



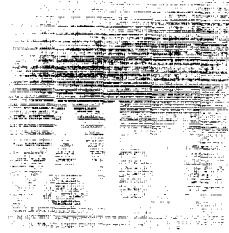
**United States  
Department of  
Agriculture**

**Food and  
Nutrition  
Service**

**Office of  
Analysis and  
Evaluation**

# **Child Nutrition Meal Cost Methodology Study**

## **Final Report**



**CHILD NUTRITION MEAL COST  
METHODOLOGY STUDY:  
Final Report**

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## **EXECUTIVE SUMMARY**

### **BACKGROUND AND NEED FOR THE STUDY**

There have been several studies and attempts to measure the cost of producing reimbursable meals in the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). However, past efforts were limited for several reasons, namely:

- 1) The inability to directly measure and allocate meal production costs to School Food Authority (SFA) activities. Existing meal cost measurement approaches heavily rely on indirect, econometric techniques to allocate costs to various food service functions, e.g., breakfast production and lunch production and reimbursable and non-reimbursable meals. Direct measurement is infeasible due to joint production: there is no separate accounting of food, labor and other costs used to produce different meals (e.g., reimbursable versus a la carte meals). A widely used approach to allocate meal production costs to different activities is to convert breakfasts, adult meals, and a la carte sales into NSLP-lunch equivalents (LEQ). A variety of techniques have been used by SFAs and researchers to construct a LEQ measure. However, while feasible, this methodology does not provide a true measure of the costs directly attributed to each SFA activity.
- 2) Not considering the full cost of meal production when calculating per-meal costs. Previous studies have almost always relied on costs as *reported* by SFAs when measuring meal production costs. However, reported costs do not include all resources used by the SFA to produce school meals. These may include costs that are either not charged to, or paid by the SFA. Often space, utility and some labor costs may be subsidized by the school district. Omitting these costs reduces the total cost attributable to meal production.

The Food and Nutrition Service (FNS) is in need of accurate, comprehensive meal production cost estimates to inform policy and to facilitate program decision-making. The purpose of this study was to develop a methodology to provide the Agency with a feasible tool to collect reliable meal cost data on a national level.

### **STUDY OBJECTIVES AND DESIGN**

The major goal of the Child Nutrition Meal Cost Methodology Study is to identify the best practical approach for measuring meal production costs for reimbursable meals in the NSLP and SBP. Primary study objectives include:

- 1) To determine the full costs of producing reimbursable meals in the NSLP and SBP;
- 2) To assess the reliability and validity of meal production costs reported by SFAs;
- 3) To develop technical assistance materials for use by SFAs that will enable them to calculate meal production costs for their own school districts.

The study was conducted by Abt Associates Inc. (AAI) of Cambridge Massachusetts under contract to the Food and Nutrition Service. After designing the methodology, AAI pilot tested the methodology in 18 SFAs nested in four States: New Jersey, Maryland, Arizona, and Florida. Overall, 91 schools participated in the study. The study collected data on-site on food, labor, and other meal production costs for a five day period. A major goal was to test the feasibility of identifying meal production costs that were not charged to the SFA account (to obtain full costs) and directly allocating costs to different SFA activities. Data collection occurred in 1990; the data reflect meal production costs for the 1989-1990 school year.

## **SUMMARY OF FINDINGS**

The methodology developed and tested in this study builds on previous work to measure meal production costs. Major advancements were made in the area of identifying the full cost of meal production. The pilot also indicates that it is possible to allocate major meal production costs (food and labor) to the various SFA activities in a more direct fashion than algorithms currently used. The methodology was adaptable to the different types of meal production systems included in the study; on-site and satellite kitchens, and in districts receiving vended meals and using food service management companies.

### ***Feasibility***

The results of the pilot study indicate that the approach developed by this study is a feasible mechanism for measuring per-meal costs for reimbursable school meals. The methodology can be used in future studies to obtain reliable estimates of the full cost of meal production.

