Appendix E
Effect on Nutrient Estimates of Using Different Nutrient Databases

This report of the *Family Child Care Homes Legislative Changes Study* addresses the question of whether the food and nutrient composition of meals offered to children in CACFP family child care has changed since tiering was implemented. To ensure comparability of data for the two analysis periods, 1999 meal data were collected using essentially the same instruments that were used in the 1995 *Early Childhood and Child Care Study*. In addition, the same version of the University of Texas' Food Intake and Analysis System (FIAS 2.3) was selected for coding and nutrient analysis as was used for the earlier study. Despite the availability of a newer version (FIAS 3.98), it was felt that using FIAS 2.3 would allow the cleanest comparisons of the 1999 Tier 2 menu data with the 1995 menu data—that is, the comparisons would not be affected by technical differences between the old and new databases.[1] However, using FIAS 2.3 might not yield the best possible point-in-time estimates of the food and nutrient content of the 1999 menus, a limitation that has been acknowledged in Appendix C of this report. For this reason, a substudy was conducted to examine the differences between the older and newer versions of the nutrient database and the implications for nutrition-related findings of the study.

The first section of this appendix describes the methodology used to estimate the effect of a change in nutrient database on the nutrient composition of meals offered by a subsample of Tier 2 providers in 1999. It includes a description of the sample and procedures for applying the new database and analyzing the results. The subsequent sections include a summary of results and conclusions.

Methodology

Nutrient databases are updated periodically to reflect real changes in the nutrient composition of foods and to make improvements in the quality of the data. Real changes in food products most often occur when manufacturers change their ingredient formulation, for example, to lower the fat content or to increase iron content of a food. Many of the changes, however, are due to new foods in the marketplace, improved analytic techniques, and a better understanding of common food practices. All of these changes hold the potential for influencing nutrient analysis results, although the direction and magnitude of the differences for a particular research application cannot be predicted without conducting analyses such as those described below. There does not seem to be a single, standard method for determining whether differences in nutrient estimates derived from different nutrient analysis systems are nutritionally important. Therefore, several methods were used here.

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[1] It is important to note that neither the FIAS 2.3 nor the newer FIAS 3.98 database were completely appropriate for comparing 1995 and 1999 results, because the two databases differ in two respects. First, there are some *time-independent* differences that simply represent improvements in measurement and would be equally applicable to 1995 and to 1999. An example would be adjustments to gram weights for ingredients in particular ethnic foods based on better understanding of the foods (but not on changes in the foods themselves). Second, some differences are *time-sensitive*, reflecting changes in common food formulation practices between 1995 and 1999 (such as the reduction in fat content of many packaged foods). Ideally, one would like to compare 1995 with 1999 nutrient values by holding the time-independent elements of the database constant and allowing the time-sensitive ones to vary. Because this option was not available, the second-best approach was to hold both the time-independent and the time-sensitive elements constant, which was accomplished by using the FIAS 2.3 database for both periods.

The basic approach was to re-analyze a subsample of the Tier 2 1999 menu surveys with the newer version of the FIAS database (FIAS 3.98) and compare results with the FIAS 2.3 estimates for the same subsample. The analysis is based on calculating the mean nutrient content under both databases for all providers in the subsample. It is limited to the *nutrient composition* of meals and snacks offered; a change in nutrient database was not expected to have any effect on findings regarding foods offered. Nutrient estimates were expected to differ, however, given the nature of the changes to the FIAS system between versions 2.3 and 3.98 and preliminary evidence of differences for some nutrients.[2]

Sample

A simple random sample of 200 Tier 2 providers who completed a menu survey in 1999 was selected. Four cases were omitted from the analysis: one that was later determined to be ineligible for the main study analysis; one because the menu survey was completed for fewer than 3 days; and two because the providers served only supper and/or evening snack, meals which were not included in the database comparison. The size of the sample was based on the statistical power necessary to detect a difference of 2 percentage points or more in the mean percentage of calories from fat offered at lunch (80-percent power at 5-percent level of significance). Exhibit E.1 shows the sample sizes and percentage of providers in the subsample offering each type of meal and snack. The distribution of meals and snacks offered by providers in the subsample is very similar to the distribution for all 1999 Tier 2 providers in the study.

