gleason & Suitor, 2000). Even fewer met the recommended standards for consuming a variety of fruits and vegetables.

The Dietary Guidelines for Americans recommends that all people ages 2 and older choose a wide variety of fruits and vegetables each day because different fruits and vegetables are rich in different nutrients. One target for variety, which is used in the Federal Healthy People 2010 objectives, is an increase in the percentage of children who consume one-third of their vegetable servings from dark-green or orange vegetables. In 1994-96, only 6 percent of 6- to 19-year-old females and about 5 percent of 6- to 19-year-old males met that goal (HHS, 2001).

One proposed way to improve children's consumption of fruits and vegetables is to increase the number of schools that offer salad bars as part of the National School Lunch Program. A group of policy officials, the National 5-A-Day Partnership, has proposed that all schools have salad bars as a way to increase the number and variety of fruits and vegetables that children consume at school (U.S. General Accounting Office [GAO], 2002).

Our study expanded upon a previous USDA study (Schmidt, Hirschman, & McKinney, 2002) on salad bars that examined whether salad bars were associated with a greater variety of fruits and vegetables being offered in school lunches. It was the first analysis of nationally representative data on

foods offered in school lunch salad bars.

In the interest of presenting a balanced view of salad bars, this study also described items other than fruits and vegetables in salad bars to provide a sense of how often high-fat salad bar ingredients (including regular salad dressing, regular cheese, and mayonnaise-based salads) are offered. Any policy discussion of school lunch salad bars should consider whether these ingredients also could contribute to an increase in children's total dietary fat intake because school-age children consume too much dietary fat. In 1994-96, only 25 percent of school-age children met the Dietary Guidelines for Americans' recommendation of consuming no more than 30 percent of calories from fat (Gleason & Suitor, 2000).

Definitions

Salad bar is a self-serve station where students can select two or more fruits and/or vegetables.

Green salad bars are those in which lettuce is intended to serve as the base of the salad.

Entrée salad bars are green salad bars that include a meat or meat alternate.

Side salad bars are green salad bars that do not include a meat or meat alternate.

Theme salad bars include potato bars, taco salad bars, soup and salad bars, salad and sandwich bars, and potato and salad bars.

"Other" self-serve bars include theme salad bars, fruit bars, and assorted raw vegetable bars.

A serving day for a school is a day on which the school cafeteria serves National School Lunch Program meals. The terms "serving day" and "daily menu" are used interchangeably in this paper.

High-fat items are foods that have more than 38 percent of their calories from fat.

Low-fat items are foods that have no more than 30 percent of calories from fat.

Previous Research

Previous research on the foods offered in salad bars has been limited. One study (Garceau et al., 1997) examined directly the nutrient content of food bars, including salad bars, in 96 elementary schools that participated in an intervention designed to reduce the total fat, saturated fat, and sodium content of school lunches and breakfasts. It found that side salad bars had more total fat than was found in the regular fruit and vegetable components of traditional school lunches. It also found that, compared with the vegetables and fruits served in the regular serving line, side salad bars had similar amounts of saturated fat, vitamin A, iron, and dietary fiber but less calcium and ascorbic acid. One study limitation, however, was that the nutrient analysis was based on assumptions about foods selected from salad bars because data on foods selected were not available. In particular, the results were sensitive to assumptions about how much salad dressing children placed on salads. The report did not examine which foods were offered, so it did not investigate the issue of fruit and vegetable variety.

Methods

This analysis used data from the School Nutrition Dietary Assessment Study-II (SNDA-II), which was designed to produce national cross-sectional estimates of the nutrient composition of USDA meals served in elementary and secondary schools. The data were collected in late September 1998 to May 1999. The study focused exclusively on public schools, which account for roughly 90 percent of all participants in the National School Lunch Program. The study design included separate nationally representative probability samples of public elementary schools, middle schools, and high schools participating in the National School Lunch Program (Fox, Crepinsek, Connor, & Battaglia, 2001). Alaskan and Hawaiian schools were not included in the study.

The sample of schools was developed in several steps. First, a stratified random sample of School Food Authorities,[1] which are typically school districts, was selected. To the extent possible, one elementary school, one middle school, and one high school were chosen from each School Food Authority. Finally, the schools in the sample were recruited, and 80 percent of the schools agreed to participate in the study.

[1]School Food Authorities are the governing bodies responsible for the administration of one or more schools and have the legal right to operate a National School Lunch Program.

Table 1. Percentage of public schools[1] offering different types of salad bars as part of the National School Lunch Program

Variables	Elementary schools	Middle schools	High schools	All schools
Sample size (number of schools)	385	329	328	1,042
			Percent	
All types of salad bars				
Salad bar of any type daily	10*+	20*	32	16
Any type of salad bar at least once per week	14*+	26*	41	21
Green salad bars				
Entrée salad bar daily	4*+	12*	22	9
Entrée salad bar at least once per week	6*+	18*	31	12
Side salad bar daily	6	8	7	7
Side salad bar at least once per week	8	10	10	9
Other salad bars				
Theme salad bar *(potato bar or combination salad/sandwich, salad/soup or salad/potato bar)* daily	0.3	0	1	0.4
Theme salad bar at least once per week	2	1*	3	2
Self-serve fruit bar daily	2	1	1	2
Self-serve fruit bar at least once per week	2	1	3	2
Self-serve assorted raw vegetables daily	1	1	1	1
Self-serve assorted raw vegetables at least once per week	1	1	1	1

[1] Based on 5-day menu data from SNDA-II.
* Difference, when compared with high schools, is statistically significant at the .05 level.
+ Difference, when compared with middle schools, is statistically significant at the .05 level.

The data analyzed in this study came from a survey of school cafeteria managers, which was collected via mail. Among the schools that agreed to participate in the study, the response rate for the menu survey was 88 percent (Fox et al., 2001). A total of 435 elementary schools, 390 middle schools, and 407 high schools completed the survey. Cafeteria managers were asked to provide detailed information about all foods served as part of the National School Lunch Program during a 5-day period, as well as to provide a description of each item. For the 258 schools with salad bars, respondents were asked to list all ingredients, including salad dressings and toppings. SNDA-II did not collect data on the amount and types of food that children consumed.

The statistical techniques used in this study were relatively straightforward. The weighted averages and percentages were calculated by using sampling weights that adjusted for nonresponse. The standard errors were adjusted to account for the geographic clustering of schools,[2] and a 5-percent level of significance was used for statistical significance.

Results and Discussion

Availability of Salad Bars

Sixteen percent of public schools (n =1,042 in fiscal year 1999) participating in the National School Lunch Program offered salad bars daily; 21 percent offered salad bars at least once a week (table 1). School lunch salad bars were more widely available for children in the higher grades: 41 percent of high schools, compared with 26 percent of middle schools and 14 percent of elementary schools offering some type of salad bar at least once a week. The differences among the three grade levels were statistically significant.

Green salad bars, including entrée salad bars and side salad bars, were the most common forms of salad bars offered by National School Lunch Program schools. Entrée salad bars were present at least once per week in 12 percent of all schools, and side salad bars were offered at least once per week in 9 percent of all schools. Entrée salad bars can be used instead of traditional entrées because these types of salad bars include a meat or meat alternate. The foods in side salad

[2]The SAS macro program, smsub.sas, was used to calculate the correct standard errors. This program is available at www.SAS.com.

bars count only as fruit or vegetable components of a meal.[3]

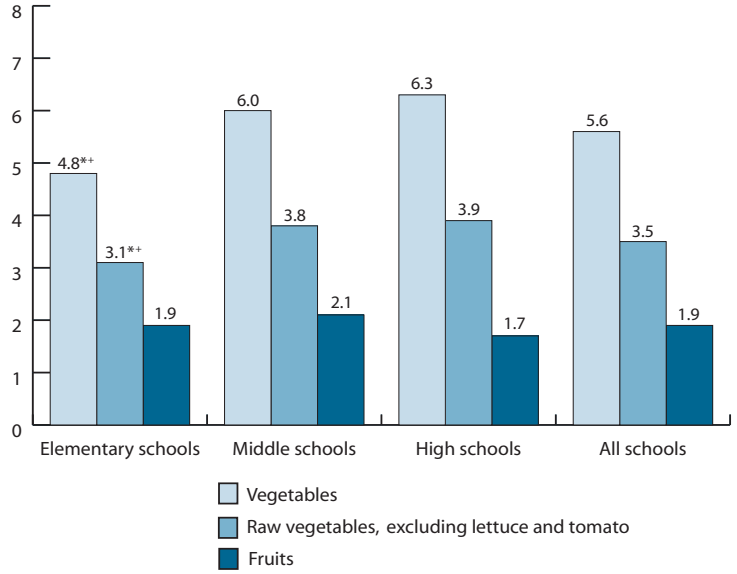
Other types of self-serve bars were offered less frequently in the schools offering the National School Lunch Program. Two percent of all the schools offered theme salad bars at least once a week, 2 percent offered self-serve fruit bars, and 1 percent offered self-serve raw vegetables at least once a week. Theme bars count as entrées; whereas, fruit bars and assorted self-serve raw vegetables count as the fruit or vegetable component of the meal. For the remainder of this paper, schools with salad bars are defined as those that offer any type of salad bar at least once per week.

The Variety of Fruits and Vegetables Offered by Schools With Salad Bars and Without Salad Bars

On average, the typical high school salad bar offered a variety of vegetables (6.3) and fruits (1.7) (fig. 1). In particular, high school salad bars included a wide variety of raw vegetables (3.9 on average) other than lettuce or tomato. The results for middle schools were similar. Elementary schools offered significantly fewer vegetables on their salad bars than did middle or high schools, with an average of 4.8 vegetables and 3.1 raw vegetables other than lettuce and tomatoes.

The remainder of the paper focuses on findings for high school salad bars because they are the most common.[4] With a few exceptions, the results for middle schools and elementary schools are qualitatively similar to those for high schools.

Figure 1. Mean number of fruits and vegetables offered in salad bars, by Grade level



*Difference, when compared with high schools, is statistically significant at the .05 level.
+Difference, when compared with middle schools, is statistically significant at the .05 level.

Categories of Vegetables and Fruits Offered by High Schools

High schools with salad bars offered a greater variety of vegetables and fruits than did schools without salad bars. The analysis focused on fruits and vegetables served both in the salad bar and in the traditional serving line; in schools with salad bars, the analysis focused on both serving days with and without salad bars on the menu. The most striking results were for lettuce, raw tomato, and other raw vegetables, which were offered on 91, 73, and 87 percent of serving days, respectively, in high schools with salad bars (table 2). In schools without salad bars, lettuce, raw tomato, and other raw vegetables were significantly less common, being offered on 49, 13, and 15 percent of serving days, respectively. (The results for lettuce and raw tomato are shown because traditional serving lines frequently offer lettuce and raw tomatoes in green salads or as sandwich toppings.[5])

[3]To count as a reimbursable traditional meal of the National School Lunch Program, a lunch must include a meat or meat alternate, grain or bread, a fruit or vegetable, and milk. However, students in high schools and some middle and elementary schools may choose three of the five food items under the Offer versus Serve option.

[4]Statistics comparing schools at all Grade levels with and without salad bars can be misleading. Elementary schools comprise a disproportionate share of schools without salad bars, and high schools comprise a disproportionate share of schools with salad bars. Therefore, differences in food offerings among schools at all Grade levels with and without salad bars are partly driven by the fact that high schools tend to offer different types of fruits and vegetables than do elementary schools, regardless of whether the schools have salad bars.

[5]High schools without salad bars offered chef's salads or green side salads more frequently than did schools with salad bars. Chef's salads, which count as an entrée because they include meat or meat alternates, were served on 8 percent of serving days in schools with salad bars and 21 percent of serving days in schools without salad bars. Green side salads were offered in schools with salad bars on 18 percent of serving days and 29 percent of serving days in schools without salad bars.

Table 2. Percentage of daily menu items either in salad bar or regular serving line of public schools offering the National School Lunch Program

Categories of fruits and vegetables served	High schools		All Grade levels	
	With salad bars	Without salad bars	With salad bars	Without salad bars
Sample size (number of schools)	118	210	258	784
		Percent		
Vegetables				
Lettuce	91*	49	89*	35
Tomato, raw	73*	13	64*	7
Raw vegetables, excluding lettuce and tomato	87*	15	84*	16
Cooked vegetables	61*	45	49	44
Legumes	18*	9	13*	7
Other (non-green) salads	30*	8	19*	7
Fruits				
Canned	74*	53	73*	56
Fresh	70*	50	69*	42
Dried	7*	1	12*	1
Frozen	6	4	8	7

Notes: Green salads or salad bars with multiple vegetables are categorized in multiple rows.
Based on 5-day menu data from SNDA-II.
*Difference in those schools with and without salad bars is statistically significant at the .05 level.

Students in schools with salad bars need to select foods from the salad bar to take advantage of the wider variety of fruit and vegetable offerings in their school cafeterias, because schools with salad bars do *not* serve a greater variety of fruits and vegetables in their regular serving lines.

In addition, cooked vegetables, legumes, and non-green vegetable salads were significantly more common in high schools with salad bars than in high schools without salad bars.

High schools with salad bars also offered a significantly greater variety of fruits than did high schools without salad bars. On 74 and 70 percent of serving days, high schools with salad bars offered canned and fresh fruit, respectively, compared with 53 and 50 percent of serving days, respectively, in high schools without salad bars. Dried fruit was also more common in high schools with salad bars than in high schools without salad bars: 7 percent versus 1 percent of serving days.

Students in schools with salad bars need to select foods from the salad bar to take advantage of the wider variety of fruit and vegetable offerings in their school cafeterias, because schools with salad bars do *not* serve a greater variety of fruits and vegetables in their regular serving lines. All of the statistically significant differences in fruit and vegetable category offerings among schools with and without salad bars are due to the greater prevalence of fruits and vegetables in salad bars.[6]

Individual Nutrient-Dense Vegetables

Certain nutrient-dense vegetables were much more common in salad bars than in traditional serving lines (fig. 2), and these differences were statistically significant. Carrots, rich in vitamin A, were offered in either raw or cooked form on 70 percent of serving days in high schools with salad bars. Broccoli, which is rich in calcium and vitamin C,

[6]Tables that illustrate this finding are available upon request from the primary author.

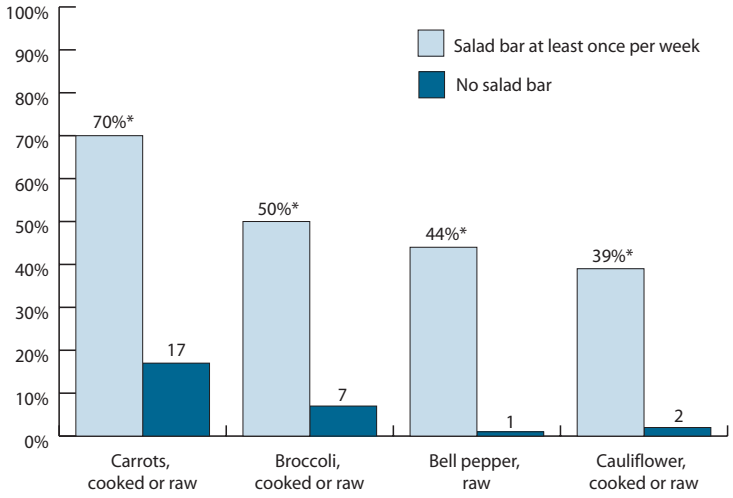
was offered in either raw or cooked form on half of the serving days in high schools with salad bars. In contrast, high schools without salad bars served carrots on 17 percent of serving days; and broccoli, on 7 percent of serving days. Carrots and broccoli are the only orange and dark-green vegetables commonly served in school lunches. Other types of orange and dark-green vegetables, including sweet potatoes, pumpkin, spinach, and other greens, were rarely offered in school lunches—less than 1 percent of daily menus in schools with and without salad bars.

Similar to broccoli, cauliflower, a cruciferous vegetable rich in vitamin C, was offered more widely in high school lunch salad bars than in traditional serving lines. Cruciferous vegetables may play a role in reducing the risk of cancer (National Research Council, 1989). Cauliflower was served on 39 percent of serving days in high schools with salad bars, but on only 2 percent of serving days in high schools without salad bars. Another vitamin-C rich vegetable, bell pepper, was offered on 44 percent of serving days in high schools with salad bars, but rarely appeared (1 percent of serving days) in the lunch menus of high schools without salad bars.

Other Items on Salad Bars

To provide a more balanced view of school lunch salad bars, we now present a description of the items other than fruits and vegetables offered in salad bars. Public discussions of the benefits of school lunch salad bars typically focus on achieving the goal of increased vegetable and fruit consumption. But another important dietary goal is reducing children's fat consumption, because only one-quarter of children meet the recommendation of the 2000 Dietary Guidelines for Americans that children should consume no more than 30 percent of their calories from dietary fat

Figure 2. Percentage of high school daily menus that include certain nutrient-dense vegetables



*Difference, when compared with high schools without salad bars, is statistically significant at the .05 level.

(Gleason & Suitor, 2000). In 1995, USDA launched the School Meals Initiative for Healthy Children (Initiative), which was designed to improve the nutritional quality of school meals. The Initiative requires that school menus comply with the Dietary Guidelines for Americans' recommendations for fat.

On those days when high schools offered salad bars, salad dressing, offered on 95 percent of salad bar serving days, was the most common non-fruit or non-vegetable offering in high school salad bars (table 3). Regular salad dressing was offered on 66 percent of these serving days, and either low-fat or fat-free salad dressing was offered on 67 percent of serving days. On about 28 percent of serving days, regular salad dressing was offered but low-fat or fat-free salad dressings were not.[7]

[7] The figure of 28 percent is obtained by subtracting the percentage of serving days in which low-fat or fat-free salad dressings were offered (67 percent) from the percentage of serving days in which any type of salad dressing was offered (95 percent).

Salad bars typically include one or more high-fat items in addition to salad dressing. The most common high-fat item was regular cheese, which was offered on 61 percent of high school salad bar serving days. Regular cheese was much more common than was reduced-fat cheese, which was offered on only 22 percent of salad bar serving days. Similarly, meat and pasta salads made with regular mayonnaise or salad dressing were more commonly offered than were their low-fat versions. High-fat meat or pasta salads were offered on 26 percent of salad bar serving days; whereas, their low-fat meat or pasta salads were offered on 7 percent of salad bar serving days. Other common high-fat items offered on salad bar serving days were hard-boiled eggs and bacon bits (21 and 34 percent of serving days, respectively).

Some low-fat meat or meat alternates, grains, and toppings were commonly offered on salad bars. The most common low-fat item such as turkey, water-packed tuna, chicken, or ham, was served on 56 percent of salad bar

Table 3. Percentage of salad bar serving days in which other selected items were offered in public schools with salad bars, as part of the National School Lunch Program

	High schools	All Grades
Any salad dressing	95	94
Regular	66	72
Low-fat or fat-free	67	60
Low-fat	49	44
Fat-free	33	26
Selected high-fat meat or meat alternates or toppings		
Regular cheese	61	52
Bacon bits	34	28
Hard-boiled eggs	21	22
Meat or pasta salad with regular mayonnaise or salad dressing (*tuna salad, chicken salad, macaroni salad)*	26	17
Sunflower seeds	8	10
Olives	16	10
High-fat meat *(pepperoni, breaded chicken, beef, etc.)*	8	5
Creamed cottage cheese	10	5
Selected reduced-fat meat or meat alternates or toppings		
Reduced-fat cheese	22	13
Selected low-fat meat or meat alternates or toppings		
Low-fat meats (*turkey, water-packed tuna, chicken, ham, etc.*)	56	43
2% or 1% cottage cheese	17	12
Meat or pasta salad with low-fat mayonnaise or salad dressing (*tuna salad, chicken salad, macaroni salad, etc.*)	7	3

Note: Based on 5-day menu data from SNDA-II.

serving days.[8] Two-percent or one-percent cottage cheese was also relatively common, being offered on 17 percent of salad bar serving days.

Depending on what children select and consume, the high-fat items could be a significant source of added fat and calories in salad bar meals (Flowers-Willets, McNaughton, Levine, & Ammerman, 1985). For example, analyses of the USDA's 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) have shown that for a significant minority of children, serving sizes of salad dressing are fairly large (Smicklas-Wright et al., 2002). At the 75th percentile of quantity consumed per eating occasion, 12- to 19-year-old males and females consumed about 4 tablespoons of salad dressing. For blue cheese salad dressing, that translates into 30 grams of total fat, which is more dietary fat (26 grams) than the average National School Lunch Program meal in schools without salad bars (Schmidt, Hirschman, & McKinney, 2002; USDA, 2004). The typical child eating a salad bar lunch probably consumes a more modest serving of salad dressing, since the median serving size of salad dressing, reported in the CSFII, for 12- to 19-year-olds was 2 tablespoons for females and 2-1/3 tablespoons for males (Smicklas-Wright et al., 2002).

[8] More detailed tables on meat and meat alternates, grains, and toppings on salad bars are available from the first author upon request.

Conclusions

This analysis has focused on the foods *offered* in salad bars. In schools with salad bars, students have the opportunity to choose from a wider range of fruits and vegetables, including lettuce, tomato, other raw vegetables, fresh fruit, and canned fruit. In particular, salad bars are the best source of orange and dark-green vegetables in school lunches, because salad bars commonly offer carrots and broccoli.

The School Nutrition Dietary Assessment-II (SNDA), from which our data were derived, has several limitations. The study did not collect data on the quantity of foods that school children consumed. To understand whether the more widespread adoption of salad bars would improve dietary quality, one would need to know what school-children eat from salad bars. If students select lettuce, tomato, other raw vegetables, fresh fruit, low-fat or fat-free dressings, and low-fat meats, their salad bar meal could have a greater variety of fruits and vegetables and be lower in dietary fat than would be the case for a typical meal from the National School Lunch Program. If students choose to load their salads with regular salad dressing, regular cheese, bacon bits, or mayonnaise-based salads, then their salad bar meal could actually be higher in total fat than found in the average meal from the National School Lunch Program. Future research on what students *select* and *consume* from school lunch offerings is needed to examine the implications of the wider availability of salad bars in more schools.

Another limitation is that SNDA-II did not collect detailed ingredient information on non-salad bar items (in the traditional serving line) that contained more than one ingredient. For example, green salads were

frequently offered in the traditional serving line, but no information was available on whether carrots or broccoli was offered. The SNDA-II did collect information on the nutritional composition of foods offered in the traditional serving line.

We analyzed the nutrient composition of green side salads and chef's salads, and our results suggested that vitamin A- and vitamin C-rich vegetables appeared relatively infrequently in green salads served in the traditional serving line. In particular, only 3 percent of chef's salads and green side salads were a good source of vitamin C (i.e., greater than 20 percent of the Recommended Daily Allowance); 27 percent of chef's salads and 20 percent of green side salads were a good source of vitamin A. If one assumed that all of the vitamin A-rich chef's salads and green side salads contained carrots, which is the most common vitamin A-rich vegetable in school lunch salads, our analysis would still show that carrots were served much more frequently in schools with salad bars than was the case in schools without salad bars.

Another limitation is that data are not available on fruits and vegetables that are included as part of entrées other than entrée salad bars and theme bars. For example, tomato sauce topping for pasta would not be counted as a tomato in our analysis examining whether tomatoes appeared more frequently in schools with salad bars, even though that tomato sauce would count as at least part of a serving of vegetables in the USDA Food Guide Pyramid.

Despite these caveats, our study suggests two types of policies that might increase children's fruit and vegetable consumption while maintaining or reducing dietary fat consumption. The first policy would be to encourage schools with salad bars to continue to offer a wide variety of fruits and vegetables and low-fat meats and to change their offerings to include more low-fat or fat-free salad dressings, reduced-fat cheese, and low-fat versions of meat or pasta salads. In addition, another policy might be to improve nutrition education, as well as the palatability and appearance of salad bar meals so that children in schools with salad bars choose salad bars rather than the traditional serving line. In schools with salad bars, children get the benefit of increased fruit and vegetable offerings only if they choose the salad bar.

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Explaining Variations in State Hunger Rates

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A large and rapidly expanding body of research has examined causes of household-level food insecurity and hunger. A definitive explanation has not emerged that links State prevalence rates of hunger to State-level characteristics such as poverty, employment, and per capita income. In this article, we examined the effect of State-level economic and demographic characteristics on State prevalence rates of food insecurity and hunger. Using food-security data from the U.S. Department of Agriculture and Census data on all 50 States and the District of Columbia, we first estimated, by using ordinary least squares regression, the associations of food insecurity and hunger with a small number of carefully chosen State-level factors. Based on these associations, we then examined the extent to which these factors explained the high rate of hunger in Oregon and, as a contrast, the lower-than-expected rate of hunger in West Virginia. Findings of our study suggest that to reduce hunger rates, policymakers should consider ways to mitigate income shocks associated with high mobility and unemployment and reduce the share of income spent on rent by low-income families.

The U.S. Department of Agriculture (USDA) monitors annually the food security of U.S. households. This monitoring includes calculating the share of households that are food insecure—meaning that they had difficulty at times during the year having enough to eat—and the share of households in which people were hungry at times during the year because of their food insecurity. The USDA reports these statistics for the Nation and for each State (Nord, Jemison, & Bickel, 1999; Nord, Andrews, & Carlson, 2002).

The USDA's Food and Nutrition Service (FNS) uses these statistics to assess the level of need for its food assistance programs and to measure their performance. Advocates for programs that serve low-income families have used these statistics to call for a variety of policy initiatives. The Food Research and Action Center (FRAC), a prominent national organization seeking to end hunger, recently urged Congress to authorize additional funding for the Summer Nutrition and School Lunch Programs (Food Research and Action Center, 2003b). America's Second Harvest, the Nation's largest hunger-relief organization, has also relied on the USDA's hunger estimates in supporting efforts to alleviate hunger (America's Second Harvest, 2002).

State government agencies and the media have used the USDA's State-level statistics to draw attention to the problem of hunger. In Idaho and Tennessee, newspaper editorial boards have taken the opportunity to use hunger estimates to suggest policy (*Idaho Statesman*, 2002; Cooper, 2002). The State-level estimates have received considerable attention in the Pacific Northwest, particularly in Oregon, where posted rates have been at or near the top of the USDA's hunger rankings (Graves, 2002; Harrison, 2002; Cook, 2002). In spring 2003, Oregon Governor Ted Kulongoski convened a hunger summit and discussed possible solutions with human service providers, business executives, and academic experts and

has since made the eradication of hunger a top priority of his administration. Subsequently, the Governor announced a strategic plan—principally focused on job creation—to reduce the State's hunger rate. However, with no precise information about how job growth or unemployment relates to hunger, the Governor was unable to predict the degree to which his approach would affect the State's hunger rate, if at all (Kulongoski, 2003).

The high hunger rates of Oregon and its Northwest neighbors (Washington and Idaho) have surprised policymakers and the Federal officials who oversee USDA's Current Population Survey Food Security Supplement (CPS-FSS) (Nord et al., 1999). A definitive explanation linking State prevalence rates of hunger to State-level characteristics such as poverty, employment, and per capita income has not emerged. Because the underlying reasons have—to this point—gone unexplained, policy responses have been hampered and some observers have challenged methods used in the survey and deemed the USDA's findings inaccurate or misleading (Charles, 2003).

In this article, we examined the effects of State-level economic and demographic characteristics on State prevalence rates of food insecurity and hunger. Using food-security data and Census data of all 50 States and the District of Columbia, we first estimated the associations of food insecurity and hunger with a small number of carefully chosen State-level factors. Based on these associations, we then examined the extent to which these factors explained the high rate of hunger in Oregon and, as a contrast, the lower-than-expected rate of hunger in West Virginia.

Background

In 1990, Congress enacted the National Nutrition Monitoring and Related Research Act (U.S. Department of Agriculture [USDA], 2002a). Under the national plan mandated by this Act, the USDA and the U.S. Department of Health and Human Services (HHS) formed the Food Security Measurement Project. Several Federal agencies, as well as academic and private researchers, worked as a team to develop standardized measures of household food security that could be used nationally as well as in State and local surveys.

