



United States
Department
of Agriculture
Food and Nutrition Service

School Nutrition and Meal Cost Study Summary of Findings



Mathematica Policy Research

In partnership with:
Abt Associates Inc.

April 2019

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OVERVIEW



OVERVIEW OF THE SCHOOL NUTRITION AND MEAL COST STUDY

The U.S. Department of Agriculture’s (USDA) Food and Nutrition Service (FNS) administers the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) to ensure that school-age children have access to nutritious meals and snacks that support normal growth and development. In school year (SY) 2012–2013, the school meal programs began to undergo widespread changes, including new requirements that affect the food and nutrient content of school meals; the types of foods students need to select in order for their meal to be eligible for Federal reimbursement; pricing for full-price (also called “paid”) meals; and the types of foods and beverages that can be sold in schools during the school day (“competitive foods”).

This report presents findings from the School Nutrition and Meal Cost Study (SNMCS), the first comprehensive, nationally representative study of the school meal programs since these program reforms were implemented. The SNMCS continues FNS’s long-standing commitment to periodically assess the school meal programs. Compared to prior studies, the SNMCS is unique in three important ways. No previous national study of the school meal programs has (1) simultaneously examined the nutritional quality of school meals and the cost of producing those meals;

(2) assessed students’ acceptance of school meals in a quantitative way, using data on the amount of food students waste (plate waste); or (3) examined associations between major outcomes of interest, for example, the association between the nutritional quality of school meals and student participation and the association between the cost and nutritional quality of school meals.

Key findings from the SNMCS are summarized below. The rest of this report describes the design and implementation of the SNMCS and provides detailed summaries of other important findings.

Nutritional Quality of School Meals

NSLP Lunches

- Based on mean total scores on the Healthy Eating Index (HEI)-2010, the nutritional quality of NSLP lunches increased significantly between SY 2009–2010 and SY 2014–2015. Over this period, the mean total HEI-2010 score for NSLP lunches increased 41 percent—from 57.9 to 81.5 out of a possible 100. This finding suggests that updated nutrition standards for school meals have had a positive and significant influence on nutritional quality.

- For NSLP lunches, mean scores increased for 10 of the 12 components included in the HEI-2010.
- For the nine adequacy components, which focus on meeting food group and nutrient needs without exceeding calorie requirements, the largest increases were observed for the whole grains and greens and beans components. Between SY 2009–2010 and SY 2014–2015, the score for whole grains increased from 25 to 95 percent of the maximum score, and the score for greens and beans increased from 21 to 72 percent of the maximum score.
- Mean scores for the three moderation components also increased significantly between SY 2009–2010 and SY 2014–2015. This indicates that concentrations of refined grains, empty calories, and sodium in NSLP lunches *decreased* over time.

SBP Breakfasts

- The nutritional quality of SBP breakfasts also increased significantly between SY 2009–2010 and SY 2014–2015. The mean total HEI-2010 score for SBP breakfasts increased 44 percent—from 49.6 to 71.3 out of a possible 100.
- For SBP breakfasts, mean scores increased for 7 of the 12 components of the HEI-2010.
- For the nine adequacy components, the largest increases were observed for whole grains and whole fruit. Between SY 2009–2010 and SY 2014–2015, the score for whole grains increased from 38 to 96 percent of the maximum score, and the score for whole fruit increased from 50 to 89 percent of the maximum score.
- Mean scores for the three moderation components also increased significantly between SY 2009–2010 and SY 2014–2015. This indicates that concentrations of refined grains, empty calories, and sodium in SBP breakfasts *decreased* over time.

Compliance with Updated Nutrition Standards

NSLP Lunches

- At least 80 percent of daily lunch menus met each of the daily NSLP meal pattern quantity requirements. Over 90 percent of daily lunch menus met the daily quantity requirements for fruits (95 percent), meats/meat alternates (91 percent), and milk (100 percent). About 80 percent of daily lunch menus met the daily quantity requirements for vegetables (81 percent) and grains (80 percent).
- More than three-quarters (79 percent or more) of weekly lunch menus met weekly NSLP meal pattern requirements for milk, fruits, and vegetables. Fewer weekly lunch menus met the weekly quantity requirements for meats/meat alternates (58 percent) and grains (49 percent). Weekly menus in elementary schools were significantly more likely than weekly menus in middle or high schools to meet the weekly quantity requirements for meats/meat alternates and grains.
- Only about four in ten (41 percent) weekly lunch menus fell within the specified calorie range (that is, they met both the minimum and maximum calorie levels). Average weekly lunch menus in elementary and middle schools were more likely to exceed the maximum calorie level, while weekly high school lunch menus were more likely to fall below the minimum calorie level.
- More than one-third of weekly lunch menus did not meet the specified calorie range but came close to doing so. The average calorie content of weekly menus in 33 percent of elementary schools, 35 percent of middle schools, and 38 percent of high schools was within 10 percent of the calorie range. Thus, overall, more than three-quarters of weekly lunch menus (76 percent) met both the minimum and maximum calorie levels or came close to meeting these specifications.

SBP Breakfasts

- More than eight of ten daily breakfast menus met each of the daily SBP meal pattern quantity requirements. More than three-quarters (79 percent or more) of weekly SBP menus met each of the weekly quantity requirements. A slightly smaller percentage (69 percent) complied

with the requirement that no more than half of the fruits offered be in the form of juice.

- More than half (56 percent) of average weekly breakfast menus fell within the specified calorie range (that is, they met both the minimum and maximum calorie levels). It was more common for average weekly breakfast menus to exceed the maximum calorie level (36 percent) than to fall below the minimum calorie level (8 percent).
- Twenty-two percent of weekly breakfast menus did not meet the specified calorie range but came within 10 percent of the calorie range. Thus, overall, more than three-quarters (78 percent) of weekly breakfast menus met both the minimum and maximum calorie levels or came close to meeting these specifications.

Plate Waste in NSLP Lunches

- Plate waste is a measure of the amount of available food that is discarded (or not consumed). Overall, plate waste in NSLP lunches was highest for vegetables—an average of 31 percent of the vegetables on observed lunch trays was wasted—followed by milk (29 percent), fruits and 100% fruit juice (26 percent), and separate or side grains/breads (23 percent). Mean levels of waste were lower for desserts and other menu items (20 percent), and lowest for entrées and meats/meat alternates (16 and 14 percent, respectively).
- For each type of food, the mean proportion wasted was higher in elementary schools than in middle or high schools and was higher in middle schools than in high schools (though not all differences between middle and high schools were statistically significant).
- One factor that may, in part, explain the differences in plate waste observed across school types is differences in the use of the offer-versus-serve (OVS) option, which allows students to decline some components of a reimbursable meal as a way of providing choice and reducing waste. OVS is mandatory for high schools, but optional for middle schools and elementary schools (81 percent of all elementary and middle schools used OVS at lunch). Multivariate analyses found that, among elementary schools, use of OVS was associated with significantly lower levels of plate waste.



Dietary Intakes of NSLP Participants and Nonparticipants

- Lunches consumed by NSLP participants achieved a higher mean total score on the HEI-2010 than lunches consumed by a matched comparison group of nonparticipants (80.1 versus 65.1 out of a possible 100). As a point of reference, the average total HEI-2010 score for the diets consumed by the U.S. population as a whole in 2011–2012 was 59.0 and the average score for children was 55.1.¹
- Mean scores for HEI-2010 components showed that lunches consumed by NSLP participants had higher concentrations of vegetables, whole grains, and dairy and lower concentrations of refined grains and empty calories than lunches consumed by matched nonparticipants. Lunches consumed by NSLP participants achieved perfect scores for whole grains and dairy and a near-perfect score for empty calories.
- The significant difference in mean total HEI-2010 scores observed between NSLP participants and matched nonparticipants at lunch persisted over 24 hours (65.2 versus 60.6), although the magnitude of the difference was smaller.

- The positive and significant differences observed between NSLP participants and matched nonparticipants at lunch for HEI-2010 scores for whole grains, dairy, and refined grains also persisted over 24 hours, but significant differences for total vegetables and empty calories did not.

School Meal Costs and Revenues

- In SY 2014–2015, reported costs of producing a reimbursable meal in most school food authorities (SFAs) exceeded the Federal subsidies for free meals. For the average SFA, the mean reported cost to produce a reimbursable lunch was \$3.81, compared to the average Federal free lunch subsidy of \$3.32; the mean reported cost to produce a reimbursable breakfast was \$2.72, compared to the average Federal subsidy of \$1.88.
- Food and labor accounted for 90 percent of the average SFA’s reported costs. Food costs (including USDA Foods) and labor costs each accounted for approximately 45 percent of reported costs. All other costs (for example, supplies, contract services, and capital expenditures) accounted for the remaining 10 percent.
- USDA subsidies, including cash reimbursements and USDA Foods, represented the largest single source of SFA revenues, accounting for an average of 63 percent of total revenues. Student payments for reimbursable meals represented about 20 percent of total SFA revenues. A la carte and other nonreimbursable food sales accounted for 11 percent of total revenues.
- On average, across all SFAs, revenues from reimbursable lunches covered only an average of 93 percent of reported costs of producing those meals, and revenues from SBP breakfasts covered an average of 82 percent of reported costs. Net revenues from nonreimbursable food sales (a la carte, adult meals, and other nonreimbursable meals) supported school foodservice operations by partially offsetting the gap between costs and revenues for reimbursable meals.
- For the average SFA, total revenues covered 97 percent of total reported costs, indicating that the average SFA operated at a small deficit.

Relationships Between the Nutritional Quality of NSLP Lunches and Other Key Outcomes

Student Participation

- There was a positive and statistically significant association between student participation in the NSLP and the nutritional quality of NSLP lunches, as measured by the HEI-2010. Rates of student participation were significantly higher in schools with HEI-2010 scores in the third and highest quartiles (that is, the top half) of the distribution compared to the lowest quartile.
- Specifically, the average NSLP participation rates for schools with lunches in the two highest quartiles of the HEI-2010 distribution were 61 and 60 percent, compared to 50 percent for schools with lunches in the lowest quartile of the distribution.

Diets of NSLP Participants

- There was no significant positive association between the nutritional quality of NSLP lunches and the nutritional quality of the overall diets of students who consumed the lunches.

Reported Meal Costs and Revenues

- There was no significant association between reported cost per NSLP lunch and the nutritional quality of the meals. That is, mean reported costs per NSLP lunch were not significantly higher in schools that prepared more-nutritious meals—schools that had higher scores on the HEI-2010—than in schools that produced the least-nutritious meals—schools that scored the lowest on the HEI-2010.
- There was no significant association between revenue as a percentage of reported cost and compliance with updated nutrition standards for NSLP lunches.

SECTION I



BACKGROUND

The National School Lunch Program (NSLP) and School Breakfast Program (SBP), which are administered by the U.S. Department of Agriculture (USDA), Food and Nutrition Service (FNS), provide 30 million Federally subsidized lunches and 15 million Federally subsidized breakfasts to children each school day.² For children who qualify for free or reduced-price meals, the NSLP and SBP provide an important nutrition safety net at school. FNS provides assistance for the NSLP and SBP in the form of cash reimbursements for each qualifying meal, with reimbursement rates for each program depending on a variety of factors, primarily whether the child is or is not approved for free or reduced-price meals. Federal reimbursements supplement State and local resources (including student payments) to help ensure children receive nutritious school meals. FNS also provides foods that USDA purchases (called “USDA Foods”) as additional support to schools participating in the NSLP.

In school year (SY) 2012–2013, the school meal programs began to undergo widespread changes, mainly stemming from the Healthy, Hunger-Free Kids Act of 2010 (HHFKA; Public Law 111-296). Key reforms included (1) more fruits, vegetables, and whole grains in the school menu;

(2) updated nutrition standards to improve the nutritional quality of school meals and students’ diets to reduce children’s risk of developing chronic diseases; (3) a new requirement that students select at least a half cup of fruits or vegetables for their meal to be eligible for Federal reimbursement; (4) equitable price setting for full-price (also called “paid”) meals; and (5) the introduction of nutrition standards for all foods and beverages sold in competition with reimbursable meals in schools during the school day (“competitive foods”).

All these reforms have important implications for the school meal programs. The updated nutrition standards are intended to improve the nutritional quality of school meals. However, complying with the updated standards may affect the costs schools face in producing school meals. In addition, meals that comply with the updated standards, as well as new menu options that schools develop, may not be as acceptable to students as some of the former choices. If student acceptability is not taken into account, this could lead to changes in student participation. The requirement to take at least a half cup of fruits or vegetables or the prices charged for paid meals also may affect students’ decisions to eat school meals. The new nutrition standards

for competitive foods may affect students' consumption of these foods, as well as the likelihood of purchasing reimbursable meals. Ultimately, changes in school meal participation and consumption of competitive foods may affect the quality of students' diets.

There is a critical need for information about (1) how school food authorities (SFAs) and schools are doing in implementing the changes made in response to the HRFKA; and (2) whether and how these changes are affecting school foodservice operations; the nutritional quality, cost, and acceptability of meals; student participation and satisfaction; plate waste; and the quality of students' diets. To ensure this information would be available to policymakers and other stakeholders, FNS sponsored the School Nutrition and Meal Cost Study (SNMCS). The SNMCS continues FNS's long-standing commitment to periodically assess the school meal programs and is the first nationally representative, comprehensive assessment of these programs since major reforms began in SY 2012–2013.

Compared to prior studies of the school meal programs, the SNMCS is unique in three important ways. No previous national study of the school meal programs has (1) simultaneously examined the nutritional quality of school meals and the cost of producing of those meals; (2) examined students' acceptance of school meals in a quantitative way, using data on the amount of food students waste (plate waste); or (3) examined associations between major outcomes of interest, for example, the association between the nutritional quality of school meals and student participation and the association between the cost and nutritional quality of school meals.

Research Questions

The SNMCS addressed research questions of interest to stakeholders at the national, State, and local levels. These questions were grouped under four broad domains, as shown in Box 1.

To address these questions, the SNMCS collected data from nationally representative samples of public SFAs and public, non-charter schools participating in the NSLP; students enrolled in these schools; and their parents. Most data collection took place in the spring of SY 2014–2015. Study findings are presented in four report volumes, plus

Box 1. The School Nutrition and Meal Cost Study Addressed Research Questions in Four Broad Domains:

1. School meal program operations and school nutrition environments
2. Food and nutrient content of school meals and afterschool snacks and overall nutritional quality of meals
3. School meal costs and school foodservice revenues
4. Student participation, student and parent satisfaction, plate waste, and students' dietary intakes

this summary report that highlights key findings across the volumes.³

Data

The SNMCS collected data from SFAs, schools in those SFAs, and students in sampled schools. SFA-level data are representative of all public SFAs that offer the NSLP in the 48 contiguous States and the District of Columbia. School- and student-level data are representative of all public, non-charter schools offering the NSLP and students attending those schools.

To describe **SFA and school characteristics, foodservice operations, and school nutrition environments**, SFA and school-level staff participated in the following data collection activities:

- SFA directors and school nutrition managers (SNMs) completed separate web-based surveys. Topics included foodservice operations, implementation of the updated nutrition standards, meal pricing, provision of afterschool snacks and suppers, and nutrition promotion and outreach. SNMs also completed the A la Carte Checklist to describe items available for a la carte purchase at breakfast or lunch.

- Principals completed the web-based Principal Survey, which asked about school characteristics, school meal policies, competitive foods sources and policies, and nutrition education and promotion.
- School liaisons (non-foodservice staff identified during school recruitment) completed two forms known collectively as the Competitive Foods Checklists. These forms captured information on the nonreimbursable items available for sale to students in locations such as vending machines or school stores.
- Trained field interviewers completed observations of the cafeteria environment (for example, serving line configurations and the availability of potable water) during breakfast and lunch. SNMs provided input to answer some of the questions on the form, called the Cafeteria Observation Guide.

To describe **the food and nutrient content of school meals and afterschool snacks and the overall nutritional quality of meals**, SNMs completed the web-based Menu Survey.⁴ The Menu Survey collected detailed information on the foods offered, prepared, and served in reimbursable meals and afterschool snacks during one school week, referred to as the “target week.” Most SNMs completed an expanded version of the Menu Survey that collected additional information needed for cost analyses, including information on nonreimbursable foods and the total quantity of food used at each meal.