### **Measuring the Full Cost of Meal Production**

- Efforts to identify the full cost of meal production were successful; in most instances, respondents (SFA Directors and other school district personnel) were able to identify uncharged costs and provide information needed to estimate their value.
- Uncharged costs were primarily made up of space, labor (usually at the school district level), and indirect costs that were not charged to the SFA.



- Imputing space costs used in support of meal production, but not charged to the SFA was problematic. While the participating SFAs were able to provide information necessary to impute space costs (square footage); the study team was unable to obtain rental values for comparable space in order to assign space costs. In these instances, construction costs were used to impute space costs. Due to the difficulty in obtaining rental values, construction costs are a viable alternative for imputing space costs.
- Efforts to estimate the utility costs associated with meal production were also problematic. While there are a number of ways to identify SFA utility costs, they represent a small proportion of operational costs (about 2%) and efforts to obtain these costs may not be worth the cost.

### **Allocating the Full Cost of Meal Production to Breakfast, Lunch and Other Meal Production Activities**

- The allocation of total annual food costs between breakfast, lunch, and other meals was conducted by extracting data from menus, production, and recipe records during a sample week. While data collectors were able to capture all food items served, some of the schools failed to correctly identify some (or all) of the costs of non-reimbursable lunch food items. Future uses of this methodology should highlight the importance of capturing the cost of a la carte food items when measuring total lunch food costs. This may be done by extensive training in this area. To correct this problem, the study team used an alternative approach to estimate meal costs based on food costs for all other meals; data which were measured reliably. No other problems occurred when allocating food costs to lunch, breakfast, and other meals.
- The allocation of food costs between reimbursable and non-reimbursable meals is based on estimates of the costs of food that students actually take as part of reimbursable meals. Meal observers were able to accurately record the food items taken on reimbursable breakfasts and lunches at a sample of schools during the 5-day observation period.
- A time study was used to allocate the majority of labor costs between SFA activities. Professional estimates made by school district staff were used to obtain estimates of labor for staff that only worked on one or two readily identifiable SFA activities (e.g., principals reviewing meal applications). These allocation methods proved feasible; however there was some confusion regarding the definition of one time category in the time study.

Additional examples and/or training should eliminate this problem in future applications of the methodology.

### ***Meal Cost Estimates***

- There is substantial difference between the reported cost and full cost of meal production. On average, 19% of the full cost of meal production was not charged to the SFA. Among the pilot sites, the range of full costs per reimbursable lunch was \$1.235 to \$2.236 with a median cost of \$1.698. The range of full costs per reimbursable breakfast was \$0.991 to \$1.792 with a median cost of \$1.443.
- The range of reported (charged to the SFA) costs per reimbursable lunch was \$1.034 to \$1.704 with a median cost of \$1.353. The range of reported costs per reimbursable breakfast was \$0.68 to \$1.492 with a median cost of \$1.207.
- The major elements of uncharged costs are space (32%), off-budget labor (27%), indirect costs that are not charged to the SFA budget (21%), utilities (12%), and equipment depreciation (7%). None of the 18 SFAs in the study were charged space costs for the use of school district facilities (e.g., kitchens, warehouses).
- While all food costs, and the majority of labor costs are included in the reported cost of meal production, 61% of "other" costs (space, utilities) were not charged to the SFA budget.
- There is no apparent relationship between the type of production system and the elements of uncharged costs.
- The study team suggested that a comparison of meal cost estimates obtained from the direct measurement approach used in this study yield similar estimated meal costs. The study team suggests further that the LEQ approach may be viewed as a cost-effective alternative to the more expensive, yet precise direct measurement approach. In conclusion, the study team recommends that a two-phase approach, combining the direct and indirect approaches, may be the best methodology to use in a national study of meal costs.