Coding and Analysis

Senior nutritionists at Abt Associates reviewed the coding rules, default entries, and decision rules used to enter the menu surveys in FIAS 2.3 and revised them as necessary for use with FIAS 3.98. Two nutrition coders were trained on the new features of the FIAS 3.98 system and new coding rules. The coders then entered the subsample of menu surveys using FIAS 3.98. Quality control procedures were the same as for entry of menu surveys for the main study.

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[2] Database documentation from the University of Texas indicated the addition of approximately 700 new foods. These included vegetables, margarines and spreads, fast-food sandwiches, home-prepared soups, ethnic foods in many food groups, and foods modified to be lower in fat, sodium, or sugar. Some foods' nutrient values and gram weights were updated, and standard recipes were revised to reflect current food consumption and food preparation practices.

Prior to collecting the 1999 data, Abt nutritionists performed a simple database comparison of the nutrient values for 67 of the most common foods in menus offered by 1995 family child care providers. We found that nutrient values for 40 percent of the individual *foods* varied by 20 percent or more when calculated with FIAS 2.3 vs. FIAS 3.98. Nutrient differences for a hypothetical *menu*, however, were much smaller in magnitude.

Exhibit E.1
Percentage of Tier 2 Provider Subsample Offering Specified Meals and Snacks During a Sample Week Based on Recorded Menus

	Percentage of Providers Offering Meal/Snack to Children			
	Age 1-2	Age 3-5	Age 6-12	All Ages
Breakfast	92.7%	89.3%	77.1%	91.8%
Morning snack	52.1	47.2	21.1	49.5
Lunch	98.2	94.9	48.6	95.4
Afternoon snack	90.9	92.7	89.0	92.3
Supper	10.9	14.0	16.5	14.8
Evening snack	3.6	3.4	4.6	5.1
Unweighted sample	165	178	109	196

Portion size estimates for the database comparison subsample of Tier 2 menus were derived in the same manner as the menus analyzed with FIAS 2.3 (described in Appendix C). However, since the new database consists of 8-digit rather than 7-digit food codes and also includes new foods, some additional work was required. The appropriate portion sizes were remapped to the specific food codes that appeared in the subsample of menus coded with FIAS 3.98. After portion sizes were assigned to each menu, the mean energy and nutrient estimates for the observation days were calculated using the new nutrient database.

Estimates were developed for total food energy plus all 10 nutrients included in the main analysis of the menu survey. The mean energy and nutrient content was compared—for breakfasts, lunches, and afternoon snacks for the 1999 subsample—with results obtained for the same Tier 2 homes using the FIAS 2.3 database. Separate analyses were conducted for each CACFP age group for which sufficient observations were available and for all ages combined.

Results

Comparison of the Nutrient Content of Breakfasts, Lunches, and Afternoon Snacks Relative to RDA

Exhibit E.2 shows, for each database, the mean percentage of RDA at breakfast, lunch, and afternoon snack. There were few substantive differences in the values across the three CACFP age groups (1-2, 3-5, and 6-12 years), so results are shown for all age groups combined. The largest difference between the FIAS 2.3 and 3.98 databases was a drop in the percentage of RDA for vitamin C at lunch of approximately 7 percentage points. The next largest change was an increase of about 3 percentage points in the percent of RDA for iron at breakfast. There were virtually no database-related differences in the mean percentage of RDA at afternoon snack.

Exhibit E.2
Mean Percentage of RDA Offered at Breakfast, Lunch, and Afternoon Snack: 1999 Tier 2 Subsample[a]

	Breakfast			Lunch			Afternoon Snack		
	FIAS 2.3	FIAS 3.98	Difference	FIAS 2.3	FIAS 3.98	Difference	FIAS 2.3	FIAS 3.98	Difference
Food energy	21.1%	21.3%	0.2%	28.8%	28.8%	0.0%	15.3%	15.5%	0.2%
Protein	55.4	53.5	-1.9	99.7	98.4	-1.3	33.3	32.8	-0.5
Vitamin A	58.5	59.8	1.3	68.5	66.4	-2.2	19.6	19.3	-0.3
Vitamin C	70.3	68.5	-1.8	48.1	41.5	-6.7	29.8	30.3	0.4
Calcium	35.7	34.1	-1.6	39.3	38.5	-0.8	19.7	19.2	-0.4
Iron	37.0	40.3	3.4	24.8	25.1	0.3	13.6	14.0	0.4
Un-weighted sample	180	180		187	187		181	181	

[a] All age groups combined (1-2, 3-5, and 6-12-year-olds).