To describe **the costs of producing school meals and school foodservice revenues**, trained field interviewers completed cost interviews with SFA directors and business managers, SNMs, and school principals to capture the labor costs associated with producing school meals. As part of their interview, SFA directors and business managers also answered questions on SFA staffing and operations and indirect costs. During follow-up interviews, researchers reviewed each SFA’s SY 2014–2015 annual financial statement with SFA and school district officials to verify reported costs, identify unreported costs, obtain information to impute the value of unreported costs, and determine the SFA’s annual revenues. These cost interview data were combined with the data



collected in the Menu Survey, as noted above, to determine the composition of school foodservice costs and revenues.

Finally, to describe **student participation, parent and student satisfaction, plate waste, and students’ dietary intakes**, respondents participated in the following activities:

- Sampled students in participating schools completed a 24-hour dietary recall and the Child/Youth Interview, and trained field interviewers measured their height and weight.
- The parents/guardians of students participating in the study completed the Parent Interview in person (for parents of elementary school students) or by telephone (for parents of middle and high school students).
- School foodservice staff provided administrative data, typically generated by point-of-sale systems, on whether the school recorded sampled students as having received a reimbursable breakfast or lunch on the day referenced in the 24-hour dietary recall.

- Trained field interviewers conducted plate waste observations on a sample of breakfasts and lunches in participating schools. These observations documented the foods and beverages taken by students and the amounts of these foods that students did not consume (wasted).

Most data were collected from January through June 2015. Data were collected from 518 SFAs, more than 1,200 schools (completed sample sizes vary by data collection instrument), 2,165 students, and 1,850 parents. In addition, plate waste observations were completed for 6,253 lunch trays (in 165 schools) and 3,601 breakfast trays (in 154 schools).

SECTION II



PROGRAM OPERATIONS

The NSLP and SBP are administered at the State level by State child nutrition (CN) agencies and at the local level by SFAs. SFAs and schools have discretion in how they administer the programs within Federal and State guidelines. For example, SFAs and schools do not have to participate in both the NSLP and SBP and may elect to participate in other FNS-sponsored programs that provide meals and snacks to students. In addition, SFAs and schools have options in how they set meal prices—including potentially offering all meals free of charge—and whether they offer competitive foods. These and other decisions about program operations may influence student participation rates.

Meals and Snacks Offered

- Most public, non-charter schools that participated in the NSLP in SY 2014–2015 (94 percent) also participated in the SBP.
- Twenty-five percent of NSLP schools offered reimbursable afterschool snacks, suppers, or both. Of these schools, 80 percent offered snacks through the NSLP, 11 percent offered snacks through the Child and Adult Care Food Program (CACFP), and 22 percent provided suppers through the CACFP.
- Among schools that operated their own afterschool program (with or without USDA support), 61 percent offered only afterschool snacks, 12 percent offered only suppers, 7 percent offered both snacks and suppers, and 20 percent provided neither.

Universal Free Meals

- About one in five schools (19 percent) offered free lunch to all students, and 29 percent of SBP-participating schools offered free breakfast to all students. Universal free meals were somewhat more common in elementary schools than in middle or high schools.
- The Community Eligibility Provision (CEP), which allows school districts with 40 percent or more students directly certified for free meals to provide free breakfast and lunch to all students, was the most common means by which schools offered universal free meals—80 percent of schools that offered free lunch to all students and 56 percent of schools that offered free breakfast to all students did so under the CEP.



- Use of Provisions 2 and 3, which also allow schools to serve universal free meals, was much less common. Only 19 percent of schools that offered free lunch to all students and 20 percent of schools that offered free breakfast to all students did so under Provision 2 or 3.

Prices Charged for Paid Meals

- Excluding schools that provided universal free lunch, the most commonly charged price for a paid lunch in SY 2014–2015 was \$2.50, and the mean was \$2.42. On average, large schools charged higher prices for paid lunches than small and medium-sized schools (\$2.59 versus \$2.37 and \$2.42, respectively), and suburban schools charged somewhat higher prices than urban or rural schools (\$2.46 versus \$2.43 and \$2.36, respectively).
- The average price of a paid lunch increased by 25 percent between SY 2009–2010 and SY 2014–2015 (from \$1.93 to \$2.42). This increase is consistent with the Paid Lunch Equity (PLE) rule, which went into effect in SY 2011–2012 and affected the minimum price SFAs may charge for paid lunches.
- The purpose of the PLE rule is to ensure that SFAs’ foodservice accounts receive sufficient funds for paid lunches from student payments or other non-Federal sources so that paid lunches are not subsidized by the

reimbursement for free and reduced-price meals. The standard of equity is that the price of a paid lunch equals or exceeds the difference in USDA reimbursements between paid and free lunches. A comparison of reimbursement rates and average prices charged for paid meals in SY 2009–2010 and SY 2014–2015 suggests that the increase in paid meal prices over time is having the intended effect. Over this time period, the gap between the price of a paid lunch and the difference between USDA reimbursement rates for free and paid lunches decreased by 44 percent (from \$0.50 to \$0.28).⁵

- In SY 2014–2015, a 10 cent increase in the price of a paid lunch was associated with a decline of 0.7 percentage points in the rate of paid meal participation in the NSLP. For the SBP, the association between paid meal price and participation was not statistically significant.
- Excluding schools that provided universal free breakfast, the most commonly charged price for a paid breakfast in SY 2014–2015 was \$1.25, and the mean was \$1.43.

Perceived Challenges in Implementing the Updated Nutrition Standards

SFA directors were asked to provide feedback on the challenges they faced in fully implementing or maintaining compliance with the updated nutrition standards that were implemented starting in SY 2012–2013.⁶ SFA directors rated eight potential challenges on a scale from 1 (not a challenge) to 5 (a significant challenge). Figure 1 presents the mean rating for each potential challenge (across all SFAs).

- The greatest challenge SFAs faced in implementing or maintaining compliance with the updated nutrition standards was the cost of foods that need to be incorporated into menus in order to meet the standards (mean rating of 3.8).
- With mean ratings of 3.0 to 3.1, SFA directors rated the availability of appropriate foods, staff training, the need for additional labor, and the need to offer different portion sizes to different grade groups as more moderate challenges (mid-way between “not a challenge” and “a significant challenge”).
- Two of the remaining challenges—need for additional equipment and need for kitchen remodels or upgrades—

had lower mean scores of 2.7, which suggest that, relative to the other challenges, more SFA directors found these issues to be less of a challenge and assigned them a rating of 1 or 2.

- Of the potential challenges included in the survey, SFA directors found understanding the updated nutrition standards to be the least challenging (mean rating of 2.5).

Competitive Foods

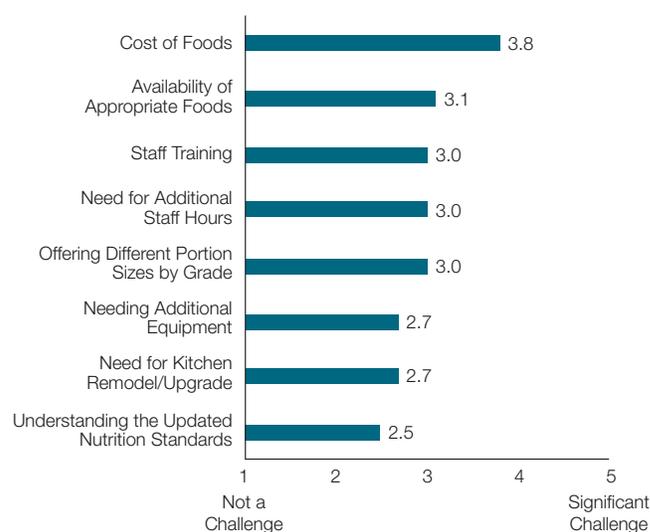
- Most schools had at least one source of competitive foods available to students. Foods available for a la carte purchase during meal times were the most common source of competitive foods (87 percent of schools for lunch and 56 percent for breakfast).
- Vending machines were available in 30 percent of all schools, with wide variation across school types. Seventy-one percent of high schools had vending machines, compared with 44 percent of middle schools and just 10 percent of elementary schools.
- Nearly one-fourth (24 percent) of schools had competitive foods available through alternative sources such as school stores, snack bars, food carts, kiosks, bake sales, or fundraisers.
- The items most commonly offered on an a la carte basis at lunch included milk (73 percent of all schools); water and 100% juices (48 percent); fresh, canned, or dried fruit (42 percent); and baked goods or desserts (30 percent). Low-fat baked goods and desserts were more prevalent than their regular-fat counterparts.

Student Participation in the NSLP and SBP

- Overall, an average of 56 percent of students participated in the NSLP on a typical school day in SY 2014–2015. Participation among students who received meals free or at a reduced price (including students who attended schools that offered free meals to all students) was more than double the rate for students who were participating at the paid rate (that is, students who were not certified to receive meal benefits) (78 percent versus 35 percent;

Figure 1.

Challenges faced in fully implementing or maintaining compliance with the updated nutrition standards (mean rating)



Source: School Nutrition and Meal Cost Study, School Food Authority Director Survey, SY 2014–2015. See Volume 1 of the SNMCS final report, Figure 2.7.

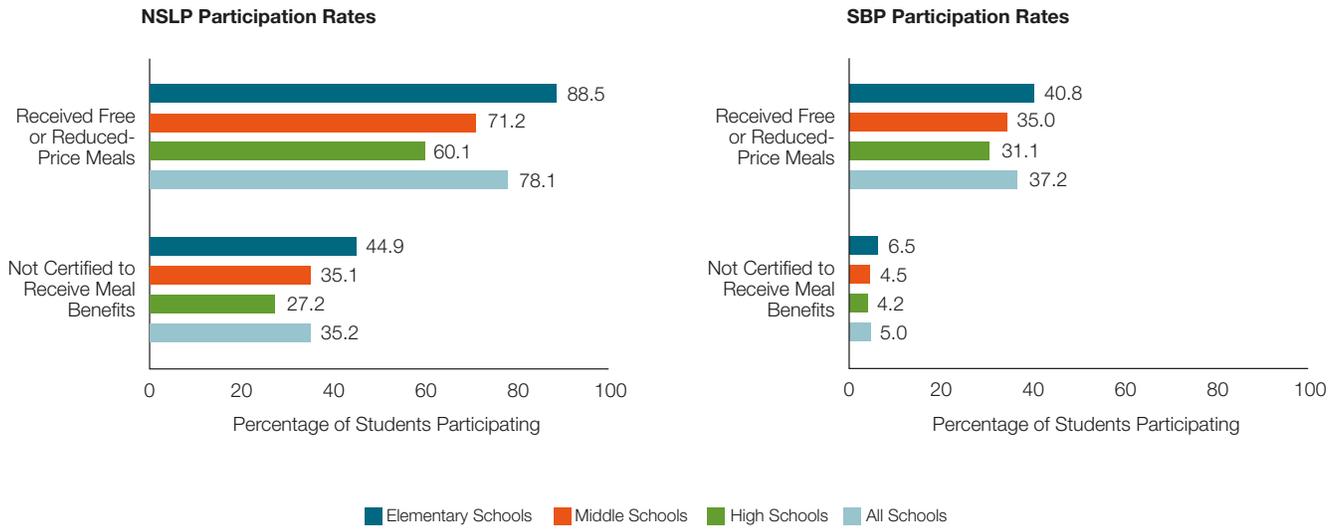
Note: The survey did not assign meanings to the other points on the scale.

Figure 2). In both groups, NSLP participation was highest among elementary school students and lowest among high school students.

- Participation rates in the SBP were notably lower overall, compared to the NSLP. Also, the difference in participation among students who were certified to receive free or reduced-price meals and students who were not certified was more pronounced (37 percent versus 5 percent; Figure 2).
- Multivariate analyses showed that use of HealthierUS School Challenge Smarter Lunchroom Techniques was associated with significantly higher NSLP participation rates.⁷ Mean NSLP participation rates ranged from 57 to 59 percent among schools that used one or more Smarter Lunchroom Techniques, compared to 47 percent among schools that did not use any of these techniques.

Figure 2.

Students who received free or reduced-price meals and elementary school students participated in the NSLP and SBP at higher rates than other students



Source: School Nutrition and Meal Cost Study, Reimbursable Meal Sales Form, 24-Hour Dietary Recall, and Child/Youth Interview, SY 2014–2015. See Volume 4 of the SNMCS final report, Tables 2.1 and 2.3.

NSLP = National School Lunch Program; SBP = School Breakfast Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

SECTION III



NUTRITIONAL CHARACTERISTICS OF SCHOOL MEALS

To be eligible for Federal reimbursement, school meals must meet defined nutrition standards. Updated nutrition standards for NSLP lunches and SBP breakfasts were phased in over several years, beginning in SY 2012–2013 (USDA, FNS 2012). The updated standards, which were based on recommendations from the Institute of Medicine (IOM),⁸ were designed to better reflect the *Dietary Guidelines for Americans* and improve the nutritional quality of school meals (IOM 2010; USDA and DHHS 2010).

The SNMCS collected data in SY 2014–2015, the first year school meals had to meet all the updated requirements for both NSLP lunches and SBP breakfasts. The study examined the overall nutritional quality of school meals using the Healthy Eating Index (HEI)-2010 (Guenther et al. 2013), and also examined the extent to which daily and weekly menus complied with the updated nutrition standards.

Overall Nutritional Quality of School Meals

The HEI-2010 assesses conformance to key recommendations of the 2010 *Dietary Guidelines for Americans* (Guenther et al. 2013).⁹ The index consists

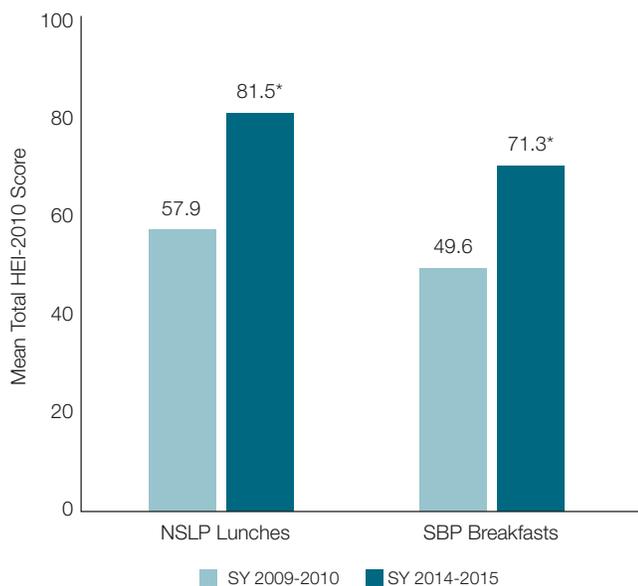
of 12 component scores, each reflecting a key aspect of nutritional quality, and a total score that measures overall nutritional quality. Nine of the 12 components are adequacy components, which focus on meeting food group and nutrient needs without exceeding calorie requirements. The three remaining components, referred to as moderation components, measure dietary components that people are encouraged to limit. Maximum scores for the components range from 5 to 20, and the total score, computed by summing scores for each of the 12 components, has a maximum of 100. For both total and component scores, higher scores reflect better conformance with *Dietary Guidelines for Americans* recommendations and higher nutritional quality. To assess differences in the nutritional quality of meals before and after implementation of the updated nutrition standards, HEI-2010 scores for meals served in SY 2014–2015 were compared with scores for meals served in SY 2009–2010. Because maximum scores for the components vary, findings for component scores are expressed as a percentage of the maximum possible score.

Total HEI-2010 Scores

- Between SY 2009–2010 and SY 2014–2015, the mean total HEI-2010 scores for NSLP lunches and SBP breakfasts increased significantly, suggesting that the updated nutrition standards have significantly improved the nutritional quality of school meals (Figure 3). Over this period, the mean total HEI-2010 score for NSLP lunches increased from 57.9 to 81.5—and the mean total HEI-2010 score for SBP breakfasts increased from 49.6 to 71.3.
- As a point of reference, the average total HEI-2010 score for the overall diets consumed by the U.S. population as a whole in 2011–2012 was 59.0 and the average score for children was 55.1.¹⁰

Figure 3.