## **CHAPTER I**

### **INTRODUCTION**

This report presents the findings from the Child Nutrition Program Meal Cost Methodology Study. This study was conducted by Abt Associates Inc. (AAI) of Cambridge, Massachusetts under contract to the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture.

The major goals of the Child Nutrition Program Meal Cost Methodology Study are to identify the best practical approach to directly measure the full cost of meal production in the National School Lunch and School Breakfast Programs, and to relate costs to characteristics of School Food Authorities (SFAs). Previous studies have used indirect approaches to estimate per-meal costs in the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). These studies relied on econometric techniques to allocate costs among the different types of meals produced. FNS is interested in improving the methodology to measure meal costs to more accurately reflect the cost of producing NSLP and SBP reimbursable meals. To achieve these goals, FNS identified four objectives:

- To determine the full cost of producing lunches in the National School Lunch Program and breakfasts in the School Breakfast Program by using a direct measurement approach.
- To determine the validity and reliability of meal production costs reported by School Food Service Authorities.
- To identify those cost capturing and allocation practices currently in use among SFAs that most fully and accurately record school meal production costs.
- To develop technical assistance materials, for use by SFAs, that will enable them to use regularly collected data (or readily obtainable data) to calculate the full cost of meal production.

To meet these objectives, AAI developed a methodology for measuring the full cost of producing NSLP-reimbursable lunches and SBP-reimbursable breakfasts. This methodology was pilot tested in a sample of 18 SFAs in four states.

Results of this study are presented in three volumes. Volume 1 includes this introductory chapter which provides an overview of the two child nutrition programs, an operational definition of meal costs, and an overview of the approach taken to measure them. The remainder of Volume 1 describes the methodology and the results of the pilot test. Volume 1 also presents our recommendations regarding the use of the methodology in future national studies of the NSLP and SBP.

Volume 2 contains copies of the data collection instruments. Finally, Volume 3 presents detailed tables of the analysis for each for each of the 18 SFAs included in the pilot test.

## **OVERVIEW OF THE NSLP AND SBP**

### ***The National School Lunch Program***

The NSLP is the largest and oldest Child Nutrition Program. The Federal contribution for School Year (SY) 1990-91 was about \$4 billion, including donated commodities.

The NSLP provides Federal subsidies for school lunches served to children at all income levels. Eligible institutions include public schools, private non-profit schools, and public or licensed residential child care institutions. Nationally, about ninety-five percent of all public schools and 29 percent of all private schools participate in the NSLP.<sup>1</sup> Any child in a participating school is eligible to purchase a school lunch. About two-thirds of all children in schools regularly participate in the program.<sup>2</sup>

Federal assistance takes two forms: cash and commodities. To be eligible for Federal subsidy, lunches served must meet nutritional guidelines set forth by the Secretary of Agriculture designed to ensure that the meal provides, on average, one-third of a student's daily nutritional requirements. Federal assistance is performance-based--i.e., reimbursement is provided to States only for meals actually served to students. Two kinds of cash assistance are provided. Under Section 4 of the National School Lunch Act, a uniform cash subsidy is provided for every lunch served, regardless of the family income of the child. Under Section 11 of the National School Lunch Act, additional cash subsidies are provided for children qualifying for free or reduced-price lunches. Currently, students eligible for a free lunch are those from families with incomes at or below 130 percent of poverty. Reduced-price lunches may be served to students from families whose incomes fall between 130 and 185 percent of poverty. These students may be required to contribute an additional amount of their own money for the lunch--up to \$0.40 per lunch.

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<sup>1</sup>Committee on Agriculture, Nutrition, and Forestry, U.S. Senate. **Child Nutrition Programs: Description, History, Issues, and Options** (Washington, D.C.: 1983).

<sup>2</sup>U.S. Department of Agriculture, Food and Nutrition Service. **Characteristics of the National School Lunch and School Breakfast Program Participants** (Washington, D.C.: U.S. Government Printing Office, 1988).