The team working on the Food Security Measurement Project used, as its starting point, the definitions of food security, food insecurity, and hunger established by the American Institute of Nutrition (Anderson, 1990). Whereas food security means assured access by all people at all times to enough food for active, healthy lives, food insecurity means limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Anderson, 1990).[1] Hunger refers to the uneasy or painful sensation caused by lack of food. As measured and described by the project, hunger refers specifically to hunger that results from food insecurity (USDA, 2003b).

Based on these definitions and earlier research, the members of the project developed a series of questions about behaviors and experiences known to characterize households that are having difficulty obtaining enough food. These questions (i.e., the U.S. Food Security Survey Module) are included in an annual nationally representative survey as a supplement to the monthly Current Population Survey (CPS) of the U.S. Census Bureau. Based on the number of food-insecure conditions they report, surveyed households are identified as food secure, food insecure without hunger, or food insecure with hunger.

A large and rapidly expanding body of research has examined causes of food insecurity and food insufficiency (a related measure based on a single question used in earlier surveys). To date, however, almost all of this research has examined these associations at the household level. The annual reports of food security by the USDA reveal that households headed by single parents, especially women, and Black and Hispanic households were more likely than others to be food insecure (Nord et al., 2002). Poor households have rates of food insecurity far above the national average, and food insecurity is more prevalent in the South and West than in the Northeast and Midwest (Nord et al., 2002).

Using data from the Survey of Income and Program Participation (SIPP by the Census Bureau), Gundersen and Gruber (2001) used a variety of indicators to compare food-insufficient households with food-sufficient ones. They found that "income shocks" were a major factor leading to food insufficiency (especially for households that lacked savings) and that rates of food insufficiency were lower among homeowners, households headed by senior citizens, and married couples without children than among other households. The authors also speculated that moves by a household might reduce the amount of resources available to buy food, but they found no statistically significant differences

[1]Current methods of measuring food insecurity may not fully take into account whether food was acquired in socially acceptable ways. In particular, reliance on Federal and community food assistance programs by a household is not directly considered in assessing the food-security status of the household.

between food-insufficient and food-sufficient households in this regard. Gunderson and Gruber (2001) concluded that, compared with their counterparts, food-insufficient households faced more unemployment, losses to the receipt of food stamps, and other income shocks and were less able to withstand these shocks by using savings. Thus, these researchers suggested that food insufficiency should be addressed with policies that mitigate income shocks commonly experienced by low-income families.

Other studies have also examined causes of household-level hunger. Similar findings have emerged. Rose, Gundersen, & Oliveira (1998) found that high school graduates, homeowners, and seniors were less likely than others to be food insufficient. Their findings showed that Whites, compared with other racial groups, had the lowest rates of food insufficiency. Not surprisingly, Rose and colleagues also concluded that the less money a household had, the more likely it was to be food insufficient.

In a more recent study, Nord (2003) found hunger to be associated strongly with low income, as expected, and also found that, even with analytic controls for income, hunger was associated strongly with unemployment, part-time employment for economic reasons (i.e., because more work could not be found), not working because of a disability, recent household moves, and low education. Hunger rates were found to be lower for homeowners and for households with the elderly—especially households with retired elderly—compared with their respective counterparts.

All of these analyses were based on household-level associations. To date, little research attention has been given to State-level food insecurity and hunger and the extent to which these household-level factors account for the differences in prevalence rates of food insecurity and hunger across States. In an analysis of rates of State hunger estimated by a FRAC-sponsored survey, Ryu and Slottje (1999) concluded that high school graduates were less likely to be hungry than were those who did not receive a high school diploma. Nord et al. (1999) reviewed USDA-measured rates and demonstrated a strong association between State poverty and prevalence rates of food insecurity. However, the authors also acknowledged that the association was not perfect and pointed in particular to Washington and Oregon as exceptions to the general pattern. They concluded: ". . . reasons for these unexpected high rates of food insecurity in the Pacific Northwest are not known, and further research is needed on this subject" (p. 8).

Data and Empirical Model

We were interested in explaining State-level variations in two related prevalence rates: food insecurity and food insecurity with hunger, the more severe condition. State-level prevalence rates of food insecurity and hunger for our analysis were taken from work by Nord et al. (2002)—the most recent statistics on food security that are published by the USDA. These statistics are particularly well suited for analysis of the associations of State-level characteristics with State hunger rates, because they span 1999 to 2001—a period that overlaps the collection of data through the 2000 Decennial Census and the Census Supplemental Survey. State-level statistics based on these Census data are highly precise.

The USDA's statistics on food insecurity and hunger are based on data collected in the CPS-FSS of April 1999, September 2000, and December 2001. The CPS-FSS is a nationally representative survey of about 50,000 households that is conducted annually by the U.S. Census Bureau for the USDA. Representative of both the U.S. civilian noninstitutionalized population and each State, the CPS-FSS is conducted as a supplement to the monthly CPS, a labor force survey conducted by the Census Bureau for the Bureau of Labor Statistics. Households are classified as food secure, food insecure without hunger, or food insecure with hunger,[2] a classification that is based on the number of food-insecure conditions they report in response to the 18 questions in the food-security module.

For most monitoring and analytic purposes, the CPS sample size in most States is too small to produce annual food insecurity or hunger rates with sufficient reliability. Consequently, the USDA routinely reports State-level food insecurity and hunger rates as 3-year averages. We used the 3-year averages for 1999 to 2001 (Nord et al., 2002) as our main analytic variables.

Our method to assess the associations of State-level food insecurity and hunger rates with State economic and demographic characteristics was a straightforward application of ordinary least squares (OLS) regression analysis. We hypothesized that a number of State-level characteristics independently affect State-level food-insecurity and hunger rates. The relationship between the State hunger rate Y and the explanatory variables X is generally assumed to take this form:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + ... + \beta_n X_{ni} + \varepsilon_i.$$

[2]A complete description of the CPS sample design is available at http://www.bls.census.gov/cps/tp/tp63.htm.

OLS provides estimates of the values of the β terms, which quantify the relationship between each of the explanatory variables and hunger or food insecurity. We analyzed the associations between food insecurity and explanatory variables in a separate model.

We selected the explanatory variables (X_{1i}, X_{2i}, etc.) based on our review of the literature and discussions with experts on food insecurity and hunger. The limited degrees of freedom in this cross-sectional analysis called for a parsimonious model. The literature and program experts identified associations between five individual characteristics (change of residence, unemployment status, poverty status, age, and race) and food insecurity and hunger. We additionally included a measure of housing cost because a number of observers had identified a correlation between high housing costs and food insecurity. Housing is a major item in the budget of most low-income households and, if too high, can "crowd out" resources available for food (Gundersen & Gruber, 2001; Rose et al., 1998; Food Research and Action Center, 2003a).

Table 1. Descriptive statistics for the 50 States

Variables[1]	Mean	Standard deviation
	Percent [2]	*Percentage points*
Share of population experiencing food insecurity with hunger	3.1	0.9
Share of population experiencing food insecurity	10.2	2.2
Share of population in a different house	16.4	2.7
Peak unemployment rates during 1999-2001	5.0	1.1
Share of population living in poverty	12.1	3.3
Share of renters paying more than 50 percent of income on gross rent	16.4	1.8
Share of population non-Hispanic White	74.9	16.1
Share of population under age 18	25.5	1.9

[1]Percentages for all variables are for 2000 unless noted otherwise.
[2]These figures report the simple average of 50 individual State observations with each State's observation given equal weight. That is, California's observation is given the same weight as North Dakota's. Consequently, the figure does not represent a U.S. average, which would vary the States' weighting by their size.

Hypothesized Relationships

In this section, we discuss the hypothesized relationship between change of residence, unemployment status, poverty status, age, and race and rates of food insecurity and hunger. We describe these variables as well as report the means and standard deviations (table 1).

- ***Percentage of households in 2000 that moved within the last year.*** The Census Supplemental Survey reports the share of households in a State that indicate whether they changed dwellings between 1999 and 2000. Households can move for a number of reasons—some positive (e.g., house upgrade or relocation to a new job) and some problematic (e.g., evictions or household dissolutions such as divorces or separations). Household-level research has suggested that, overall, households that have moved recently, compared with households that have not moved recently, were more likely to be food insecure. We hypothesized that this measure is a proxy for income shocks, which Gundersen and Gruber (2001) demonstrated had a positive relationship with hunger. The variable's mean across States was 16.4 percent, and the standard deviation was 2.7 percentage points.
- ***Average of 1999, 2000, and 2001 peak unemployment rates.*** We constructed this variable as the average of the peak State unemployment rates in each of three years: 1999, 2000, and 2001. The 3 years coincide with the period of measurement for the dependent variables. We selected the peak rate in each year, rather than the average, to capture the worst economic conditions reported in the States. Peak unemployment rate is likely to be a better measure of the share of the labor force that experienced job loss and a related income shock at some time during the year. This measure is, therefore, temporally consistent with the measures of food insecurity and hunger, which reflect the most

problematic food-access conditions of the year. (Households were classified as food insecure or food insecure with hunger if they experienced these conditions at any time during the year.) Based on the work of Gundersen and Gruber (2001) and others (Rose et al., 1998), we hypothesized that high peak unemployment would be associated with high food insecurity and hunger rates. We used the applicable variable from the Local Area Unemployment Statistics series of the Bureau of Labor Statistics. Its mean was 5.0 percent; the standard deviation, 1.1 percentage points.

- ***State poverty rate.*** Other studies have indicated that a household's income level is a determinant of food insufficiency (Gundersen & Gruber, 2001; Rose et al., 1998; Gundersen & Oliveira, 2001; Nord, 2003). Moreover, the most recent USDA report showed that 12.9 percent of households with incomes below the Federal poverty level experienced hunger, compared with a national average of only 3.3 percent (Nord et al., 2002). Therefore, we anticipated that States with higher poverty rates would also register higher hunger rates. State poverty rates, measured for calendar year 1999 through the 2000 Decennial Census, averaged 12.1 percent; the standard deviation, 3.3 percentage points.

- ***Share of renters spending more than 50 percent of income on gross rent.*** Just as limited income can put a household at risk for hunger, high expenses can do the same. Past studies have reported that renters were more likely than homeowners to be food insecure (Gundersen & Gruber, 2001; Rose et al., 1998; Gundersen & Oliveira, 2001; Nord, 2003). Therefore, we used the share of renter-households in the State that spent more than 50 percent of their incomes on gross rent as an explanatory variable.[3] We anticipated that within the group of renting households, those with high rents relative to their incomes would be particularly prone to hunger. We used the variable from the 2000 Decennial Census. The mean for the variable was 16.4 percent; its standard deviation was 1.8 percentage points.

- ***Population share of non-Hispanic Whites.*** Previous research has offered mixed findings about the effect of race and ethnicity on hunger or food insufficiency (Gundersen & Gruber, 2001; Rose et al., 1998; Gundersen & Oliveira, 2001; Nord, 2003). We included the variable that measured the share of a State's population that was non-Hispanic White, but we had no *a priori* assumption about its effect on hunger rates. This variable averaged 74.9 percent; its standard deviation was 16.1 percentage points.

- ***Population share under age 18.*** Researchers have indicated that larger households, and particularly large households with children, have higher hunger rates (Rose et al., 1998). We anticipated that as a State's share of the population under age 18 rose, so would its hunger rate. The mean for this variable was 25.5 percent; its standard deviation was 1.9 percentage points.

Finally, we explored the extent to which the regression model could account for the high rate of hunger in Oregon. Based on the regression coefficients and the values of each State's independent variables, we calculated the rates of hunger predicted by the regression model for each State. We also calculated the contribution of each factor to Oregon's higher-than-average hunger rates. As a counter-example, we examined the contribution of each factor to the hunger rate in West Virginia, which was near the national average despite a relatively high State poverty rate.

[3]Gross rent consists of direct rental costs plus essential utilities.

Results

Because of the limited number of observations (51) and the estimation error associated with prevalence rates of State-level hunger, the model predicted State hunger rates quite well. Overall, the six independent variables explained 64 percent (unadjusted R^2) of the variation in State hunger rates—a high rate for this type of model—and 74 percent (unadjusted R^2) of the variation of State rates of food insecurity (table 2). Moreover, the measured relationships between most of the independent variables and State rates of hunger and food insecurity were statistically significant and sufficiently strong to be of substantive importance. Also, both in-sample and out-of-sample predictions ranked Oregon with the second highest hunger rate.

Examination of the estimated relationships between each of the independent variables and State hunger and insecurity rates revealed that the "different house," or mobility variable, had the most robust and consistent relationship with State hunger and food insecurity rates. The hunger model suggests that each percentage-point increase in the share of a State's households that reported changing dwellings between 1999 and 2000 was associated with a 0.13-percentage-point increase in the State's hunger

Table 2. Estimated relationships between selected State characteristics and rates of hunger and food insecurity

	Food insecurity with hunger		Food insecurity (with or without hunger)	
	Regression coefficient	Standard error	Regression coefficient	Standard error
Share of population in a different house	0.132	(0.034)*	0.280	(0.073)*
Peak unemployment rates during 1999-2001	0.314	(0.100)*	0.187	(0.215)
Share of population living in poverty	0.034	(0.031)	0.360	(0.067)*
Share of renters paying more than 50 percent of income on gross rent	0.130	(0.055)*	0.276	(0.118)*
Share of population non-Hispanic White	0.011	(0.006)	0.014	(0.013)
Share of population under age 18	0.112	(0.047)*	0.434	(0.101)*
Constant	-0.069	(0.018)*	-0.164	(0.040)*
R^2	0.638		0.736	
Adjusted R^2	0.588		0.700	

Note: The data are based on ordinary least squares analysis.
*p < .05.

A 1-percentage-point increase in peak unemployment rates was associated with an increase of 0.31 percentage points in a State's hunger rate.

rate. The magnitude of the coefficient was roughly twice as large in the estimate of food insecurity (but the level of food insecurity was also much higher, so the proportional association was similar or somewhat smaller). We interpret the coefficient of the "different house" variable as primarily measuring the associations of food insecurity and hunger with economic shocks and family disruptions.

Effects of peak unemployment rates also were quite strong. A 1-percentage-point increase in peak unemployment rates was associated with an increase of 0.31 percentage points in a State's hunger rate. This relationship is consistent with earlier research findings that job loss and income shocks are associated with a higher likelihood of food insufficiency (Gundersen & Gruber, 2001; Nord, 2003). We also found unemployment to put upward pressure on food insecurity rates; this association, however, was weaker than the one for hunger and was not statistically significant.

As expected, high poverty rates also put upward pressure on hunger and food insecurity rates. This association for hunger, however, was not statistically significant. The relatively high correlation between State-level poverty and unemployment measures accounted for the weakness of the estimated relationship between poverty and hunger on the one hand and between peak unemployment and food insecurity on the other. Because States with high poverty rates tended also to

have high peak unemployment rates, the models had difficulty disentangling the independent effects of poverty and unemployment. In the case of the hunger model, the stronger association with the unemployment variable left little residual association with the poverty rate. However, when we removed the unemployment variable from the model (analysis not shown), the poverty variable became statistically significant. In the case of the food-insecurity model, poverty had the strong relationship with food insecurity; removing it from the model resulted in a statistically significant association with unemployment.

The additional analyses with poverty rates and peak unemployment rates, omitted in turn, also confirmed that the peak unemployment variable was more strongly associated with hunger rates than with food insecurity rates while the poverty variable was more strongly associated with food-insecurity rates (data not shown). These findings suggest that economic shocks at the household level, for which peak unemployment is a proxy at the State level, are associated with the more severe hunger condition. In States with high poverty rates, by contrast, low-income households and their communities are more likely to have adjusted to sustained low levels of income. Persistently poor households are likely to have developed ways to avoid hunger by relying on family, friends, and local institutions and by altering their consumption patterns. Community institutions in States with consistently high poverty rates will have had time to adjust and better reach families in need.

High housing costs were strongly associated with hunger and food-insecurity rates. Our model estimated that a 1.0-percentage-point increase in the share of a State's renters who paid more than 50 percent of income for gross rent was related to a 0.13-percentage-point increase in the State's hunger rate. For example, the 8.9-percentage-point difference between New York (the Nation's highest) and South Dakota (the Nation's lowest) and the housing-burden measure is expected to result in a 1.1-percentage-point difference in hunger rates between the two States (data not shown).

We had no expectations about the effects of the non-Hispanic White variable on rates of hunger and food insecurity. The variable showed a positive but weak and statistically insignificant relationship with the dependent variables. The lack of a conclusive relationship is consistent with previous, generally mixed, findings reported by researchers (Rose et al., 1998).

As the share of a State's population under age 18 increased, so did both hunger and food insecurity. A 1-percentage-point increase in the State's population share under age 18 was significantly associated with a 0.11-percentage-point increase in hunger and a 0.43-percentage-point increase in food insecurity. We were concerned that this variable could be confounding the effects of a larger share of children with a smaller share of elderly in the State. However, including the elderly population share in the model (analysis not shown) resulted in no substantial change in the coefficient on the share of the State's population under age 18.[4] The measured associations of hunger and food insecurity with the elderly population share remained, even when all households with elderly were excluded from the sample used in the analysis for calculating rates of food insecurity and hunger. We thus concluded that the association was spurious, resulting from other characteristics of States with large elderly population shares.

We also examined the extent to which the regression models accounted for hunger rates in Oregon and West Virginia (table 3). Oregon registered one of the highest hunger rates (5.8 percent) in the Nation; yet, it had a poverty rate slightly below the national average (11.6 vs. 12.1). West Virginia, on the other hand, had a hunger rate near the national average (3.3 percent); yet, it had the fifth highest poverty rate of all States (17.9 percent). We estimated—based on the model's regression coefficients and the States' values on each independent variable—how Oregon's and West Virginia's hunger rates would change if the State's levels were equal to the mean for all 50 States.[5]

For example, Oregon's share of renters paying more than 50 percent of their income in rent is 2.9 percentage points higher than the U.S. average (19.3 vs. 16.4 percent, table 3 and table 1, respectively). If Oregon's rate fell to the 50-State mean, we estimated that the State's hunger rate would fall by 0.4 percentage points (table 3). Oregon's high levels of peak unemployment rate and residential mobility, as measured by the share of the population in a different house, explained even more of the gap between Oregon's hunger rate and those of other States. For each of these two variables, if Oregon's rate fell to the 50-State mean, the model predicted that the State's hunger rate would decline by 0.6 percentage points.

In West Virginia, high peak unemployment pushed the hunger rate up. Bringing peak unemployment down to

[4]To obtain the detailed data for each State, please contact the first author.

[5]These values are not national averages because they are unweighted; they are means for the 50 States.

Table 3. Estimated effect of key characteristics on hunger rates in Oregon and West Virginia

	Oregon		West Virginia	
	Rate	Estimated effect[1]	Rate	Estimated effect[1]
	Percent	*Percentage point*	*Percent*	*Percentage point*
Share of population in a different house	21.1	-0.6	12.9	0.5
Peak unemployment rates during 1999-2001	7.0	-0.6	6.9	-0.6
Share of population living in poverty	11.6	0.0	17.9	-0.2
Share of renters paying more than 50 percent of income on gross rent	19.3	-0.4	17.7	-0.2
Share of population non-Hispanic White	83.5	-0.1	94.5	-0.2
Share of population under age 18	24.7	0.1	22.2	0.4
Total		-1.6		-0.3
State hunger rate	5.8		3.3	

[1]The effect refers to the estimated change in hunger rate if the rate equaled the mean hunger rate of the 50 States. For example, Oregon's share of the population in a different house in 2000 was 18 percentage points higher than the 50-State mean (21.1 vs 3.1). If Oregon's mean were the same as that of the 50 States, Oregon's hunger rate would fall by 6 percentage points.

the 50-State mean (5 percent) would lower the hunger rate by 0.6 percentage points. West Virginia's high poverty rate (17.9 percent) was estimated to push up the hunger rate only 0.2 percentage points. As we observed, with peak unemployment in the model, the effect of the poverty rate was small. Furthermore, West Virginia's share (17.7 percent) of renters paying more than 50 percent of their income for gross rent was nearer the 50-State mean (16.4 percent) than was Oregon's (19 percent), putting a smaller upward pressure on the hunger rate. The most important difference between the two States, however, was that the factors pushing the hunger rate up were largely offset by West Virginia's much lower rate of residential mobility, well below the U.S. mean, and the considerably smaller-than-average share of children in the population. Taken together, these factors resulted in a hunger rate in West Virginia that was similar to the mean for the 50 States.

Policy Implications and Conclusions

Prior research provided considerable insight about factors affecting household-level hunger, food insecurity, and food insufficiency but little information about the extent to which these factors explained differences in State prevalence rates.

The lack of an intuitively satisfying explanation for high estimated hunger rates in the Pacific Northwest left policymakers unsure about how to address the problem of hunger and led critics to question the validity of the USDA survey and its measurement techniques. The ability to associate State hunger rates to key social and economic conditions at the State level, as demonstrated in this study, sheds light on State rankings and, by doing so, both lends credibility to the State hunger statistics and provides policymakers with some guidance about policy responses. Nevertheless, this relatively simple cross-sectional analysis points only to associations between hunger and food insecurity and the hypothesized explanatory variables. Our work falls short of establishing definitive causal relationships.

The findings suggest that highly transient populations put upward pressure on the hunger rates in their States. High mobility serves as a proxy for a variety of lifetime disruptions—divorce, separation, eviction, and other shocks to family income—that put people and families at risk of hunger and food insecurity. This risk may be exacerbated by the diminished social cohesion that characterizes highly mobile populations.

Paradoxically, good regional economic conditions often lead to high levels of mobility. States with booming economies attract an influx of job seekers. States with a high percentage of seasonal jobs may experience substantial internal migration during the year. States with strong economies may experience rapid growth in housing prices, resulting in both high housing costs for residents and relatively large portions of the population shifting into new or less expensive areas. People living through these types of economic conditions may be at a higher risk of hunger; because, they are more likely than others to be living in new neighborhoods, distant from family

and friends and disconnected from the local infrastructure of social support. Religious institutions and government programs may not effectively reach people who have lived in the area for only short periods.

In trying to lower hunger rates in highly mobile States in the West and South, policymakers may want to focus their efforts on vulnerable, mobile populations—newcomers, seasonal workers, and displaced renters, for example. In doing so, policymakers in these States can assume a role in overcoming, or partially offsetting, the lack of social cohesion in their communities. If some Western and Southern States lack natural support networks (e.g., family and long-time neighbors) found in the Northeast or Midwest, citizens and policymakers can attempt to substitute for the lack of cohesion through nonprofit or public efforts.

For example, a highly developed network of food banks may prove more important in Oregon than in States in other regions with more stable populations. Also, a state-of-the-art information and referral system, as envisioned by United Way's 211 coalition, can provide much-needed direction to those who relocate and need to know what resources are available to them. Policymakers can also reform the State unemployment insurance programs to better reach seasonal workers, focus food stamp outreach efforts on newcomers, and devise effective support programs for displaced renters.

The association between unemployment and hunger suggests that an economic development policy could serve a dual purpose as an anti-hunger strategy. Many governors have indicated that they want an integrated approach to economic development—one that stimulates job growth and trains workers. Plans on both fronts are necessary to help State economies and their hungry citizens. Economic development efforts that lower poverty rates, reduce seasonal fluctuations in unemployment rates, and provide jobs in rural areas experiencing high unemployment may be particularly effective in fighting hunger.

Another policy direction to emerge relates to increasing the supply of affordable housing. Findings of this study indicate a substantial reduction in the hunger rate for moderate decreases in the share of renters who pay more than 50 percent of their income on gross rent. States with the largest share of such renters, such as Oregon, have room to improve and the potential to address concerns of both housing and hunger advocates. Competing proposals have been offered to increase the supply of affordable housing: construction of more affordable housing projects and vouchers for existing units, on the one hand, and relaxation of land-use controls to lower the price of land, on the other hand. If further research demonstrates that these approaches do, in fact, increase the supply of low- and moderate-cost housing, then both may reduce the prevalence of hunger, whatever the other strengths and weaknesses of these approaches might be.

In each State that has a high prevalence of hunger, a different combination of factors may be responsible. The results of this study can help policymakers and the concerned public in each of these States understand more fully the factors that particularly affect their State. We hope that this improved understanding will lead to increasingly effective policies, programs, and community institutions to reduce hunger and food insecurity.

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The Pitfalls of Using a Child Support Schedule Based on Outdated Data

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A strong rationale for updating child support guidelines arises from changes over time in the measurement of expenditures on children, as well as from changes in the empirical relationship between expenditures on children and the income of parents. Such changes affect the accuracy of the numerics upon which States' child support guidelines are based. This study evaluated an alternative child support guideline that was proposed for Virginia and drew lessons for other States that similarly base their guidelines on older survey data. Regression results showed that, over time, the child expenditure and household income relationship has changed considerably. Furthermore, the largest increases in expenditures attributable to children have occurred for lower and middle-income households.

While the Family Support Act of 1988 requires all States to assess their child support guidelines at least once every 4 years, States are not mandated to change their guidelines following the assessment. A number of economic changes could warrant the updating of a State's child support guidelines. One such change: Today, most obligors are fathers who are more involved in child-rearing than they were 20 years ago. In addition to paying child support, many obligors spend money on their children during visitation hours. This increase in father involvement and spending provides a rationale for implementing adjustments to child support schedules. Another change: A worsening in labor-market opportunities for less-skilled men has led to sharp increases in arrearages (Katz & Krueger, 1999; Welch, 2001). Including a downward adjustment for low-income obligors in child support schedules can help to reduce arrears caused by child support awards that surpass the ability of low-income obligors to pay (Holzer, Offner, & Sorenson, 2003; Sorenson & Zibman, 2001).

Another rationale for updating child support guidelines arises from changes that have occurred in the measurement of expenditures on children, as well as from changes in the empirical relationship between expenditures on children and the income of parents. These changes affect the accuracy of the numerics upon which States' child support guidelines are based. To understand better the implications of these changes, we examined the costs involved when States use schedules based on statistical relationships derived from outdated survey data. We evaluated an alternative child support guideline that was proposed for the Commonwealth of Virginia and then drew lessons for other States that similarly base their guidelines on older estimates of child-rearing expenditures. The alternative schedule for Virginia proposed that total child support awards as a share of monthly income be raised at all income levels except for the lowest end of the income distribution.

Virginia's child support schedule has not been updated since the mid-1980s. The schedule is based on a study of child-rearing expenditures published in 1984 that used the 1972-73 Consumer Expenditure Survey (CES), the best household expenditure data available at the time. Because the Bureau of Labor Statistics has made significant

improvements in the quality and comprehensiveness of its data collection and because the data are collected annually, Virginia's current schedule is no longer tied to the best quality data from the CES. As was the case for Lino (2001), we found that average total expenditures on children have risen in past decades and have changed in composition. However, the child expenditure and income relationship upon which Virginia's schedule is based may also have changed since the 1970s, a hypothesis that was tested in this study. Such a change would imply that Virginia and 10 other States with older guidelines are no longer generating child support orders that are linked to accurate estimates of the child expenditure and income relationship. Statistical evidence in this study provides a strong economic rationale for developing a new child support schedule in Virginia and in other States with similar guideline structures.

Underlying Models and Measurement Issues

Federal legislation requires all States to have formal guidelines for calculating the dollar value of child support awards. These child support guidelines must take into account the earnings of the nonresidential parent, they must base support obligations on numerical criteria, and they must include the child's health care costs into the calculations. No particular method to determine State guidelines is mandated, so States must make decisions about the underlying model and measurement issues surrounding the definition of income and child-rearing costs (Beller & Graham, 1993; Venohr & Williams, 1999). States have chosen versions of three underlying models: the "Percentage of Obligor Income" model, the "Income Shares" model, and the "Melson Formula" model.

The Percentage of Obligor Income model entails the most basic calculations of the three models, in which the noncustodial parent pays a certain share of his or her income to the custodial parent. The share rises with the number of children; for some States, however, the share also changes as the income level of the obligor changes.