The nutritional quality of NSLP lunches and SBP breakfasts increased significantly from SY 2009–2010 to SY 2014–2015



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. Data for SY 2009–2010 are from SNDA-IV (Fox et al. 2012). See Volume 2 of the SNMCS final report, Figures 9.1 and 9.7.

Note: Higher total scores reflect higher nutritional quality.

*Difference between SY 2009–2010 and SY 2014–2015 is significantly different from zero at the 0.05 level.

HEI = Healthy Eating Index; NSLP = National School Lunch Program; SBP = School Breakfast Program; SNDA = School Nutrition Dietary Assessment Study; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

HEI-2010 Component Scores for NSLP Lunches

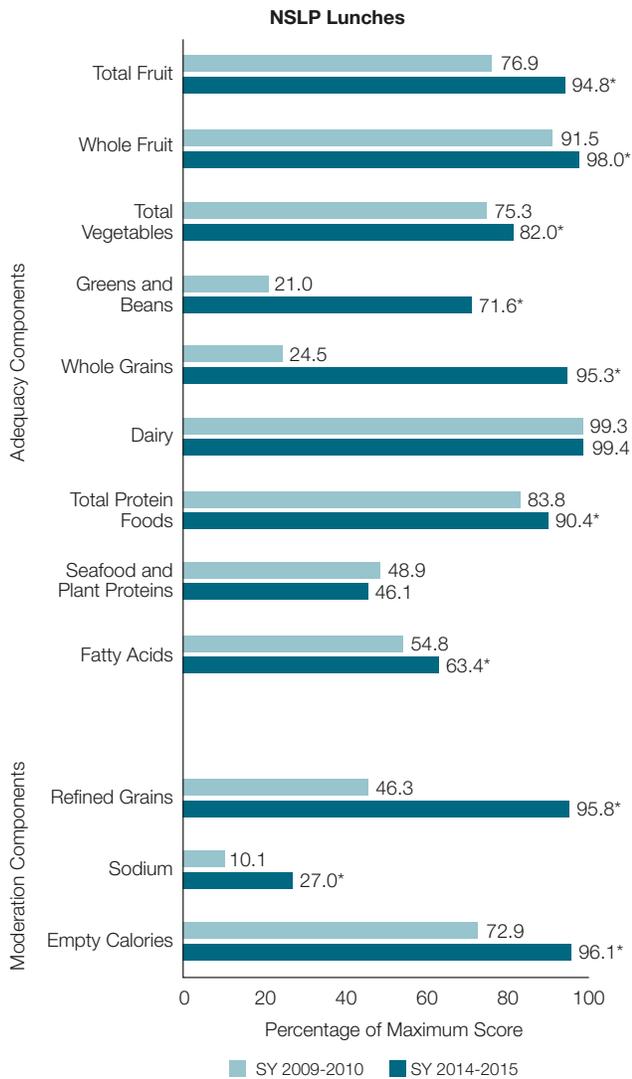
- For NSLP lunches, scores for seven of the nine adequacy components in the HEI-2010 increased significantly between SY 2009–2010 and SY 2014–2015 (Figure 4).
 - The largest increases were observed for greens and beans and whole grains. Between SY 2009–2010 and SY 2014–2015, the score for greens and beans increased from 21 to 72 percent of the maximum score, and the score for whole grains increased from 25 to 95 percent of the maximum score.
- Scores for the three moderation components also increased significantly between SY 2009–2010 and SY 2014–2015, indicating that the concentrations of refined grains, sodium, and empty calories in NSLP lunches decreased over time (Figure 4). For refined grains and empty calories, the scores for SY 2014–2015 were close to the maximum possible scores.
 - The score for refined grains more than doubled (from 46 to 96 percent of the maximum score), indicating a dramatic decrease in the concentration of refined grains in NSLP lunches over time.
 - The score for sodium almost tripled, from 10 to 27 percent of the maximum score. The increased score indicates that progress has been made in decreasing the sodium content of NSLP lunches. However, the fact that the SY 2014–2015 score was only 27 percent of the possible maximum indicates that more progress is needed to meet *Dietary Guidelines* recommendations for sodium.
 - The score for empty calories increased from 73 to 96 percent of the maximum score, indicating that the number of empty calories in NSLP lunches decreased over time.

HEI-2010 Component Scores for SBP Breakfasts

- For SBP breakfasts, scores for four of the nine adequacy components in the HEI-2010 increased significantly between SY 2009–2010 and SY 2014–2015 (Figure 5).

Figure 4.

For NSLP lunches, mean scores for most HEI-2010 components increased significantly from SY 2009–2010 to SY 2014–2015



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. Data for SY 2009–2010 are from SNDA-IV (Fox et al. 2012). See Volume 2 of the SNMCS final report, Figures 9.2 and 9.3.

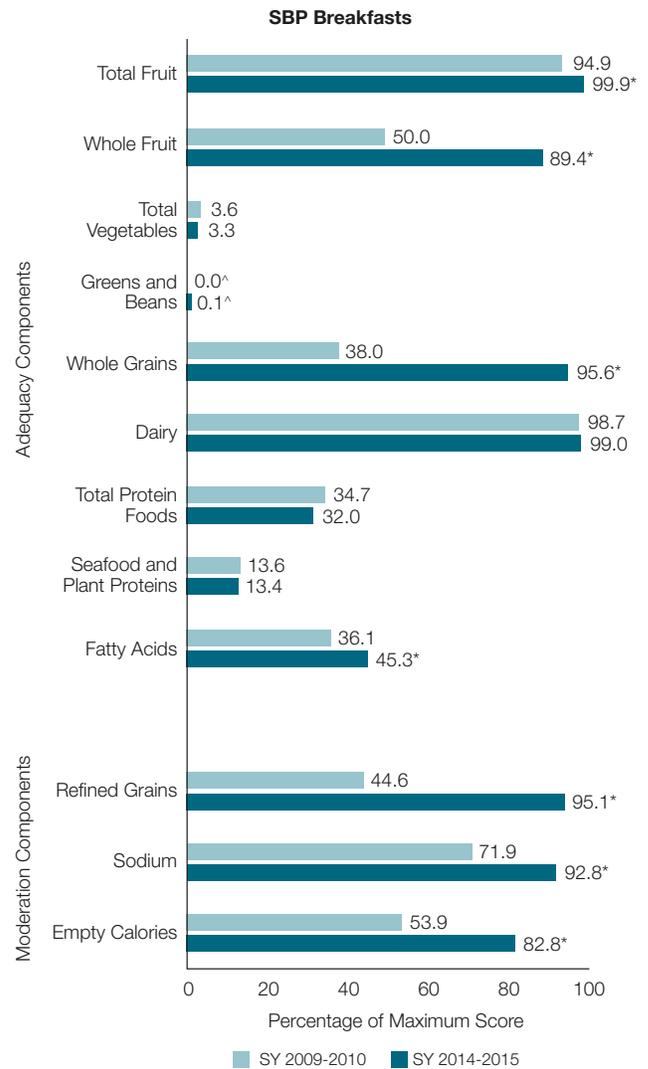
Note: Higher scores for adequacy components indicate higher concentrations in NSLP lunches; whereas, higher scores for moderation components indicate lower concentrations in NSLP lunches.

*Difference between SY 2009–2010 and SY 2014–2015 is significantly different from zero at the 0.05 level.

HEI = Healthy Eating Index; NSLP = National School Lunch Program; SNDA = School Nutrition Dietary Assessment Study; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Figure 5.

Mean HEI-2010 component scores for SBP breakfasts also increased significantly from SY 2009–2010 to SY 2014–2015



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. Data for SY 2009–2010 are from SNDA-IV (Fox et al. 2012). See Volume 2 of the SNMCS final report, Figures 9.8 and 9.9.

Note: Higher scores for adequacy components indicate higher concentrations in SBP breakfasts; whereas, higher scores for moderation components indicate lower concentrations in SBP breakfasts.

*Difference between SY 2014–2015 and SY 2009–2010 is significantly different from zero at the 0.05 level.

^ = Point estimate is considered less precise than estimates that are not flagged because the sample size is small or the coefficient of variation is large.

HEI = Healthy Eating Index; SBP = School Breakfast Program; SNDA = School Nutrition Dietary Assessment Study; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

- The largest increases were observed for whole fruit and whole grains. Between SY 2009–2010 and SY 2014–2015, the score for whole fruit increased from 50 to 89 percent of the maximum score, and the score for whole grains increased from 38 to 96 percent of the maximum score.
- Scores for the three moderation components also increased significantly between SY 2009–2010 and SY 2014–2015, indicating that the concentrations of refined grains, sodium, and empty calories in SBP breakfasts decreased over time (Figure 5).
 - Similar to NSLP lunches, the score for refined grains for SBP breakfasts more than doubled (from 45 to 95 percent of the maximum score), indicating a marked decrease in the concentration of refined grains in SBP breakfasts.
 - There were also substantial increases in the scores for sodium (from 72 to 93 percent of the

maximum score) and empty calories (from 54 to 83 percent of the maximum score), indicating that the concentrations of sodium and empty calories in SBP breakfasts decreased over time.

Compliance with Daily and Weekly Meal Pattern Requirements

Nutrition standards for NSLP lunches and SBP breakfasts include four types of requirements, shown in Box 2. The general approach used in assessing compliance with the nutrition standards was based on the approach FNS uses in determining whether an SFA is eligible to receive an additional 6-cent reimbursement per lunch. However, because the data collected in the Menu Survey were used to address many research questions not related to compliance, there were some differences in how the data were collected and analyzed. Therefore, results of this analysis are not directly comparable to the 6-cent reimbursement assessment.

Box 2. Nutrition Standards for NSLP Lunches and SBP Breakfasts

- Daily and weekly meal pattern requirements specify minimum amounts of foods to be offered each day and over the course of a week. Depending on the ages of students served, schools may have to offer more than the daily minimum amounts required for grains and meats/meat alternates on some menus in order to meet the associated weekly requirements.
- Weekly meal pattern requirements for NSLP lunches also specify weekly minimum amounts for five vegetable subgroups (dark green, red and orange, legumes, starchy, and other).
- Dietary specifications that (1) set average weekly minimum and maximum calorie levels; (2) set limits on saturated fat; (3) require foods to contain zero grams (less than 0.5 grams) of synthetic trans fat per serving; and (4) set limits on sodium to be phased in over several years. In SY 2014–2015, schools were expected not to exceed Target 1 levels for sodium.
- For some meal components, restrictions on the types of foods include the following:
 - Milk must be fat-free (flavored or unflavored) or low-fat (1% or less) unflavored, and at least two choices must be offered daily.
 - No more than 50 percent of fruit and vegetable offerings over the course of a week can be in the form of juice.
 - All grains must be whole grain-rich (contain at least 50 percent whole grains).
 - For NSLP lunches, no more than two ounce-equivalents of grains can be provided by grain-based desserts over the course of a week.

NSLP Lunches

Daily Meal Pattern Requirements

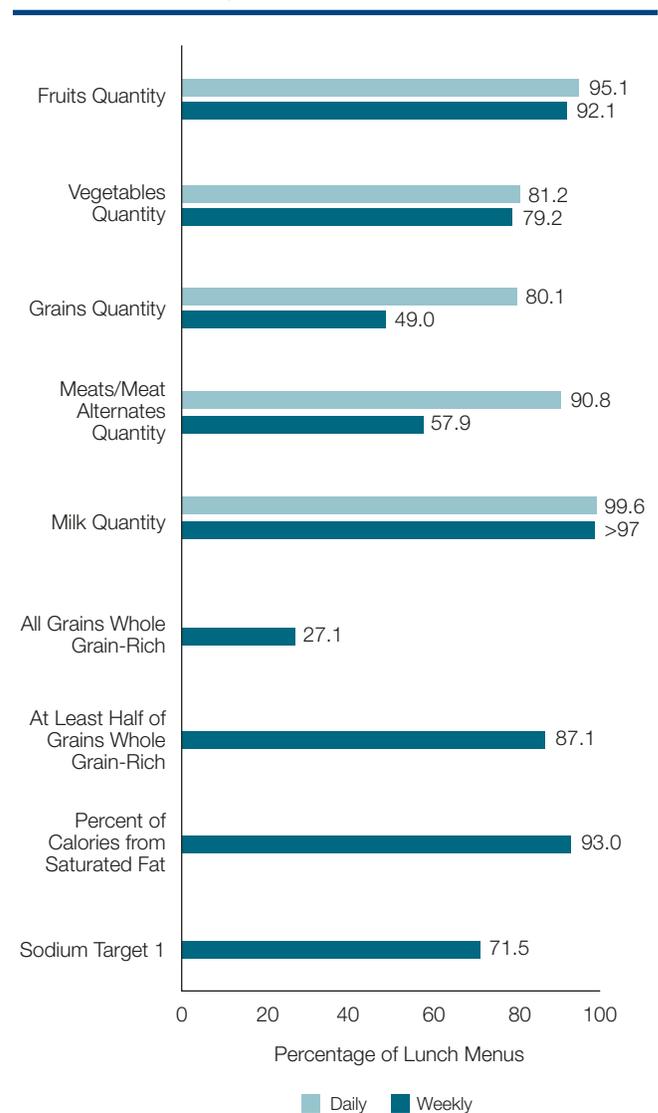
- Virtually all daily lunch menus met the daily quantity requirement for milk (Figure 6). Nearly all daily lunch menus met the daily quantity requirements for fruits (95 percent) and meats/meat alternates (91 percent). Roughly 8 in 10 daily lunch menus met the daily quantity requirements for vegetables and grains (81 and 80 percent, respectively).
- Almost all daily lunch menus (91 percent) offered only allowed types of milk.¹¹

Weekly Meal Pattern Requirements

- Virtually all weekly lunch menus met the weekly quantity requirement for milk (Figure 6). Nearly all weekly lunch menus (92 percent) met the weekly quantity requirement for fruits, and nearly four out of five (79 percent) met the weekly quantity requirement for vegetables.
- Fewer weekly lunch menus met the weekly quantity requirements for meats/meat alternates (58 percent) and grains (49 percent) (Figure 6). Weekly menus in elementary schools were significantly more likely than weekly menus in middle or high schools to meet these weekly quantity requirements.
- Slightly more than one-quarter (27 percent) of weekly lunch menus offered only whole grain-rich grain items (Figure 6). In SY 2014–2015, SFAs that demonstrated a hardship in meeting this requirement could seek an exemption that allowed them to meet a relaxed requirement that at least half of all grains must be whole grain-rich. Most weekly lunch menus (87 percent) met this relaxed requirement for whole grain-rich items.
- Almost all weekly lunch menus (97 percent) complied with the requirement that no more than half of the fruits offered be in the form of juice.
- Between 92 and 95 percent of weekly lunch menus met weekly quantity requirements for vegetable subgroups (dark green vegetables, red and orange vegetables, starchy vegetables, and other vegetables). A smaller

Figure 6.

Most daily and weekly lunch menus met daily and weekly quantity requirements for fruits, vegetables, and milk, but fewer menus met weekly quantity requirements for grains and meats/meat alternates



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. See Volume 2 of the SNMCS final report, Figures 3.1, 3.2, 3.4, and 3.7.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

>97 = Point estimate is considered less precise than estimates that are not flagged because the sample size is small or the coefficient of variation is large.

proportion (79 percent) of weekly lunch menus met the weekly quantity requirement for legumes.

- Nearly all weekly lunch menus (96 percent) met the grain-based dessert restriction, which sets a limit on the maximum amount of grains allowed as grain-based desserts.