An additional \$0.02 per lunch is reimbursed for each meal served in schools in which 60 percent or more of the lunches in the second preceding year were claimed as free or reduced-price meals. Total cash reimbursements received by schools during Fiscal Year (FY) 1990 amounted to \$3.2 billion.

The NSLP is the only Child Nutrition Program that requires a matching contribution by states. States are required to provide matching funds equal to up to 30 percent of the amount of Section 4 assistance they received during FY 1980. The actual percentage depends on the average per capita income in the state as compared with the national average. States with average per capita incomes lower than the national average are required to contribute less than 30 percent.

Under Sections 6 and 14 of the National School Lunch Act, schools also receive agricultural commodities for use in school lunches. Entitlement commodity assistance, provided regardless of family income, is available for each meal served (about \$0.13 per lunch for SY 1989-90) and is provided to states based on the estimated number of lunches to be served in the school year. In addition, the school lunch program may receive "bonus commodities"-- commodities that do not count against the state's entitlement and which vary from year to year both in amount and the types of commodities provided. In SY 1989-90 the value of bonus commodities was about \$0.08 per lunch.

Peak levels of participation in the NSLP were reached in 1979 when a daily average of 27 million children ate school lunches. Participation declined from 1980 to 1982. Since then, it has increased to the level of 24.6 million daily lunches in FY 1990. The lunch reimbursement rate schedule in effect for School Year 1989-90 is as follows:<sup>1</sup>

	<u>Regular Reim- bursement Rates</u>	<u>Entitlement Commodities</u>	<u>Bonus Commodities</u>	<u>Total</u>
Paid	\$0.1475	\$0.1325	\$0.0800	\$0.3600
Reduced-price	1.1325	0.1325	0.0800	1.3450
Free	1.5325	0.1325	0.0800	1.7450

<sup>1</sup>Year data was collected for this study.

### ***The School Breakfast Program***

The SBP provides Federal funds for non-profit breakfast programs in eligible schools (i.e., public or private non-profit) and other approved child care institutions. The program began operating in 1967 in significantly fewer schools than the NSLP, but has grown at a faster rate than the older program. Changes to the program in the 1980 and 1981 Omnibus Budget Reconciliation Acts (OBRA) reduced participation, but program participation has increased each year since 1982. In 1989, P.L. 101-147 mandated that states initiate outreach efforts to school districts to increase program participation. This legislation also provides for start-up grants to assist schools initiating a breakfast program. The current cost of the breakfast program (FY 1990) is \$594 million.

Initiated in 1967, the program was targeted to "nutritionally needy" children<sup>1</sup>. Throughout its early history, legislation stressed the need to reach children in poor areas, especially rural areas where children might have to travel great distances to school, and children of working mothers. As with the NSLP, Federal SBP reimbursement is based on the number of meals served. Per-meal reimbursement rates vary in two ways. First, as in the NSLP, three categories of reimbursement are established according to family income: paid reimbursement is provided for breakfasts served to those from families with incomes above 185 percent of poverty; reduced-price rates are established for breakfasts served to children from families with incomes between 130 and 185 percent of poverty; and free rates are established for breakfast served to children from families with incomes below 130 percent of poverty. Second, a "severe need" rate is established for free and reduced-price breakfasts in schools that served 40 percent or more of their lunches to children below 185 percent of poverty two years prior to the school year for which the rate is claimed.<sup>2</sup> Schools must also demonstrate that unusually high preparation costs exceed the regular reimbursement. The breakfast reimbursement rate schedule in effect for SY 1989-90 is as follows:

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<sup>1</sup>Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, 1983.

<sup>2</sup>Prior to the 1981 OBRA, schools could be designated as severe need if state law required them to operate a breakfast program.