In contrast, the Income Shares model is more detailed. The underlying premise of this model is that the child should obtain the same percentage of total income that he or she would have obtained if the parents were together. In calculating the child support amount, the income of both the mother and father is combined to proxy for the total income of an intact family. This income calculation is then linked to estimates of child-rearing expenditures by intact families with the same income level and number of children. In the final basic step for converting estimates of child expenditures into a schedule of child support payments for noncustodial parents, the estimated child support amount is divided between the two parents according to their respective income shares.

Finally, the Melson Formula model is similar to the Income Shares model except that both parents are allowed a reserve amount to cover their own subsistence needs and to sustain employment.

No matter which model is chosen, however, States must make decisions regarding the measurement of income and expenditures on child-rearing. According to Beller and Graham (1993), to measure income, most States use either adjusted gross income (income adjusted for prior support orders and health insurance) or net income (income with these same adjustments plus deductions for taxes, mandated retirement contributions, and union dues). A few remaining States use gross income. A number of States also build into their schedules a self-support reserve that protects the ability of the obligor to meet his or her basic subsistence needs and to facilitate employment. With a self-support reserve, if the combined gross monthly income is less than a certain threshold, then the guideline is not used to compute the child support order. Instead, a fixed minimum award is applied to the noncustodial parent. At the other end of the income distribution, very high income levels are sometimes treated with an income cap, declining percentages, or noncash transfers in the application of child support guidelines.

There is less agreement among policymakers and academics about the best estimates of child-rearing costs. These estimates come from a number of studies that vary in the underlying methodology as well as the survey year used to determine the estimations. In a survey of this literature, Beller and Graham (1993) point to two indirect approaches—the Engel method and the Rothbarth method—and the direct approach for estimating child-rearing costs.

The Engel method is based on the premise that families who spend the same share of their total consumption expenditures on food are equally well off. When the Engel method is used to compute child-rearing costs, two families, one with no children and one with one child, are assigned equal proportions for food spending in the total budget. Then the cost of raising the first child is the increase in spending required to keep the one-child family spending the same budget share on food. The approach is similar for families with more children. The most important assumption this approach must satisfy is separability in consumption; that is, families will not change the way they allocate their spending across food and other

consumption items as they have children.

The Rothbarth method is similar in notion and underlying assumptions, except that the equalizing factor across families is the budget share devoted to adult goods. Deaton and Muellbauer (1986) argue that the separability assumption causes the Engel estimator to overestimate child-rearing costs (families with children are over-compensated in computations to keep the food share equal), while the Rothbarth estimator underestimates child-rearing costs (families with children are undercompensated in computations to keep the adult-goods share equal). Finally, the direct approach for estimating child-rearing costs involves directly totaling different categories of spending on children. A few categories, such as child care or children's clothing, can be measured by actual spending on children, while most other categories, such as health care or housing, are measured by estimates of spending attributable to children.

By 1990, over 30 States, including Virginia, had based their guidelines on the Income Shares model. For most of these States, the estimates of child-rearing expenditures were initially calculated from Espenshade's work (1984), which was based on the Engel method and data from the 1972-73 CES. Subsequently, a number of States have updated their child support guidelines to reflect more recent estimates of child-rearing costs. These recent estimates, drawn mostly from work in Betson (1990), use a range of methods applied to CES data from 1980 to 1986. Some States have also drawn from annual reports by the U.S. Department of Agriculture, which uses the direct approach to total categories of spending attributable to children.

In 2003, there were still 11 States, including Virginia, that based their guidelines on Espenshade's earlier estimates (Venohr & Griffith, 2003). The other 10 States were Alabama, Florida, Indiana, Louisiana, Kansas, Kentucky, Maryland, Michigan, Rhode Island, and Washington. However, these older guidelines may no longer generate realistic child support orders. In recent decades, the CES's sample size has grown and the level of detail has improved, providing better expenditure and income data. Concepts and definitions have changed so much that officials of the Bureau of Labor Statistics warn users to exercise caution when comparing current survey data with data from earlier surveys, especially with data from surveys conducted prior to 1984.

Estimating Expenditures on Children

This section describes a schedule of child support that was developed for the Quadrennial Child Support Review Panel of the Commonwealth of Virginia.[1] The schedule has been grounded in current economic research on child-rearing expenditures. New estimates of child-rearing expenditures were developed by using micro data on husband-wife households from the 2000 CES. The sample criteria included having some positive amount of household income for the past year and reporting one to three children under age 18 living in the home.[2] These criteria yielded 1,987 households with one child, 2,557 households with two children, and 990 households with three children. Data were used for households with gross monthly incomes that ranged from $1,200 to $8,500. Computed from the 2000 decennial census micro-data file for Virginia, this range of the income distribution represented 76 percent of all Virginia married-couple households with one to three children below age 18. Of the remainder, 2 percent were below the specified income range and 22 percent were above the range. Because of the CES's focus on lower and middle-income families, the Bureau of Labor Statistics cautions researchers about making statistical inferences on the expenditures of households with gross incomes above $8,500.

[1]The full report by Rodgers (2002) can be found at www.dss.state.va.us/pub/pdf/dcsepanel_final.pdf.

[2]Sample sizes for husband-wife households with more than three children were too small to generate reliable results.

Identifying Total Expenditures

This study estimated a household's expenditures on children by using the direct approach of totaling different categories of actual expenditures. A three-step procedure was used. The first step involved identifying the total expenditures on food, housing, clothing, transportation, education, miscellaneous expenditures, and nonextraordinary health expenditures. In Virginia, support for extraordinary health expenditures, child care costs, and health insurance premiums for the child are treated as add-ons after the initial level of support has been calculated.

Sample means from the 2000 CES showed that housing, variable transportation, and food expenditures comprised 70 percent of total household expenditures. Of note, expenditures on housing in the CES are underestimated because the Bureau of Labor Statistics treats mortgage principal payments as savings rather than as expenditures. Because a large

portion of an obligor's direct expenditures on children is likely to be in housing, the CES's treatment of mortgage payments generates lower expenditures on children. This downward bias can be thought of as a discount that all homeowners receive. Obligors with high incomes tend to own more expensive homes, so this treatment of the housing data generates a larger discount for these obligors.

Table 1. Housing and transportation expenditures attributable to children based on per capita and average use allocation methods

	Housing		Transportation	
	Per capita	Average use	Per capita	Average use
Number of children				
1	33.3	1.0	33.3	24.0
2	50.0	9.5	50.0	44.0
3	60.0	12.4	60.0	38.0

Source: JLARC (2001).

Determining Proportion of Expenditures Attributable to Children

The second step to estimating a household's expenditures on children was to determine in each expense category the proportion of expenditures attributable to children. For some categories, such as clothing, the CES data are reported separately for children; thus, 100 percent of these expenditures can be attributed to children. But for other categories, such as housing, transportation, and food, assumptions must be made regarding the proportion attributable to children. The most common approaches are (1) the "representative" approach, in which allocations are based on averages calculated for children and adults based on Federal studies; (2) the "per capita" approach, in which household expenditures are divided by the number of family members; and (3) the "average use" approach, in which allocations are based on the amount of a certain commodity that households with different numbers of children are observed to use on average, compared with households without children.

As discussed in a Virginia State government technical report on the costs of raising children (JLARC 2001), the choice of which assumption to use in estimating expenditures on children could lead to large differences for two major categories: housing and transportation. These differences, in turn, have an effect on estimated income shares that are used to compute child support guidelines, especially for middle- and higher income households. For those expenditure categories requiring a choice in allocation method, we compared alternative expenditure results and explored the reasons for choosing a particular method.

For housing, we estimated expenditures for four subcategories of costs: shelter, utilities, household operations and household equipment, and furnishings. Housing is an excellent example of the difficulty in assigning an expenditure amount attributable to children. If the per capita proportions were used, then 33 percent of expenditures in a one-child household were attributable to that child, compared with only 1 percent for the average use proportion (table 1). The 1-percent figure was computed by JLARC (2001), from American Housing Survey data, as the percentage difference between the estimated house size (1,776 square feet) of a two-adult household with one child and the estimated house size (1,758 square feet) of a two-adult household with no children. The other figures for average use in housing were constructed by using the same method.

Across household sizes, the per capita approach generated larger expenditures on children than did the average use approach. In effect, the per capita approach provided an upper bound on the share of housing expenditures attributable to children while the average use approach provided a lower bound. One explanation for why the average use figures were so small is that they were based on observed data on housing size that give no indication of housing and family planning decisions. Households may take longer term views of family size when they select their homes. When children are eventually added to the household, the total housing size may not increase if the children are living in extra space that had already been intended for their use. To estimate housing expenditures on children, our preferred approach was to apply the per capita proportions shown in table 1, mainly because the approach is more equitable in its assumption that each household member shares equally in the use of the home.

Following the method in JLARC (2001), we defined two types of transportation costs: fixed vehicle and variable costs. Fixed vehicle costs capture spending on new and used cars and trucks, vehicle financing, and vehicle insurance. This expense component captures the start-up cost of

obtaining a vehicle and does not vary much with mileage. When the average use approach is used, the estimated share of fixed vehicle costs that can be attributed to having children is 8.0 percent (JLARC, 2001). Variable transportation costs capture spending on gas and oil, licenses, other vehicles, maintenance and repairs, public transportation, and incremental expenses of operating a vehicle. Thus, this component captures the incremental expenses of operating a vehicle.

The fraction of transportation costs that can be attributed to children is 33 percent in a one-child household, based on the per capita approach, compared with 24 percent, based on the average use approach. Again, the average use proportions are well below the per capita proportions across household size. To estimate the transportation costs attributable to children, we alternatively applied the per capita proportions to all transportation expenditures (the per capita approach) and we applied the average use proportions to the fixed transportation subcategory (the "average use in vehicles" approach). Because neither approach offered a clear *a priori* advantage, the empirical analysis used both approaches.

The proportion of food expenditures attributable to children was based on four official U.S. Department of Agriculture food plans for May 2002. This approach is similar to the treatment of food expenditures in JLARC (2001). To compute this figure for each food plan, we averaged across gender and ages the estimated monthly food costs for children. This computation resulted in the monthly food cost for an average child under each plan.

Each plan also contains the average monthly food costs for an adult. Hence, for each plan, we could compute total household spending on food for dual-parent households of different sizes; from there, we could construct the proportion of average household expenditures on food that are attributable to children. These proportions were fairly consistent across plans. For example, the proportion of food expenditures attributable to children ranged from 28.4 to 29.5 percent for dual-parent households with one child (data not shown). The average of the four plans for each dual-parent household size was multiplied by household expenditures on food. The resulting product was the estimate of food expenditures on children.

Clothing expenditures were divided into clothes and footwear and other apparel products and services (e.g., dry cleaning, repairs, and alterations). In the CES, clothes expenditures are reported for infants, children, and teens up to age 16. Thus, 100 percent of these expenditures are attributed to children. However, expenditures for 16- and 17-year-olds are not separately reported from expenditures for adults in the household. To address this issue, we identified households with children 16 and 17 years old and pro-rated, on a per capita basis, the clothing expenditures for men and women aged 16 and older.[3] Footwear and other apparel products and services are not reported separately for children. Proportions based on the per capita approach were used for this expense category.

To estimate housing expenditures on children, our preferred approach was to apply the per capita proportions shown in table 1, mainly because the approach is more equitable in its assumption that each household member shares equally in the use of the home.

[3] An alternative method was to compare households with 16- and 17-year-olds with households with no children in this age group and then attribute the difference to clothing expenditures for 16- and 17-year-olds. Applying this method to data from the 2000 CES yielded quarterly clothing costs for children that were slightly higher than those reported in the test. In particular, child clothing costs using the reported method versus the alternative method were, respectively, $140 and $143 for one-child households, $187 and $194 for two-child households, and $205 and $219 for three-child households.

Table 2: Average quarterly household expenditures on food, clothing, care, and other items in 2000, by number of children

	Total household expenditures			Child-related expenditures		
	1 Child	2 Children	3 Children	1 Child	2 Children	3 Children
Food and beverage						
Food	$1,599	$1,810	$1,836	$466	$816	$1,013
Alcohol and tobacco	161	175	169	—	—	—
Clothing						
Child clothing	140	187	205	140	187	205
Adult clothing	231	219	162	—	—	—
Other apparel	153	168	158	51	42	32
Care						
Child care	224	335	190	224	335	190
Health care	523	531	567	95	163	226
Personal care	100	104	92	33	26	18
Other						
Education	276	180	227	276	180	227
Personal insurance	1,700	1,859	1,544	—	—	—
Entertainment	644	859	795	215	215	159
Books	46	53	46	15	13	9
Pets and toys	126	156	157	126	156	157
Miscellaneous	115	128	144	39	32	29

— Not applicable.
Source: Calculations are based on the 2000 Consumer Expenditure Survey.

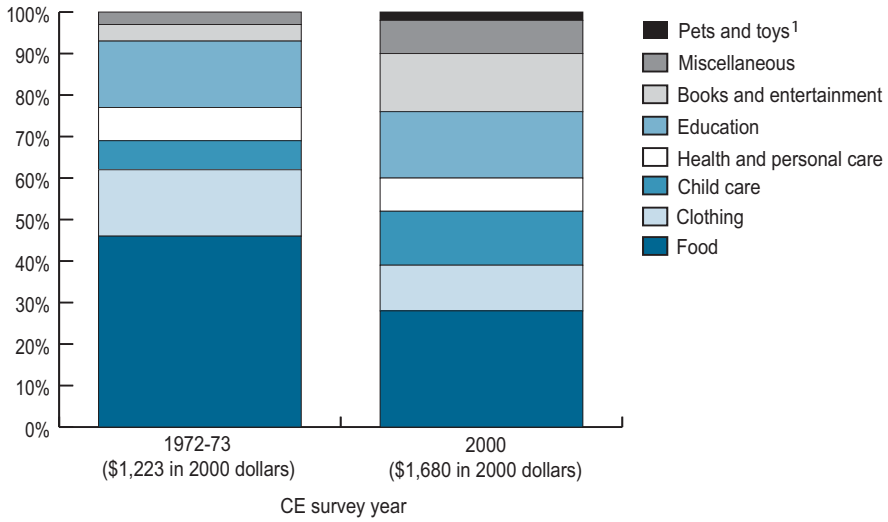
Because of its simplicity in generating per person expenditure estimates, the per capita approach was applied to all remaining expense categories, which include such items as entertainment, personal care items, and reading materials. Entertainment expenses comprise entrance fees and admission costs for various events, clubs, and memberships, as well as spending on equipment, including video games. Exceptions to this per capita approach occur for CES's education expenditures, which are fully identifiable for children, and for expenditures on a sub-category that includes pets, toys, and playground equipment. For these exceptions, we assumed that 100 percent of expenditures are attributable to children.

Results for average quarterly expenditures on food, clothing, health care, child care, and miscellaneous items are reported in table 2 as absolute numbers and in figure 1 as relative shares. Food expenditures comprised by far the largest single category, followed by child care and education expenditures. Actual quarterly child care expenditures are considerably higher than the reported results for those households that have preschool children and both parents working traditional shifts, and similarly for households that must pay for after-school care (Bernstein, Brocht, & Spade-Aguilar, 2000).

The reported child care results averaged these households together with all other households with children over the age of 5 and make little use of paid child-care services or after-school care. This averaging issue helps to explain why Virginia and numerous other States treat child care costs as an add-on in their guidelines. These States remove child care expenses from the underlying calculations when determining the structure of their child support guidelines. Later, they add on child care expenses on a case-by-case basis. We followed the same approach in developing the alternative guideline for Virginia.

To help demonstrate that the 2000 CES better portrays family expenditure patterns than does the 1972-73 CES, we performed the same procedure for estimating expenditures on children by using the 1972-73 CES. In particular, the 1972-73 calculations for total household expenditures were converted into real 2000 dollars. Then, to estimate child-related expenditures, we used the 2000 weights and shares. The resulting expenditures on children were then compared with the 2000 expenditures reported in figure 1, which shows results for a one-child household. The figure has a similar format to that of Lino's study (2001), which found a significant increase in real expenditures on children between 1960 and 2000. Our findings show that in real dollar terms, average quarterly

Figure 1. Changes over time in average quarterly expenditures on children for a one-child household



[1]Pets and toys are included in the miscellaneous category for 1972-73.

In contrast to these expenditure jumps, spending on food for children has dropped noticeably in relative terms. . . . More puzzling is the absolute spending decline for children's food.

expenditures attributable to children have risen considerably over time: from $1,223 in 1972-73 to $1,680 in 2000 (fig. 1). Consistent with Lino's comparison for 1960 and 2000, one of the key factors behind this increase was the jump in child care expenses, both in absolute and relative terms. Greater use of child care services, in turn, was driven by the surge in women's labor force participation during the period.

Spending on entertainment has also risen in both absolute and relative terms as structured activities for children have become more widespread over time and as technological change has produced a wider variety of audio and visual equipment. Results also show a sizeable jump in spending on pets and toys, an expenditure item that was small enough in the 1970s data to be classified within the miscellaneous category. These increases in items relating to recreation are consistent with results by Jacobs and Shipp (1990) and Costa (1999), who argued that such spending has grown historically as innovations have occurred in consumer goods industries, as new electronic toys and gadgets have become more available, and as participatory and spectator sports have become increasingly popular.

Spending on education has also risen in absolute terms as school tuition increases have outpaced inflation. In contrast to these expenditure jumps, spending on food for children has dropped noticeably in relative terms. The relative decline is consistent with Engel's law: as income increases, the share of expenditures for food declines. More puzzling is the absolute spending decline for children's food. In Lino's (2001) study, a similar finding that the absolute amount of food expenditures for children has declined in real terms since 1960 was explained by differences over time in CES measures of spending for food at home. Before 1988, the CES estimated food-at-home spending on a child by using a scientific standard based on USDA food plans; after 1988, the CES used actual

food-at-home spending on children rather than on the food plans. Hence, the absolute decline we observed for spending on children's food may mostly reflect the comparison of two different concepts.[4] Comparisons over time in quarterly expenditures on children for two-child and three-child households, not reported, yielded similar conclusions.

Household Expenditures on Children and Gross Income

The third step to estimating a household's expenditures on children was to evaluate the statistical relationship between household expenditures on children and combined gross income. To do so, for each household size, we regressed the logarithm of average monthly child-rearing expenditures on the logarithm of average monthly gross income:

$$\ln(Expenditures_i) = \alpha_0 + \alpha_1 \ln(Income_i)$$

These estimates will vary in magnitude when the per capita and average use approaches are alternatively used to calculate housing and transportation expenditures attributable to children. Because the per capita approach generates higher estimated expenditures on children, schedules based on the per capita relationships will be uniformly higher than schedules based on the average use relationships. We estimated a variety of specifications by using the different per capita and average use assumptions in table 1 and reported results for two alternatives: (1) per capita approach applied to all housing and transportation expenditures and (2) per capita approach applied to housing and variable transportation expenditures and the average use approach applied to fixed transportation expenditures.

Table 3. Coefficient estimates on the child-expenditure and household[1]-income relationship (standard errors in parentheses)

Panel A: Estimated elasticities derived from the 2000 Consumer Expenditure Survey

	Per capita approach		Average use approach	
	Constant	Log(Income)	Constant	Log(Income)
Number of children				
1	4.902	0.237	4.839	0.235
	(0.107)	(0.013)	(0.113)	(0.014)
2	5.786	0.179	5.679	0.180
	(0.080)	(0.010)	(0.085)	(0.010)
3	5.921	0.180	5.852	0.176
	(0.122)	(0.015)	(0.127)	(0.015)

Panel B: Estimated elasticities derived from the 1972-73 Consumer Expenditure Survey (in 2000 dollars)

	Per capita approach		Average use approach	
	Constant	Log(Income)	Constant	Log(Income)
Number of children				
1	2.624	0.492	2.475	0.498
	(0.104)	(0.012)	(0.113)	(0.013)
2	3.233	0.460	3.112	0.461
	(0.109)	(0.013)	(0.118)	(0.014)
3	3.789	0.419	3.626	0.425
	(0.135)	(0.016)	(0.145)	(0.017)

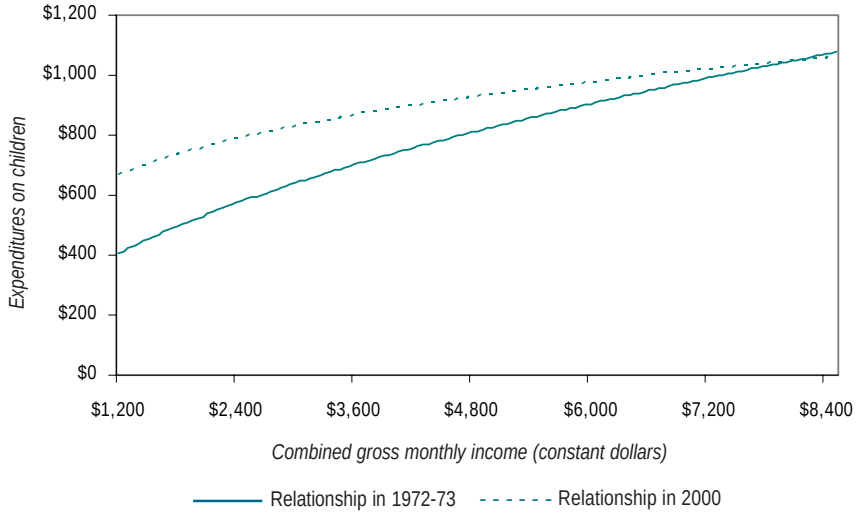
[1]Husband-wife households with children.
Note: The per capita approach and the average use approach are alternatively used to estimate vehicle costs attributable to children.

Panel A of table 3 presents the regression estimates, based on 2000 CES data, for husband-wife households with children (one to three). The coefficient estimates are interpreted as elasticities. For example, the estimated coefficient $\alpha_1 = 0.235$ (with the average use in vehicles approach) for a one-child household implies that a 10-percent increase in gross income is associated with an approximate 2.35-percent increase in expenditures on the child. Results were similar in magnitude and precision across the two approaches, with a higher expenditure-income elasticity for one-child households, compared with households consisting of more children. We found differences between the constants in the per capita and average use models, implying that the per capita expenditure-income profiles would be 6 to 10 percent higher at all income levels, compared with the average use relationships.

To test the hypothesis that the underlying relationship between child-related expenditures and household income has changed over time, we used the 1972-73 CES to re-estimate the

[4]Actual spending on away-from-home food has been included in the food estimates throughout the period.

Figure 2. Change over time in the child-expenditure and household-income relationship



Note: The relationship represents one-child households. Patterns for two-child and three-child households are similar.

expenditure-income regression for intact households of one, two, and three children. Results showed that over time, the regression line has changed considerably. The constant (intercept) has increased, indicating an upward shift in the child-expenditure and household-income relationship. In addition, the elasticities have fallen from a range of 0.42 to 0.49 to a range of 0.18 to 0.24.

To convert the statistical relationship between child-rearing expenditures and gross income into a schedule of total child support awards, one needs to predict expenditures on children at a succession of income levels. To do so, we evaluated the regression model for a large range of steadily increasing income levels and then took the exponential of each value. The average use in vehicles approach was used for one child and two children, and the per capita approach was used for three children. For example, for a one-child household (α_0 = 4.839 and α_1 = 0.235) with a monthly gross income of $5,000, the predicted monthly expenditure on that child would be $934. To predict child-rearing expenditures, we applied this data transformation to all monthly gross income levels ranging from $1,200 to $8,500 in increments of $50.

As predicted, for the 1972-73 and 2000 survey years, child expenditures rose with household income (constant dollars). As an indicator of plausibility, the relationship for 2000 fell within the range of the upper bound and lower bound relationships estimated in JLARC (2001) for Virginia when the 1997-98 expenditure data were used. The effect of the behavioral change in the child-expenditure and income relationship was striking (data not shown). The updated schedule showed a strong increase over time in estimated child-related expenditures at the lower and middle levels of the income scale. Hence, since the early 1970s, the largest increases in expenditures attributable to children have occurred for lower income and middle-income households. The main explanation for this result is that in the past three decades, real expenditures on children have risen at all levels of the income distribution because of changes in technology and preferences. Yet, during this period, real incomes have been falling at the lower and middle portions of the income scale. Together, these changes have produced a shift in the child-expenditure and income relationship as observed in figure 2.

How plausible is this finding? First, one could argue that our estimates of α_1 could be biased because of sample selection. In particular, since the 1970s, single-parent households have increased. Our use of data on intact lower and middle-income families may then have misrepresented expenditure patterns for all lower and middle-income families. Under this scenario, our method would effectively impose the expenditure patterns of more privileged families on less privileged families, causing an increasing upward bias in expenditure estimates over time as the number of single-parent households grew.

Evidence in JLARC (2001) did not support this argument for smaller households but did provide some support for larger households. The JLARC study found that, when income is controlled, dual-parent households actually spent less on children than did single-parent households if there were one or two children, while dual-parent households spent slightly more, on average, than did single-parent households if there were three children. These results helped to explain JLARC's recommendation that the methodological underpinnings of Virginia's guideline be based on the child-expenditure and income relationship for dual-parent households. Small CES sample sizes for single-parent households were another reason to focus on intact households when

estimating the expenditure and income relationship. Finally, there was little conclusive evidence to suggest that the dissolution of dual-parent households has been nonrandom across the income distribution (Bedard & Deschenes, 2003; Bramlett & Mosher, 2002).

We also conducted a number of robust tests to confirm that the child-expenditure and income relationship has changed over time because of behavioral changes rather than empirical irregularities. First, we re-estimated the child-expenditure and income equations for each major expenditure category and found that the main conclusion (rising intercepts and falling slope coefficients over time) held for each category of spending on children. Second, we addressed the argument that problems with missing income in the CES leads to differential sample selectivity across the 2 years in the analysis. In the 1972-73 CES, close to 6 percent of dual-parent households with one to three children reported zero income but had positive expenditures on children; this proportion rose to 21 percent in the 2000 CES. Although reported income was zero, the CES did report income brackets for these households. We compared total expenditures, child expenditures, and income brackets for households with positive and zero reported income and found similar distributions in each year, suggesting that selection was random.

Furthermore, we re-estimated the statistical relationship between child expenditures and income by using median regression analysis applied to the full sample, including observations with zero reported incomes. Means, and thus ordinary linear regressions, are sensitive to outliers such as zero and top-coded values, while median regressions yield estimates that are robust to the inclusion of outliers in the sample. The median regressions yielded results that were qualitatively similar: the intercepts rose and the elasticities fell over time. In particular, by using the per capita approach, we found that the child-expenditure elasticities for one-child, two-child, and three-child households were, respectively, 0.518, 0.473, and 0.437 in 1972-73 and 0.289, 0.290, and 0.226 in 2000. With the average use approach, the elasticities were, respectively, 0.518, 0.475, and 0.423 in 1972-73 and 0.276, 0.354, and 0.230 in 2000.[5] The similarity in median and mean regression results also helped to bolster the case that top-coding was not driving the results. For example, in the 2000 CES, about 3 percent of dual-parent households with one to three children were top-coded.

Comparing Child Support Schedules

To facilitate a more realistic comparison between the revised schedule and the existing legislated schedule for Virginia, we included in the revised schedule a self-support reserve that is also built into the existing legislated schedule. In Virginia's legislation, if the combined gross monthly income is less than $600 (the 1987 poverty line for a single individual), then the economic data are not used to compute the total child support order. Instead, a fixed minimum award of $65 is applied to the noncustodial parent. This $65 figure in Virginia's legislation is consistent with the range suggested in Williams's work (1987) for the obligor self-support reserve, allowing for cost-of-living increases. Williams's review of the economics literature supports the premise that low-income obligors be allowed a self-support reserve.

[5]All estimates were statistically significant at the 1-percent level. Complete estimation results and computations are available upon request.

Low-income obligors are more likely than are higher income obligors to have arrears, thus making it harder for them to have a stable record of support payments. The self-support threshold makes it easier for such low-income obligors to support their children financially without creating a disincentive to pay support. Hence, the guideline model and calculations will, in principle, not take the obligor below subsistence-level existence.