Dietary Specifications

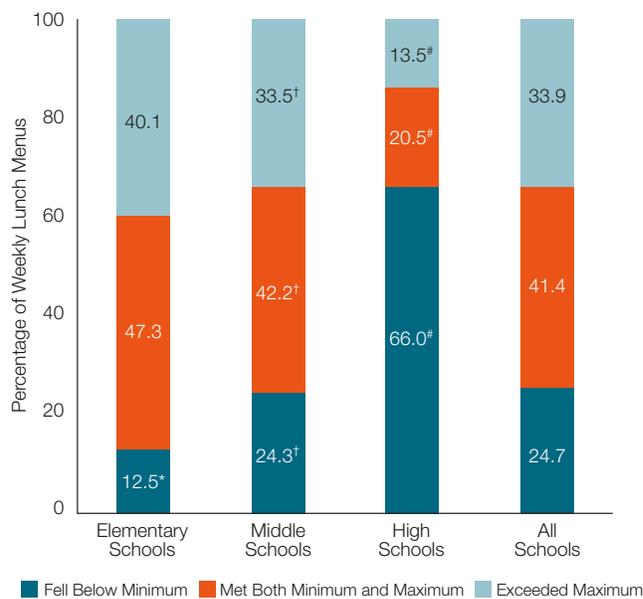
- Almost all average weekly lunch menus (93 percent) met the limit on the percentage of calories from saturated fat (Figure 6).
- Roughly 7 in 10 average weekly lunch menus (72 percent) met the Target 1 sodium limit that was in place in SY 2014–2015 (Figure 6), and another 13 percent of weekly menus were within 10 percent of the limit. Average weekly menus in middle schools were significantly more likely than those in high schools to meet the Target 1 sodium limit.
- Overall, 41 percent of average weekly lunch menus fell within the specified calorie range—that is, the weekly menus met both the minimum and maximum calorie levels (Figure 7). Average weekly lunch menus in elementary and middle schools were significantly more likely than those in high schools to fall within the specified calorie range (47 percent and 42 percent, respectively, versus 21 percent).
- It was more common for average weekly lunch menus in elementary and middle schools to exceed the maximum calorie level (40 percent and 34 percent, respectively) than to fall below the minimum calorie level (13 percent and 24 percent, respectively) (Figure 7). Among high schools, however, it was more common for average weekly lunch menus to fall below the minimum calorie level than to exceed the maximum calorie level (66 percent versus 14 percent).
- More than one-third of weekly lunch menus did not meet the specified calorie range but came within 10 percent of doing so. The average calorie content of weekly menus in 33 percent of elementary schools, 35 percent of middle schools, and 38 percent of high schools was within 10 percent of the calorie range. Thus, overall, more than three-quarters of weekly lunch menus (76 percent) met both the minimum and maximum calorie levels or came close to meeting these specifications.

All Nutrition Standards for NSLP Lunches

- Overall, just over half (56 percent) of daily lunch menus met all of the daily meal pattern requirements (Figure 8). To meet all of the daily requirements, a daily lunch

Figure 7.

Average weekly lunch menus in elementary and middle schools were more likely than those in high schools to meet NSLP dietary specifications for minimum and maximum calorie levels



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. See Volume 2 of the SNMCS final report, Figure 3.5.

* Difference between elementary and middle schools is significantly different from zero at the 0.05 level.

† Difference between middle and high schools is significantly different from zero at the 0.05 level.

Difference between elementary and high schools is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

menu must be compliant with each of the six daily meal pattern requirements. If a daily menu includes a choice of foods for students to select from (for example, two milk choices or four entrée choices), each choice must meet the relevant daily meal pattern requirement. This means that a daily menu could fail to meet all of the daily meal pattern requirements because of just one noncompliant food.

- To meet all the weekly meal pattern requirements, weekly lunch menus must meet each of the 14 weekly requirements. Overall, only 7 percent of weekly lunch menus met all of the weekly meal pattern requirements (Figure 8). The percentage increases to 18 percent if the relaxed requirement for whole grains is used (that is, that

at least half of grains must be whole grain-rich rather than all grains).

- Meeting all the weekly lunch requirements is challenging because there are so many requirements and because a single noncompliant food on one daily menu can cause a weekly menu to be noncompliant with all of the weekly requirements.
- Another challenge for weekly lunch menus in elementary and middle schools is that, in order to meet the weekly requirements for grains and meats/meat alternates, at least some of the daily menus have to provide more than the daily minimum amount. For example, for grains, the daily requirement for elementary and middle schools is 1 ounce, but the weekly requirement is 8 ounces. To meet the weekly requirement, some of the daily menus must provide more than the 1 ounce minimum.

- About one-third (34 percent) of weekly lunch menus met all of the dietary specifications (Figure 8). Weekly menus that met all the dietary specifications had an average weekly calorie content that was within the specified range, and also met limits on saturated fat and sodium.

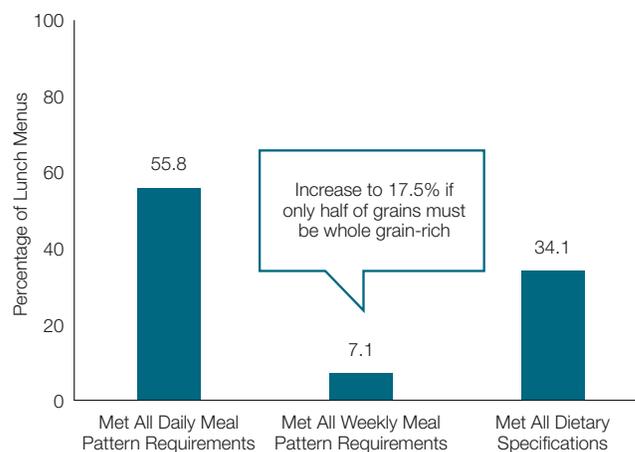
SBP Breakfasts

Daily and Weekly Meal Pattern Requirements

- Virtually all daily and weekly breakfast menus met the quantity requirements for milk. Almost 9 in 10 (89 percent) daily breakfast menus offered only allowed types of milk.
- Most daily breakfast menus met the daily quantity requirements for grains (87 percent) and fruits (83 percent). Daily menus in elementary schools were significantly more likely than those in high schools to meet the daily quantity requirement for grains.
- More than three-quarters (79 percent) of weekly breakfast menus met the weekly quantity requirement for fruits. A slightly smaller percentage (69 percent) complied with the requirement that no more than half of the fruits offered be in the form of juice.
- Nearly 8 in 10 weekly breakfast menus (79 percent) met the weekly quantity requirement for grains.

Figure 8.

More than half of lunch menus met all daily meal pattern requirements, but meeting all weekly meal pattern requirements and all dietary specifications was more challenging



Source: School Nutrition and Meal Cost Study, Menu Survey, SY 2014–2015. See Volume 2 of the SNMCS final report, Tables C.1, C.6, and C.10. SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Weekly menus in elementary and middle schools were significantly more likely than those in high schools to meet this requirement.

- About half of all weekly breakfast menus (47 percent) offered only whole grain-rich grain items. However, 95 percent of all weekly breakfast menus met the relaxed requirement that at least half of the grains offered must be whole grain-rich.

Dietary Specifications

- More than half (56 percent) of average weekly breakfast menus fell within the specified calorie range (that is, they met both the minimum and maximum calorie levels). It was more common for average weekly breakfast menus to exceed the maximum calorie level (36 percent) than to fall below the minimum calorie level (8 percent).
- Twenty-two percent of weekly breakfast menus did not meet the specified calorie range but came within 10 percent of the calorie range. Thus, overall, more than three-quarters (78 percent) of weekly breakfast menus met both the minimum and maximum calorie levels or came close to meeting these specifications.

- Nearly all (97 percent) average weekly breakfast menus met the limit on the percentage of calories from saturated fat. Two-thirds (67 percent) of average weekly breakfast menus met the Target 1 sodium limit that was in place in SY 2014–2015 and another 10 percent were within 10 percent of the limit.

All Nutrition Standards for SBP Breakfasts

- Overall, almost two-thirds (64 percent) of daily breakfast menus met all four of the daily meal pattern requirements. Less than one-quarter (23 percent) of weekly breakfast menus met all five of the weekly meal pattern requirements; however, the percentage increases to 42 percent if the relaxed requirement for whole grains is used.
- Relative to lunch menus, larger proportions of breakfast menus met all of the daily and weekly meal pattern requirements. This is consistent with the fact that there are fewer daily and weekly meal pattern requirements for breakfasts than lunches.
- Almost half (47 percent) of weekly breakfast menus met all of the dietary specifications—that is, the menus had an average weekly calorie content that was within the specified range, and also met limits on saturated fat and sodium.

SECTION IV



PLATE WASTE IN THE NATIONAL SCHOOL LUNCH PROGRAM

Plate waste is a measure of the amount of available food that is discarded (or not consumed). Some level of plate waste is inevitable in feeding programs like the school meal programs. Because required minimum portion sizes reflect average calorie and nutrient needs of specific grade groups, they may overestimate the needs of some students. However, the level of plate waste can be an important gauge of student satisfaction with meal offerings. It may also reflect menu planning that does not take students' food selection patterns or preferences into account. Plate waste varies because of individual student characteristics and preferences, but policy and environmental factors at the school and SFA levels may also influence it.

The SNMCS is the first national study in more than two decades to examine plate waste in school meals, and it is the first to examine the extent of plate waste since the updated nutrition standards went into effect.¹² For operational reasons, schools recruited for the plate waste observations had to serve a minimum number of lunches per day.¹³ In addition, meals had to be served in cafeterias, and students had to consume the meals in the cafeteria. For these reasons,

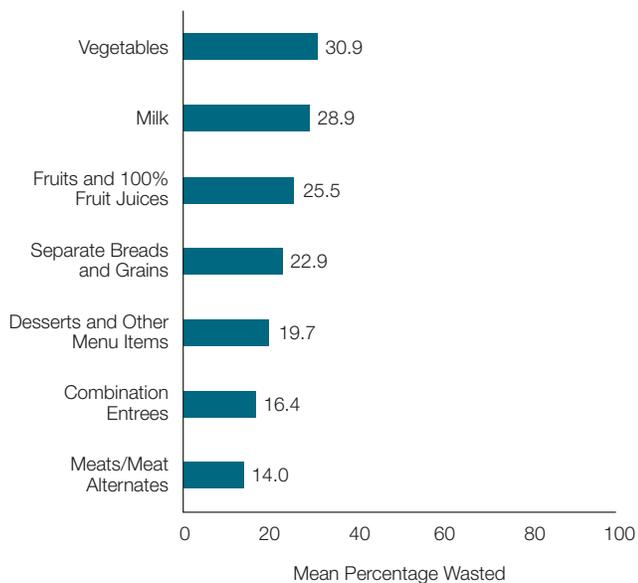
findings related to plate waste are representative of public, non-charter schools that offer the NSLP, serve a minimum number of lunches per day,¹⁴ and serve meals in cafeteria-based settings.

Extent of Plate Waste for Specific Types of Food in NSLP Lunches

- Overall, plate waste in NSLP lunches was highest for vegetables—an average of 31 percent of the vegetables on observed trays was wasted—followed by milk (29 percent), fruits and 100% fruit juice (26 percent), and separate or side grains/breads (23 percent) (Figure 9). Mean levels of waste were lower for desserts and other menu items (20 percent), and lowest for entrees and meats/meat alternates (16 and 14 percent, respectively). These findings are generally comparable to findings from studies that examined plate waste prior to implementation of the updated nutrition standards.¹⁵ Moreover, small, local studies that examined plate waste before and after implementation of the updated nutrition standards found that levels of plate waste were reduced or unchanged.¹⁶

Figure 9.

Mean levels of plate waste in the NSLP were highest for vegetables and lowest for meats/meat alternates and entrees



Source: School Nutrition and Meal Cost Study, Plate Waste Observations, SY 2014–2015. See Volume 4 of the SNMCS final report, Table 5.1.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

- For each type of food, the mean proportion wasted was higher in elementary schools than in middle or high schools and was higher in middle schools than in high schools (though not all differences between middle and high schools were statistically significant).

Calories and Nutrients Wasted in NSLP Lunches

- On average, about one-fifth (21 percent) of the calories available in NSLP lunches overall were wasted, as well as one-quarter or more of the available vitamin A, vitamin C, vitamin D, calcium, and potassium.
- In keeping with the variation observed across school types in levels of plate waste for specific types of food, the average proportion of calories and most nutrients wasted was significantly higher in elementary schools than in either middle or high schools, and was significantly higher in middle schools than in high schools. The only exceptions were total fat and saturated fat, where differences between middle and high schools were not statistically significant.

Factors Associated with Plate Waste

- One factor that may, in part, explain the differences in plate waste observed across school types is differences in the use of the offer-versus-serve (OVS) option, which allows students to decline some components of a reimbursable meal as a way of providing choice and reducing waste. OVS is mandatory for high schools, but optional for middle schools and elementary schools (81 percent of all elementary and middle schools used OVS at lunch). Multivariate analyses found that, among elementary schools, use of OVS was associated with significantly lower levels of plate waste.
- Multivariate analyses also found a significant association between the timing of lunch periods and plate waste. The mean percentage of calories wasted was significantly lower in lunch periods that started at 12:00 PM or later than in lunch periods that started before 11:30 AM (18 percent versus 20 percent).

SECTION V



DIETARY INTAKES OF NSLP PARTICIPANTS AND NONPARTICIPANTS

An important part of the SNMCS was comparing meal-specific and usual dietary intakes of school meal participants and nonparticipants. To support these analyses, 24-hour dietary recalls were completed with sampled students. These interviews collected detailed information on all foods and beverages consumed during a midnight-to-midnight recall period covering a school day. Data on the calorie and nutrient content of foods obtained from reimbursable school meals were taken from the detailed analysis of each school's reimbursable menus (see Section III). This ensured that the dietary intake data represented, as accurately as possible, the nutrient content of foods obtained in reimbursable meals.

Students identified in administrative records as having received a reimbursable breakfast or lunch on the day referenced in the 24-hour dietary recall (the target day) were considered SBP participants and NSLP participants, respectively.¹⁷ Students not identified as having received a reimbursable meal on the target day were considered nonparticipants. In comparing the food and nutrient intakes of school meal participants and nonparticipants, the study team used inverse probability weighting to construct matched comparison groups of nonparticipants (for

example, NSLP nonparticipants in elementary schools). These matched comparison groups were weighted to more closely resemble participants on observable characteristics that are believed to influence participation, for example, age, gender, household income, and whether a student was a picky eater. Even with these controls, differences between participants and matched nonparticipants may exist for unmeasured characteristics. For this reason, findings from these comparisons should not be interpreted as causal effects of school meal participation.

This summary focuses on the dietary intakes of NSLP participants and nonparticipants.¹⁸ Findings are presented for dietary intakes at lunch as well as usual daily (24-hour) intakes on school days. For both NSLP participants and the matched comparison group of nonparticipants, the analysis of dietary intakes at lunch included all foods and beverages consumed as part of this meal. For NSLP participants, this may include, in addition to foods and beverages obtained as part of a reimbursable lunch, foods and beverages obtained from non-reimbursable sources at school, from home, and/or from other sources outside of school.

Lunch Intakes of NSLP Participants and Matched Nonparticipants

Foods Consumed at Lunch

- NSLP participants were more likely than matched nonparticipants to consume milk (66 percent versus 23 percent), fruit or 100% fruit juice (58 percent versus 47 percent), and vegetables (43 percent versus 21 percent) at lunch. The difference in vegetables was largely driven by higher percentages of NSLP participants consuming starchy vegetables (French fries, other potatoes, and corn) and side salads, relative to matched nonparticipants.
- NSLP participants were less likely than matched nonparticipants to consume desserts, snacks, or beverages other than milk or 100% juice (48 percent versus 75 percent) at lunch.