	<u>Regular Reim- bursement Rates</u>	<u>Severe Need Reimbursement</u>
Paid	\$0.1750	\$0.1750
Reduced-price	0.5600	0.7200
Free	0.8600	1.0200

Federal law prohibits schools from charging students who qualify for free breakfasts, but allows them to charge up to \$0.30 for reduced-price breakfasts. There is no limit placed on what paying students may be charged for breakfast.

Most subsidies are for meals served in elementary schools; not only do more elementary schools participate in the program, but student participation is much greater in these schools. The great majority of children who participate in the program receive free breakfasts (i.e., have incomes below 130 percent of poverty). In 1990, 86 percent of all breakfasts were served free or at a reduced-price rate.

### **DEFINING MEAL COSTS**

The major goal of the study is to develop a direct measurement methodology that will obtain valid and reliable estimates of the full cost of producing school lunches and breakfasts. In existing reporting systems, the definition and measurement of meal production costs depends on the vantage point adopted and on how the information is to be used. At the local level, cost accounting systems are designed to inform managerial decisions. Most often, school districts expect their food service authorities to operate at the break-even level. The cost elements included in the SFA's cost accounting system are, for the most part, limited to those costs that the food service authority is expected to cover from revenues generated from food service sales and government reimbursements. These costs may not reflect the full cost of meal production in the school district. For example, they may not include the cost of school district resources used in support of SFA operations. Conceptually, however, the full cost of meal production should include the current cost of all resources used in meal production, including those charged to the SFA budget and those charged to other budgets or donated. These costs include:

- **Direct Meal Production Costs.** Direct meal production costs are those directly traceable to meal production and service. They include such items as food cost, SFA food service labor costs, and other identifiable meal production costs (e.g., supplies).

- **Non-meal Production Costs.** These costs can be incurred at the SFA and school district level. These costs are not directly traceable to meal production, but support the production of meals in schools. At the SFA level, these costs include labor for food service administration and other SFA support activities, the cost of the facilities occupied by the SFA, storage and transportation of foods, and transportation of meals within the district.

School district costs (both labor and materials), while not always traceable to SFA operations, nevertheless facilitate these operations and should properly be included in the full cost of meal production. For example, school district business managers often are responsible for SFA as well as school district purchases; school principals, custodians and secretaries provide administrative services that facilitate the operation of school cafeterias; and cafeteria and kitchen utility costs are often included in school district utility bills. Other examples of school district costs include: the cost of school facilities used to store and transport inventories of food (and other SFA supplies); the cost of school district facilities used to prepare and serve meals; and the cost of transporting meals prepared at central or base kitchens to satellite and receiving kitchens.

Some or all of these costs may be directly charged to the SFA and appear as line-items on the SFA financial statement; they may appear as part of an indirect cost rate; or they may be absorbed by the school district and not charged in any way to the SFA.

- **Costs of Other Resources.** Examples of other resources (which may be meal production or non-meal production costs) that do not appear in either SFA or school district budgets are: volunteers and student aides who routinely assist in the cafeteria; and depreciation of capital equipment.

## **OVERVIEW OF THE STUDY APPROACH AND DATA COLLECTION ACTIVITIES**

The study used information obtained from case studies of 18 SFAs to test the feasibility of a new methodology for measuring the full cost of producing NSLP-reimbursable lunches and SBP-reimbursable breakfasts. In contrast to the methods used by SFAs and prior research studies, this methodology relies on the direct measurement of the costs attributable to the various SFA



activities rather than the use of indirect allocation rules.<sup>1</sup> Exhibit 1.1 presents an overview of the study approach.

The methodology consists of four elements:

- 1) measuring the full cost of SFA operations;
- 2) distributing the full cost of SFA operations to the production of lunches, the production of breakfasts, and non-meal production activities;
- 3) distributing a share of the cost of non-meal production activities to the production of lunches and breakfasts to obtain the full cost of producing these meals; and
- 4) distributing the full cost of meal production to the production of reimbursable and non-reimbursable meals.