Virginia does not apply the self-support reserve to the custodial parent. The custodial parent, on the receiving end of the guideline calculations, cannot be taken to a below-subsistence level of existence simply because of the guideline model (even though she or he may already be at that level). To make the revised schedule politically more tractable, we increased the self-support reserve from $600 to $1,108 per month or $13,025 annually, which was equivalent to 150 percent of the February 2002 poverty level for one person. This increase in the self-support reserve ensured that while all parents contribute financially to their children, the order would not cause the obligor to fall below the poverty level.

To minimize work disincentives that might occur at the self-support reserve's threshold, we slowly phased in the level of total child support just above the cutoff. This process prevented a large discrete jump in the order from $65. (While the $65 minimum payment at the self-support threshold was applied only to the noncustodial parent, all subsequent levels of total child support were divided between the custodial and noncustodial parents according to their respective shares in total income.) At gross incomes just above the self-support reserve, the estimates from the economic data were compared with a series of phased-in costs. For low levels of gross income, we computed

the difference between gross income and the self-support reserve and then multiplied this difference by 0.90 for one-child households, 0.91 for two-child households, and 0.92 for three-child households. We compared this obligation with the obligation predicted by the estimated coefficients, and the smaller of the two was included in the updated income shares.

The adjustment affected one-child households with gross incomes below $1,450 per month, two-child households with gross incomes below $2,450 per month, and three-child households with gross incomes below $2,850 per month (data not shown). The 0.90, 0.91, and 0.92 adjustment factors have their origins in State-level child support panel discussions. By including a range in which the high shares are phased in, we included an adjustment that helped to address the problem of very high estimated income shares at the lowest tail of the income distribution.

The final step in developing an updated schedule for Virginia was to generate estimates of child-rearing expenditures for households with monthly incomes between $8,500 and $15,000, the latter point being the endpoint in Virginia's current schedule. Because the Bureau of Labor Statistics cautions CES users against making statistical inferences on expenditures for households with monthly gross incomes in excess of $8,500, we applied the income share at $8,500 per month to all higher income households.

Results, reported as child expenditure shares in combined gross monthly income, are illustrated in figure 3. The current income shares as specified in Virginia's child support guidelines are labeled "Legislated," and the new estimated shares based on the 2000 CES are labeled "Updated." The figure indicates that Virginia's legislated shares were well below the updated shares at all income levels except for very low income levels close to $1,200 per month. For example, for a two-child household earning $3,550 in gross income per month, the current schedule sets the order at 22 percent per month, compared with a CES estimate of 36 percent.

This difference between the legislated income shares and the CES-estimated income share devoted to children was greatest for low-income households and smallest for higher income households. The difference also rose as the number of children per household increased. For a household with three children and earning $3,550 per month, the order was set at 28 percent, compared with a CES estimate of 46 percent. These results point to a considerable gap between mandated support levels based on outdated CES data and updated support levels based on recent CES data. Therefore, the evidence suggests a need to increase total child support awards as a share of monthly income at all income levels except for the very lowest end of the income distribution.

These results help to explain why Virginia is one of numerous States that have child support orders that do not sufficiently reflect typical expenditures on children. According to calculations reported in Pirog, Klotz, and Byers (1998), Virginia's child support orders for most income levels ranked slightly above the mean and median child support orders for all 50 States during the 1988-97 period. However, at most income levels, Virginia joined the majority of States that failed to meet even the lower bound estimates of adequate child support orders that reflected the actual costs of raising children. For example, for a two-child divorced family scenario with a combined monthly income of $4,400, Pirog et al. reported that Virginia's

The figure indicates that Virginia's legislated shares were well below the updated shares at all income levels except for very low income levels close to $1,200 per month.

child support order in 1997 for the noncustodial parent would have been $641, slightly above the mean of $624 for all 50 States.[6] Yet, this order fell well below $827, Pirog et al.'s minimum estimate of what a noncustodial parent should have paid to meet the cost of raising children. The benchmarks used in Pirog, Klotz, and Byers also assumed that data in the CE from intact families should be used to generate the estimated costs of raising children.

Similar conclusions that child support awards across States fell short of the actual cost of raising children in earlier years were found by Lino (1998) and Beller and Graham (1993). The fact that Virginia's guidelines are based on data from the 1970s is an important source of this shortfall. Our own updated estimate for this particular level of household income in constant dollars would suggest that the noncustodial parent be awarded an obligation of $742, roughly halfway between the Pirog et al. minimum benchmark and the legislated child support order for Virginia.[7]

Thus far, the discussion has focused on revisions based on updates to the underlying economic relationship between income and child-rearing expenditures. However, policy discourse is also focusing on the need to revise schedules to adjust for expenses incurred during "shared parenting time." States are trying to develop means for compensating noncustodial parents for their direct expenditures on children during visitation hours and for the resources they need to operate and maintain a household. However, the method by which support schedules should be adjusted for parenting time is far from clear-cut for several reasons. First, child-related expenses by the noncustodial parent during visitation hours show considerable variance and unpredictability (Venohr & Williams 1999). Hence States that do have adjustments for parenting time mostly require a high share of legal custody, such as 30 percent, with the rationale that these parents are likely to incur higher direct expenditures on their children (Venohr & Williams 1999).

Second, some fixed costs incurred by the noncustodial parent are simply duplicated and do little, if anything, to reduce fixed child expenditures for the custodial parent. Because the custodial parent is also incurring expenses to maintain a separate household, some States have resisted pressures to reduce child support orders based on the noncustodial parent's direct expenses while other States have introduced adjustments based on whether the costs are "variable," "duplicated fixed," or "unduplicated fixed" (Venohr & Williams 1999). Finally, there is very little evidence on the effect of the obligor's child expenditures during visitation hours on the custodial parent's child expenditures. More scholarly research in this area is needed to inform States of the justification for whether and how much to adjust support awards for shared parenting time.

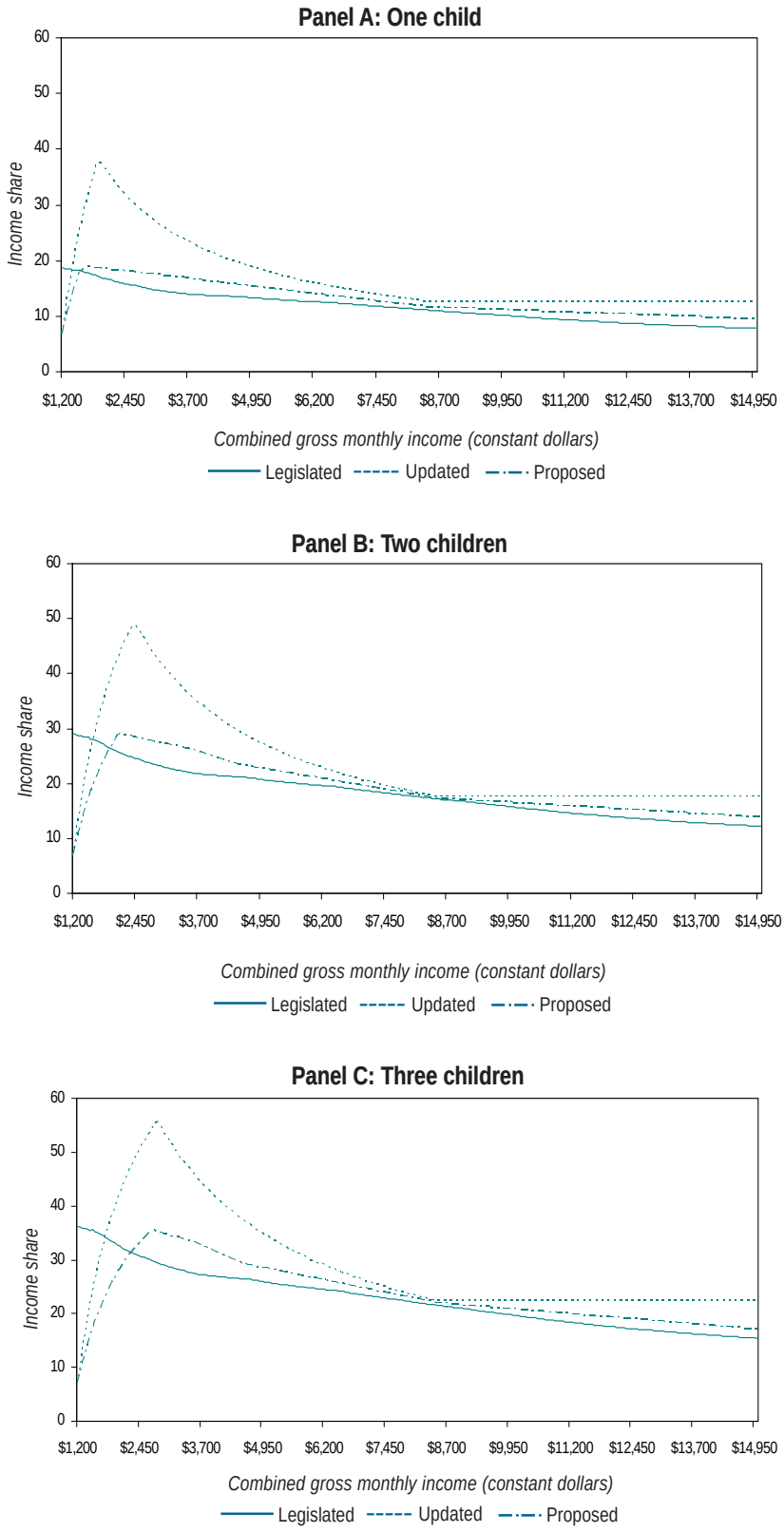
Virginia is among the States to have experienced considerable pressures to adjust the child support schedule for shared parenting time. To address this concern, we built an easily adjustable "separate household discount" into the revised schedule. Our precedent for this label came from a report developed for Minnesota's child support guidelines (Beld, 2001). The discount reserved income for expenditures that may have occurred during the noncustodial parent's visitation time and for the fixed costs of operating a second household. Adding the discount helped to smooth the updated income shares shown in figure 3 by lessening the size of jumps in support that could induce reductions in hours worked or the shielding of income. However, for the reasons just described, this discount presented some awkward problems. Because the discount was applied to the total child support order, it effectively compensated noncustodial parents for costs associated with shared parenting time while reducing the support amount received by the custodial parent. The final proposed schedule was developed by using the discount procedure described in the box (p. 36), with the strong caveat that the shared-parenting-time rationale remains a complex issue that requires more supporting evidence.

A major problem with the "phase-in" approach illustrated for the updated series in figure 3 was that large increases in the child support order occurred in the lower tail of the income range. To address the potential work disincentive that this guideline structure generated, we constructed a revised phase-in. Starting at the $1,200 income level, we moved up the schedule in $50 increments and increased the support levels by no more than $30 until they equaled the levels of support predicted by the regression model. More specifically, for one child, we began with a support level of $83 and increased support by $28 for the first 7 increments and $14 for the next 8 increments. For two children, we began with a support level of $84 and increased support by $29 for the first 19 increments and $14 for the next 7 increments. For three children, we began with a support level of $85 and increased support by $29

[6] The scenario assumed that the father contributed 60 percent of the income and the mother, 40 percent.

[7] This $742 figure was computed by taking our updated total child support estimate of $1,327 for the $4,400 income level and multiplying it by Pirog et al.'s assumed noncustodial contribution of 60 percent. The calculated amount, $796, was converted into 1997 dollars by using a discount factor of 1.073.

Figure 3. Comparison of child support guidelines, by number of children



for the first 30 increments and $20 for the next 5 increments.

The intuition behind this approach was to provide larger discounts for lower income obligors and for obligors with more children. However, the approach maintained the inverse relationship between the size of household income and the proportion of household income spent on children. It reflected the statistical reality that families with less money spend a larger percentage of their income on their children, but it acknowledged that separated families cannot afford to spend as much on their children as would be spent if they lived together.

Results from incorporating a separate household discount and revising the phase-in are reported in figure 3 as the series labeled "Proposed." Overall, the adjustments generated proposed income shares that generally fell between the lower bounds of the current Virginia guidelines and the upper bounds of the 2000 CES updated guidelines. For one child at incomes below $1,550, the support order in the proposed schedule was less than the order in the legislated schedule. From $1,550 to $3,600, the proposed schedule's order exceeded the actual order by up to 3 percentage points; thereafter, the difference fell to about 2 percentage points. The proposed and legislated schedules for two children exhibited a similar pattern. At combined gross income below $1,950, the legislated order exceeded the proposed order. From $1,950 to $3,450, the proposed schedule's order exceeded the legislated order by up to 4.5 percentage points, and at combined gross incomes in excess of $3,450, the proposed schedule's orders were higher than the legislated orders by about 2 percentage points. A similar conclusion could be made for households with three children.

Creating the Separate Household Discount

To include a separate household discount in the proposed guidelines, we took the legislated and updated income shares at the $3,550, $4,550, and $8,500 income levels; calculated proposed shares that were seven-tenths of the distance between the legislated and the updated shares; and then connected these proportions across the entire income scale to create a final proposed schedule. (To derive the seven-tenths figure as a proxy for expenditures during shared parenting time, we started with three-tenths base points for visitation days and added the child expenditure shares for shelter, household equipment, and fixed transportation. This discount was applied uniformly across the income distribution.) Starting at $3,550 and moving down to $1,200 in $50 increments, we adjusted the proportions upward for each income level and additional child by small increments. The discounted percentage for a one-child family was increased by .05 percentage points for each $50 decrease in income, the discounted percentage for a two-child family was increased by .10 percentage points for each $50 decrease in income, and the discounted percentage for a three-child family was increased by .12 percentage points for each $50 decrease in income.

The proportions from the median household income (approximately $4,550 to $8,500) were reduced as follows. For one child, the proposed proportion fell by 4.2 percentage points, from 15.8 percent at $4,550 to 11.6 percent at $8,500. For two children, the proposed proportion fell by 6.1 percentage points, from 23.4 percent at $4,550 to 17.3 percent at $8,500. For three children, the proposed proportion fell by 7.3 percentage points, from 29.3 percent at $4,550 to 22.0 percent at $8,500. Over this income range, there were 79 increments of $50. To generate a smooth transition across this range, we divided the specified percentage points for each household size equally across these 79 increments.

The discount proportions at $8,500 to $15,000 were reduced as follows. For one child, the proposed proportion fell by 2.1 percentage points, from 11.6 percent to 9.5 percent. For two children, the proposed proportion fell by 3.5 percentage points, from 17.3 percent to 13.8 percent. For three children, the proposed proportion fell by 4.9 percentage points, from 22.0 percent to 17.1 percent. Over this income range, there were 130 increments of $50. To generate a smooth transition across this range, we divided the specified percentage points for each household size equally across these 130 increments. Finally, the discount proportions for different-sized families with gross monthly incomes of $4,050 (the mid-point between $3,550 and $4,550) were calculated by averaging the discounted percentages for similar-sized families. Following this procedure provided a smooth transition for incomes between the two endpoints.

These changes may appear minor, but in absolute terms, the proposed increases were substantial. For example, at the $3,600 monthly income level, the legislated child support award for a one-child household was $507 per month. Our proposed monthly award was $610, a 20-percent increase. And without the separate household discount and revised phase-in, the updated monthly award would have been $860, a 70-percent increase. This calculation and the alternative guidelines depicted in figure 3 help to illustrate the tradeoffs involved when revisions to guidelines are based on economic criteria alone—as represented by the "Updated" series—versus revisions based on economic and political criteria—as represented by the "Proposed" series. The legislated schedules for Virginia and the 10 other States with similar guideline structures are clearly out of line with the economic reality of how much parents are spending on children.

Conclusion

About one-fifth of the Nation's State governments still use child support guidelines that are based on estimates of child-rearing expenditures that were derived from data that are three decades old. Yet during this period, the number of households covered by the CES and the level of detail have grown, providing better expenditure and income data. In addition, the fundamental relationship between child-related expenditures and parental income has changed, a result that our article has demonstrated with regression analysis. This finding expands upon Lino's (2001) earlier work showing the increase over time in average total expenditures on children.

Our article has also described a new schedule for child support payments that was proposed for Virginia, 1 of 11 States still using the 1970s data. The schedule, which was based on CES data for the year 2000, was compared with the actual schedule in place. Results showed a large gap in Virginia's legislated income shares and the revised income shares based on the 2000 CES. This gap grew as household income fell and the number of children rose. These findings provide economic and statistical rationales for updating child support schedules that have weaker relationships to statistical estimates of what families actually spend on their children today. The alternative schedule proposed in this study for Virginia raised child support awards as a share of monthly income for parents at all income levels except for those at the lowest end of the income distribution.

Any schedule created in the future must be embraced by all child support constituencies, including noncustodial and custodial parents (particularly those in the lower and middle-income brackets), social workers, attorneys, and judges. Gaining this support is quite a challenge given the wide variety of preferences among stakeholders. During the Virginia legislature's consideration of the proposed schedule, the politics of child support trumped the economics. Virginia's lack of progress in making substantial revisions to the guideline structure is consistent with a finding by Venohr and Williams (1999): since the mid-1990s, there has been a marked decline across States in major guideline updates and revisions. More common across States in recent years, and considerably less controversial and politically charged, has been the tendency for States to refine definitions and calculations related to special factors such as shared parenting time, child care services, and low-income obligors.

The experiences of other States over time show that changes in child support policy have happened, particularly with the emergence of new policy ideas and entrepreneurial individuals and groups (Crowley, 2003). Further research in this area, particularly on the political dynamics of the reform process across States, will yield valuable ideas for overcoming political factors in the determination of realistic and appropriate child support guidelines.

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The Food Environment and Food Insecurity: Perceptions of Rural, Suburban, and Urban Food Pantry Clients in Iowa

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Poverty, food insecurity, and hunger are increasing across the Nation as Federal, State, and local economies continue to struggle. In 2003, the official U.S. poverty rate was 12.5 percent (35.9 million people), up from 12.1 percent (34.6 million people) in 2002 (DeNavas-Walt, Proctor, & Mills, 2004). Meeting nutritional needs is particularly troublesome for poor families: More than 12 million households (11.1 percent) have reported food-related hardships due to insufficient resources; 3.8 million (3.5 percent) households have reported experiencing hunger (Nord, Andrews, & Carlson, 2003). Further, households with children have been reported as being twice as likely to be food insecure, compared with households without children (Nord et al., 2003).

Background

Food access is an important public policy issue across America, especially so in urban areas. The U.S. House Select Committee on Hunger studied shopping patterns of the poor and found that urban dwellers pay more for groceries in their local neighborhoods than do suburban residents (Morland, Wing, Rouz, & Poole, 2002). Others found that income affected access to rural and urban grocery stores and food varieties available for purchase (Perry, 2002; Morland et al., 2002). Moreland et al. (2002) found that residential areas where low-income households are located had fewer supermarkets and a smaller variety of foods, compared with what was available in wealthy areas. Low-income households that are unable to access the normal food system,[1] because of store locations and income constraints, are at risk of hunger and poor nutritional outcomes.

Local food safety-net providers are experiencing the strain of trying to provide food for an increasing number of struggling families. For instance, America's Second Harvest—the Nation's largest organization of emergency food providers—served 23.3 million people in 2001. Further, a survey in late 2001 and early 2002 found that 86 percent of Second Harvest's affiliates had seen an increase in requests for food assistance during the past year (America's Second Harvest, 2004). In addition, most families that turned to food pantries were working or had children (Zedlewski & Nelson, 2003). The Iowa Department of Human Services reported receiving 1.4 million requests for emergency food services in 2003, almost twice the number of requests received in 2000 (Iowa Department of Human Services, 2004). This increase in emergency food requests coincided with an increasing rate of food

[1]The normal food system consists of food from grocery stores, supermarkets, food service operations, and other retail establishments that make food available for consumer purchase in the market system (Campbell, 1991).

insecurity in Iowa: 9.1 percent in 2000-2002, up from 8.0 percent in 1996-98 (Nord et al., 2003). Thus, families throughout the United States, but especially those in the Midwest, are experiencing difficulties meeting their basic food needs.

We examined data from a purposeful study of Iowa food pantry clients living in urban, rural, and suburban settings. We focused attention on their perceptions of the environment in which they access food and their levels of food insecurity. Food pantry clients are often the most vulnerable households in a community; they lack financial and social resources that can help them solve problems related to food acquisition. In fact, community, social, economic, and institutional characteristics can influence food insecurity (Cohen, 2004). Understanding the circumstances under which these families attempt to meet their nutritional needs is vital to addressing the problems of food insecurity that permeate many U.S. communities. Of particular interest to this study are factors related to the household's participation in the normal food system, which provides a household with an initial capacity to meet its food and nutrition needs (Bitto, Morton, Oakland, & Sand, 2003; Cohen, 2004; Morton, Bitto, Oakland, & Sand, in press). Specifically, we concentrated on availability, access to and affordability of food from grocery stores, proximity to retail food stores, and transportation systems.

Methods

We developed a questionnaire to distribute to local food pantry clients to obtain information that would reflect changes over time in the food security status of low-income residents in a community (Greder, Garasky, Jensen, & Morton, 2002). The survey instrument captured broadly the conditions under which these households attempted to meet their nutritional needs. Respondents were queried about their (1) food security, (2) access to the normal food system and community food resources, (3) participation in assistance programs, (4) amounts and sources of income, (5) employment, and (6) personal characteristics. Questions about the local food environment dealt with perceptions of the adequacy of the number of grocery stores in the community, prices, store locations, transportation, and travel time to grocery stores.

The survey instrument also included six questions about behaviors and experiences known to typify households under pressure to meet their food needs (Bickel, Nord, Price, Hamilton, & Cook, 2000; Nord, 2003; Nord & Andrews, 1999). This series of questions was developed by the USDA to assess household food security along a continuum that can be divided into three ranges: food secure, food insecure without hunger, and food insecure with hunger. The first response category for each question was considered an affirmative ("yes") for computing the respondents' food security scale value. If a respondent answered "no" to the stem question (Q3), a "no" response was inferred for the follow-up questions (Q4 to Q6). The resulting scale values were as follows:

- Food secure—yes to 0 to 1 question;
- Food insecure without hunger—yes to 2 to 4 questions; and
- Food insecure with hunger—yes to 5 to 6 questions.

Questionnaires were completed by food pantry clients during the summer of 2002. Potential respondents were identified in two ways. First, completed surveys were obtained directly from food pantries in four Iowa counties. These pantries served approximately 2,400 families each month during the study period. Extension staff of Iowa State University assisted in identifying local pantries willing to participate in the study. The staff at each pantry was asked to distribute surveys to all adults who came to the pantry to obtain food. Second, five focus group interviews were conducted. Each focus group, identified with the help of the Extension staff of Iowa State University, consisted of 3 to 12 individuals who possessed key characteristics most relevant to the research problem. Specifically, we were interested in the use of community food resources by low-income (185 percent of poverty or below) individuals who either were at least 60 years old or were parents with children under 10 years old.

Completed surveys were received from 629 individuals, all of whom acquired food from food pantries. Of this total, 589 respondents were asked to complete surveys at the food pantries. Forty of the 47 (33 elderly and 14 parents with young children) focus group participants reported acquiring food from a pantry. Four hundred seventy-seven respondents used an urban pantry; 60, a suburban pantry; and 60, a rural pantry. The pantry location was not discernable for 32 individuals. The results discussed in this study are from the 597 individuals for which a pantry location could be determined.

Results

Clients of rural food pantries, compared with those of suburban and urban food pantries, were more likely to be older and likely to have fewer people in the household. Rural clients of food pantries were, on average, 49 years old; suburban clients, 40 years old; and urban clients, 39 years old (table 1). This age difference, although not

Table 1. Urban, rural, and suburban food pantry users' demographic characteristics and perceptions of their food environment

Variable	Urban	Rural	Suburban
Demographic characteristics			
Age (years)	38.9	49.0	40.4
Household size (persons)	2.9	2.5	3.3
Monthly income ($)	739.40	905.17	781.25
Less than high school education (%)	35.6[b]	23.4	13.3[b]
Work at a paid job (%)	35.8	27.1	34.5
		Percent[1]	
Perceptions			
There are enough supermarkets/grocery stores in my community.			
Not enough	21.6[a]	50.0[a,c]	12.7[c]
Enough	55.6	44.8	56.4
More than enough	22.8	5.2	30.9
Supermarkets/grocery stores in my community offer an affordable variety of healthy food choices.			
Not affordable	10.7[b]	14.3	3.8[b]
Seldom affordable	21.1	10.7	5.8
Sometimes affordable	53.8	60.7	57.7
Always affordable	14.4	14.3	32.7
Supermarkets/grocery stores in my community are located where people feel safe.			
Not safe	3.6[a,b]	0.0[a]	0.0[b]
Usually safe	58.9	46.4	25.5
Always safe	37.6	53.6	74.5
There is affordable transportation to get to supermarkets/grocery stores in my community.			
Yes	76.1[a,b]	62.2[a]	61.2[b]
No	23.9	37.8	38.8
Currently receiving food stamps	34.6	27.1	22.0
Currently receiving WIC (Women, Infants, & Children) program benefits	12.9	13.6	3.3
Community/school gardens are available for people to get food in my community.			
No gardens	34.6[a,b]	68.0[a]	75.0[b]
Few gardens	53.5	24.0	18.8
Many gardens	11.8	8.0	6.3
There are group meal sites and home-delivered meals available for elderly persons where I live.			
Not available	15.9[b]	15.4	37.5[b]
Available 1-4 days per week	18.1	20.5	4.2
Available Monday through Friday only	42.2	51.3	50.0
Available 6-7 days per week	23.7	12.8	8.3
		Mean	
Minutes to the nearest grocery store	12.88	9.26	10.16
(standard deviation)	(12.27)	(6.82)	(5.74)
Number of times respondent used food pantries in the past 12 months	4.59	1.36	4.03
(standard deviation)	(3.35)	(1.33)	(2.95)

[1]Percent of pantry clients providing each particular response.Categorical responses may not sum to 100 percent because of rounding.
[a]Difference between the distribution of responses for the urban and rural samples is statistically significant at the $p < .05$ level.
[b]Difference beween the distribution of responses for the urban and suburban samples is statistically significant at the $p < .05$ level.
[c]Difference between the distribution of responses for the rural and suburban samples is statistically significant at the $p < .05$ level.
N = 477 (urban), 60 (rural), and 60 (suburban).

Overall, among all pantry clients, suburban pantry clients were the least food secure. . . . Rural respondent households were the most food secure.

statistically different among food pantry users, reflects a general pattern of the age distribution in Iowa: rural places have an older population than do urban areas. The households of rural pantry users consisted of 2.5 people, compared with 2.9 for the urban group and 3.3 for the suburban group.

Compared with other food pantry clients, those of urban food pantries had the lowest income and educational level. The relatively younger users of urban food pantries reported the lowest average monthly income ($739) of the three groups, followed closely by the suburban sample ($781). Users of rural food pantries reported an average monthly income of $905. Thirty-six percent of the urban sample had less than a high school education, compared with 23 percent of the rural group and 13 percent of the suburban population. The difference in educational attainment between the urban and suburban clients was statistically significant. About one-third of the survey respondents in each group worked at a paid job.

Perceptions of the Food Environment

Rural food pantry clients (50 percent) were significantly more likely than were urban (22 percent) or suburban clients (13 percent) to perceive their community as having an inadequate number of grocery stores or supermarkets (table 1). Although the suburban sample did not always find affordable varieties of foods, they reported significantly greater affordability than did their urban counterparts (90 vs. 68 percent reported that community supermarkets or grocery stores sometimes or always offered affordable varieties of healthful foods). Rural perceptions of affordability were similar to those of the urban sample. All three groups reported that the places where their grocery stores were located were usually safe or always safe (urban, 96 percent; rural and suburban, 100 percent each). However, compared with rural and suburban clients, urban pantry clients believed they were least safe, a difference that was statistically significant.

Transportation concerns were greatest in suburban and rural places, with 39 and 38 percent, respectively, of the respondents reporting no affordable transportation in their community. About one-quarter of the urban food pantry clients said there was no affordable transportation to the grocery store in their community. All three samples reported similar average traveling times to the nearest grocery store, ranging from 9 to 13 minutes. Although one might expect that rural respondents would travel further to the grocery store, it is possible that all groups experienced similar traveling times because the rural pantry clients lived closer to a town where the food pantry and grocery stores were located.