Mean Calorie and Nutrient Intakes at Lunch

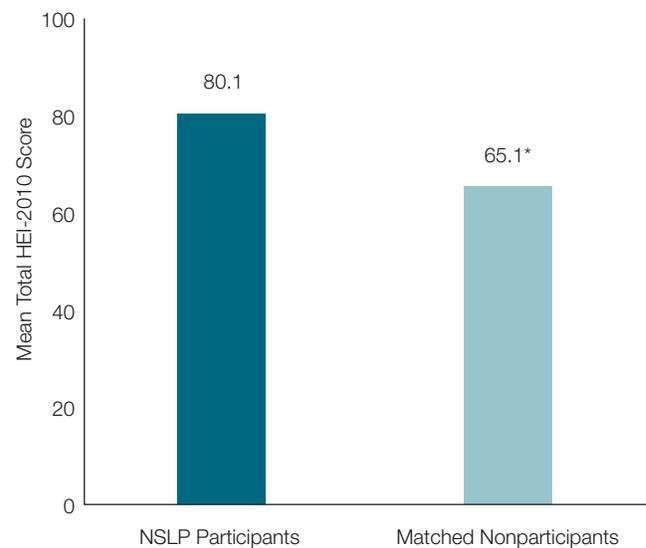
- NSLP participants consumed lunches that provided significantly fewer calories than lunches consumed by matched nonparticipants (515 calories versus 643 calories).
- Relative to lunches consumed by matched nonparticipants, lunches consumed by NSLP participants provided a smaller percentage of calories from total fat (28 percent versus 31 percent), a smaller percentage of calories from saturated fat (9 percent versus 10 percent), and a larger percentage of calories from protein (19 percent versus 15 percent).

Nutritional Quality of Lunches Consumed

- Overall, the lunches consumed by NSLP participants achieved a higher mean total score on the HEI-2010 than lunches consumed by matched nonparticipants (80.1 out of a possible 100 versus 65.1; Figure 10).¹⁹ As noted previously, the average total HEI-2010 score for the overall diets consumed by the U.S. population as a whole in 2011–2012 was 59.0 and the average score for children was 55.1.²⁰
- Mean scores for HEI-2010 components showed that lunches consumed by NSLP participants had higher concentrations of vegetables, whole grains, and dairy and lower concentrations of refined grains and empty calories

Figure 10.

Lunches consumed by NSLP participants were more nutritious than lunches consumed by matched nonparticipants



Source: School Nutrition and Meal Cost Study, 24-Hour Dietary Recalls: Day 1, SY 2014–2015. See Volume 4 of the SNMCS final report, Figure 9.1.

Note: Higher total scores reflect higher nutritional quality.

*Difference between participants and the matched comparison group of nonparticipants is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

than lunches consumed by matched nonparticipants (Figure 11). Lunches consumed by NSLP participants achieved perfect scores for whole grains and dairy and a near-perfect score for empty calories.

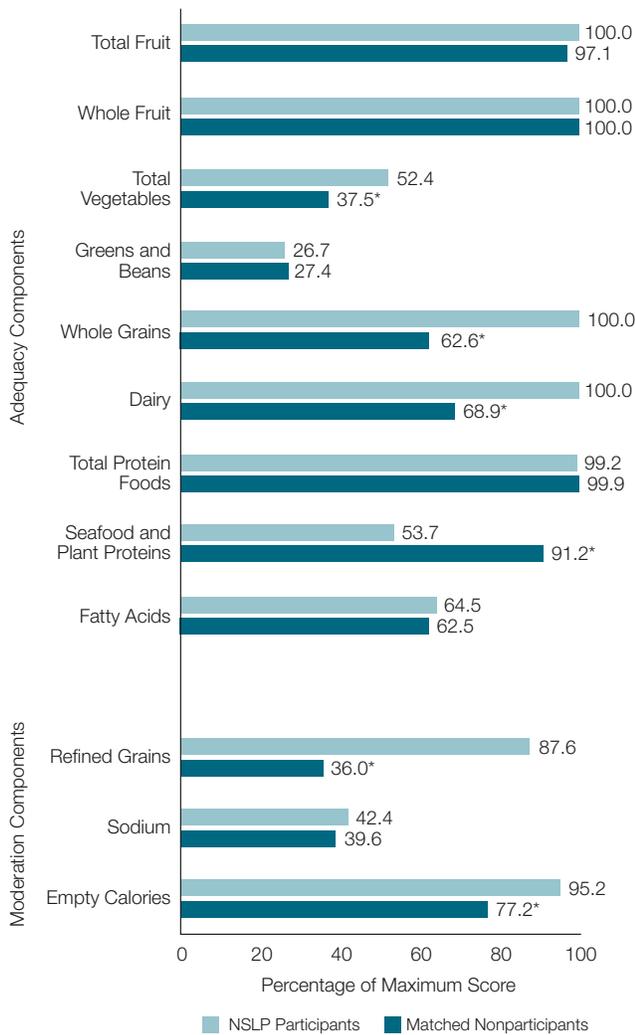
Usual Daily Intakes of NSLP Participants and Matched Nonparticipants on School Days

Overall Nutritional Quality

- The significant difference in mean total HEI-2010 scores observed among NSLP participants and matched nonparticipants at lunch persisted over 24 hours, although the magnitude of the difference was smaller (65.2 out of a possible 100 versus 60.6 for 24-hour intakes of NSLP participants and matched nonparticipants, respectively, compared to 80.1 versus 65.1 for lunch intakes; Figure 12).

Figure 11.

Lunches consumed by NSLP participants were more consistent with Dietary Guidelines recommendations than lunches consumed by matched nonparticipants



Source: School Nutrition and Meal Cost Study, 24-Hour Dietary Recalls: Day 1, SY 2014–2015. See Volume 4 of the SNMCS final report, Figures 9.2 and 9.3.

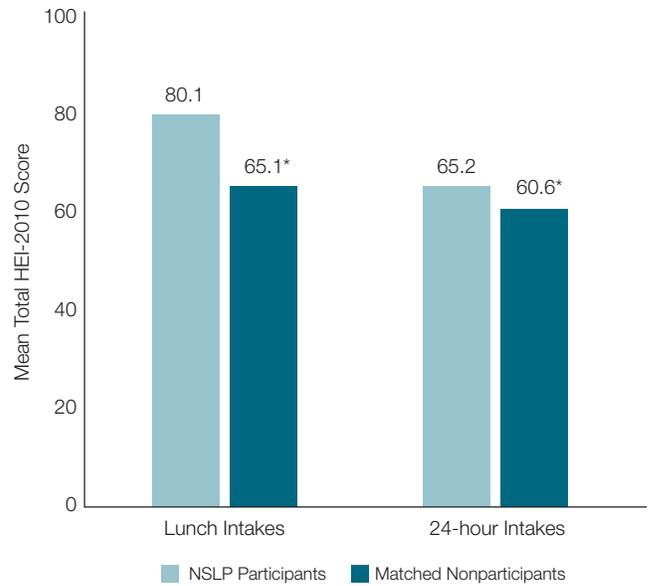
Note: Higher scores for adequacy components indicate higher concentrations in lunches consumed; whereas, higher scores for moderation components indicate lower concentrations in lunches consumed.

*Difference between participants and the matched comparison group of nonparticipants is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Figure 12.

The positive difference between total HEI-2010 scores of NSLP participants and matched nonparticipants persisted over 24 hours, but the size of the difference was smaller



Source: School Nutrition and Meal Cost Study, 24-Hour Dietary Recalls: Day 1, SY 2014–2015. See Volume 4 of the SNMCS final report, Figures 9.1 and 9.4.

Note: Higher total scores reflect higher nutritional quality.

*Difference between participants and the matched comparison group of nonparticipants is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

- A similar pattern was observed for the positive and significant differences between NSLP participants and matched nonparticipants in HEI-2010 component scores for whole grains, dairy, and refined grains at lunch. The significant differences persisted over 24 hours (Figure 13), but the magnitude of the differences between NSLP participants and matched nonparticipants was smaller.
- The positive and significant difference observed at lunch for total vegetables did not persist over 24-hours (Figure 13). A comparison of mean scores for lunches and 24-hour intakes suggest that, relative to lunches, the concentrations of vegetables in other meals and snacks were lower for NSLP participants and higher for matched nonparticipants, resulting in comparable concentrations of vegetables in 24-hour intakes.

- The positive and significant difference between NSLP participants and matched nonparticipants observed at lunch for empty calories also did not persist over 24-hours (Figure 13). A comparison of mean scores for lunches and 24-hour intakes suggests that, relative to lunches, the concentrations of empty calories in other meals and snacks were higher for both groups of students, particularly for NSLP participants.

Prevalence of Acceptable, Inadequate, and Excessive Nutrient Intakes

The study team used the 24-hour recalls collected from all students, as well as a second 24-hour recall collected from a representative subset (about 27 percent) of students, to estimate usual daily intake distributions of calories and nutrients on school days. Usual intake distributions were compared with standards defined in the Dietary Reference Intakes (DRIs) and 2010 *Dietary Guidelines for Americans* to estimate the percentages of students with acceptable, inadequate, or excessive usual nutrient intakes.²¹ The DRIs provide standards for the amounts of nutrients healthy individuals should consume, based on age, gender, and life stage (IOM 2006).

Macronutrients

- Most NSLP participants and matched nonparticipants had acceptable usual intakes of macronutrients on school days (defined as intakes that fell within the Acceptable Macronutrient Distribution Ranges), and there were few significant differences between the two groups.
- Overall, about 60 percent of students had usual daily intakes of saturated fat that exceeded the 2010 *Dietary Guidelines for Americans* recommended limit. Findings were comparable for NSLP participants and matched nonparticipants.

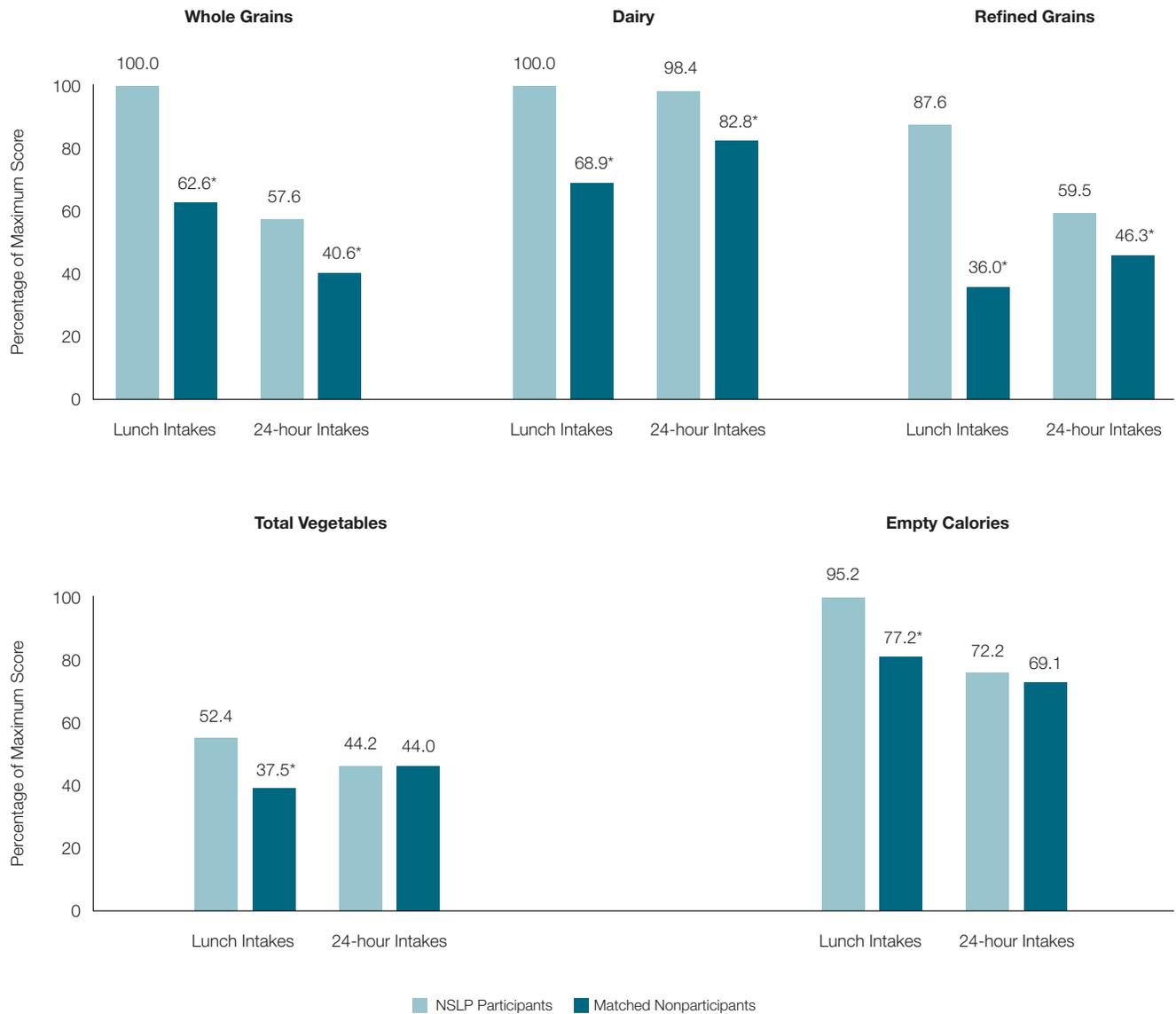
Vitamins and Minerals

Nutrient requirements vary for students of different ages. Consequently, there were notable differences across school types in the prevalence of inadequate nutrient intakes (defined as intakes that were less than age-and-gender-specific Estimated Average Requirements).

- Among elementary school students, inadequate usual intakes of vitamins and minerals were relatively uncommon, except for vitamins A, D, and E²², and calcium—which had rates of inadequacy above 10 percent for both NSLP participants and nonparticipants—and magnesium and phosphorus, with rates of inadequacy above 10 percent for matched nonparticipants only.
 - NSLP participants in elementary schools were significantly less likely than matched nonparticipants to have inadequate usual intakes of vitamin D (68 percent versus about 96 percent), calcium (28 percent versus 46 percent), and phosphorus (less than 3 percent versus 14 percent).
- Among middle school students, the prevalence of inadequate usual intakes exceeded 10 percent for both NSLP participants and matched nonparticipants for vitamins A, C, D, and E, and for calcium, magnesium, and phosphorus. In addition, among matched nonparticipants, the prevalence of inadequate usual intakes exceeded 10 percent for vitamin B₆, folate, and zinc.
 - NSLP participants in middle schools were significantly less likely than matched nonparticipants to have inadequate usual intakes of vitamin B₆ (less than 3 percent versus 10 percent) and zinc (about 4 percent versus 28 percent).
- High school students—who have the highest nutrient requirements relative to the other age groups considered in this study—had the greatest prevalence of inadequate usual intakes of vitamins and minerals. The prevalence of inadequacy exceeded 10 percent for both NSLP participants and matched nonparticipants for vitamins A, C, D, and E, and for calcium, magnesium, and phosphorus. In addition, for matched nonparticipants, the prevalence of inadequate usual intakes exceeded 10 percent for vitamins B₆ and B₁₂, folate, riboflavin, thiamin, and zinc.

Figure 13.

Differences between NSLP participants and matched nonparticipants in HEI-2010 scores at lunch persisted over 24 hours for some but not all components



Source: School Nutrition and Meal Cost Study, 24-Hour Dietary Recalls: Day 1, SY 2014–2015. See Volume 4 of the SNMCS final report, Figures 9.2, 9.3, 9.5, and 9.6.

Note: Higher scores for adequacy components (whole grains, dairy, and vegetables) indicate higher concentrations in lunches and 24-hour intakes; whereas, higher scores for moderation components (refined grains and empty calories) indicate lower concentrations.

*Difference between participants and the matched comparison group of nonparticipants is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

- NSLP participants in high schools were significantly less likely than matched nonparticipants to have inadequate usual intakes of several vitamins and minerals, including vitamins B₆ and B₁₂, niacin, riboflavin, thiamin, folate, calcium, phosphorus, and zinc.

Sodium and Fiber

- Overall, more than 81 percent of NSLP participants and matched nonparticipants had excessive usual intakes of sodium. Despite significantly lower sodium intakes among NSLP participants at lunch, there were no significant differences between NSLP participants and matched nonparticipants in the prevalence of excessive usual intakes of sodium.
- Mean usual dietary fiber intakes of both NSLP participants and matched nonparticipants were low, relative to the 14 grams of fiber per 1,000 calories benchmark on which the DRIs are based. Overall, there were no statistically significant differences between NSLP participants and matched nonparticipants in usual intakes of dietary fiber.