With both databases, the percent of RDA exceeds the benchmark of one-third of the RDA for vitamin C at lunch and one-fourth of the RDA for iron at breakfast. The small increases in the percent of RDA for these nutrients translate to a decrease of 15 percent (range of 15-18 percent) of providers meeting the RDA benchmark for vitamin C at lunch and an increase of about 9 percent (range of 5-13 percent across age groups) meeting the RDA benchmark for iron at breakfast (Exhibit E.3). Although the majority of providers still meet the lunch benchmark for vitamin C, this finding suggests that the FIAS 2.3 estimates in this report probably overstate the true proportion of providers meeting the RDA benchmark for vitamin C at lunch. Conversely, an even larger proportion of providers meet the RDA benchmark for iron at breakfast than FIAS 2.3 estimates suggest.

To investigate the source of the vitamin C difference, an analysis was conducted to identify the foods offered in lunch menus with the largest differences in vitamin C content between the two databases. Surprisingly, hot dogs, corn dogs, and prepackaged deli ham were the most important sources of the different values. For example, 100 grams of hot dog contributed 20 milligrams (mg.) of vitamin C in the FIAS 2.3 analysis and 0 mg. in the FIAS 3.98 analysis. The newer database reflects the discovery that not all vitamin C measured in these foods is ascorbic acid, the active form of the vitamin. In the older database, erythrobate, which is present in these foods as a preservative, was counted in the total vitamin C value. Erythrobate, however, loses its vitamin C activity before the food is eaten.[3]

[3] Personal communication with Dr. Juliet Howe at the Nutrient Data Laboratory, USDA, Agricultural Research Service, Beltsville Human Nutrition Research Center, October, 2000.

Exhibit E.3
Percentage of Providers Offering At Least One-Fourth RDA at Breakfast and One-Third RDA at Lunch: 1999 Tier 2 Subsample[a]

	Breakfast			Lunch		
	FIAS 2.3	FIAS 3.98	Difference	FIAS 2.3	FIAS 3.98	Difference
Food energy	14.3%	15.9%	1.6%	17.2%	16.3%	-0.8%
Protein	100.0	100.0	0.0	100.0	100.0	0.0
Vitamin A	98.1	98.7	0.6	88.2	86.7	-1.5
Vitamin C	90.3	90.3	0.0	75.9	61.0	-15.0
Calcium	99.6	94.1	-5.4	86.0	84.7	-1.4
Iron	75.2	84.2	9.1	8.0	7.8	-0.2
Unweighted sample	180	180		187	187	

[a] All age groups combined (1-2, 3-5, and 6-12-year-olds).

A similar analysis of the increase in the iron content of breakfasts indicates that the difference is due primarily to a change in the iron values for a single brand of corn flakes cereal, oatmeal, waffles, and pancakes. The iron values for these foods are 2 to 5 times higher in the FIAS 3.98 database, most likely reflecting changes in the level of iron fortification and/or the amount of enriched grain in the product.

Comparison of the Nutrient Content of Breakfasts, Lunches, and Afternoon Snacks Relative to *Dietary Guidelines* and NRC Recommendations

The mean percentage of food energy from fat, saturated fat, and carbohydrate and the mean sodium and cholesterol values for breakfasts, lunches, and afternoon snacks offered by the subsample of 1999 Tier 2 providers were calculated, with both FIAS 2.3 and FIAS 3.98. The analysis is limited to the 3-5 and 6-12 age groups since *Dietary Guidelines* and NRC recommendations are only intended to apply to children age 2 and above.