Use of the normal food system is dependent upon financial resources to purchase foods. Lacking these resources, many food-insecure households must turn to secondary food sources. These secondary sources range from government programs such as the Food Stamp Program and the Special Supplemental Nutrition Program for Women, Infants, and Children (popularly known as WIC) to community programs that include school gardens, group meal sites, and food pantries. More than one-third (35 percent) of the urban sample received food stamps, compared with about one-fourth (27 percent) of the rural and about one-fifth (22 percent) of the suburban respondents. These differences, however, were not statistically different. Compared with the other food pantry users, suburban food pantry users (3 percent) were significantly less likely to be enrolled in WIC, despite having the largest

Table 2. Urban, rural, and suburban food pantry users' perceptions of food insecurity

Variable	Urban	Rural	Suburban
		Percent[1]	
Q1. The food that I/we bought just didn't last, and I/we didn't have money to get more.			
Often or sometimes true	84.1[a]	61.7[a,c]	91.7[c]
Never true	15.9	38.3	8.3
Q2. I/we couldn't afford to eat balanced meals.			
Often or sometimes true	75.5[a]	61.7[a,c]	85.0[c]
Never true	24.5	38.3	15.0
Q3. In the last 12 months did you and/or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?			
Yes	59.1[a]	41.7[a,c]	61.7[c]
No	40.9	58.3	38.3
Q4. **If yes to Q3,** how often did this happen?			
Almost every month, some months but not every month	88.2	84.0	91.4
For only 1 or 2 months	11.8	16.0	8.6
Q5. **If yes to Q3,** in the last 12 months, did you ever eat less than you felt you should have because there wasn't enough money to buy food?			
Yes	92.8	92.0	91.7
No	7.2	8.0	8.3
Q6. **If yes to Q3,** in the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?			
Yes	76.4	68.0	72.2
No	23.6	32.0	27.8

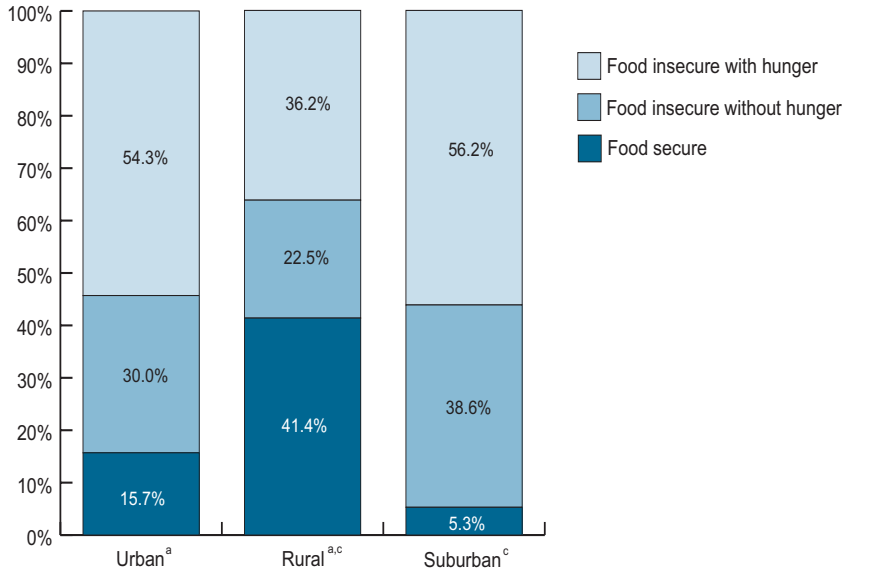
[1]Percentage of pantry clients providing each particular response. Categorical responses may not sum to 100 percent because of rounding.
[2]The first response category for each question (Q1 - Q6) is considered an affirmative response ("yes") for computing the respondent's food security scale value. If the respondent answered "no" to Q3, a "no" response was inferred for Q4 - Q6. Cell values are the percentage of pantry clients in each food security category. Categorical percentages may not sum to 100 percent because of rounding.
[a]Difference between the distribution of responses for the urban and rural samples is statistically significant at the $p < .05$ level.
[b]Difference beween the distribution of responses for the urban and suburban samples is statistically significant at the $p < .05$ level.
[c]Difference between the distribution of responses for the rural and suburban samples is statistically significant at the $p < .05$ level.

households. The urban and rural samples were more similar; 13 and 14 percent, respectively, were enrolled in WIC. Urban food pantry clients, compared with the others, were significantly more likely to say that community gardens and school gardens were available as food sources in their community. Group meal sites and home-delivered meals for the elderly were reported to be available more days of the week in urban and rural settings than in suburban ones, although only the difference between urban and suburban settings was statistically significant. Lastly, urban clients reported using a food pantry more often (4.6 times, on average) in the last year than did suburban (4.0 times) and rural (1.4 times) clients, although these differences were not statistically significant.

Food Insecurity

Although food security was not the norm among the food pantry clients, differences in rates of food security clearly existed among the three groups (table 2). The rural pantry users consistently reported having significantly lower proportions of individuals experiencing problems related to food acquisition. For example, compared with the other pantry clients, the rural clients were least likely to report that it was often or sometimes true that the food they bought did not last and that they did not have money to obtain more food. Similarly, they were least

Figure 1. Household food security among urban, rural, and suburban food pantry clients



[a]Difference between the distribution of responses for the urban and rural samples is statistically significant at the p < .05 level.
[b]Difference beween the distribution of responses for the urban and suburban samples is statistically significant at the p < .05 level.
[c]Difference between the distribution of responses for the rural and suburban samples is statistically significant at the p < .05 level.

likely to say that it was often or sometimes true that they could not afford to eat balanced meals. In the last 12 months, the rural clients, compared with the suburban and urban clients, also were least likely to report that adults in their household cut the size of their meals, or skipped meals, because there was not enough money for food.

Overall, among all pantry clients, suburban pantry clients were the least food secure (5 percent) (fig. 1). A slightly higher percentage of the urban households (16 percent) were food secure. Rural respondent households were the most food secure (41 percent). These differences were statistically significant. At the other end of the continuum, food insecurity with hunger among the three groups closely paralleled overall food security: The rural group had the smallest proportion reporting hunger (36 percent), and over half of the urban (54 percent) and suburban (56 percent) households reported being food insecure with hunger.

Conclusions

This purposeful study of Iowa food pantry clients offers a snapshot of some of the most resource-stressed and vulnerable households in a community. These families face many common challenges to accessing food, such as having reliable and affordable transportation. Although almost all (94 percent) Iowa households have a vehicle (U.S. Census Bureau, 2002), study participants, especially those in rural and suburban areas, report that access to affordable transportation to grocery stores is problematic. This result is consistent with other research that has found that both the inner city and the rural poor often face transportation issues related to meeting their nutritional needs (Bitto et al., 2003; Moreland et al., 2002).

Households lacking transportation will have problems that go beyond accessing the normal food system. Troubling among the participants of this study are the low rates of participation in government food assistance programs. Only one-in-three of our urban food pantry users currently receive food stamps; the rate is about one-in-four for rural and suburban pantry clients. While WIC benefits are more targeted (eligibility criteria are more restrictive), WIC participation rates range from 14 percent among the rural group to 3 percent among suburban respondents (table 1).

Other evidence suggests that non-participation among families eligible for food assistance program benefits is a problem that goes beyond Iowa and food pantry users (Bartlett & Burstein, 2004; USDA, 2003b). Recent Food Stamp Program policy focusing on increasing participation (USDA, 2003a) must continue and be expanded to address the transportation-related program access problems of eligible families. Further, this policy objective of increasing participation among eligible families must be expanded to all USDA food assistance programs. Low-income parents access a range of other community resources to meet the food needs of their families. The volunteer sector of the community is especially important. Our research suggests that all communities, regardless of rural-urban orientation, need to find formal and informal ways to ensure access to food.

Despite the common label "food pantry client," rural, urban, and suburban pantry users are not a homogenous group: They do not have the same personal characteristics; they do not access their food environments in the same way. If effective policy is to be developed, additional research is needed regarding the circumstances under which urban, rural, and suburban low-income families access their food environment and meet their nutritional needs. Our findings are consistent with other studies of food access by low-income households. Nevertheless, families who participated in this study lived in selected rural and urban communities in Iowa and received food from food pantries. Our respondents are representative of families in similar contexts. However, given our purposeful sampling approach, the findings are not generalizable to broader limited-income populations. Clearly, more research is needed.

Acknowledgments

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Developing a Measure for the Dietary Guidelines Recommendation to Eat a Variety of Foods

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Eating a variety of foods—especially whole grains, fruits, and vegetables—ensures the intake of many of the nutrients and other substances essential for good health. Measuring variety is complex, and many different definitions have been proposed. Eating a variety of foods is one of the Dietary Guidelines for Americans—though written in slightly different terms in some of the 5-year updates since the Guidelines were first introduced by the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (DHHS) in 1980. An application of the variety guideline is a component of the USDA's Healthy Eating Index (HEI), a summary measure of overall diet quality that measures compliance with the Guidelines. This report explains the methodology of the HEI's variety measure, as calculated by the USDA Center for Nutrition Policy and Promotion (CNPP). CNPP uses four main databases to construct the variety measurement: the Food Guide Pyramid Servings Database, the Recipe Database, a list of distinct foods, and a dietary intake database. An HEI variety score is assigned between 0 and 10 points, with eight or more different or "unique" foods consumed during 24 hours earning 10 points; three or fewer unique foods, 0 points. To demonstrate this methodology, we applied the HEI variety measured to the U.S. population by using dietary intake data from the National Health and Nutrition Examination Survey 1999-2000 to estimate 1-day dietary variety in the United States.

Since the first edition of the *Dietary Guidelines for Americans* in 1980, the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (DHHS) have recommended eating a variety of foods to ensure individuals consume all essential nutrients for both general health and chronic disease prevention (USDA & DHHS, 1980; USDA & DHHS, 1985; USDA & DHHS, 1990; USDA & DHHS, 1995; USDA & DHHS, 2000). Over the course of the five editions, guidance has evolved: "eat a variety of foods" (1980, 1985, 1990, 1995), "choose a variety of grains daily, especially whole grains" (2000), and "choose a variety of fruits and vegetables daily" (2000). The five food groups consist of grains, vegetables, fruits, milk and milk products, and meat and beans. No single food or food group supplies adults and children 2 years and older with all the essential nutrients and other important food substances in the amounts needed for good health. Analysis of data from the first National Health and Nutrition Examination Survey (NHANES I) Epidemiologic Follow-up Study demonstrated that those who consume foods from only one or two food groups had a significantly higher risk of all-cause mortality. This was the case even after other major risk factors such as race, education, smoking, and dietary fiber consumption were controlled (Kant, Schatzkin, Harris, Ziegler, & Block, 1993).

Whole grains, fruits, and vegetables contain concentrated amounts of vitamins, minerals, antioxidants, dietary fiber, phytochemicals, and

other substances that may protect against several chronic diseases. For example, increased consumption of good sources of dietary fibers—such as grains, fruits, vegetables, and beans—can lower blood cholesterol levels; help to regulate blood sugar; and lower the risks of cardiovascular disease, diabetes, and colon cancer (Marlett, McBurney, & Slavin, 2002). Similarly, regular consumption of whole grains has been associated with a reduction in cardiovascular disease, diabetes, cancer mortality, and premature death (Lang & Jebb, 2003).

A recent research review illustrated that while there are thousands of beneficial plant substances, no *single* plant substance alone provides the protective effects from chronic diseases. Also, when these plant substances are taken as supplements rather than consumed as they naturally occur in plant products, their protective effects are minimal (Buttriss, 2004). Therefore, the basis for recommending a variety of whole grains, fruits, and vegetables is well founded.

Within the nutrition field, the definition of variety is inconsistent; and misinterpretation of the term can potentially lead to confusion or unintended consequences. Focus group research on the 2000 Dietary Guidelines found that consumers interpreted eating a "variety" to mean that one should eat foods from all food groups, which may lead to eating a variety of foods high in fat and added sugars (Prospect Associates, 1998).

Methods used to measure variety also matter in examining the link between food consumption and health outcomes. Researchers have used at least three different methodologies to measure variety: (1) count the number of unique foods[1] (used in our methodology) (Bernstein et al., 2002; Krebs-Smith, Smiciklas-Wright, Guthrie, & Krebs-Smith, 1987); (2) count the number of foods from each Pyramid food group (Kant et al., 1993; Kim, Haines, Siega-Riz, & Popkin, 2003); and (3) divide foods as consumed into groups (Drewnowski, Henderson, Driscoll, & Rolls, 1997; Haines, Siega-Riz, & Popkin, 1999; McCrory et al., 1999; Wirfalt & Jeffery, 1997). For example, the first two methods would classify a vegetable stir-fry by the unique foods it contains (e.g., onions, carrots, and string beans); the third method would classify this mixed dish as a "vegetable stir-fry."

In 1995, the USDA Center for Nutrition Policy and Promotion (CNPP) constructed the Healthy Eating Index (HEI) to measure individuals' overall diet quality based on current dietary guidance, including the Dietary Guidelines for Americans as well as the Food Guide Pyramid—a teaching tool developed by the USDA in 1992 that includes the messages of the Guidelines. The HEI measure consists of 10 components worth 10 points each, for a perfect score of 100. For each component, scores are assigned proportionately from no compliance with the recommendation (0 points) to full compliance (10 points). Five components measure whether the individual consumes the recommended number of servings from each of the five Pyramid food groups for his or her age and gender group. The next four components measure the compliance with dietary recommendations of total fat, saturated fat, cholesterol, and sodium. The detailed methodology for these nine components is described elsewhere (Basiotis, Carlson, Gerrior, Juan, & Lino, 2002).

The measurement of the HEI's variety component is complex. There is a lack of scientific evidence on the exact number of different foods that should be consumed per day to achieve the benefits of meeting nutrient recommendations and protection from disease outcomes. Additionally, the benefits of consuming a variety of foods seem to stem from eating a variety of unique agricultural commodities (Buttriss, 2004; Kim et al., 2003), not from consuming a variety of food mixtures made up of the same commodities. For example, a vegetable stir-fry might contain the same ingredients as a vegetable soup; these would be considered different food mixtures but are made up of the same commodities. Thus, we base our measure on eating a variety of commodities. In the best professional judgment of USDA nutrition staff, eight different unique foods is considered a sufficient number; whereas, three unique foods is considered insufficient.

It is important to understand the differences between the variety measures, because the effect of the recommendation to eat a variety of foods changes with respect to overall diet quality, nutrient adequacy, and obesity. Bernstein and colleagues (2002) defined variety as the number of different foods consumed. Using this definition, they found that elderly nursing home residents who ate a wider variety of foods had better nutritional status.

On the other hand, Drewnowski's team (1997) grouped foods (including mixed dishes) into 147 groups and counted the number of different groups consumed by 24 younger and 24 older respondents. The results demonstrated that the older adults consumed a more varied diet; and higher dietary variety was associated with higher intakes of vitamin C and lower intakes of salt,

[1]"Unique foods," "distinct foods," and "commodities," as used in this report, refer to a basic non-mixed food. These foods may be from mixed dishes that have been aggregated into agricultural commodities. For example, pizza is considered wheat-based bread dough, cheese, tomato sauce, mushrooms, and so forth.

sugar, and saturated fat. This team defined diet quality on a 5-point scale with 1 point each for limiting consumption to the recommended amounts of total fat, saturated fat, sodium, and cholesterol, and a fifth point for eating at least half of calories as carbohydrates. These definitions of variety and diet quality led the team to conclude that dietary variety was not related to overall diet quality.

Stallings, Wolman, and Goodner (2001) used the HEI score to measure variety based on the previous CNPP Variety Database and diet quality among 208 low-income women in South Carolina. They found no statistical difference in the variety score between the normal weight group and the overweight, obese, and extremely obese groups based on BMI. Thus, based on this measure, we can conclude that individuals who are normal weight do not consume a less varied diet than those who are overweight or obese. Using data from NHANES 1999-2000 and the previous CNPP Variety Group List containing nearly 350 distinct foods,[2] Basiotis, Carlson, and Murphy (2003) found that compared with their normal-weight counterparts, obese men have less variety in their grain and fruit consumption, while obese women have less variety in their fruit consumption.

Hann, Rock, and Drewnowski (2001) also used the HEI to measure both overall diet quality and variety of the diet among 340 women participating in a case-controlled study of breast cancer. To conduct this study, they used 3-day food records. And like Basiotis and colleagues (2002), Hann and colleagues also used the previous CNPP Variety Group List. The results showed that dietary variety and fruit intake were the strongest predictors of the variation in overall diet quality. The group with the best diets (total HEI score greater than 80 points of a possible 100) consumed nearly twice as many foods as did the group with poor diets (less than 65 points). The results also showed that the HEI score correlates positively with biomarkers such as circulating plasma carotenoid and plasma vitamin C.

Using the updated Variety Group List and data from adults participating in the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, Foote, Murphy, Wilkens, Basiotis, and Carlson (2004) found that increased dietary variety, especially in the grain and milk and milk products groups, increased the mean nutrient adequacy of 15 nutrients. Furthermore, the team found that variety counts had a greater effect on the individual's mean adequacy ratio than did the number of Pyramid servings.

In this report, we outline the method used to calculate the HEI variety score. We also present summary results of the variety score for the U.S. population by using 1-day dietary intake data from NHANES 1999-2000.

Data

The HEI variety score calculation uses four main data sets: the Food Guide Pyramid Servings Database, the Recipe Database, a list of distinct foods, and a dietary intake database. The Food Guide Pyramid Servings Database was developed by the USDA Agricultural Research Service and contains the number of Pyramid servings in 100-gram weights of more than 7,000 USDA survey food codes. The Recipe Database contains a list of ingredients and quantities of each food with an 8-digit USDA survey food code. Both of these databases were developed by using data from the Continuing Survey of Food Intake by Individuals (CSFII) 1994-96.

The third database is a list of 289 distinct foods or commodities developed by CNPP and the Cancer Research Center at the University of Hawaii. Examples of distinct food items from the grain group include whole-grain rice, pasta and macaroni, and refined wheat products. Pasta and macaroni are separated from other wheat products because pasta and other wheat products are made from different wheat grains. Each distinct food is assigned to one of the Pyramid subgroups (table 1).

The fourth database is any database containing 24-hour dietary data, coded with USDA 8-digit food codes. For example, when the initial HEI methodology was developed in 1995, we used data from CSFII 1994 to measure the quality of Americans' diets. For the illustration of the methodology in this report, we used data from NHANES 1999-2000 to estimate the average variety score and the average unique food consumption for individuals in the United States.

Methodology

The HEI variety calculation consists of two main steps: (1) creating the CNPP Food Variety Database and (2) calculating the variety score for an individual's food intake for 1 day.

Step One: Creating the CNPP Variety Database

The CNPP Variety Group List consists of the 289 distinct foods matched with the USDA 8-digit survey food codes, as well as the number of Pyramid subgroup servings in 100-gram weights of each food. The current list represents an improvement from the original 1994 Variety Group List that contained

[2]Our methodology uses an updated Variety Group List that is detailed later in this report.

Table 1. Number of variety foods, by Food Guide Pyramid group

Pyramid food groups/ subgroups	Number
Milk	7
Milk	4
Cheese	2
Yogurt	1
Meat and meat substitutes	104
Meat	8
Poultry	6
Fish	40
Organ	9
Franks	3
Nuts and seeds	18
Legumes	13
Eggs	2
Soy	5
Grains	20
Whole grain	14
Non-whole grain	6
Fruits	69
Citrus, melon, berries	27
Other fruits	42
Vegetables	89
Deep yellow	4
Dark green	17
Starchy vegetables	15
Potato	1
Other vegetables	50
Tomato	2
Total	289

349 distinct foods but did not proportionately distribute fractional quantities of individual foods that were part of mixed dishes. In 2002, the Variety Groups were broken into Pyramid subgroups and the number of Pyramid servings became the basis to determine how much of each food was consumed. The Variety Group List was further refined in 2004 to reflect individual commodities, such as refined or whole-wheat products as opposed to the former, more generic "bread group." For this report, we used the current version of the Variety Group List, which was recently revised based on food commodities.

To create the CNPP Variety Database,[3] we combined the USDA Pyramid Servings Database and the Recipe Database with the Variety Group List. Each USDA food code is listed by the appropriate Pyramid subgroup, the number of Pyramid subgroup servings per 100-gram weight of the food code, and the appropriate distinct food(s) from the Variety Group List. Food codes were matched to distinct foods. If a food contained more than one distinct food from the same Pyramid subgroup, we matched the number of servings to the ingredient used in the largest amount. For example, many soups contain both onions and celery, both of which are in the "other vegetables" Pyramid subgroup. The number of Pyramid servings for this subgroup would be assigned to onions if more onions than celery were in the soup.

Step Two: Calculating the Variety Score

After the CNPP Variety Database was established, we first calculated the total quantity of each distinct food consumed in a day and then counted the total number of distinct foods consumed to assign a variety score. In the best professional judgment of USDA staff, an individual must consume at least one-half of a Pyramid serving of eight or more distinct foods throughout the day to obtain adequate amounts of nutrients and substances for a good diet and to receive a perfect score of 10 for the variety component of the HEI.

To calculate the number of Pyramid servings consumed of each distinct food, we merged the CNPP Variety Database with the NHANES 24-hour dietary intake data. We then calculated the number of Pyramid subgroup servings consumed of the distinct food represented by a USDA 8-digit food code.

We then computed the total number of Pyramid subgroup servings for each distinct food that the individual consumed in a day and eliminated any distinct foods where the total amount consumed was less than one-half of a serving. Finally, we counted the total number of distinct foods consumed in a day and assigned a variety score. Individuals who consumed eight or more distinct foods in a day received a score of 10 from 10 possible points; those who consumed three or fewer distinct foods received a score of 0. Points were prorated among three and eight distinct foods.

Application: Calculating a U.S. Variety Score by Using Data From NHANES 1999-2000

We calculated the average 1-day dietary variety score of the U.S. population by using 24-hour dietary recall data from NHANES 1999-2000 for 986 men and 1,236 women aged 20 to 50 years.[4] We also calculated this group's average number of distinct foods consumed in each of the five major food groups. Both the average variety score and the number of distinct foods provide insight on quality of an individual's or a

[3]The current version of the CNPP Variety Database was completed in collaboration with Kim Yonemori, Suzanne Murphy, and Janet Foote of the Cancer Research Center at the University of Hawii and is available on the CNPP Web site at www.usda.gov/Pubs/HEI/HEIVarietyPOR.exe.

[4]The NHANES 1999-2000 is a complex, multistage probability sample of the civilian, noninstitutionalized population of the United States. Data were collected through in-person interviews with individuals of all ages. The NHANES 1999-2000 is described in detail elsewhere (Center for Disease Control and Prevention, 2003).

population's diet. When examining the number of distinct foods consumed, one must recognize that the counts are not necessarily the number of Food Guide Pyramid servings consumed. However, in our current application, we did find a correlation between the number of distinct foods consumed in a Pyramid food group and the number of total servings consumed (data not shown). A previous application demonstrated that Americans do not eat enough fruit (Basiotis et al., 2002).

Results

By using the HEI variety score methodology, we found that, from a possible score of 10, the average 1-day variety score was 7.9 for men and 7.5 for women. The average variety count was 8.3 and 7.7 for men and women, respectively (table 2). This result indicates that, on average, American men and women from this sample consumed about eight distinct foods per day. The breakdown by Pyramid food groups allows us to examine how varied Americans' diets are.

The results show that adult men and women have very similar patterns of consumption. The largest difference between men and women is in the meat and beans group, where men consumed an average of 0.3 more distinct meat and bean items than did women. It appears that the major contributors to the distinct foods in this group are from three food groups: meat and beans, grains, and vegetables. We conclude that on the day of the survey, the representative population of adult Americans aged 20 to 50 years ate a variety of meat and beans, grains, and vegetables, but not a variety of fruits.

Table 2. Average number of unique foods consumed by men and women, 1-day data[1]

Food group	Unique foods consumed	
	Men	Women
Grain	2.5	2.4
Vegetable	1.8	1.7
Fruit	0.8	0.9
Meat and beans	2.1	1.8
Milk	1.1	0.9

[1]One-day dietary intake source data from NHANES 1999-2000 for 986 men and 1,236 women aged 20 to 50.

Discussion

Since inception in 1980, the Dietary Guidelines for Americans have recommended that Americans consume a variety of foods to obtain the nutrients and other substances needed for good health. This concept has continued through all five editions of the *Dietary Guidelines* (1980, 1985, 1990, 1995, and 2000). In 2000, research supported the distinction to specify consuming a variety of whole grains, fruits, and vegetables. Selecting a variety of foods within the groups may help to ensure that an adequate amount of nutrients and other potentially beneficial substances are consumed. Additionally, variety was one of the main messages of the original USDA Food Guide Pyramid released in 1992.

Researchers have used varying methods to measure the quality of the diet of individuals or populations. The HEI uses a commodity base to measure variety, with 289 distinct foods that count toward a variety score if an individual consumes at least one-half of a Pyramid subgroup serving. Others have counted the number of unique foods, which means two mixed dishes can each count as one item, even if they have the same ingredients.

By using the HEI variety score methodology, we found that, from a possible score of 10, the average 1-day variety score was 7.9 for men and 7.5 for women. The average variety count was 8.3 and 7.7 for men and women, respectively.

A third method is to divide mixed dishes into pre-defined groups of foods and then count the number of different groups. Researchers have also counted the number of Food Guide Pyramid food groups an individual consumes.

The USDA Healthy Eating Index uses agricultural food commodities to calculate the variety count for the variety score. This method counts different food commodities within the subgroups of the basic food groups as separate foods. The cooking method and amount of fat and sugar added does not affect the assignment to the variety group. Thus, a vegetable stir-fry and a vegetable soup may contain the same vegetable commodities, but are prepared in different ways, and the ingredients in both dishes would not be considered different foods.

In this report, we counted the number of different food commodities consumed by men and women, aged 20 to 50, from among and within each Pyramid group. The results of this analysis indicate that Americans are not eating enough variety in a single day. This is especially true within the fruit group. One way, perhaps, to encourage greater fruit consumption would be to promote the consumption of a wider *variety* of fruits every day, because some individuals may find it easier to eat more fruit if they eat different types.

Although the Healthy Eating Index is designed to measure the quality of an individual's diet over the course of 1 day, the variety consumed in a single day may not necessarily represent an individual's usual intake. However, we believe that the variety score of nationally representative data from NHANES 1999-2000 can adequately measure the dietary variety for the population in the United States. Therefore, applying our Healthy Eating Index variety measurement methodology to populations and subpopulations can provide researchers and nutrition educators with a better understanding of where attention should be focused for nutrient adequacy and its effect on overall diet quality.

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The U.S. Food Supply Series: Selected Food and Nutrient Highlights, 1909 to 2000

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The U.S. food supply data series, beginning with 1909, reports the amounts of nutrients available for consumption on a per capita and per day basis. Estimates of nutrients in the food supply are used to monitor the potential of the food supply to meet the nutritional needs of the U.S. population, to examine historical trends, and to evaluate changes in the American diet. Significant changes in food supply nutrients and food commodities providing these nutrients have occurred since 1909. This report[1] provides information on availability and consumption of the major food groups of the food supply; highlights nutrient availability and contributions of vitamin A, folate, calcium, and potassium from these food groups for 1909, 1945, 1970, and 2000; and provides a discussion of critical events since 1909 that were responsible for changes in nutrients and food commodities in the U.S. food supply.

The variety and types of food commodities in the U.S. food supply and the nutrients they provide have undergone significant changes since 1909. In the 1930s, advancements in food-processing technologies introduced into the marketplace canned, frozen, and packaged items such as canned soups and vegetables, frozen vegetables and fruits, and packaged cereals. The result has been an increase in national availability and shelf life of these foods. During the 1930s, margarine was fortified with vitamin A and beta-carotene (for color) and milk was fortified with vitamins A and D. In the 1940s, flour and flour products were enriched with thiamin, riboflavin, niacin, and iron. Such events ensured an adequate supply of some nutrients and enhanced the healthfulness of the U.S. food supply.