SECTION VI



MEAL COSTS AND SCHOOL FOODSERVICE REVENUES

Under USDA regulations, SFAs must balance the costs and revenues of school foodservice to operate on a nonprofit basis. All revenues must be used solely to operate or improve meals and foodservice operations. SFAs may accumulate net cash resources (cumulative revenues less expenses) equal to no more than three months' mean expenditures. SFAs generally seek to “break even”; that is, to make sure that their total costs and revenues from all school meal programs and from the sale of non-program foods are equal. Non-program foods include competitive foods, adult meals, catering, and meals provided to schools, day care, or other programs outside the SFA.

The analysis of meal costs distinguished between reported, unreported, and full costs. *Reported costs* include only the costs charged to the school foodservice account. Reported costs are the costs of running the foodservice operation that the SFA expects to be able to pay for from the foodservice account. Typically, reported costs include food; pay and fringe benefits for foodservice personnel; supplies; and

(less frequently) charges for facilities and other resources provided by the school district. *Unreported costs* are costs attributable to foodservice operations that are not charged to the school foodservice account, such as costs for non-foodservice personnel and facilities costs that are paid by the school district and not passed on to the SFA. The *full costs* of a school district's foodservice operations are the sum of total reported costs and total unreported costs. This summary focuses on *reported costs*. Details about unreported costs and full costs are provided in Volume 3 of the SNMCS final report.

The study team examined mean costs of producing reimbursable meals in the NSLP and SBP using two different units of analysis, as outlined in Box 3.

In the discussion that follows, cost estimates reported “for the average SFA” used the SFA as the unit of analysis, and cost estimates reported “for the average NSLP lunch” or “for the average SBP breakfast” used the meal as the unit of analysis.

Box 3. Units of Analysis Used in Examining Meal Costs

SFA as the Unit of Analysis

For this perspective, the study sample was weighted so that each SFA nationwide was represented equally, regardless of the number of meals served.

SFAs serving more meals had the same influence as SFAs serving fewer meals in determining the mean cost per meal.

Cost estimates represent the mean costs of a typical SFA. This perspective is useful when considering costs from the SFA's point of view.

Meal as the Unit of Analysis

For this perspective, the study sample was weighted so that each meal served nationwide was represented equally.

SFAs serving more meals had more influence than SFAs serving fewer meals in determining the mean cost per meal.

Cost estimates represent the average meal served. This perspective is useful when considering costs for the NSLP/SBP as a whole.

Reported Cost per NSLP Lunch

- In SY 2014–2015, the mean reported cost per NSLP lunch for the average SFA was \$3.81 (Figure 14). As shown in Figure 14, the average SFA spent more to serve an NSLP lunch than the mean Federal subsidy of \$3.32 per free NSLP lunch. This mean subsidy included \$3.05 in USDA reimbursements and \$0.27 worth of USDA Foods.²³ In approximately three of five SFAs, the reported cost of producing a reimbursable lunch in SY 2014–2015 was greater than the mean Federal subsidy for a free lunch estimated for this study.
- Using the meal as the unit of analysis, the mean reported cost of the average NSLP lunch was \$3.66. This was less than the mean reported cost for the average SFA (\$3.81) but still substantially more than the mean Federal subsidy of \$3.32 per free NSLP lunch. The difference in the two estimates of the mean reported cost per NSLP lunch reflects that the reported cost of the average NSLP lunch was smaller in the large SFAs, which produced a disproportionate share of NSLP lunches, than in the medium-sized SFAs, which were far more numerous.²⁴

Reported Cost per SBP Breakfast

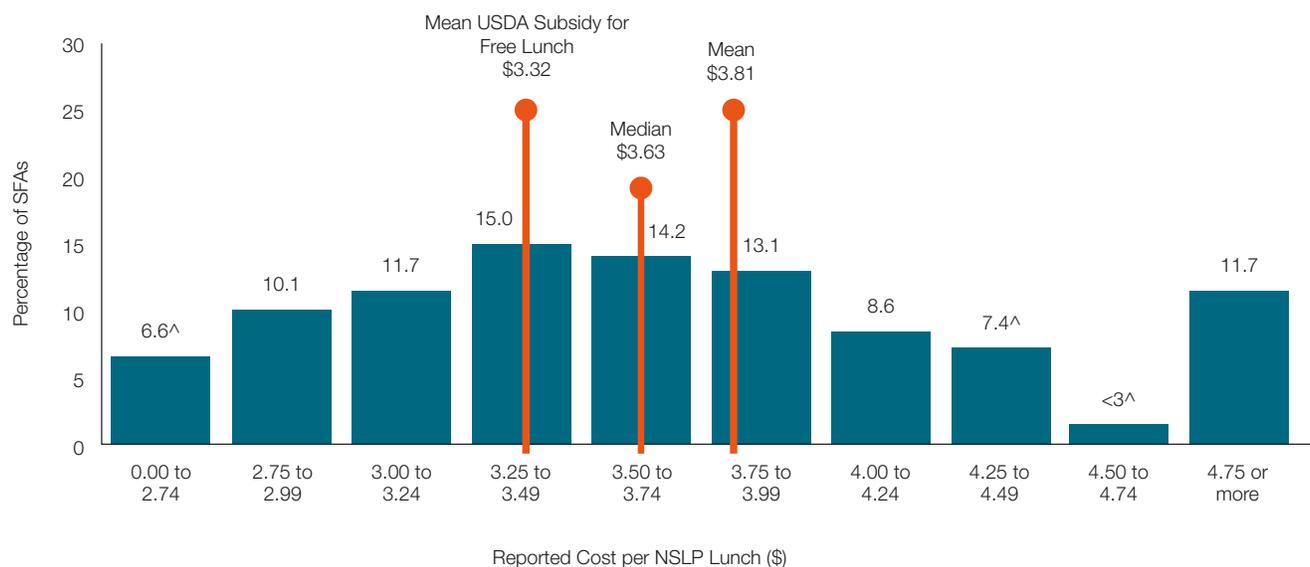
- In SY 2014–2015, the average SFA had a reported cost of \$2.72 per SBP breakfast (Figure 15). The mean free breakfast reimbursement rate across SFAs as estimated for this study was \$1.88.²⁵ One-quarter of the SFAs (25 percent) spent \$3.00 or more per SBP breakfast.
- Using the meal as the unit of analysis, the mean reported cost of an SBP breakfast was \$2.34. As with NSLP lunches, this mean was less than the reported cost for the average SFA of \$2.72 per SBP breakfast, due to the influence of large SFAs, but still more than the mean Federal reimbursement of \$1.88.

Composition of Reported Meal Costs

- Food and labor costs accounted for the vast majority (90 percent; 45 percent each) of the average SFA's reported cost per NSLP lunch in SY 2014–2015 (Figure 16).
- Other reported direct costs (which may include non-food supplies, equipment purchases, utilities, and any other costs not classified as food, labor, or indirect costs) constituted 10 percent of the reported cost per NSLP lunch.

Figure 14.

For the average SFA in SY 2014–2015, the cost of producing an NSLP lunch exceeded the average USDA subsidy for a free lunch



Source: School Nutrition and Meal Cost Study, Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews, SY 2014–2015. See Volume 3 of the SNMCS final report, Figure ES.2.

Note: SFA is the unit of analysis.

NSLP = National School Lunch Program; SFA= school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year; USDA = U.S. Department of Agriculture.

[^] Point estimate is considered less precise than estimates that are not flagged because the sample size is small or the coefficient of variation is large. Percentages close to 0 or 100 are often flagged. In this figure, flagged percentages between 0 and 3 percent are displayed as <3 percent.

- The remaining 1 percent of the reported cost comprised indirect costs for facilities and other resources provided by the district to the school foodservice program.
- The composition of the reported cost was very similar for SBP breakfasts (Figure 16).
- In general, the composition of reported meal costs by component was consistent with the composition in SY 2005–2006 (School Lunch and Breakfast Cost Study-II; Bartlett et al. 2008) and SY 1992–1993 (School Lunch and Breakfast Cost Study-I; Glantz et al. 1994).
- other nonreimbursable sales, (5) State and local government funds, and (6) other cash revenues.
- In SY 2014–2015, revenues derived from USDA subsidies accounted for an average of 63 percent of total SFA revenues, with 57 percent from meal reimbursements and 6 percent from USDA Foods (Figure 17).²⁶
- Student payments for reimbursable meals accounted for an average of 20 percent of total SFA revenues (Figure 17). A la carte sales, adult meals, and other nonreimbursable food sales represented about 11 percent of the average SFA’s total revenues. Finally, State and local government funds accounted for 6 percent of total SFA revenues; other cash revenues were less than 1 percent

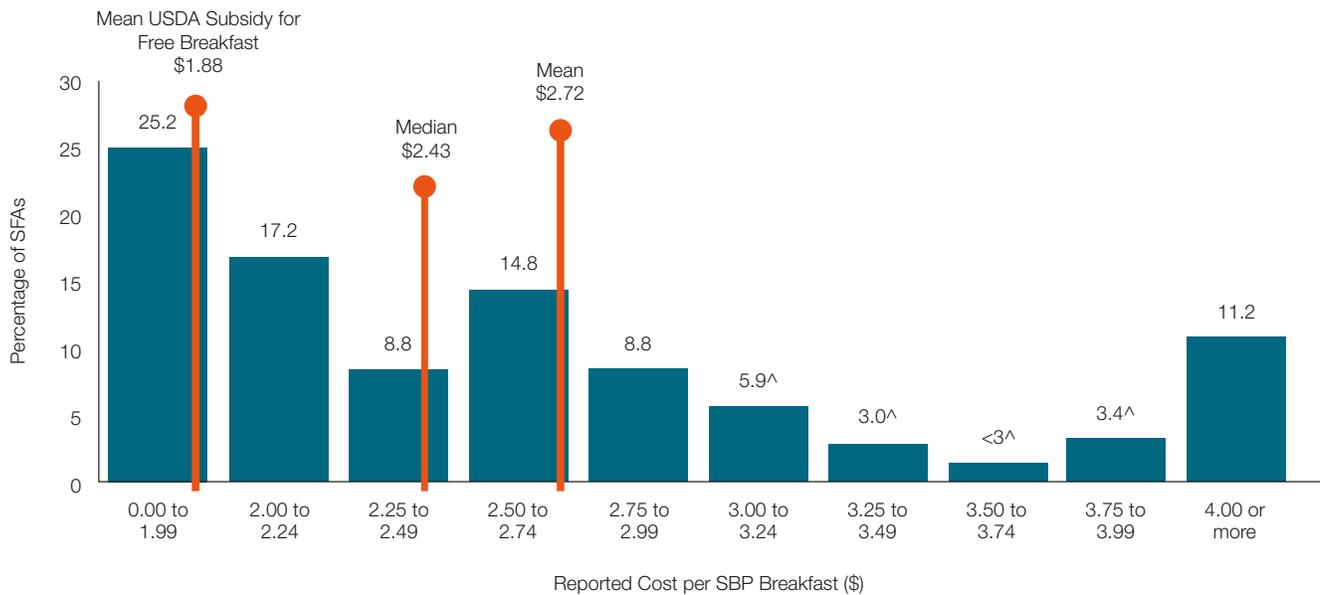
Composition of SFA Revenues and Comparison to Reported Costs

SFAs generate revenues through many sources, including: (1) USDA meal reimbursements, (2) USDA Foods, (3) student payments for reimbursable meals, (4) a la carte and

- USDA meal reimbursements in SY 2014–2015 accounted for a significantly larger share of SFA revenues relative to SY 2005–2006 (57 percent versus 45 percent; Figure 17). Meanwhile, the shares of SFA revenues from student

Figure 15.

For the average SFA in SY 2014–2015, the cost of producing an SBP breakfast exceeded the average USDA subsidy for a free breakfast



Source: School Nutrition and Meal Cost Study, Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews, SY 2014–2015. See Volume 3 of the SNMCS final report, Figure ES.3.

Note: SFA is the unit of analysis.

SBP = School Breakfast Program; SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year; USDA = U.S. Department of Agriculture.

[^] Point estimate is considered less precise than estimates that are not flagged because the sample size is small or the coefficient of variation is large. Percentages close to 0 or 100 are often flagged. In this figure, flagged percentages between 0 percent and 3 percent are displayed as <3 percent.

payments for reimbursable meals and a la carte and other nonreimbursable food sales declined. These changes are consistent with the recent increase in the percentage of meals claimed at the higher free and reduced-price rates, as well as the additional performance-based payment for SFAs meeting the updated nutrition standards for school meals and the alternative funding formula for the Community Eligibility Provision.

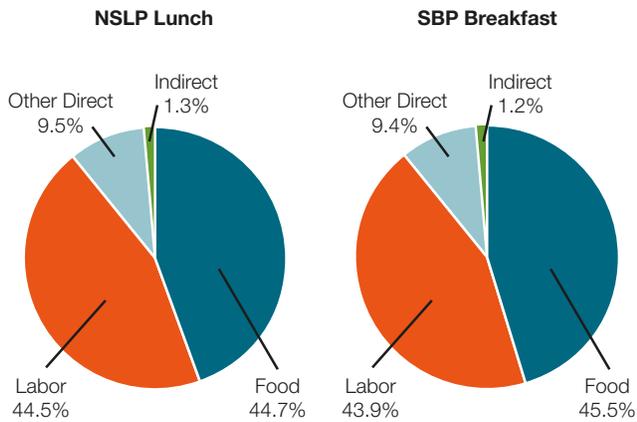
- For the average SFA in SY 2014–2015, total SFA revenues covered only 97 percent of total reported costs, indicating that the average SFA operated at a small deficit (Figure 18). In nearly half of SFAs (47 percent), total revenues were between 95 percent and 105 percent of total reported costs; that is, within 5 percentage points of the break-even point where revenues equal reported costs. On the other hand, 10 percent of SFAs had revenues that covered less than 80 percent of reported

costs, and 12 percent had revenues that were equal to or greater than 110 percent of reported costs.

- Revenues from NSLP lunches (including USDA meal reimbursements, USDA Foods, State and local funds, and student payments) fell short of the costs of producing those meals, covering only an average of 93 percent of reported costs. The gap between revenues and costs was even larger for SBP breakfasts, with revenues from SBP breakfasts covering only an average of 82 percent of reported costs.
- Net revenues from nonreimbursable food sales (that is, revenues from the sale of these foods less costs) supported school foodservice operations by partially offsetting the gap between costs and revenues for reimbursable meals. Thus, while nonreimbursable sales were a small source of revenue for most SFAs, for the

Figure 16.

For both NSLP lunches and SBP breakfasts, food and labor accounted for 90 percent of reported costs in SY 2014–2015



Source: School Nutrition and Meal Cost Study, Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews, SY 2014–2015. See Volume 3 of the SNMCS final report, Figure ES.4.

Note: SFA is the unit of analysis.

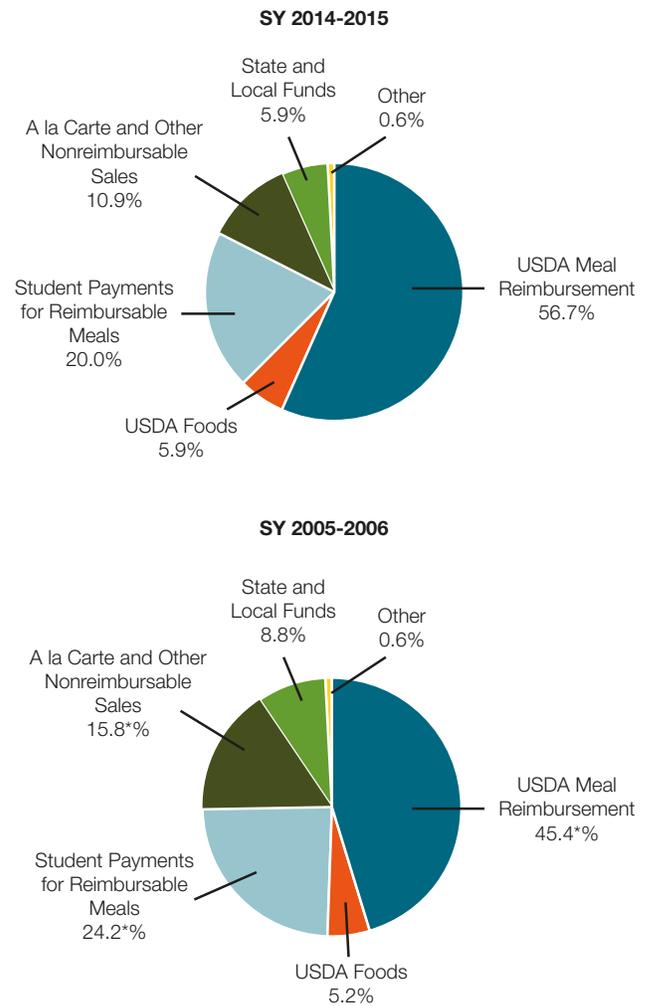
NSLP = National School Lunch Program; SBP = School Breakfast Program; SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

average SFA they provided a revenue surplus that helped offset the extent to which SFA costs exceeded revenues for reimbursable meals.