To complete these four processes, data were collected during on-site visits to each of the 18 SFAs. Data collectors reviewed SFA financial statements, meal production records, recipes, invoices, and other documentation. SFA and school district officials were interviewed to provide data to impute the value of school district costs that were not charged to the SFA budget. Food service staff participated in a time study, using a simple grid to check off their activities to provide data on the distribution of labor costs across food service activities. A sample of meals taken by students was observed to obtain data on the distribution of menu items sold between reimbursable and non-reimbursable meals. The relationships between these data collection activities and the four components of the study design are summarized in Exhibit 1.2.

Data collection activities were conducted in three separate phases. In Phase 1 study staff from Cambridge visited each school district participating in the study to discuss data collection with the food service director, review practice day Time Records, train meal observers and kitchen managers for the Phase 2 data collection, and visit the meal observation schools to supervise the meal observers during the first day of data collection. Forms were left with the food service director to assemble the required information (which would be reviewed during the Phase 3 site visit).

During Phase 2, meal production records were collected in a sample of schools for a period of five consecutive school days (i.e., the study week).

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<sup>1</sup>These indirect cost allocation methods are discussed in Chapter II.

During this period all kitchen staff in the sample of schools completed Daily Time Records. In a subsample of schools, on-site meal observers recorded the foods selected by students at breakfast and/or lunch for the 5-day period.<sup>1</sup>

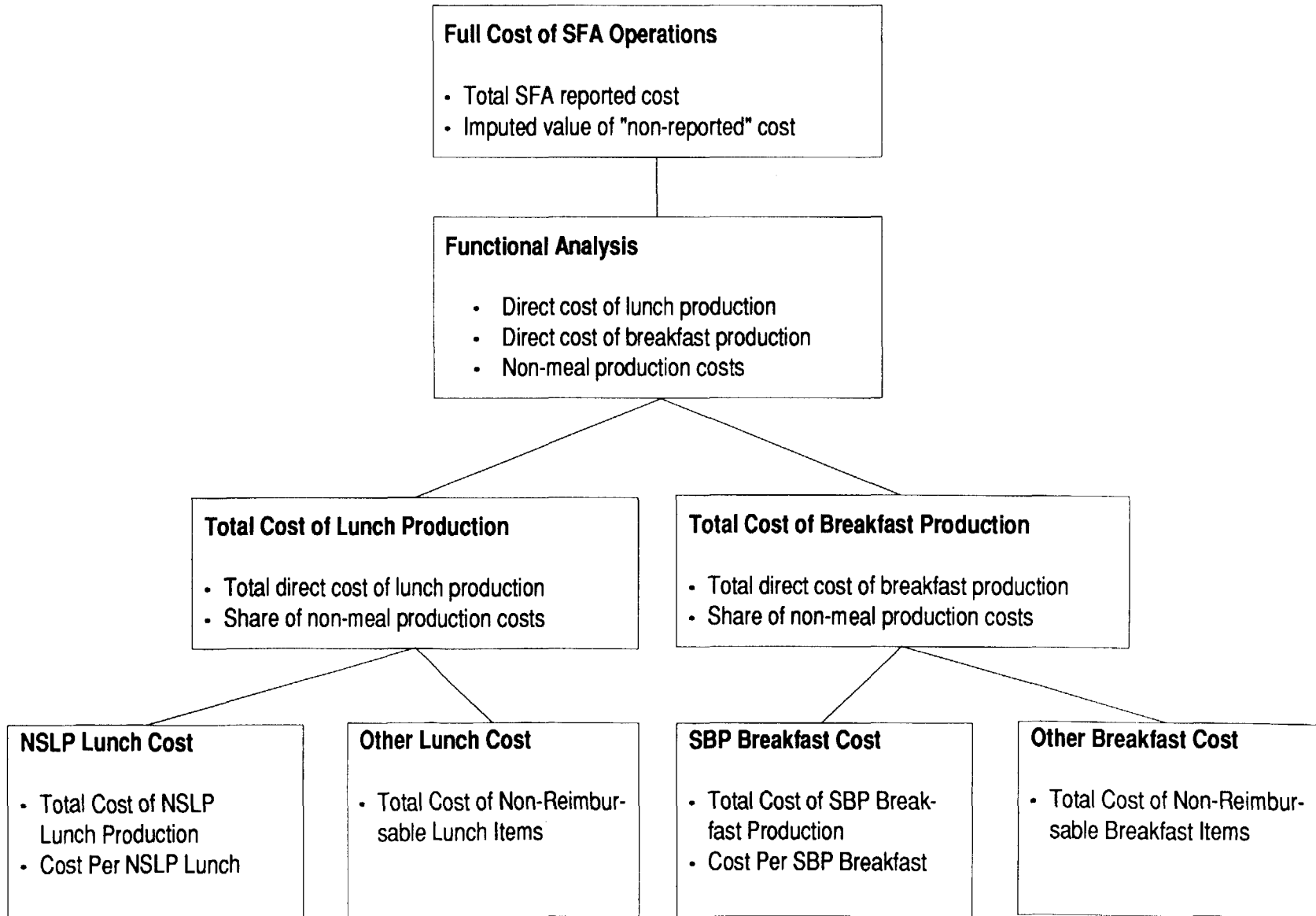
In Phase 3 study staff visited each school district to review the SFA's expense statement with the SFA director and/or business manager. Information needed to identify and estimate the unreported costs and the cost of food and labor for the sample week were obtained during this visit. This visit was also used as an opportunity to review incomplete (or questionable) Phase 2 data with the food service director and/or kitchen managers.