The findings presented in Exhibit E.4 show that there were no important differences between the two nutrient databases for any of these nutrient measures for breakfast and lunch; results for afternoon snack are not shown but also indicate no database-related differences. The percentage of energy from fat, saturated fat, and carbohydrate varies by less than one percentage point for both the 3-5 and 6-12 age groups. Mean sodium values drop by 3-14 mg. at breakfast and lunch (2 percent or less) with the newer database. Cholesterol values fall by an average of 5-7 mg. (10-12 percent) at breakfast across both age groups. The change in cholesterol is the largest in magnitude and seems to be related primarily to the lower cholesterol content of pancakes, waffles, and muffins in FIAS 3.98 compared with the FIAS 2.3 database. Since mean levels of the nutrient measures examined here were all within the *Dietary Guidelines* and NRC recommended ranges with FIAS 2.3, the newer database would likely have no effect on this finding for the 1999 Tier 2 meals and snacks.

Exhibit E.4
Mean Nutrient Levels Relative to *Dietary Guidelines* and NRC Recommendations Offered at Breakfast and Lunch: 1999 Tier 2 Subsample[a]

		Breakfast			Lunch		
	Daily Recommen-dation	FIAS 2.3	FIAS 3.98	Differ-ence	FIAS 2.3	FIAS 3.98	Differ-ence
Percent of food energy from:				**Meals Offered to Children Age 3-5**			
Fat	≤ 30%	22.3	23.1	0.8	35.5	35.5	0.0
Saturated fat	<10%	10.4	9.7	-0.7	14.7	13.9	-0.8
Carbohydrate	> 55%	66.1	66.4	0.3	48.2	48.3	0.1
Cholesterol	≤ 300 mg	53.8	48.5	-5.3	50.4	48.3	-2.1
Sodium	≤ 2,400 mg	477.2	467.6	-9.6	891.9	885.3	-6.5
Unweighted sample		159	159		169	169	
Percent of food energy from:				**Meals Offered to Children Age 6-12**			
Fat	≤ 30%	21.8	22.6	0.8	37.8	37.8	0.0
Saturated fat	<10%	9.8	9.0	-0.8	15.8	15.0	-0.8
Carbohydrate	> 55%	67.2	67.4	0.2	45.3	45.3	0.0
Cholesterol	≤ 300 mg	58.5	51.8	-6.7	69.5	66.8	-2.7
Sodium	≤ 2,400 mg	553.3	550.7	-2.6	1,103.0	1,089.0	-13.8
Unweighted sample		84	84		53	53	

[a] Note that the *Dietary Guidelines* and NRC recommendations are only applicable to children beginning at 2 years of age and older. This analysis is limited to meals offered to children 3-5 and 6-12, the only CACFP age groups for which the recommendations fully apply.

Exhibit E.5 shows the proportion of providers meeting the *Dietary Guidelines* and NRC recommendation benchmarks for breakfasts and lunches offered to children 3-5 and 6-12, for the two databases. Despite the very small differences between databases in the mean percentage of energy from fat and saturated fat and the mean amount of sodium, there are some changes in the proportions of providers that meet the benchmarks at breakfast and lunch. The findings vary somewhat by age group. For meals offered to the 3-5 age group, 9 percent more Tier 2 providers are meeting the recommendation for saturated fat and 6 percent more meet the recommendation for sodium at breakfast when the newer database is used.[4] Although the majority of providers still meet the benchmark for percent of energy from fat at breakfast, approximately 4 percent fewer meet the goal when FIAS 3.98 is applied. While less fat and saturated fat are contributed by pancakes, waffles, and some doughnuts

[4] The benchmark used in this study for sodium at breakfast is one-fourth of the recommended daily maximum of 2,400 mg., or 600 mg.