- This finding differs from previous studies of costs and revenues in the school meal programs, which found the opposite relationship—that revenues from reimbursable meals subsidized nonreimbursable sales.²⁷ To address this issue, USDA established a rule on pricing of nonreimbursable foods. The change in net revenues from nonreimbursable food sales suggest that the rule may have shifted the pattern of cross-subsidization between reimbursable meals and nonreimbursable sales in the desired direction.

Figure 17.

In SY 2014–2015, USDA meal reimbursements accounted for a significantly higher percentage of SFA revenues relative to SY 2005–2006



Source: School Nutrition and Meal Cost Study, Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews, SY 2014–2015. Data for SY 2005–2006 are from the School Lunch and Breakfast Cost Study-II (Bartlett et al. 2008). See Volume 3 of the SNMCS final report, Table 5.10.

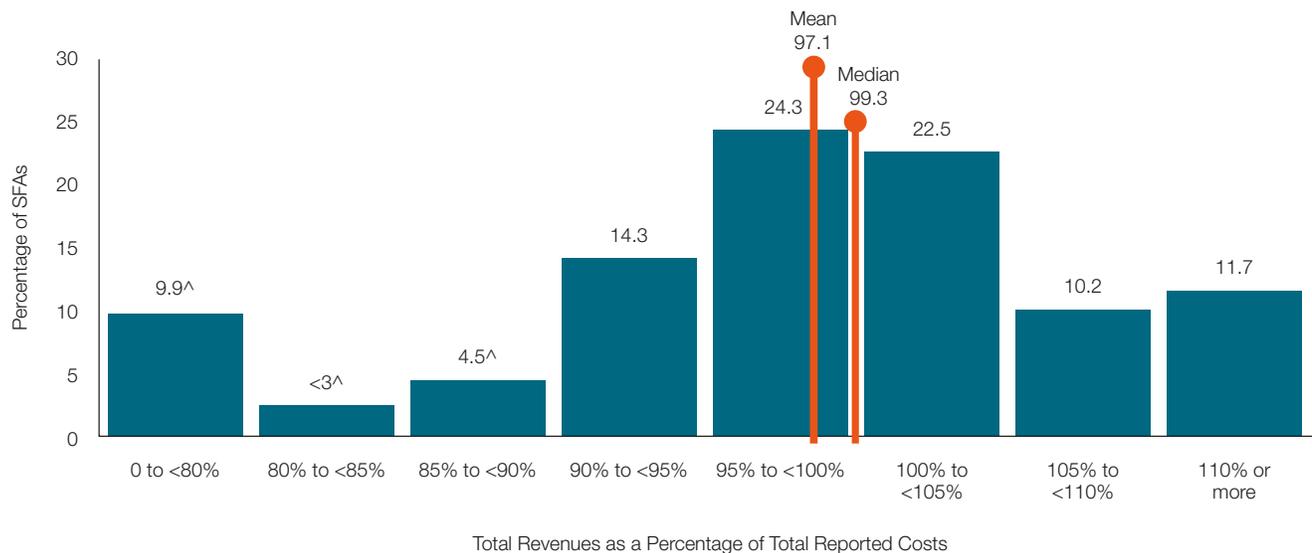
Note: SFA is the unit of analysis.

*Difference between SY 2014–2015 and SY 2005–2006 is significantly different from zero at the 0.05 level.

SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year; USDA = U.S. Department of Agriculture.

Figure 18.

For the average SFA in SY 2014–2015, total revenues covered only 97 percent of total reported costs



Source: School Nutrition and Meal Cost Study, Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews, SY 2014–2015. See Volume 3 of the SNMCS final report, Figure ES.6.

Note: SFA is the unit of analysis.

[^] Point estimate is considered less precise than estimates that are not flagged because the sample size is small or the coefficient of variation is large. Percentages close to 0 or 100 are often flagged. In this figure, flagged percentages between 0 and 3 percent are displayed as <3 percent.

SFA= school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Comparisons to SY 1992–1993 and SY 2005–2006

There were statistically significant differences in the real (inflation-adjusted) reported costs of producing reimbursable meals in SY 2014–2015, relative to reported costs in SY 1992–1993 (School Lunch and Breakfast Cost Study-I) and SY 2005–2006 (School Lunch and Breakfast Cost Study-II). At \$3.81, the average SFA’s reported cost per NSLP lunch in SY 2014–2015 was 26 percent greater than the comparable (inflation-adjusted) cost in SY 2005–2006 (\$3.03) and 30 percent greater than in SY 1992–1993 (\$2.93) (Figure 19). In contrast, the reported cost per NSLP lunch for the average SFA in SY 2005–2006 was not significantly different from the comparable cost in SY 1992–1993 (Bartlett et al. 2008).

Similarly, for SBP breakfasts, the reported cost per SBP breakfast in 2015 dollars for the average SFA in SY 1992–1993 was \$2.27, and in SY 2014–2015 it was 20 percent higher at \$2.72 (Figure 20). However, the reported

cost per SBP breakfast for the average SFA did not change significantly from SY 2005–2006 to SY 2014–2015, after adjusting for inflation. (The inflation-adjusted average cost per SBP breakfast also did not change significantly from SY 1992–1993 to SY 2005–2006.)

Much has changed in the school meal programs since SY 2005–2006. Updated nutrition standards for reimbursable meals may have increased food and/or labor costs. Indeed, food, labor, and other costs per NSLP lunch were significantly greater in SY 2014–2015 than in SY 2005–2006 and SY 1992–1993.²⁸ Increases in the pricing of paid lunches (mandated by the HHFKA) may have reduced NSLP participation rates in lower-poverty SFAs and thereby reduced economies of scale.²⁹ Following the establishment of nutrition standards for competitive foods, SFAs’ revenues from these and other nonreimbursable foods have decreased (as discussed below), and SFAs’ fixed costs may have shifted more to the NSLP and SBP.

Figure 19.

The reported cost of producing an NSLP lunch in SY 2014–2015 was significantly higher than the inflation-adjusted costs of producing NSLP lunches in SY 2005–2006 and SY 1992–1993



Source: Data for SY 1992–1993 are from the School Lunch and Breakfast Cost Study-I (Glantz et al. 1994); data for SY 2005–2006 are from the School Lunch and Breakfast Cost Study-II (Bartlett et al. 2008); and data for SY 2014–2015 are from the School Nutrition and Meal Cost Study (Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews). See Volume 3 of the SNMCS final report, Figure ES.7.

Note: SFA is the unit of analysis.

*Difference between SY 2014–2015 and prior SY is significantly different from zero at the 0.05 level.

NSLP = National School Lunch Program; SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Figure 20.

The reported cost of producing an SBP breakfast in SY 2014–2015 was significantly higher than the inflation-adjusted cost of producing an SBP breakfast in SY 1992–1993, but not SY 2005–2006



Source: Data for SY 1992–1993 are from the School Lunch and Breakfast Cost Study-I (Glantz et al. 1994); data for SY 2005–2006 are from the School Lunch and Breakfast Cost Study-II (Bartlett et al. 2008); and data for SY 2014–2015 are from the School Nutrition and Meal Cost Study (Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews). See Volume 3 of the SNMCS final report, Figure ES.8.

Note: SFA is the unit of analysis.

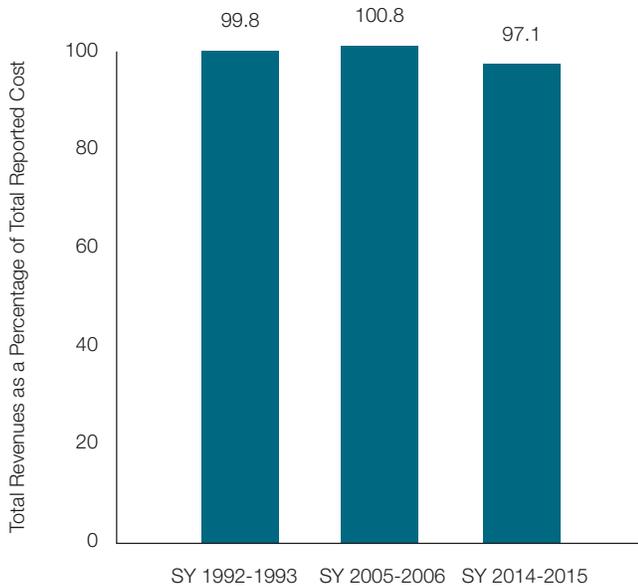
*Difference between SY 2014–2015 and prior SY is significantly different from zero at the 0.05 level.

SBP = School Breakfast Program; SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Although the reported cost per meal for NSLP lunches and SBP breakfasts increased significantly from levels in SY 1992–1993, total foodservice revenues kept pace with the trend in costs. The average SFA had revenues equal to 97 percent of reported costs in SY 2014–2015, and this measure was not significantly different from the break-even levels of approximately 100 percent (where revenues equal reported costs) in SY 2005–2006 and SY 1992–1993 (Figure 21). As shown in Figure 17, the share of SFA revenues from USDA reimbursements increased substantially. In summary, USDA reimbursements helped to offset both the increases in the costs of reimbursable meals and the decline in other sources of revenues, thereby sustaining the overall financial status of school foodservice accounts.

Figure 21.

There was no significant difference between SY 1992–1993, SY 2005–2006, and SY 2014–2015 in total revenue as a percentage of total reported costs (in 2015 dollars)



Source: Data for SY 1992–1993 are from the School Lunch and Breakfast Cost Study-I (Glantz et al. 1994); data for SY 2005–2006 are from the School Lunch and Breakfast Cost Study-II (Bartlett et al. 2008); and data for SY 2014–2015 are from the School Nutrition and Meal Cost Study (Menu Survey, School Nutrition Manager Cost Interview, and SFA Director and Business Manager Onsite and Follow-Up Cost Interviews). See Volume 3 of the SNMCS final report, Figure ES.9.

Note: SFA is the unit of analysis.

SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

None of the differences between SY 2014–2015 and prior SYs is significantly different from zero at the 0.05 level.

SECTION VII



RELATIONSHIPS BETWEEN NUTRITIONAL CHARACTERISTICS OF NSLP LUNCHES AND OTHER KEY OUTCOMES

The research questions defined for the SNMCS included several questions about relationships between the key outcomes described in the preceding sections. The three most important questions addressed the relationships between the nutritional characteristics of school meals and (1) student participation, (2) the nutritional quality of school meal participants' overall diets, and (3) meal costs.³⁰ This summary focuses on key outcomes related to the NSLP, but the study also examined similar outcomes for the SBP.

To answer these questions, the study team used multivariate analyses. These analyses explored associations among the three outcomes identified above and three characteristics of school meals: (1) nutritional quality, as measured by total HEI-2010 scores, (2) compliance with the updated nutrition standards, and (3) types of foods offered. To characterize compliance with the nutrition standards, the study team collaborated with FNS to identify a parsimonious set of variables, focusing on standards that were more challenging for one or more school types to meet and had enough variation within the sample. Many characteristics related to the types of foods offered were considered. The final set of characteristics, shown in Table 1, was identified

by eliminating, from the pool of potential characteristics, those that (1) contained valid values for a relatively low proportion of the sample, (2) exhibited insufficient variation within the sample, or (3) were highly correlated with other considered characteristics that better explained variation in the outcome of interest.

Multivariate analyses were implemented using logistic or linear regression and weights that accounted for the study's complex sample design. All models controlled for demographic and institutional characteristics of SFAs and schools (including school size, school type, urbanicity, FNS region, and share of students approved for free or reduced-price meals), and student-level models also controlled for students' demographic characteristics (including race and ethnicity, gender, and certified for free or reduced-price meals).

Because the probability of finding significant associations by chance increases with the number of associations tested, findings for the many associations explored in these analyses should be interpreted with caution. In addition, it is important to understand that significant

Table 1. Measures included in multivariate analyses that explored associations between nutritional characteristics of NSLP lunches and other key outcomes

Overall Nutritional Quality of NSLP Lunches

- Total HEI-2010 score of average lunch prepared

Compliance with Nutrition Standards

- Met daily quantity requirement for grains
- Met daily quantity requirement for meats/meat alternates
- Met daily quantity requirement for vegetables
- Met weekly requirement for meats/meat alternates
- Met weekly requirement for vegetables
- Met requirement that at least half of weekly grains are whole grain-rich
- Met minimum calorie level
- Met maximum calorie level
- Met Target 1 sodium level

Types of Foods Offered in NSLP Lunches

- All daily menus offered raw vegetables
- Median number of vegetable choices offered per day
- More than half of daily menus offered red or orange vegetables
- At least one daily menu offered side salad bar
- No daily menus offered French fries or similar products
- Percentage of daily menus that offered pizza or pizza products
- At least one daily menu offered breaded meat item

HEI = Healthy Eating Index; NSLP = National School Lunch Program.

associations do not imply causality. Because of the study's cross-sectional design, it is not possible to conclusively attribute associations observed between key nutritional characteristics of schools meals and the outcomes of interest to the characteristic's influence on the outcome.

Associations Between Nutritional Characteristics of NSLP Lunches and Student Participation

- There was a positive and statistically significant association between student participation in the NSLP and the nutritional quality of NSLP lunches, as measured by the HEI-2010. Rates of student participation were significantly higher in schools with HEI-2010 scores in the third and highest quartiles (that is, the top half) of the distribution compared to the lowest quartile (Figure 22).

- Specifically, the average NSLP participation rates for schools with lunches in the two highest quartiles of the HEI-2010 distribution were 61 and 60 percent, compared to 50 percent for schools with lunches in the lowest quartile of the distribution (Figure 22).
- Overall, there were significant associations between NSLP participation and compliance with two of the NSLP nutrition standards examined in this analysis. Specifically, compliance with the daily quantity requirement for meats/meat alternates was associated with a significantly higher NSLP participation rate (59 percent versus 49 percent). However, compliance with the Target 1 sodium limit was associated with a significantly lower NSLP participation rate (54 percent versus 64 percent).

- Offering red or orange vegetables on more than half of daily lunch menus was associated with a significantly higher NSLP participation rate (60 percent versus 53 percent).

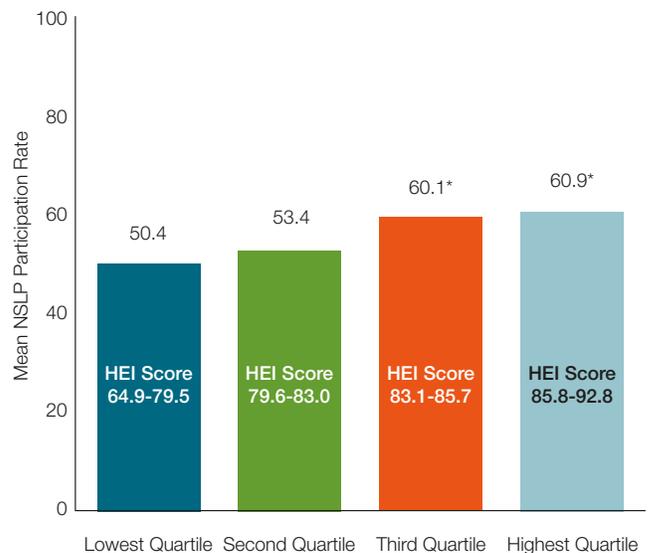
Associations Between Nutritional Characteristics of NSLP Lunches and the Nutritional Quality of NSLP Participants' Diets

This analysis estimated how the nutritional quality of NSLP participants' diets (measured by total scores on the HEI-2010) was associated with key characteristics of NSLP lunches. The sample included students who (1) had a completed 24-hour dietary recall, (2) were identified as school meal participants on the day covered in the dietary recall, and (3) attended schools where the SNM completed the SNM Survey and the Menu Survey.