During the second half of the 20th century, changes in animal husbandry and marketing practices resulted in different nutrient composition and forms of red meat and poultry, such as leaner meat cuts and a variety of poultry products. Over the last three decades, an increase in ethnic diversity, more elderly consumers, and the expansion of government-mandated nutrition policies[2] changed the demand for some foods and expanded the variety of others. These events resulted in changes in commodities and nutrients in the food supply (see box). For example, in 2000, the food supply provided a greater variety of grain products, fruits and vegetables, reduced-fat meats, and dairy products than was the case in 1970; however, during 2000, the food supply also provided higher amounts of caloric sweeteners and added fats. The increased variety and availability of grain products, along with changes in grain fortification policy during this

[1]For the full report, see Gerrior, Bente, and Hiza (2004).

[2]These policies included mandatory nutrition labeling of purchased foods, revision of the U.S. grain fortification policy, publication of the *Dietary Guidelines for Americans*, and the development of the Recommended Daily Allowances (RDAs) and the Dietary Reference Intakes (DRIs).

Availability of Food Groups of the Food Supply

Throughout the U.S. food supply series, substantial changes occurred in the availability or per capita consumption of many of the major food groups. Many of these changes were linked to advances in food production and technology, Federal standards for enrichment and fortification, the Federal Dietary Guidance System, or increasing consumer demand for nutritionally improved foods. Based on food supply per capita estimates, the following trends are noted.

Meat, Poultry, and Fish Group; and Meat Alternates

Per capita consumption from the meat, poultry, and fish group increased during the period 1909 to 2000. Although consumption of red meat reached a record high in 1971, per capita consumption was lower in 2000. Alternately, per capita consumption of poultry increased dramatically from the early and mid-1970s, almost doubling in 2000, and thus contributed to the overall increased availability from this group in 2000. Fish consumption also increased somewhat from 1909 to 2000.

The consumption of eggs, a meat alternate, reached record-high levels from 1950 to 1951. Egg use generally declined over the series, remained stable from 1989 to 1997, but increased in 2000. The consumption of legumes, nuts, and soy products generally remained stable in 2000.

Milk and Milk Products

The demand for whole milk has declined; whereas, the demand for cheese, lowfat and skim milks (fat-free or nonfat), and yogurt has increased substantially. Per capita use of lowfat and skim milks nearly doubled; whereas, cheese increased sixfold from 1909 to 2000. A demand for hard cheeses used in pizza making, an increased use of cheeses in prepared foods, and the development of processed cheeses are mostly responsible for the increase in per capita cheese consumption.

Vegetables and Vegetable Juices

Per capita consumption of vegetables and vegetable juices in 2000 was somewhat higher than was consumption in 1970 but substantially lower than it was in 1909. Consumption of vegetables generally declined over the series; however, vegetable use increased during World War II because of the popularity of U.S. “victory gardens” (vegetables).

Since 1920, the decreased use of fresh vegetables was due to the marked decline in the use of fresh white potatoes and a shift from fresh to frozen potatoes. This shift is associated with the increased popularity of fried potatoes (especially french fries) at fast-food restaurants. This decline has been slightly offset since the 1980s because of the increased consumption of other fresh vegetables, such as bell peppers, onions, and broccoli. Also, beginning in 2000, ERS’s data on vegetable consumption were expanded to include fresh pumpkin, several leafy greens, and okra, which was reflected in the increased consumption of dark-green and deep-yellow vegetables in 2000.

Fruits and Fruit Juices

Consumption of fruits and fruit juices increased from 1909 to 2000 with the per capita availability of citrus fruits and juices increasing by about fourfold. Since the early 1970s, use of non-citrus fruits and melons has generally increased. Increased availability of fruits is related to increases in juice consumption and the introduction of a greater variety of fruits, including tropical fruits (e.g., kiwi, pineapple, and mangoes) into the food supply.

Grain Products; Sugars and Sweeteners

The per capita use of grain products increased in 2000 from a low usage in 1972. Despite this 50-percent increase in grain products, consumption in 2000 was still lower than it was in 1909. In contrast, consumption of sugars and caloric sweeteners increased sequentially over the series. Between 1945 and 2000, this consumption increased by about two-thirds, reflecting the increased consumption of carbonated soft drinks and other sweetened beverages, such as fruit drinks and ades. Use of corn sweeteners surpassed the use of refined sugar in the mid-1980s and reached an all-time high in 1999.

Fats and Oils

Consumption of fats and oils remained relatively stable through 1945 but has generally increased since then. Over the series, a shift has occurred from the use of animal sources to vegetable sources because of a substantial increase in the use of vegetable-fat products, such as margarine, shortening, and salad and cooking oils. The increase in total fats and oils since 1970 probably resulted from the greatly expanded use of fried foods by the fast-food industry and in food service outlets, as well as the increased use of salad oils consumed both at home and away from home.

period, were responsible for the higher levels of folate in the 2000 food supply.

This report provides information on availability and consumption of the major food groups of the food supply; highlights nutrient availability and contributions of vitamin A, folate, calcium, and potassium from these food groups for selected years (1909, 1945, 1970, and 2000[3]); and provides a discussion of critical events since 1909 that were responsible for changes in the U.S. food supply.

The Source and Importance of Food Supply Data

The U.S. food supply data series measures the amount of food available for consumption per capita per year and the amount of nutrients available for consumption per capita per day. This series is the only continual source of data on food and nutrient availability in the United States dating back to 1909. Food supply nutrient estimates were calculated for the first time during World War II to assess the nutritive value of the food supply for civilian use in the United States and to provide a basis for international comparisons with the food supplies of our allies (U.S. Department of Agriculture [USDA], 1949; Gerrior & Bente, 2001).

Per capita food supply estimates provide unique and essential information on the amount of food and nutrients available for consumption. They are useful for assessing trends in food and nutrient consumption over time, for monitoring the potential of the food supply to meet the nutritional needs of Americans, and for examining relationships between food availability and diet-health risk. In particular, food supply data provide useful information to policymakers who are responsible for establishing food and nutrition policy.

Methods Used to Calculate Availability and Consumption

The USDA's Economic Research Service (ERS) annually calculates the amount of food available for consumption on a per capita basis in the United States. Food supply data measure national consumption of about 400 basic commodities. For most commodity categories, the available food supply is measured as the sum of beginning inventories, annual production, and imports minus exports, farm and nonfood uses, and end-of-year inventories. Per capita consumption is calculated by dividing the available food supply by the total U.S. population as of July 1 each year (Putnam & Allshouse, 1999).

Using per capita consumption data and information on the nutrient composition of foods from USDA's Agricultural Research Service, the Center for Nutrition Policy and Promotion calculates the nutrient content of the U.S. food supply. Per capita consumption for each commodity is multiplied by the amount of food energy and also by each of 27 nutrients and dietary components in the edible portion of the food. Results for each nutrient from all foods are totaled and converted to amount of nutrient per capita per day. Nutrients added through fortification and enrichment are also included in the nutrient content of the food supply. Because food supply data represent the disappearance of food into the marketing system and no adjustments are made for food waste, per capita consumption and nutrient estimates typically overstate the amount of food and nutrients people actually ingest.

In 1998, ERS published a method to adjust food supply data for losses due to food waste and to express the data in terms of Food Guide Pyramid serving recommendations (Kantor, 1998). This methodology expanded the usefulness of food supply data by allowing researchers and policymakers to gauge food availability in terms of current dietary guidance and Americans' progress in following the *Dietary Guidelines for Americans*.

Since 1943, the nutrient adequacy of the food supply was assessed in terms of the Recommended Dietary Allowances (RDAs)[4] for macronutrients, vitamins, and minerals (i.e., food energy, vitamin A, iron, and calcium). The RDAs have been revised and replaced with the Dietary Reference Intakes (DRIs) by the National Academy of Sciences (NAS). The DRIs expand upon the RDAs, including them as goals for intake by individuals and including three additional types of reference values: Estimated Average Requirements (EARs) for group assessment; Adequate Intake (AI), a specific indicator of adequacy; and Tolerable Upper Level (UL), a specific indicator of excess.

[3]The years 1909 and 2000 represent the initial and final years of the food supply series for which data are currently available; 1945 reflects increased food production of a number of foods associated with World War II and advances in enrichment and fortification during the 1930s and early 1940s; 1970 serves as a benchmark year for a review of food supply estimates over the past 30 years.

[4]The RDAs were formulated by the Food and Nutrition Board of the National Academy of Sciences (NAS).

Since the U.S. food supply accounts for food and nutrient availability on a national level, the EARs are used to assess food supply nutrients. For some nutrients, NAS has not determined an EAR, so an AI is used for population studies. While the AI is a less robust indicator of population nutrient intake than of individual intake, it is still a useful measurement to assess the availability of a nutrient to satisfy the needs of all individuals in a population or group (Yates, Schlicker, & Suitor, 1998).

Availability and Contribution of Selected Nutrients

Vitamin A

Vitamin A is a fat-soluble antioxidant essential for vision, growth, bone development, development and maintenance of epithelial tissue, integrity of the immune system, and reproduction. A variety of foods rich in vitamin A and provitamin A carotenoids is available in the U.S. food supply; thus, overt symptoms of vitamin A deficiency are rare. Vitamin A occurs as either preformed retinoids or carotenoids. Preformed vitamin A is abundant in some animal-derived products; whereas, provitamin A carotenoids are abundant in darkly colored fruits and vegetables and red palm oil. Beta carotene is the most active of the carotenoids. Both preformed retinoids and carotenoids are converted to retinol in the body.

Historically, Retinol Equivalents (REs) have been used to calculate the vitamin A activity of foods in the food supply; however, in 2001 the NAS released new guidelines for estimating the amount of provitamin A carotenoids needed to synthesize one unit of retinol (Institute of Medicine [IOM], 2001). Retinol Activity Equivalents (RAEs) are now the unit used to indicate vitamin A activity. The RAE is based on recent studies, which show that the conversion of provitamin A carotenoids to retinol is only half as great as previously thought (IOM, 2001). As such, retinol activity in the food supply may be lower than previously reported as vitamin A (RE). However, the U.S. food supply reports an abundance of vitamin A-rich foods; therefore, the EAR for the U.S. population is achievable through the diet.

Total vitamin A availability increased from 1,080 µg RAE per person per day in 1909 to 1,260 µg RAE per person per day in 2000 (table 1). Levels of vitamin A availability were highest in 1945: 1,300 µg RAE per person per day because of increases in the World War II food supply of foods rich in vitamin A that included foods from home "victory gardens" (vegetables).

The meat, poultry, and fish group was the leading source of vitamin A in both 1909 and 2000; however, this contribution dropped from 40 percent in 1909 to 27 percent in 2000 (fig.1). Organ meats accounted for an appreciable amount of vitamin A from this group in the earlier years of the series, but more recent use has declined. The vegetable group was the second leading source of vitamin A in both 1909 and 2000, providing 19 and 24 percent, respectively, to the total vitamin A in the food supply. Dark-green and deep-yellow vegetables accounted for most of the vegetable contribution to vitamin A.

When µg RAE is used as the assessment reference, one finds that the vitamin A activity of provitamin A carotenoids is half the vitamin A activity assumed when using µg retinol equivalents (RE) (IOM, 2001); therefore, vitamin A contributions from vegetables reported here are less than those in previous, similar reports and also lower than some readers may expect. The dairy group was the third leading source of vitamin A, providing 16 percent in 1909 and 22 percent in 2000. This rise was due to increased use of yogurt and frozen desserts. Fortification of margarine with vitamin A (since the mid-1940s) and breakfast cereals (beginning in 1974) has also made important vitamin A contributions to the total vitamin A content of the food supply.

Folate

Folate functions as a coenzyme and is essential for the biosynthesis of nucleic acids and normal maturation of red blood cells. Low levels of serum folate have been associated with elevated serum homocysteine, an independent risk factor for vascular disease and, during pregnancy, with an increased risk for neural tube defects.

The DRI for folate considers its bioavailability from a particular food source (IOM, 1998). Thus, folate is reported in units of dietary folate equivalents (DFE)—taking into account the significant differences in its absorption from different foods. Earlier analyses utilized enzymatic digestion to determine folate contents. This approach is now believed to have significantly underestimated the available amount of folate in many foods (Yates, 2001). To account for this change and to capture better the different forms of folate and folate bioavailability from foods, scientists now report folate levels in the food supply as total folate (µg) and as folate DFE µg. This method of reporting should substantially improve information on the folate available for consumption on a per capita basis or on a national basis (Yates, 2001; Lewis, Crane, Wilson, & Yetley, 1999).

The lowest level of total folate and folate DFE in the food supply was in 1965, at 278 and 277 µg per person per day, respectively (data not shown).

Table 1. Nutrients available (per person per day) in the U.S. food supply, selected years

	1909	1945	1970	2000
Food energy (kcal)	3500	3300	3300	3900
Carbohydrate (g)	501	429	389	490
Fiber (g)	30	26	19	24
Protein (g)	101	104	96	110
Fat (g)	122	138	151	170
Saturated fatty acids (g)	52	55	53	54
Monounsaturated fatty acids (g)	47	54	61	72
Polyunsaturated fatty acids (g)	13	18	26	36
Cholesterol (mg)	450	540	470	430
Vitamin A (µg RE)	1240	1540	1460	1670
Vitamin A (µg RAE)	1080	1300	1220	1260
Carotene (µg RE)	430	560	480	720
Vitamin E (mg)	7.2	10.5	13.3	19.2
Vitamin C (mg)	98	119	104	126
Thiamin (mg)	1.6	2.1	1.9	2.9
Riboflavin (mg)	1.9	2.6	2.3	2.9
Niacin (mg)	18	22	21	32
Vitamin B_6 (mg)	2.3	2.1	2.0	2.4
Total folate (µg)	328	351	290	691
Folate DFE (µg)	327	350	290	907
Vitamin B_{12} (µg)	8.5	9.4	9.5	8.3
Calcium (mg)	770	1080	930	960
Phosphorus (mg)	1520	1690	1510	1670
Magnesium (mg)	390	410	330	380
Iron (mg)	14.3	16.5	15.6	23.1
Zinc (mg)	13.5	13.2	12.3	14.9
Copper (mg)	1.7	1.8	1.5	1.9
Potassium (mg)	3830	4130	3480	3740
Sodium (mg)	940	1180	1360	1330
Selenium (µg)	168.5	150.3	127.0	176.3

Vegetables were the leading source of folate DFE prior to 1974, accounting for nearly 29 percent of the folate in the food supply in 1909; grain products were second, providing 24 percent of folate DFE to the U.S. food supply.

This low level was due to the decreased use of grain products and vegetables, mostly potatoes. Both folate measurements remained similar over the series until 1974, when cereal fortification (containing the synthetic form of folate) resulted in higher values for folate DFE than for total folate. In 1998, with mandatory folate fortification of processed grain products, both measures of folate increased as expected. Folate DFE levels, however, were about 30 percent higher than those for total folate (data not shown). The highest level of total folate (691 µg) and folate DFE (907 µg) per person per day was in 2000 (table 1).

Vegetables were the leading source of folate DFE prior to 1974, accounting for nearly 29 percent of the folate in

the food supply in 1909; grain products were second, providing 24 percent of folate DFE to the U.S. food supply (fig. 2). From the late 1940s through the mid-1970s, folate contributions from grains dropped significantly because of a decreased use of grain products. Until folate fortification of breakfast cereals, the legumes, nuts, and soy group consistently provided about one-fifth of the total folate in the food supply.

Calcium

Calcium is essential for the formation of bones and teeth; and requirements are highest during adolescence, later adult years, pregnancy, and lactation. Calcium is very important from a public health perspective because inadequate intake may increase the risk of osteoporosis—a condition of reduced bone mass resulting in increased skeletal fragility. Osteoporosis affects 25 to 30 million Americans. The important role of calcium intake to bone health and osteoporosis prevention was the primary consideration of the Food and Nutrition Board to increase dietary calcium recommendations for setting the new requirement (Bryant, Cadogan, & Weaver, 1999; IOM, 1997). The DRIs for calcium are reported as AIs and are used to report calcium availability in the food supply.

The amount of calcium available in the food supply has shifted over the years. Increased use of whole, canned, and dried milk as well as cheese resulted in an increase in calcium levels by 40 percent between 1909 and 1945 when calcium reached a peak value of 1,080 mg per capita per day (due to the production levels associated with the war years). From the mid 1940s through the early 1980s, calcium levels generally declined. Since then, however, levels have tended to increase because of a greater use of lowfat and skim milks, yogurt, and cheese.

Figure 1. Percent contributions from vitamin A (RAE) in the U.S. food supply, selected years

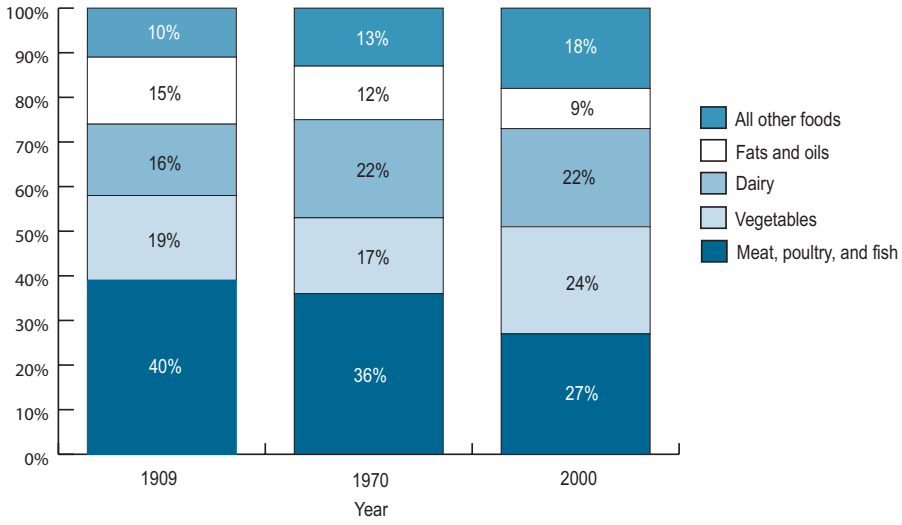


Figure 2. Percent contributions from folate DFE in the U.S. food supply, selected years

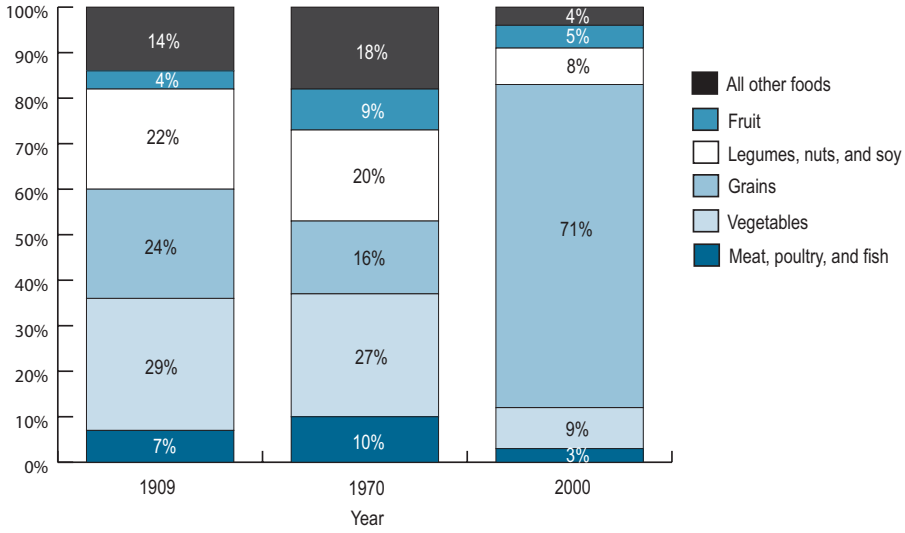
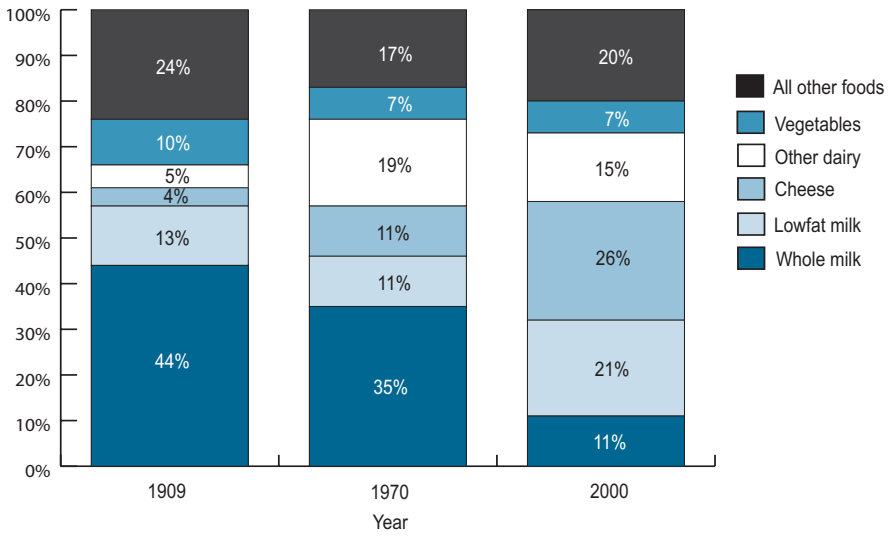


Figure 3. Percent contributions from calcium in the U.S. food supply, selected years



Dairy products have always been the predominant source of calcium in the food supply; however, a shift within the dairy group from whole milk to lowfat and skim milks has occurred over the years.

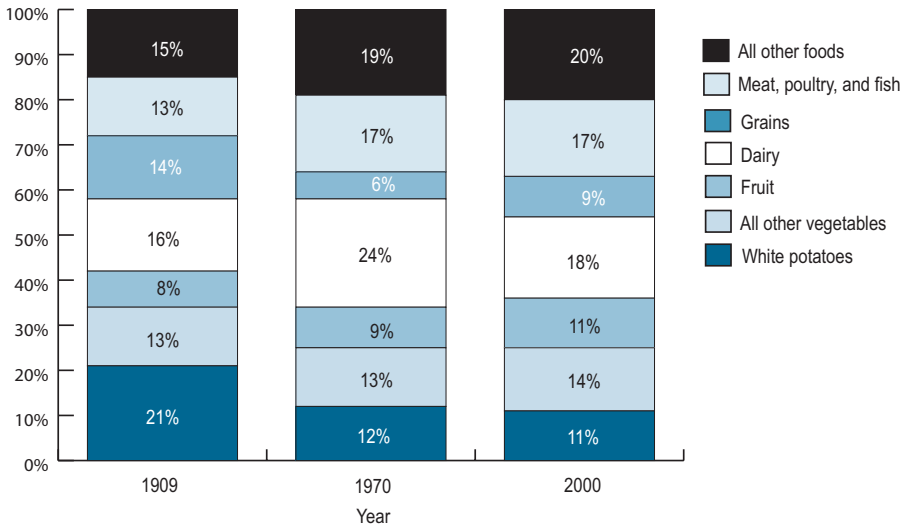
Dairy products have always been the predominant source of calcium in the food supply; however, a shift within the dairy group from whole milk to lowfat and skim milks has occurred over the years (fig. 3). In 1909, whole milk accounted for 44 percent of the calcium in the food supply; whereas, in 2000, it contributed only 11 percent. Even though the share of calcium contributed by lowfat and skim milks has increased, this share does not completely compensate for the calcium loss due to the decreased use of whole milk. The share of calcium provided by cheese was more than six times higher in 2000 (at 26 percent) than in 1909 (at 4 percent). The share of the vegetable group contributing to calcium in the U.S. food supply series has generally declined, dropping from 10 percent in 1909 to 7 percent in 2000.

Potassium

Potassium aids in muscle contraction and in maintaining fluid and electrolyte balance in body cells; it functions in nerve impulses as well as in carbohydrate and protein metabolism. The DRI committee could not determine an EAR for potassium; therefore, the AI is used to report calcium availability in the food supply.

During the earlier years of the food supply data series and during World War II, potassium levels were generally higher in the food supply. This was due to the high use of dairy products and vegetables. From the peak level of 4,130 mg potassium per person per day in 1945, values primarily fluctuated but were mainly on the decline. Potassium values dropped 390 mg per person per day between 1965 and 2000: 3,350 to 3,740 mg. Even though there has been a general increase of potassium levels since the mid-1980s—primarily because of an increase in fruit use—potassium levels available from the U.S. food supply in 2000 may not be sufficient to meet the current AI for adults (4,700 mg per day). Evidence indicates that this level of potassium intake derived mainly from food that is naturally high in potassium, such as fruits and vegetables, should reduce blood pressure, limit the adverse effects of sodium chloride on blood pressure, lower the risk of kidney

Figure 4. Percent contributions from potassium in the U.S. food supply, selected years



stones, and possibly reduce bone loss. In U.S. population groups with lower intakes of potassium, such as African Americans, there is a higher prevalence of elevated blood pressure and salt sensitivity, suggesting that such groups would especially benefit from an increased intake of potassium (IOM, 2004).

Foods from plants (e.g., grains, fruits, vegetables, legumes, nuts, and soy) have been the primary sources of potassium. Over the series, the leading source of potassium has been the vegetable group, followed by the dairy and the meat, poultry, and fish groups. In 1909, foods from plants (grains, fruits, and vegetable sources) provided 70 percent of the potassium in the food supply (fig. 4). Even though this percentage decreased over the years, foods from plant sources still provided 65 percent in 2000. This decreased contribution is attributed to the decline in the consumption of vegetables, particularly white potatoes. In the early years of the series, vegetables contributed 34 percent of the potassium in the food supply, with white potatoes alone contributing 21 percent. By 2000, the share from potatoes had dropped by about one-half and vegetable contributions dropped overall to 25 percent of the potassium in the food supply.

On the other hand, the contribution from fruit has generally increased over time, from 8 percent in the early 1900s to 11 percent in 2000. The share of potassium provided by the dairy group increased somewhat, from 16 percent in 1909 to 18 percent in 2000, as did the share provided by the meat, poultry, and fish group (from 13 to 17 percent, respectively, during this period). However, the share from grains decreased from 14 percent in 1909 to 9 percent in 2000.

Conclusions

Advances in food production and fortification technologies resulted in increased availability of foods and nutrients in the U.S. food supply. The recent release of the Dietary Reference Intakes provides new nutrition knowledge for analysis of nutrient availability in the food supply in terms of nutrient needs. The food supply will continue to provide a safe source of nutritious foods in the years ahead and to reflect changes in marketing practices, food technologies, and consumer demand.

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Report Card on the Quality of Americans' Diets

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The diets of most Americans need to improve, as indicated by the 1999-2000 Healthy Eating Index (HEI). This finding is a concern, because dietary factors are associated with 4 of the 10 leading causes of death (coronary heart disease, certain types of cancer, stroke, and type 2 diabetes). Less than optimal diets, as well as inactivity among Americans, are key factors affecting the degree to which people are overweight.

To assess the status of Americans' diets and to monitor changes in these patterns, the U.S. Department of Agriculture's (USDA) Center for Nutrition Policy and Promotion (CNPP) developed the HEI, the only instrument computed on a regular basis by the Federal Government that gauges the overall quality of the population's diet. This report presents the HEI for 1999-2000—the most recent period for which nationally representative data are available to compute the HEI. Data used for analysis are from the Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey, a nationally representative survey containing information on the diets of 8,070 people.

How the Healthy Eating Index Is Computed

The HEI is a summary measure of the quality of people's diets. The HEI, consisting of 10 components (each representing different aspects of a healthful diet), provides an overall picture of the type and quantity of foods people eat, their compliance with specific dietary recommendations, and the variety in their diets.