Exhibit E.5
Percentage of Providers Meeting *Dietary Guidelines* and NRC Recommendations at Breakfast and Lunch: 1999 Tier 2 Subsample[a]

		Breakfast			Lunch		
	Daily Recommendation	FIAS 2.3	FIAS 3.98	Difference	FIAS 2.3	FIAS 3.98	Difference
				Meals Offered to Children Age 3-5			
Percent of food energy from:							
Fat	≤ 30%	87.8	84.0	-3.9	17.5	15.5	-2.1
Saturated fat	<10%	52.1	61.1	9.0	6.4	7.8	1.4
Carbohydrate	> 55%	92.0	92.6	0.6	8.7	9.2	0.5
Cholesterol	≤ 300 mg	72.8	74.7	2.0	98.0	98.6	0.6
Sodium	≤ 2,400 mg	77.2	82.9	5.7	31.4	32.9	1.5
Unweighted sample		159	159		169	169	
				Meals Offered to Children Age 6-12			
Percent of Food Energy from:							
Fat	≤ 30%	84.2	82.4	-1.9	3.2	2.6	-0.6
Saturated fat	<10%	63.6	68.8	5.2	0.6	3.2	2.6
Carbohydrate	> 55%	88.7	96.7	8.0	5.0	4.4	-0.6
Cholesterol	≤ 300 mg	67.8	71.4	3.6	96.3	96.3	0.0
Sodium	≤ 2,400 mg	70.6	70.6	0.1	8.1	13.0	4.9
Unweighted sample		84	84		53	53	

[a] Note that the *Dietary Guidelines* and NRC recommendations are only applicable to children beginning at 2 years of age and older. This analysis is limited to meals offered to children 3-5 and 6-12, the only CACFP age groups for which the recommendations fully apply.

served at breakfast when the newer database is used, 2-percent fat milk, oatmeal, and biscuits contribute more fat than they did with FIAS 2.3. More providers meet the benchmark for sodium at breakfast because of the lower sodium content of some cooked and ready-to-eat cereals in FIAS 3.98 relative to 2.3. The differences in the mean cholesterol content of breakfasts do not affect the proportion of providers meeting the recommended level for this nutrient.

With the exception of percent of energy from saturated fat, nutrient differences due to the database follow a somewhat different pattern for the analysis of meals offered to children 6-12 years of age (Exhibit E.5). More providers (about 5 percent) offer lunches that meet the sodium benchmark with FIAS 3.98 compared with FIAS 2.3, but this represents only a couple of providers as the number offering lunch to this age group is small (unweighted n=53). Changes in the FIAS 3.98 databases are also reflected in the proportion of providers that meet the recommendation for percent of energy from carbohydrate (an increase of 8 percent) at breakfast.

Most Tier 2 providers meet the *Dietary Guidelines* and NRC recommendation benchmarks for all nutrient measures in breakfasts offered. If FIAS 3.98 had been used, even more Tier 2 providers might be meeting the saturated fat recommendation for breakfasts offered to both the 3-5 and 6-12 age groups. It is difficult to make any inferences about the main analysis based on the difference in the proportion of providers meeting sodium recommendations at lunch for 6-12 year olds given the small sample; very few providers meet the benchmark with either database.

Conclusions

An analysis of the mean energy and nutrient content of breakfasts, lunches, and afternoon snacks offered by a representative sample of 196 Tier 2 providers was conducted to compare the FIAS 2.3 nutrient database with the newer 3.98 version. It was expected that, if differences were large enough, they could lead to substantively different conclusions regarding the nutrient composition of CACFP Tier 2 meals in 1999 and possibly the estimated 1995-99 differences due to tiering. The analyses presented in this appendix provide little evidence that differences between the databases affect the conclusions drawn about the nutrient composition of CACFP Tier 2 meals in 1999. There are three exceptions: (1) the FIAS 2.3 estimates in this report probably overstate the true proportion of providers meeting the RDA benchmark for vitamin C at lunch, (2) they may understate the percentage of providers meeting the RDA for iron at breakfast, and (3) the proportion of providers meeting the *Dietary Guidelines* recommendation for saturated fat at breakfast is probably understated. There are no database-related differences that affect 1999 Tier 2 results for afternoon snacks.

None of the observed differences would affect conclusions about the effect of tiering. Some might lead to greater estimated differences between 1995 and 1999. However, this applies only to the nutrients whose FIAS values changed because of new product formulation, as was the case for iron and saturated fat. If we applied the FIAS 3.98 values to the 1999 data, and the FIAS 2.3 values for 1995, we would see larger proportions of the providers in 1999 than 1995 meeting the benchmark levels of these nutrients. This would reflect the effect of manufacturers' changes in food product formulation, however, and not an effect of tiering.