- There was no significant positive association between the nutritional quality of NSLP lunches prepared and the nutritional quality of NSLP participants' diets. That is, the nutritional quality of students' overall diets was not significantly higher in schools that had higher scores on the HEI-2010 than in schools that scored the lowest on the HEI-2010. This is not necessarily surprising, given the influence of students' diets outside of school on the nutritional quality of their overall diets (see Section V).^{31, 32}
- Of the nine measures of compliance with NSLP nutrition standards included in this analysis, only one—meeting the Target 1 sodium limit—was associated with a significantly higher average HEI-2010 score for NSLP participants (58.0 points versus 55.2 points).
- There were no significant associations between NSLP participants' HEI-2010 scores and the characteristics of NSLP menu offerings examined in this analysis.

Figure 22.

There was a positive and statistically significant association between student participation in the NSLP and the nutritional quality of NSLP lunches as measured by the HEI-2010



Source: School Nutrition and Meal Cost Study, Reimbursable Meal Sale Form, 24-Hour Dietary Recalls: Day 1, and Menu Survey, SY 2014–2015. See Volume 4 of the SNMCS final report, Figure 4.1.

Notes: Estimates are regression-adjusted mean NSLP participation rates (as percentages) that control for demographic characteristics of each student, institutional characteristics of schools and SFAs, and the price charged by each school for a paid lunch.

The maximum possible score for the HEI-2010 is 100. A higher total score indicates higher nutritional quality.

*Difference in participation rates between schools in this category and schools in the lowest quartile of the HEI-2010 distribution is statistically different from zero at the 0.05 level.

HEI = Healthy Eating Index; NSLP = National School Lunch Program; SFA = school food authority; SNMCS = School Nutrition and Meal Cost Study; SY = school year.

Associations Between Nutritional Characteristics of NSLP Lunches and Reported Meal Costs

This analysis examined relationships between the nutritional characteristics of NSLP lunches and the reported costs per meal.^{33,34} Because the nutritional characteristics of school meals were measured at the school level, regression models provided estimates of differences in mean costs between schools that differed on each characteristic while controlling for institutional and demographic characteristics.

- There was no significant association between reported cost per NSLP lunch in SY 2014–2015 and the nutritional quality of NSLP lunches, as measured by mean total scores on the HEI-2010. That is, mean reported costs per NSLP lunch were not significantly higher in schools that prepared more-nutritious meals—schools that had higher scores on the HEI-2010—than in schools that produced the least-nutritious meals—schools that scored the lowest on the HEI-2010.³⁵
- There were no significant associations between reported cost per NSLP lunch and any of the variables used in these analyses to characterize compliance with updated nutrition standards for NSLP lunches or the types of foods offered in NSLP lunches.

References

- Bartlett, S., F. Glantz, and C. Logan. "School Lunch and Breakfast Cost Study-II." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Office of Research, Nutrition and Analysis, April 2008.
- Cullen, K.W., T. Chen, and J.M. Dave. "Changes in Foods Selected and Consumed After Implementation of the New National School Lunch Program Meal Patterns in Southeast Texas." *Preventive Medicine Reports*, vol. 2, 2015, pp. 440-443.
- Devaney, B., M.K. Crepinsek, K. Fortson, and L. Quay. "Review of Dietary Reference Intakes for Selected Nutrients: Challenges and Implications for Federal Food and Nutrition Policy." Contractor and Cooperator Report No. 28 prepared for the USDA's Economic Research Service (ERS) Food and Nutrition Assistance Research Program (FANRP), February 2007.
- Fox, M.K., E. Condon, M.K. Crepinsek, K. Niland, D. Mercury, S. Forrestal, C. Cabili, V. Oddo, A. Gordon, N. Wozny, and A. Killewald. "School Nutrition Dietary Assessment Study-IV: Volume I: School Foodservice Operations, School Environments, and Meals Offered and Served." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis, November 2012.
- General Accounting Office. "School Lunch Program: Cafeteria Managers' Views on Food Wasted by Students." Washington, DC: U.S. General Accounting Office, 1996.
- Glantz, F., C. Logan, H. Weiner, M. Battaglia, and E. Gorowitz. "School Lunch and Breakfast Cost Study." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis and Evaluation, October 1994.
- Guenther P.M., K.O. Casavale, J. Reedy, S.I. Kirkpatrick, H.A.B. Hiza, K.J. Kuczynski, L.L. Kahle, and S.M. Krebs-Smith. "Update of the Healthy Eating Index: HEI-2010." *Journal of the Academy of Nutrition and Dietetics*, vol. 113, no. 4, 2013, pp. 569-580.
- Institute of Medicine. "Dietary Reference Intakes: The Essential Guide to Nutrient Requirements." Washington, DC: National Academies Press, 2006.
- Institute of Medicine. "School Meals: Building Blocks for Healthy Children." Washington, DC: National Academies Press, 2010.
- Schwartz, M.B., K.E. Henderson, M. Read., N. Danna., and J. Ickovics. "New School Meal Regulations Increase Fruit Consumption and Do Not Increase Total Plate Waste." *Childhood Obesity*, vol. 11, no. 3, June 2015, pp. 242-247.
- St. Pierre, R., M.K. Fox, M. Puma, F. Glantz, and M. Moss. "Child Nutrition Program Operations Study: Second Year Report." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis and Evaluation, June 1992.
- U.S. Department of Agriculture, Food and Nutrition Service. "Final Rule: Nutrition Standards in the National School Lunch and School Breakfast Programs." *Federal Register*, vol. 77, no. 17, Thursday, January 26, 2012, pp. 4088-4167. Available at <https://www.gpo.gov/fdsys/pkg/FR-2012-01-26/pdf/2012-1010.pdf>. Accessed August 28, 2018.
- U.S. Department of Agriculture, Food and Nutrition Service. "National School Lunch, Special Milk, and School Breakfast Programs: National Average Payments/Maximum Reimbursement Rates." *Federal Register*. 2014. Available at <https://www.federalregister.gov/documents/2014/07/16/2014-16719/national-school-lunch-special-milk-and-school-breakfast-programs-national-average-paymentsmaximum>. Accessed August 28, 2018.
- U.S. Department of Agriculture and U.S. Department of Health and Human Services. "Dietary Guidelines for Americans 2010." 7th edition. Washington, DC: U.S. Government Printing Office, December 2010. Available at <http://health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>. Accessed August 28, 2018.

Endnotes

¹ See https://www.cnpp.usda.gov/sites/default/files/healthy_eating_index/HEI-2010TotalAndComponentScoresTable.pdf.

² Statistics reported for the NSLP and SBP were obtained from national-level annual summary tables generated by FNS. These tables are available at <http://www.fns.usda.gov/pd/child-nutrition-tables>. Accessed April 18, 2018.

³ See “More Information” on page 44

⁴ In some schools, other respondents, such as SFA directors or other SFA staff, completed the Menu Survey.

⁵ Internal analysis completed by FNS staff; data not shown.

⁶ The updated nutrition standards and schools’ compliance with the standards are described in detail in Section III.

⁷ Smarter Lunchroom Techniques are intended to promote healthy food choices, and include strategies such as soliciting students’ input on vegetable offerings and displaying dark green, red, and orange vegetables prominently among side dish offerings.

⁸ The IOM is now referred to as the Health and Medicine Division of the National Academies of Science. Throughout this report, we refer to the IOM because that was the name of the organization when it developed recommendations for the updated nutrition standards for school meals.

⁹ The 2010 *Dietary Guidelines for Americans* were in effect when the data for this study were collected.

¹⁰ See https://www.cnpp.usda.gov/sites/default/files/healthy_eating_index/HEI-2010TotalAndComponentScoresTable.pdf.

¹¹ In SY 2014–2015, allowed milks included fat-free (flavored or unflavored) or low-fat (1% or less) unflavored. In November 2017, USDA published an interim final rule that provides flexibility in meeting the milk requirement by allowing schools to offer low-fat flavored milk.

¹² This summary focuses on plate waste in the NSLP, but the study also examined plate waste in the SBP. See Chapter 5 in Volume 4 of the SNMCS final report.

¹³ The minimum number of lunches served per day in the final sample of schools included in the plate waste analysis were 157 lunches for elementary schools, 220 for middle schools, and 87 for high schools.

¹⁴ Data for the full sample of schools that completed the SNMCS Menu Survey indicate that, in SY 2014–2015, more than three-quarters of all NSLP schools served the minimum number of lunches per day reflected in the plate waste sample (78 percent of elementary schools, 77 percent of middle schools, and 90 percent of high schools).

¹⁵ See St. Pierre et al. 1992 and General Accounting Office 1996.

¹⁶ See Cullen, Chen, and Dave 2015, and Schwartz et al. 2015.

¹⁷ When administrative data were not available for a given student, the study team constructed measures of target-day participation based primarily on the lunch and breakfast foods that the student

reported obtaining at school on the target day.

¹⁸ The study also examined the dietary intakes of SBP participants and nonparticipants. The general pattern of findings for SBP participants and matched nonparticipants was comparable to findings for NSLP participants and matched nonparticipants because most SBP participants were also NSLP participants. See Volume 4 of the SNMCS final report.

¹⁹ See Section III for a description of the HEI-2010.

²⁰ See https://www.cnpp.usda.gov/sites/default/files/healthy_eating_index/HEI-2010TotalAndComponentScoresTable.pdf.

²¹ The 2010 *Dietary Guidelines for Americans* were in effect when data for this study were collected.

²² Devaney et al. (2007) pointed out that the diets of most of the U.S. population are low in vitamin E, relative to recommended intakes, yet vitamin E deficiency is rare. They noted limitations of both the data used to establish recommendations and the data used to assess vitamin E intakes.

²³ In SY 2014–2015, the lowest Federal reimbursement rate for a free NSLP lunch was \$2.98 for schools in the continental United States (USDA, FNS 2014). Schools that served 60 percent or more lunches at a free or reduced price in the second preceding school year received a higher reimbursement rate of \$3.00 per NSLP lunch. In addition, SFAs certified by their State agency as being in compliance with the updated nutrition standards for both NSLP lunches and SBP breakfasts received an additional \$0.06 per NSLP lunch.

²⁴ About one in seven SFAs nationwide (14 percent) were large (more than 5,000 students), 43 percent were medium-sized (1,000 to 5,000 students), and 43 percent were small (fewer than 1,000 students).

²⁵ SFAs received higher Federal reimbursements for free and reduced-price breakfasts for schools classified as “severe need.” Schools qualify for the “severe need” reimbursement if they served at least 40 percent of NSLP lunches at a free or reduced price in the second preceding school year. For the SNMCS analyses, the average free SBP breakfast reimbursement rate reflected the average SFA’s proportions of free breakfasts claimed at the severe need and non-severe need rates.

²⁶ Revenue from USDA Foods also includes donated food from non-USDA sources such as food banks. Few SFAs reported that they received non-USDA donations of foods.

²⁷ Bartlett et al. 2008 and Glantz et al. 1994.

²⁸ The estimated costs of food, labor, and other expenses per SBP breakfast also were greater in SY 2014–2015 than in the prior years, but not all the differences were statistically significant.

²⁹ The average price of a paid lunch increased by \$0.49 from SY 2009–2010 to SY 2014–2015. In SY 2014–2015, a 10 cent increase in the price of a paid lunch was associated with a decline of 0.7 percentage points in the rate of paid meal participation (see Volume

1 of the SNMCS final report, Table 2.8). Lower-poverty SFAs had more paid NSLP lunches (as a percentage of total lunches) than higher-poverty SFAs, so they likely experienced more of the impact from increasing prices mandated by the PLE rule.

³⁰ Additional analyses addressed the relationships between these outcomes and key characteristics of (1) school foodservice operations, (2) the school food environment, and (3) demographic characteristics of students and demographic and institutional characteristics of SFAs and schools. See Volumes 3 and 4 of the SNMCS final report.

³¹ In addition, there was relatively little variation in total HEI-2010 scores for NSLP lunches prepared, relative to the variation in total HEI-2010 scores for usual (24-hour) dietary intakes of NSLP participants. Mean total HEI-2010 scores for NSLP lunches in the 10th and 90th percentiles of the sample were 77.0 and 87.9 points, respectively (data not shown). In comparison, mean total HEI-2010 scores for usual dietary intakes of NSLP participants in the 10th and 90th percentiles of the sample were 40.1 and 73.7 points, respectively.

³² The analyses summarized in Section V included both NSLP participants and matched nonparticipants and used rigorous methods to estimate the relationship between NSLP participation and the nutritional quality of students' diets. These estimates better isolate the average difference in the quality of students' overall diets associated with participation in the NSLP.

³³ The study team also examined the associations between the nutritional characteristics of school meals and full costs. See Volume 3 of the SNMCS final report, Chapter 6.

³⁴ As a rule, relationships were discussed only when a characteristic was associated with more than one outcome in the same direction. Given that the outcomes are associated with one another, a particular detected significant relationship's association with only one outcome increases the likelihood that it is due to random variation in the data as opposed to a true underlying difference.

³⁵ This finding is at least partially explained by the fact that there was relatively little variation in mean HEI-2010 scores of NSLP lunches in SY 2014–2015 (8.9 point standard deviation; data not shown). In contrast, the variance in HEI-2010 scores for NSLP lunches in SY 2009–2010—when the updated nutrition standards were not in effect—was 32 percent larger (11.7 points versus 8.9 points; data not shown).



For More Information

For in-depth results, please consult the following technical reports available at <https://www.fns.usda.gov/report-finder>:

U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, *School Nutrition and Meal Cost Study, Final Report Volume 1: School Meal Program Operations and School Nutrition Environments* by Sarah Forrestal, Charlotte Cabili, Dallas Dotter, Christopher W. Logan, Patricia Connor, Maria Boyle, Ayesha Enver, and Hiren Nisar. Project Officer: John Endahl. Alexandria, VA: 2019.

U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, *School Nutrition and Meal Cost Study, Final Report Volume 2: Nutritional Characteristics of School Meals* by Elizabeth Gearan, Mary Kay Fox, Katherine Niland, Dallas Dotter, Liana Washburn, Patricia Connor, Lauren Olsho, and Tara Wommack. Project Officer: John Endahl. Alexandria, VA: 2019.

U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, *School Nutrition and Meal Cost Study, Final Report Volume 3: School Meal Costs and Revenues* by Christopher W. Logan, Vinh Tran, Maria Boyle, Ayesha Enver, Matthew Zeidenberg, and Michele Mendelson. Project Officer: John Endahl. Alexandria, VA: 2019.

U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, *School Nutrition and Meal Cost Study, Final Report Volume 4: Student Participation, Satisfaction, Plate Waste, and Dietary Intakes* by Mary Kay Fox, Elizabeth Gearan, Charlotte Cabili, Dallas Dotter, Katherine Niland, Liana Washburn, Nora Paxton, Lauren Olsho, Lindsay LeClair, and Vinh Tran. Project Officer: John Endahl. Alexandria, VA: 2019.

U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, *School Nutrition and Meal Cost Study: Study Design, Sampling, and Data Collection* by Eric Zeidman, Nicholas Beyler, Elizabeth Gearan, Nikkilyn Morrison, Katherine Niland, Liana Washburn, Barbara Carlson, David Judkins, Lindsay LeClair, Michele Mendelson, Tara Wommack, Justin Carnagey, Maureen Murphy, and Andre Williamson. Project Officer: John Endahl. Alexandria, VA: 2019.

Public-use data files can be obtained by writing or calling us at:

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