- Components 1-5 measure the degree to which a person's diet conforms to serving recommendations of the five major food groups of the Food Guide Pyramid: grains (bread, cereal, rice, and pasta), vegetables, fruits, milk (milk, yogurt, and cheese), and meat (meat, poultry, fish, dry beans, eggs, and nuts).
- Component 6 measures total fat consumption as a percentage of total food energy (calorie) intake.
- Component 7 measures saturated fat consumption as a percentage of total food energy intake.
- Components 8 and 9 measure total cholesterol intake and total sodium intake, respectively.
- Component 10 measures the degree of variety in a person's diet.

Each component of the HEI has a maximum score of 10 and a minimum score of zero. Intermediate scores are computed proportionately. Whereas high component scores indicate intakes close to recommended ranges or amounts, low component scores indicate less compliance with recommended ranges or amounts.

The maximum combined score for the 10 components is 100. From this combined score, CNPP devised three ratings that imply how well Americans' diets meet dietary standards.

- A score above 80—a good diet.
- A score between 51 and 80—a diet that needs improvement.
- A score less than 51—a poor diet.

Most People Had a Diet That Was Poor or Needed Improvement

During 1999-2000, the diets of most people (74 percent) needed improvement (fig. 1). Only 10 percent of the population had a good diet; 16 percent had a poor diet. The highest mean HEI component scores for the U.S. population were for cholesterol and variety; both averaged 7.7 on a scale of 10 (fig. 2). Overall, 69 percent of the people had a maximum score of 10 for cholesterol—that is, they met the dietary recommendation; 55 percent of the people had a maximum score for variety. (The percentage of people with maximum scores is not shown in the figures.)

Fewer than 50 percent of the population, however, met the dietary recommendation for the other 8 HEI components. People had the two lowest mean scores for the fruits (3.8) and milk (5.9) components of the HEI: Only 17 percent of the people consumed the recommended number of servings of fruit per day, and only 30 percent met the dietary recommendation for milk. Average scores for the other HEI components were between 6 and 6.9. In general, most people could improve all aspects of their diets.

Figure 1. Healthy Eating Index rating, U.S. population, 1999-2000

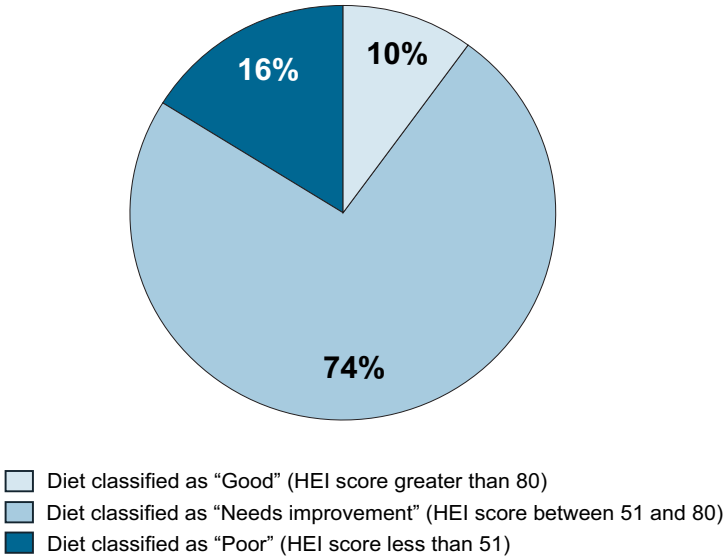
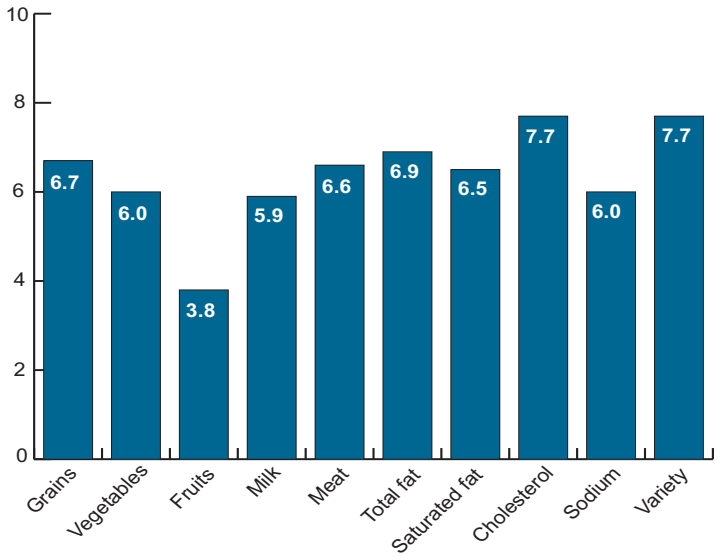


Figure 2. Healthy Eating Index: Component mean scores, 1999-2000



Healthy Eating Index Scores Varied by Americans' Characteristics

HEI scores varied significantly by Americans' demographic and socio-economic characteristics (table 1). For example, females had slightly higher scores than did males: 64.5 vs. 63.2, and children less than 11 years old had higher scores than did most other age groups. Compared with younger adults, older adults age 51 and over had higher HEI scores.

Differences in HEI scores were also apparent by racial/ethnic group, place of birth, education, and income. Mexican Americans had the highest HEI score—an average of 64.5 during 1999-2000, and non-Hispanic Whites had a higher mean overall HEI score than did non-Hispanic Blacks (64.2 vs. 61.1). Native-born Americans had a lower quality diet than did members of the U.S. population born in Mexico (63.5 vs. 66).

HEI scores generally increased with levels of education (among adults) and income. No subgroup of the population had an average HEI score greater than 80, that is, a good diet.

Trends in the Healthy Eating Index

How has the quality of the American diet changed over time? The diets of Americans have slightly improved since 1989 (the first year the Index was calculated), but they have not changed since 1996. People's diets were in the "needs improvement" range in all 3 years. In 1989, the average HEI score was 61.5; in 1996 and 1999-2000, it was 63.8, a 4-percent increase. Over the three periods, saturated fat and variety scores increased steadily while sodium scores decreased steadily.

Table 1. Healthy Eating Index scores, by selected characteristics, 1999-2000

Characteristic	Overall score
Gender	
Male	63.2
Female	64.5
Age (years)/gender	
Children, 2-3	75.7
Children, 4-6	66.9
Children, 7-10	66.0
Females, 11-14	61.4
Females, 15-18	61.7
Females, 19-50	63.2
Females, 51+	66.6
Males, 11-14	60.8
Males, 15-18	59.9
Males, 19-50	61.3
Males, 51+	65.2
Race/ethnicity	
Non-Hispanic White	64.2
Non-Hispanic Black	61.1
Mexican American	64.5
Other race[1]	63.4
Other Hispanic	64.2
Place of birth	
United States	63.5
Mexico	66.0
Other	65.7
Education[2]	
No high school diploma	61.1
High school diploma	63.0
More than high school diploma	65.3
Income as percent of poverty	
<100%	61.7
100-184%	62.6
>184%	65.0

[1]Consists of Asian, Pacific Islander, American Indian, and Alaskan Native.
[2]Consists of people age 25 and over only.

These findings provide a better understanding of the types of dietary changes needed to improve people's eating patterns. The HEI is an important tool that can be used to provide guidance to target and design nutrition education and public health interventions.

Note: For more details on the Healthy Eating Index and how it is computed, see Basiotis, P.P., Carlson, A., Gerrior, S.A., Juan, W.Y., & Lino, M. (Authors in alphabetical order.) (2002). *The Healthy Eating Index: 1999-2000*. U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. CNPP-12. Also available at www.cnpp.usda.gov.

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Quality of Diets of Older Americans

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The diets of most older Americans need to improve, as indicated by the 1999-2000 Healthy Eating Index (HEI). This is of concern given the link between diet and chronic disease even for older people. In addition, less than optimal diets, as well as inactivity among older Americans, are key factors affecting the degree to which people are overweight. Overweight and obesity can result in a number of adverse conditions.

To assess the status of Americans' diets and to monitor changes in these patterns, the U.S. Department of Agriculture's (USDA) Center for Nutrition Policy and Promotion (CNPP) developed the HEI, the only instrument computed on a regular basis by the Federal Government that gauges the overall quality of the population's diet. This report presents the HEI for older Americans (age 65 and over) for 1999-2000—the most recent period for which nationally representative data are available to compute the HEI. It also examines the diet quality of older Americans over time (1999-2000 vs. 1989-90). Data used for analysis are from (1) the Centers for Disease Control and Prevention's 1999-2000 National Health and Nutrition Examination Survey, a nationally representative survey containing information on the diets of 8,070 people, including 1,392 people age 65 and over and (2) the USDA's 1989-90 Continuing Survey of Food Intakes by Individuals, a nationally representative survey containing information on the diets of 7,463 people, including 1,181 people age 65 and older.

How the Healthy Eating Index Is Computed

The HEI is a summary measure of the quality of people's diets. The HEI, consisting of 10 components (each representing different aspects of a healthful diet), provides an overall picture of the type and quantity of foods people eat, their compliance with specific dietary recommendations, and the variety in their diets.

- Components 1-5 measure the degree to which a person's diet conforms to serving recommendations of the five major food groups of the Food Guide Pyramid: grains (bread, cereal, rice, and pasta), vegetables, fruits, milk (milk, yogurt, and cheese), and meat (meat, poultry, fish, dry beans, eggs, and nuts).
- Component 6 measures total fat consumption as a percentage of total food energy (calorie) intake.
- Component 7 measures saturated fat consumption as a percentage of total food energy intake.
- Components 8 and 9 measure total cholesterol intake and total sodium intake, respectively.
- Component 10 measures the degree of variety in a person's diet.

Each component of the HEI has a maximum score of 10 and a minimum score of 0. Intermediate scores are computed proportionately. Whereas high component scores indicate intakes

close to recommended ranges or amounts, low component scores indicate less compliance with recommended ranges or amounts. The maximum combined score for the 10 components is 100. From this combined score, CNPP devised three ratings that imply how well Americans' diets meet dietary standards.

- A score above 80—a good diet.
- A score between 51 and 80—a diet that needs improvement.
- A score less than 51—a poor diet.

Table 1. Healthy Eating Index rating for people age 65 and over

	1989-90			1999-2000		
	Good diet	Needs improvement	Poor diet	Good diet	Needs improvement	Poor diet
			Percent			
65-74 yrs	18	74	8	20	66	14
75+ yrs	26	66	8	19	68	13

Table 2. Healthy Eating Index scores, overall and component, for people age 65 and over

	1989-90	1999-2000
Grains	6.3	6.4
Vegetables	6.8	6.4
Fruits	5.5	5.5
Milk	6.2	5.9
Meat	7.4	6.4
Total fat	6.8	6.9
Saturated fat	6.3	6.9
Cholesterol	8.5	8.1
Sodium	7.9	7.1
Variety	7.4	8.2
Total HEI	**69.1**	**67.6**

Most Older Americans Have a Poor Diet or One That Needs Improvement

During 1999-2000, the diets of most older people needed improvement (table 1). Only 20 percent of people age 65 to 74 and 19 percent of people over 75 had a good diet in 1999-2000 while 18 percent and 26 percent, respectively, had a good diet in 1989-90; 14 percent of people age 65 to 74 and 13 percent of people over 75 had a poor diet in 1999-2000, up from 8 percent in 1989-90. The diet of older Americans was better than that of their younger cohorts. For example, in 1999-2000, only 11 percent of people age 45 to 64 had a good diet and 19 percent had a poor diet (data not shown).

The mean HEI score for older people was 67.6 in 1999-2000 (table 2). The highest mean HEI component score for older Americans was for variety (8.2 on a scale of 10) followed by cholesterol (8.1). Overall, 59 percent of older people had a maximum score of 10 for variety and 73 percent had a maximum score of 10 for cholesterol; that is, they met the dietary recommendation. (The percentages of people with maximum scores are not shown in the tables.)

Older people had the lowest mean scores for fruits (5.5) and milk (5.9). Less than 30 percent of people age 65 and over met the dietary recommendations for fruits and milk. Average scores for the other HEI components were between 6.4 and 7.1. In general, older people could improve on all aspects of their diets.

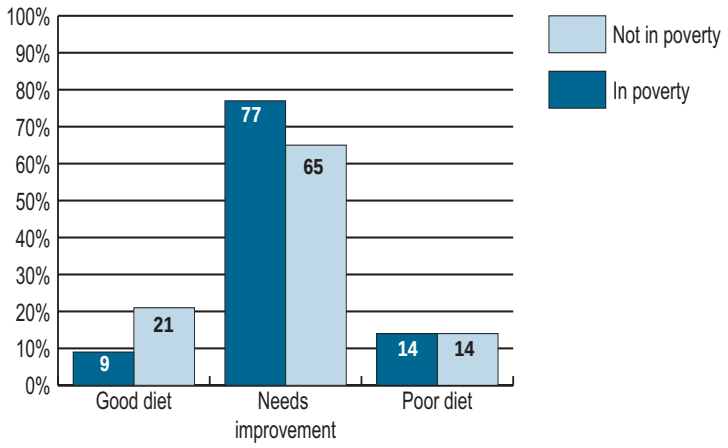
Healthy Eating Index Scores Varied by Poverty Status

HEI scores significantly varied by the poverty status of older Americans (fig. 1). In 2000, the poverty threshold for a single older person was $8,259 and $10,419 for an older couple. In 1999-2000, 21 percent of people age 65 and over who were not in poverty had a good diet, compared with 9 percent of people age 65 and over who were in poverty. Older people in poverty had significantly lower HEI component scores on cholesterol, compared with people not in poverty (data not shown).

Trends in the Healthy Eating Index: A Decade

How has the quality of older people's diet changed over time? The overall HEI score of people age 65 and over has not changed appreciably since 1989-90 (the first years the Index was calculated, table 2). In 1989-90, the HEI for older Americans was 69.1 and in 1999-2000 it was 67.6, a change that was not statistically significant. Over this time, HEI component scores for

Figure 1. Healthy Eating Index rating for people age 65 and over, by poverty status, 1999-2000



older people significantly declined for meat, cholesterol, and sodium; component scores significantly increased for saturated fat and variety (table 2).

These findings provide a better understanding of the types of dietary changes needed to improve older Americans' eating patterns. The HEI is an important tool that can be used to provide guidance to target and design nutrition education and public health interventions.

Note: For more details on the Healthy Eating Index and how it is computed, see Basiotis, P.P, Carlson, A., Gerrior, S.A., Juan, W.Y., and Lino, M. (authors in alphabetical order) (2002). *The Healthy Eating Index: 1999-2000* (CNPP-12). U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. Also available at www.cnpp.usda.gov.

Federal Studies

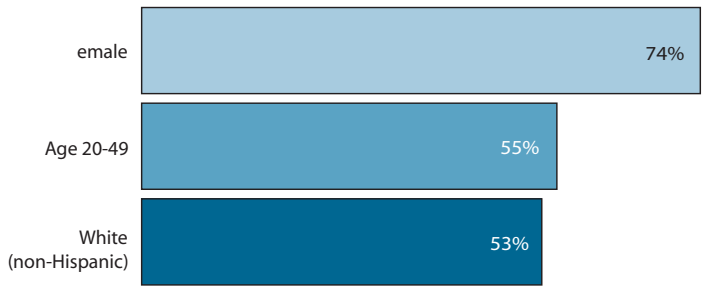
Eligible Nonparticipants in the Food Stamp Program

The caseload of the Food Stamp Program (FSP) declined sharply in the late 1990s, a period characterized by an unusually strong economy and by major changes in public assistance following the welfare reform legislation of 1996. Studies have shown that the food stamp caseload declined not only because circumstances of many households improved enough to make them ineligible for benefits but also because a smaller percentage of the potentially eligible households were participating in the program. To shed more light on this issue, the Economic Research Service of the U.S. Department of Agriculture funded a national study of FSP accessibility at the local level. This study was conducted in 2000-01 and collected information describing the policies and practices in local food stamp offices, the characteristics of participant and nonparticipant households, and why some eligible households do not participate in the FSP.

Most eligible nonparticipant households headed by females

Eligible FSP nonparticipant households in 2000-01 were headed predominantly by females (74 percent), individuals age 20 to 49 (55 percent), or non-Hispanic Whites (53 percent). Thirty-one percent were headed by individuals age 60 or older. One-third of households included children, and 37 percent included elderly members.

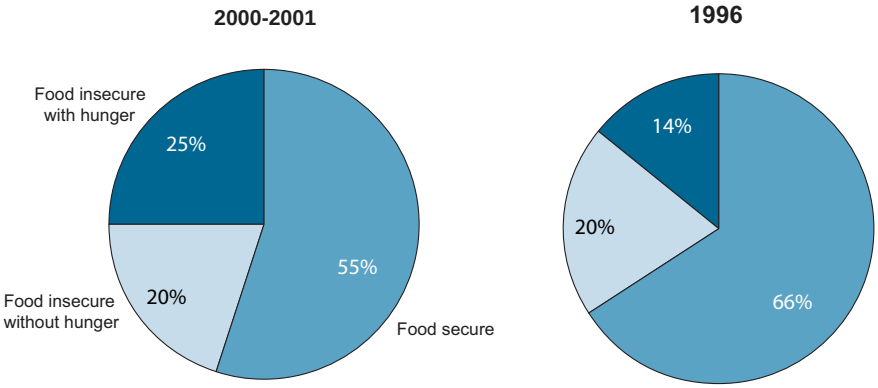
Characteristics of household heads who are eligible nonparticipants in the Food Stamp Program



One-fourth of eligible nonparticipants are food insecure with hunger

Food security measures a household's access to food that provides a nutritionally adequate diet for its members. Forty-five percent of FSP nonparticipant households were food insecure, 25 percent of whom were food insecure with hunger. This is an increase from 1996; 34 percent of FSP nonparticipant households were food insecure, 14 percent of whom were food insecure with hunger.

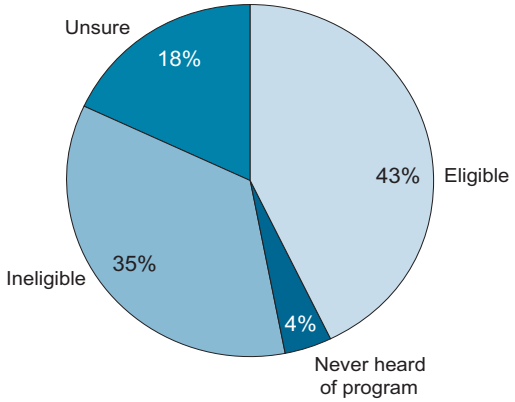
Food security status of eligible nonparticipant households in the Food Stamp Program



Many eligible nonparticipants do not know they are eligible

Less than half of nonparticipants thought they might be eligible for food stamp benefits. One-third did not think they were eligible, 18 percent were unsure whether they would qualify for benefits, and a small percentage had never heard of the FSP. Households that thought they were ineligible for food stamps or who were unsure about their eligibility had somewhat higher incomes and more assets than did those who believed they were eligible for benefits.

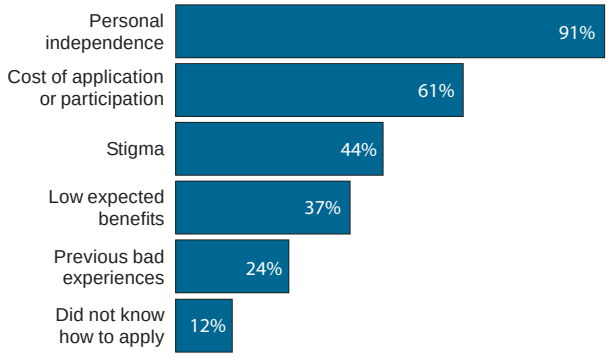
Perceived Food Stamp Program eligibility, by eligible nonparticipant households



Personal independence important to people not wanting to apply

While the majority (69 percent) of eligible nonparticipants reported they would apply for food stamps if they found out they were eligible, 27 percent reported they would not apply and the remainder were unsure. People gave a variety of reasons for not wanting to apply, or being unsure about applying, for food stamp benefits. The most common reasons given were related to a desire for personal independence.

Reasons eligible nonparticipant households do not participate in the Food Stamp Program[1]



[1]Includes nonparticipant households who would not necessarily apply to the FSP even if they had known they were eligible. Respondents could cite more than one reason.

Source: Bartlett, S., Burstein, N. (Abt Associates Inc.), & Andrews, M. (ERS project representative). (2004). Food Stamp Program Access Study: Eligible nonparticipants (E-FAN-03-013-2). U.S. Department of Agriculture, Economic Research Service.

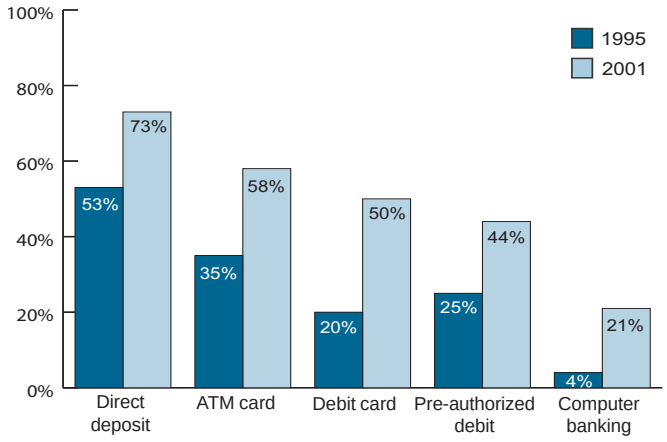
Consumers and Electronic Banking, 1995-2003

The variety of electronic banking technologies available in the marketplace has expanded greatly in recent years. For financial institutions, such technologies as direct deposit, automated teller machines, and debit cards can speed processing and reduce costs. Other products and services, for example, computer banking and stored-value payroll cards (a card on which monetary value is stored), are viewed as ways to retain existing customers and attract unbanked and underbanked customers. This article uses data from two nationwide surveys—the Federal Reserve Board's Survey of Consumer Finances and the University of Michigan Survey Research Center's Surveys of Consumers—to examine consumer use of e-banking technologies, particularly as the use relates to consumer demographic characteristics and perceptions and the relationship between these factors and the characteristics of selected e-banking products and services.

Use of electronic banking on the rise

The use of electronic banking between 1995 and 2001 became more widespread among U.S. households. The proportion of households banking by computer grew fivefold between 1995 and 2001, and the proportions using debit cards more than doubled.

Percentage of U.S. households using various electronic banking technologies, 1995 and 2001



Younger people likely to conduct banking business via computer

Households that conducted their banking business via computer in 2001 were more likely than others to be headed by a younger person. More than half of households conducting banking business in this manner were headed by a person age 44 or younger. Less than 10 percent were headed by a person age 65 or older.

Households using computer banking, by age of household head

Age	Percent[1]
<35	28
35-44	30
45-54	26
55-64	11
65-74	4
75+	3

[1]Percentages do not add to 100 because of rounding.

Preauthorized debit users likely to be White

Preauthorized debits allow consumers to set up automatic bill payments, usually on a specific date and for a specific amount. In 2001, 80 of 100 households using preauthorized debit were headed by a White person; 10 of 100, by a Black person; 4 of 100, by a Hispanic person; and 3 of 100 were headed by a person of another race or ethnicity.

Households using preauthorized debit, by race/ethnicity of head

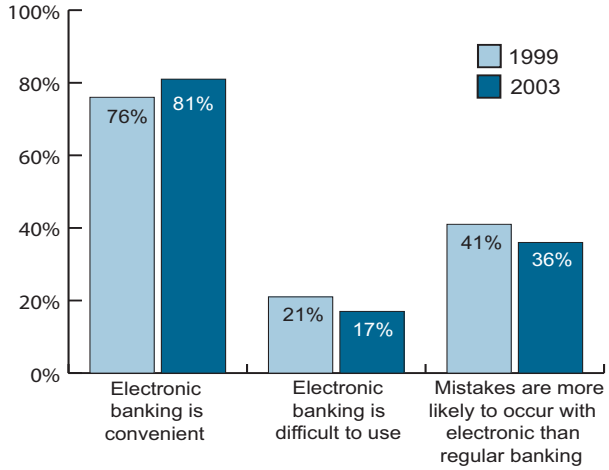
Race/ethnicity	Percent[1]
White	84
Black	10
Hispanic	4
Other	3

[1]Percentages do not add to 100 percent because of rounding.

Perceptions of electronic banking becoming more positive

Between 1999 and 2003, consumers' perceptions of electronic banking became more positive in terms of convenience, familiarity and ease of use, and security and privacy. In 2003, 81 percent of people thought electronic banking was convenient (compared with 76 percent in 1999) and 36 percent thought mistakes were more likely to occur with electronic than with regular banking (compared with 41 percent in 1999).

Percentage of people who strongly agree or agree with selected perceptions of electronic banking



Source: Anguelov, C.E., Hilgert, M.A., & J.M. Hogarth. (2004). U.S. consumers and electronic banking, 1995-2003. Federal Reserve Bulletin (Winter)1-18.

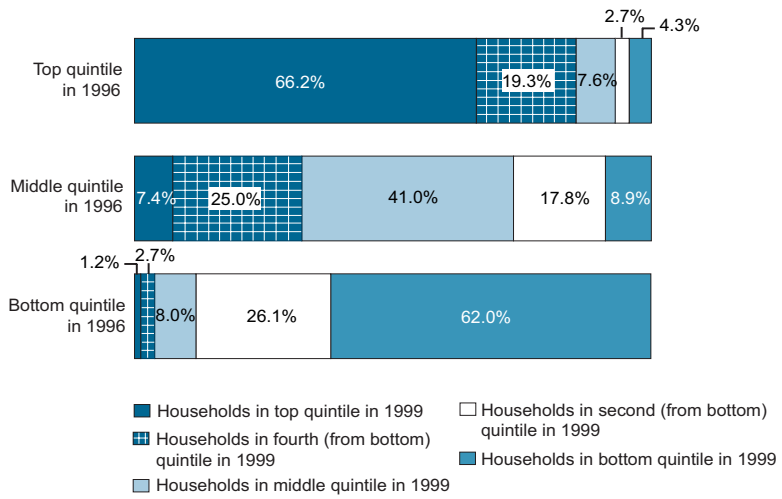
Movements in the U.S. Income Distribution, 1996-99

As measured by the most recent income data available from the Current Population Survey (CPS), between 1996 and 2002, median household income increased 4.7 percent more than did inflation. That statistic compares a "snapshot" of households in 1996 with another "snapshot" in 2002. It is not a picture of what happened to the same households over that period. Medians, like those from the CPS, can conceal an enormous amount of movement in the income of individual households. This report uses the most recent longitudinal data available from the Survey of Income and Program Participation (SIPP) to examine movements in the incomes of the same households within the income distribution during the first part of this period—1996 to 1999. SIPP data represent about 100 million U.S. households during this period. Income quintiles were constructed for each year (a quintile represents a 20-percent group of data from a frequency distribution).

More stability at top and bottom quintiles

Households in the top and bottom quintiles of the income distribution experienced the most stability from 1996 through 1999. Sixty-six percent of households starting in the top quintile and 62 percent of households starting in the bottom quintile in 1996 remained in these respective quintiles in 1999. In comparison, 41 percent of households that started in the middle quintile remained in this quintile in 1999.

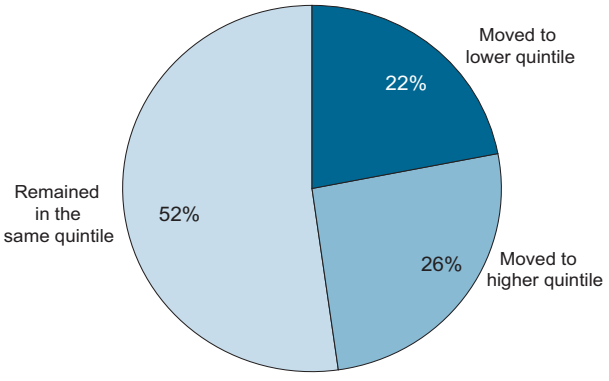
Percent distribution of households by income quintile, 1996 and 1999



More upward than downward movement

Overall, 52 percent of households remained in the same income quintile from 1996 through 1999. More households experienced an upward movement in the income distribution than a downward movement: 26 percent compared with 22 percent.

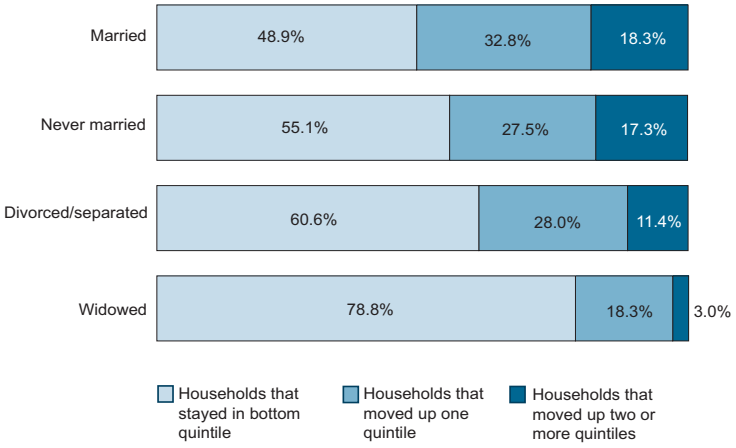
Percent distribution of households by movement in income quintiles, 1996 through 1999



Being a widow/widower affects income

Widowed householders tended to remain in the same income quintile or move down, compared with householders who were not widowed. For example, 79 percent of widows or widowers remained from 1996 through 1999 in the bottom quintile, compared with 61 percent of divorced or separated householders, 55 percent of never-married householders, and 49 percent of married householders.

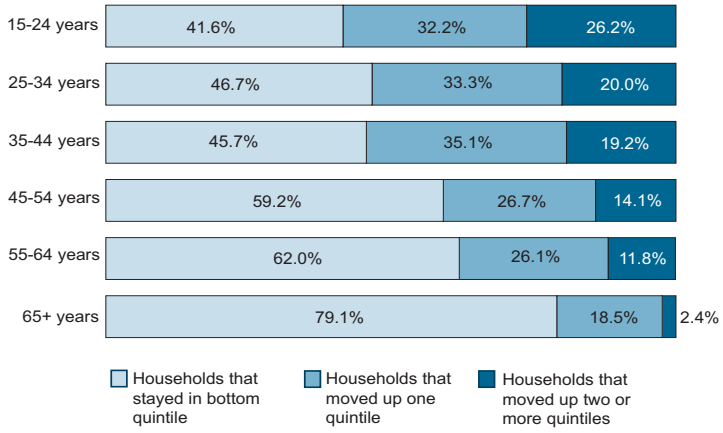
Percent distribution of household movement across income quintiles between 1996 and 1999 for households in bottom quintile in 1996, by marital status of householder



Younger householders experience greater income volatility

Younger, rather than older, householders were more likely to move up from a lower income quintile as well as move down from the top income quintile between 1996 and 1999. For example, over one-half of all householders under age 45 in the bottom income quintile in 1996 experienced increases in income that moved them up one or more quintiles by 1999. By comparison, over one-half of all householders age 45 and over in the bottom income quintile in 1996 remained in this quintile in 1999.

Percent distribution of household movement across income quintiles between 1996 and 1999 for households in bottom quintile in 1996, by age of householder



Source: J.J. Hisnanick & K.G. Walker. 2004. Dynamics of Economic Well-Being: Movements in the U.S. Income Distribution, 1995-1999. Current Population Reports, U.S. Census Bureau, P70-95.

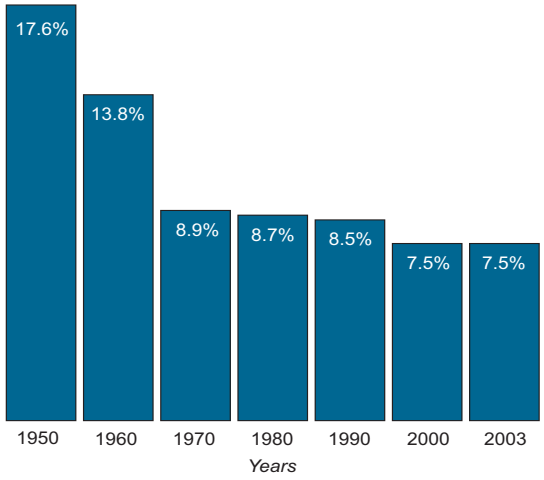
Self-employment in the United States

In 2003, 10.3 million workers were self-employed. The self-employment rate (the proportion of total employment made up of the self-employed) was 7.5 percent, up slightly from the rate in 2002. Reflecting the protracted shift away from agricultural self-employment, most (90.9 percent) of the self-employed in 2003 were in nonagricultural industries; in contrast, this proportion was 56.7 percent in the late 1940s. Using data from the Current Population Survey (CPS), the author of this article discusses the CPS measurement of self-employment, addresses historical trends in self-employment, and provides an overview of the characteristics of the self-employed.

Self-employment has steadily declined since 1950

The proportion of workers who are unincorporated self-employed (the measure that is typically used in government publications) has fallen from 17.6 percent of workers in 1950 to 7.5 percent in 2003. Agricultural employment is a main reason for this decline. A second explanation is the increased likelihood of businesses to incorporate, often for tax purposes; consequentially, workers in these businesses are not officially labeled as "self-employed."

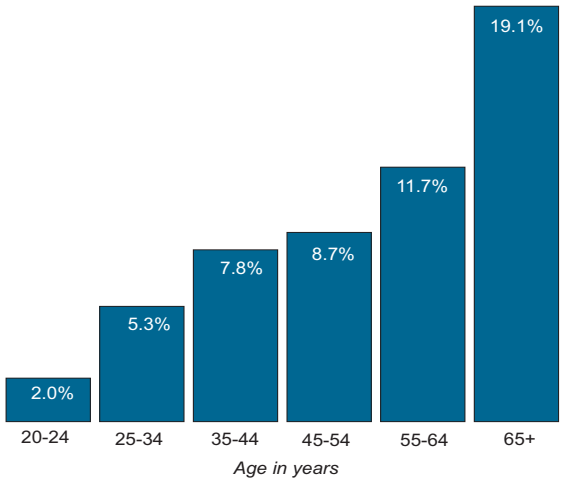
Percent of workers who are self-employed, by year



Older workers more likely to be self-employed

In 2003, the unincorporated self-employment rate for workers age 65 and older was 19.1 percent, compared with 2.0 percent for their counterparts age 20 to 24. Younger workers rarely have acquired the capital and managerial skills needed to start a business; whereas, many older workers may be able to obtain these resources through their own efforts or through access to available credit.

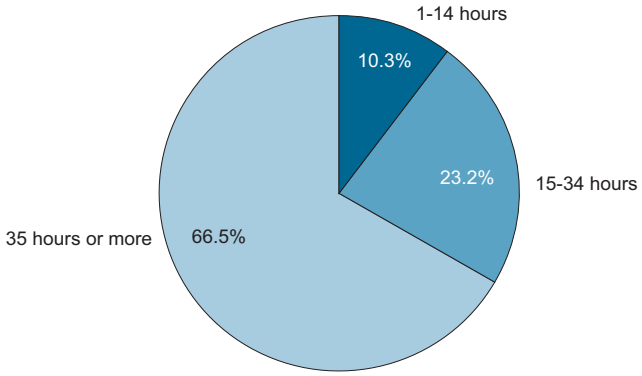
Percent of workers who are self-employed, by age



1 in 3 self-employed are part-time workers

In 2003, 10 percent of the nonagricultural self-employed worked 1 to 14 hours per week, 23 percent worked 15 to 34 hours per week, and 67 percent worked 35 hours or more per week. Self-employed females were more likely to work part-time than were self-employed males.

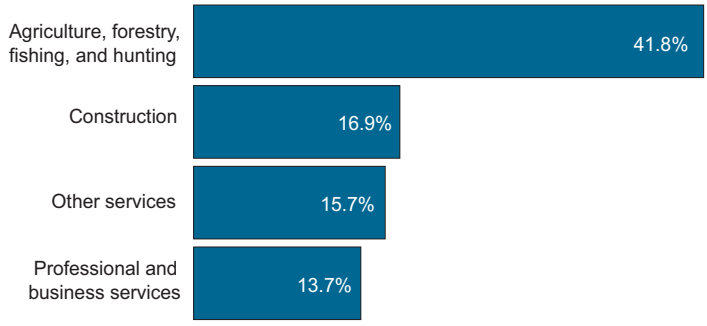
Percent distribution of hours at work per week for nonagricultural self-employed workers



Agricultural workers most likely to be self-employed

Among workers in 2003, the probability of being unincorporated self-employed was highest for workers in agriculture, forestry, fishing, and hunting; construction; other services (e.g., barber shops, personal and household goods repair and maintenance, and nail/beauty salons); and professional and business services.

Percent of workers who are self-employed, by industries with highest self-employment rates



Source: Hipple, S. (2004). Self-employment in the United States: An update. Monthly Labor Review, 127(7), 13-23.

Journal Abstracts

The following abstracts are reprinted verbatim as they appear in the cited source.

Bhargava, A. (2004). Socio-economic and behavioural factors are predictors of food use in the National Food Stamp Program Survey. *British Journal of Nutrition, 92,* 497-506.

The unhealthy dietary patterns in the USA especially among low-income households demand complex strategies for health promotion. The present paper analysed the proximate determinants of 7 d food use by 919 participants in the National Food Stamp Program Survey conducted in 1996. The households' consumption of dietary energy, carbohydrate, protein, fibre, saturated, monounsaturated and polyunsaturated fats, Ca, Fe, ß-carotene and vitamin C were explained by background, socio-economic and behavioural factors. Certain methodological issues arising in modelling food use data were addressed. The results showed that the subjects' knowledge of the US Department of Agriculture food pyramid, reading nutrition labels, adopting a low-fat diet, selecting fruits and vegetables, saving money at grocery stores and frequency of shopping trips were often significantly associated ($P<0.05$) with the densities of nutrient use. The results identified certain aspects of nutrition education programmes that deserve greater emphasis for improving diet quality. The model for energy intake indicated that disbursing half the food stamp benefits on a 2-week basis and better shopping practices can enhance food availability.

Fan, J.X., & Zick, C.D. (2004). The economic burden of health care, funeral, and burial expenditures at the end of life. *The Journal of Consumer Affairs, 38*(1), 35-55.

Research suggests that widows and widowers experience substantial economic vulnerability. Using nationally representative data from the Consumer Expenditure Surveys 1980-2000, we describe pre-widowhood shifts in medical and funeral/burial expenditures and discuss how these changes may affect post-widowhood economic well-being. Our analyses suggest that funeral/burial and medical expenditures, when combined, typically constitute a 63.1% income share for recently widowed households. Discussion focuses on what role consumer educators can play in helping families better manage end-of-life expenditures.

Glanz, K., & Hoelscher, D. (2004). Increasing fruit and vegetable intake by changing environments, policy and pricing: restaurant-based research, strategies, and recommendations. *Preventive Medicine, 39,* S88-S93.

Background. Restaurants are among the most important and promising venues for environmental, policy, and pricing initiatives to increase fruit and vegetable (F&V) intake. This article reviews restaurant-based environmental, policy and pricing strategies for increasing intake of fruits and vegetables and identifies promising strategies, research needs, and innovative opportunities for the future.
Methods. The strategies, examples, and research reported here were identified through an extensive search of published journal articles, government documents, the internet, and inquiries to leaders in the field. Recommendations were expanded based on discussion by participants in the CDC/ACS-sponsored Fruit and Vegetable, Environment Policy and Pricing Workshop held in September of 2002.
Results. Six separate types of restaurant-based interventions were identified: increased availability, increased access, reduced prices and coupons, catering policies, point-of-purchase (POP) information, and promotion and communication. Combination approaches have also been implemented. Evaluation data on these interventions show some significant impact on healthful diets, particularly with point-of-purchase information. However, most published reports emphasize low-fat eating, and there is a need to translate and evaluate interventions focused on increasing fruit and vegetable intake.
Conclusions. Several models for changing environments, policy and pricing to increase fruit and vegetable availability, access, attractiveness and consumption in restaurants have been tested and found to have some promise. There is a need to evaluate fruit and vegetable-specific strategies; to obtain data from industry; to disseminate promising programs; and to enhance public-private partnerships and collaboration to expand on current knowledge.

Hedley, A.A., Ogden, C.L., Johnson, C.L., Carroll, M.D., Curtin, L.R., & Flegal, K.M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA, 291*(23), 2847-2850.

Context The prevalence of overweight and obesity has increased markedly in the last 2 decades in the United States.

Objective To update the US prevalence estimates of overweight in children and obesity in adults, using the most recent national data of height and weight measurements.
Design, Setting, and Participants As part of the National Health and Nutrition Examination Survey (NHANES), a complex multistage probability sample of the US noninstitutionalized civilian population, both height and weight measurements were obtained from 4115 adults and 4018 children in 1999-2000 and from 4390 adults and 4258 children in 2001-2002.
Main Outcome Measure Prevalence of overweight (body mass index [BMI] ≥95th percentile of the sex-specific BMI-for-age growth chart) among children and prevalence of overweight (BMI, 25.0-29.9), obesity (BMI ≥30.0), and extreme obesity (BMI ≥40.0) among adults by sex, age, and racial/ethnic group.
Results Between 1999-2000 and 2001-2002, there were no significant changes among adults in the prevalence of overweight or obesity (64.5% vs 65.7%), obesity (30.5% vs 30.6%), or extreme obesity (4.7% vs 5.1%), or among children aged 6 through 19 years in the prevalence of at risk for overweight or overweight (29.9% vs 31.5%) or overweight (15.0% vs 16.5%). Overall, among adults aged at least 20 years in 1999-2002, 65.1% were overweight or obese, 30.4% were obese, and 4.9% were extremely obese. Among children aged 6 through 19 years in 1999-2002, 31.0% were at risk for overweight or overweight and 16.0% were overweight. The NHANES results indicate continuing disparities by sex and between racial/ethnic groups in the prevalence of overweight and obesity.
Conclusions There is no indication that the prevalence of obesity among adults and overweight among children is decreasing. The high levels of overweight among children and obesity among adults remain a major public health concern.

Hossain, F. & Onyango, B. (2004). Product attributes and consumer acceptance of nutritionally enhanced genetically modified foods. *International Journal of Consumer Studies, 28*(3), 255-267.

Using data from a national survey, this study analyses US consumers' acceptance of genetically modified foods that provide additional nutritional benefits. Using an ordered probit model, this study examines the relation between the willingness to consume genetically modified foods and consumers' economic, demographic and value attributes. Empirical results suggest that despite having some reservations, especially about the use of biotechnology in animals, American consumers are not decidedly opposed to food biotechnology. Consumers' economic and demographic variables are only weakly related to their acceptance of food biotechnology, especially when technology involves plant-to-plant DNA transfer. However, public trust and confidence in various private and public institutions are significantly related to their acceptance of food biotechnology. Overall, consumer acceptance of bioengineered foods is driven primarily by public perceptions of risks, benefits and safety of these food products.

Kwon, H-K., Zuiker, V.S., & Bauer, J.W. (2004). Factors associated with the poverty status of Asian immigrant householders by citizenship status. *Journal of Family and Economic Issues, 25*(1), 101-120.

As a response to changing profiles of the Asian population in the United States, this study examines the demographic, human capital, and acculturation factors that are associated with the official poverty status of Asian immigrant householders by their U.S. citizenship status. From the 1990 Census Public Use Microdata Sample (Census of Population and Housing, 1990a), responses from 229,004 Asian householders are analyzed using hierarchical bivariate logistic regression. The results suggests that high levels of human capital and acculturation reduce the odds of Asian householders living below the official poverty threshold, regardless of their citizenship status. The degree to which the selected variables are associated with poverty status varies by citizenship status.

Zizza, C., Herring, A.H., Stevens, J., & Popkin, B.M. (2004). Length of hospital stays among obese individuals. *American Journal of Public Health, 94*(9), 1587-1591.

Objectives. We examined lengths of hospital stay among individuals categorized according to weight status.
Methods. We used data from the First National Health and Nutrition Examination Survey Epidemiologic Followup Survey to estimate length-of-stay differences.
Results. Individuals with body mass indexes (BMIs) of 35 kg/m^2 or above, those with BMIs of 30 to 34 kg/m^2, and those with BMIs of 25 to 29 kg/m^2 had crude length-of-stay rates greater than those of normal-weight individuals. Association between BMI and length of stay varied over time.
Conclusions. Obese individuals experience longer hospital stays than normal-weight individuals.

Price Changes in the Thrifty Food Plan Versus the Consumer Price Index for Food: Why the Difference?

From June 2003 to June 2004, the cost of the Thrifty Food Plan (TFP or the Plan) increased 5.8 percent for the reference family (a husband and wife, ages 20 to 50, with two children ages 6 to 8 and 9 to 11). However, the cost of food as gauged by the Consumer Price Index (CPI) for food, the standard measure for food price changes, increased 3.7 percent over this time. The difference between these increases led to a question: Why did the cost of the TFP exceed the rate of food inflation? The answer relates to the TFP containing only food consumed at home and the types of foods in the Plan.

Two aspects of the TFP result in its price changes differing from those of the CPI for food and the CPI for food at home: (1) an assumption of the TFP that all food is prepared at home and (2) the nutritious diet that the TFP represents. The TFP consists of food purchased at stores and prepared at home (see box). From June 2003 to June 2004, the price of food "at home" (food purchased at grocery and other food stores) rose more than did the price of food "away from home" (all meals purchased at fast-food establishments, full-service restaurants, cafeterias, and other similar establishments): 4.4 percent versus 2.8 percent. Competitive pricing at many fast-food establishments moderated price increases for food purchased away from home.

Regarding the second aspect of the TFP, the CPI for food at home is based on a market basket of what households *actually buy*, which, as it turns out, is not the nutritious market basket upon which the TFP is based.

Estimates of expenditure shares show that the TFP is more heavily weighted to fruits and vegetables, milk products, and meat and meat alternates than is the CPI for food at home. Compared with the CPI for food at home, the TFP is less heavily weighted to fats, oils, sweets, and miscellaneous foods (e.g., spices, seasonings, condiments, and sauces)—because it represents a nutritious market basket. It is not

The Thrifty Food Plan

The Thrifty Food Plan (TFP) represents a nutritious diet at a minimal cost. The Plan has a set of 12 market baskets of nutritious foods (one for each of 12 different age-gender groups) and a cost attached to each market basket. Monthly cost updates of the Plan, as well as periodic revisions of the market baskets to reflect current dietary guidance, are issued by the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion. The June cost of the TFP for the reference family is used as the basis for food stamp allotments in the next fiscal year (October to October). (Approximately 8.2 million households participated in the Food Stamp Program in fiscal year 2002.)

Expenditure[1] shares for the TFP and the CPI for food at home

	TFP	CPI food at home
Grains	14.6	14.6
Fruits/vegetables	26.6	18.5
Milk products	13.0	10.2
Meat/meat alternates	39.3	28.0
Other (fats, oils, sweets, and miscellaneous foods)	6.5	28.7

[1] Approximate expenditure shares based on most current data.

surprising that the CPI for food at home is heavily weighted to fats, oils, sweets, and miscellaneous foods because it is based on actual household spending patterns. The results of the most recent (1999-2000) Healthy Eating Index show that only 10 percent of the population has a "good diet." This finding supports the spending patterns for fats, oils, sweets, and miscellaneous foods as shown in the CPI.

Price updates of the TFP and the CPI for food at home will not be uniform because the various food groups have different expenditure shares in each. Because the TFP increased at a faster rate than was the case for the CPI for food at home during the June 2003-2004 period, one might expect those food groups with a larger expenditure share in the TFP than in the CPI for food at home to have a greater price increase. That is, the price of milk products, meat, and fruits and vegetables would have increased more than the price of "other foods" (fats, oils, sweets, and miscellaneous foods).

The data on the prices of food support this lack of uniformity between the TFP and the CPI for food at home. From June 2003 to June 2004, the price of milk (which composes a large proportion of milk products in the TFP) increased 27.2 percent, the price of red meat and poultry (which composes a large proportion of meat/meat alternates) increased 10.6 and 8.9 percent, respectively, and the price of potatoes (which composes a significant proportion of vegetables) increased 2.6 percent. The price of the fats, oils, sweets, and miscellaneous foods group, however, increased only 1.5 percent over this period.

What the future holds for price changes in the TFP depends on the composition of its market baskets and changes in food prices. For example, from June 2003 to June 2004, prices of more healthful foods grew at a faster pace than was the case for less healthful food choices. This pace caused the costs of the TFP for the reference family to increase at a greater rate than the CPI for food. If the reverse were to occur—the price of less healthful food growing at a faster pace—then the increase in the cost of the TFP would not exceed the CPI for food.

Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average, December 2004[1]

AGE-GENDER GROUPS	WEEKLY COST[2]				MONTHLY COST[2]			
	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan	Thrifty plan	Low-cost plan	Moderate-cost plan	Liberal plan
INDIVIDUALS[3]								
CHILD:								
1 year	$17.90	$22.30	$26.30	$31.80	$77.60	$96.80	$113.90	$137.90
2 years	17.80	22.10	26.50	31.80	77.30	95.80	114.80	138.00
3-5 years	19.70	24.30	30.10	36.20	85.20	105.20	130.40	156.90
6-8 years	24.60	32.70	40.30	47.00	106.80	141.60	174.60	203.80
9-11 years	28.80	36.70	47.20	54.80	124.70	159.10	204.30	237.30
MALE:								
12-14 years	30.10	41.50	51.40	60.80	130.30	179.70	222.70	263.20
15-19 years	31.10	42.70	53.60	62.40	134.80	185.10	232.00	270.30
20-50 years	33.20	42.90	53.60	65.50	144.00	185.70	232.40	283.80
51 years and over	30.50	41.10	50.60	60.90	132.20	178.00	219.20	263.90
FEMALE:								
12-19 years	30.00	36.00	43.80	52.80	130.20	156.00	189.80	228.70
20-50 years	30.10	37.50	45.80	59.10	130.30	162.40	198.60	256.30
51 years and over	29.80	36.50	45.50	54.70	129.20	158.10	197.20	237.10
FAMILIES:								
FAMILY OF 2[4]:								
20-50 years	69.60	88.40	109.40	137.10	301.70	382.90	474.10	594.00
51 years and over	66.40	85.30	105.70	127.20	287.50	369.70	458.10	551.00
FAMILY OF 4:								
Couple, 20-50 years and children—								
2 and 3-5 years	100.80	126.70	156.00	192.70	436.80	549.10	676.20	834.90
6-8 and 9-11 years	116.70	149.70	186.90	226.40	505.80	648.80	809.90	981.20

[1]Basis is that all meals and snacks are purchased at stores and prepared at home. For specific foods and quantities of foods in the Thrifty Food Plan, see *Family Economics and Nutrition Review*, Vol. 13, No. 1 (2001), pp. 50-64; for specific foods and quantities of foods in the Low-Cost, Moderate-Cost, and Liberal Plans, see *The Low-Cost, Moderate-Cost, and Liberal Food Plans, 2003 Administrative Report* (2003). All four Food Plans are based on 1989-91 data and are updated to current dollars by using the Consumer Price Index for specific food items.

[2]All costs are rounded to nearest 10 cents.

[3]The costs given are for individuals in 4-person families. For individuals in other size families, the following adjustments are suggested: 1-person—add 20 percent; 2-person—add 10 percent; 3-person—add 5 percent; 4-person—no adjustment; 5- or 6-person—subtract 5 percent; 7- (or more) person—subtract 10 percent. To calculate overall household food costs, (1) adjust food costs for each person in the household and then (2) sum these adjusted food costs.

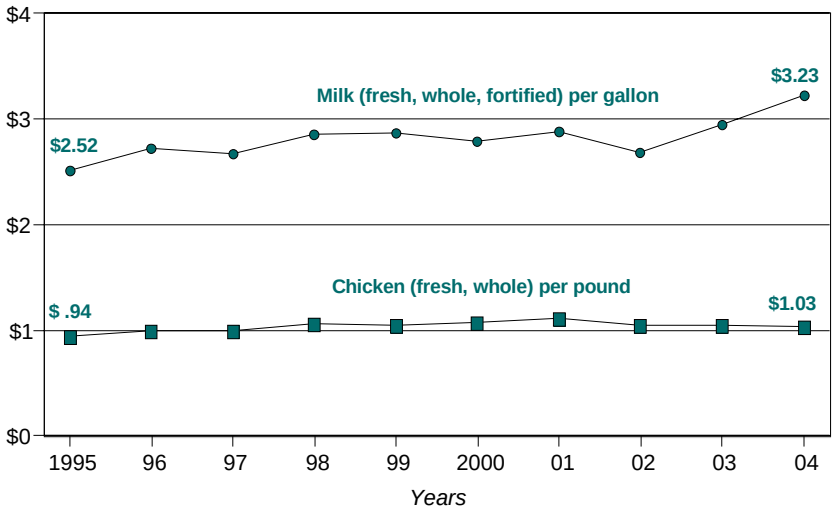
[4]Ten percent added for family size adjustment.

Consumer Prices

Average percent change for major budgetary components

Group	Annual average percent change from December of previous year to December: 1990	1995	2000	Percent change 12 months ending with December 2004
All Items	6.1	2.5	3.4	3.3
Food	5.3	2.1	2.8	2.7
Food at home	5.8	2.0	3.0	2.4
Food away from home	4.5	2.2	2.4	3.0
Housing	4.5	3.0	4.3	3.0
Apparel	5.1	0.1	-1.9	-0.2
Transportation	10.4	1.5	4.3	6.5
Medical care	9.6	3.9	4.2	4.2
Recreation	NA	2.8	1.4	0.7
Education and communication	NA	4.0	1.2	1.5
Other goods and services	7.6	4.3	4.5	2.5

Price for milk and chicken, as of December in each year



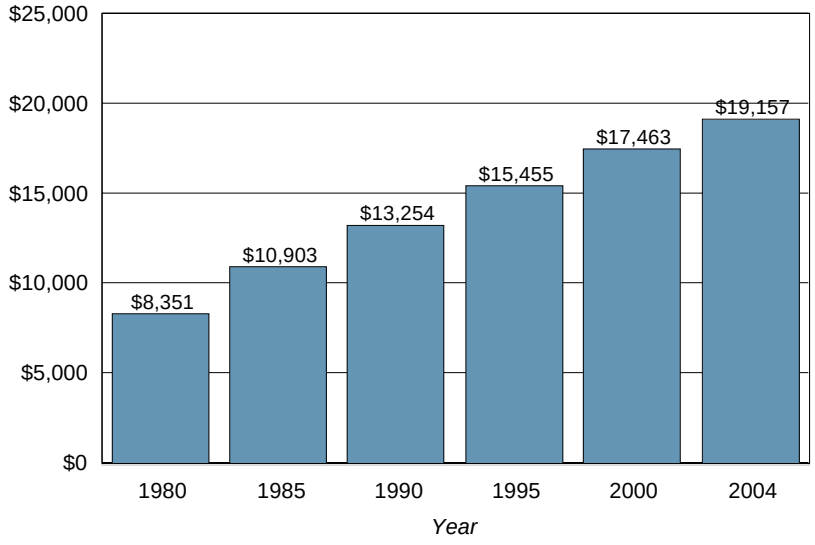
U.S. Poverty Thresholds and Related Statistics

Poverty Thresholds in 2004, by size of family and number of related children under age 18

Size of family unit	Related children under age 18								
	None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person									
Under age 65	$9,827								
Age 65 and over	9,060								
Two people									
Householder under age 65	12,649	$13,020							
Householder age 65 and over	11,418	12,971							
Three people	14,776	15,205	$15,219						
Four people	19,484	19,803	19,157	$19,223					
Five people	23,497	23,838	23,108	22,543	$22,199				
Six people	27,025	27,133	26,573	26,037	25,241	$24,768			
Seven people	31,096	31,290	30,621	30,154	29,285	28,271	$27,159		
Eight people	34,778	35,086	34,454	33,901	33,115	32,119	31,082	$30,818	
Nine people or more	41,836	42,039	41,480	41,010	40,240	39,179	38,220	37,983	$36,520

Source: U.S Census Bureau.

Poverty thresholds over time for a family of four (including two children)



Source: U.S Census Bureau.

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