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<sup>1</sup>In the meal observation schools, the production records were completed by the meal observers. In the non-observation schools, kitchen managers completed the meal production records.

Exhibit 1.1

Overview of Meal Cost Analysis



## Exhibit 1.2

### Data Collection Activities by Study Component

Element of Methodology	Data Collection Activity
Measure the Full Cost of SFA Operation	<ul style="list-style-type: none"><li>• review the SFA's annual financial statement with SFA and school district officials to verify reported costs and to identify "hidden costs"; and</li><li>• obtain information needed to impute the value of these hidden costs.</li></ul>
Distribute the Full Cost of SFA Operation between Lunch Production, Breakfast Production, and Non-Meal Production Activities	<ul style="list-style-type: none"><li>• review meal production records, recipes, and invoices to directly measure the cost of food used in lunch and breakfast production; and</li><li>• conduct a time study to identify the labor costs attributable to lunch and breakfast production and non-meal production activities.</li></ul>
Distribute a Share of Non-Meal Production Costs to Lunch and Breakfast Production	<ul style="list-style-type: none"><li>• no separate data collection; alternative approaches for allocation of non-meal production costs based on distribution of food and labor costs are discussed in Chapter 3.</li></ul>
Distribute the Full Cost of Producing Lunches and Breakfasts between Reimbursable and Non-Reimbursable Meals	<ul style="list-style-type: none"><li>• observe a sample of meals taken by students to identify the quantity of each menu item sold that is attributable to reimbursable and non-reimbursable meals.</li></ul>

## CHAPTER II

### A METHODOLOGY FOR THE DIRECT MEASUREMENT OF THE FULL COST OF MEAL PRODUCTION

To determine the full costs of NSLP-lunches and SBP-breakfasts, it is necessary to separate costs attributable to these reimbursable meals from the costs of non-reimbursable meals produced by the SFAs. The inherent problem in allocating meal production costs is the issue of **joint production**. School meal production involves the preparation and service of a range of meals and menu items, including NSLP-lunches, SBP-breakfasts, a la carte items, adult meals, and so on. Clearly these different types of meals require different amounts and kinds of food as well as different amounts of labor for preparation and serving. The problem is that the different meals are produced jointly--there is for example, no separate accounting of the food purchased or used to produce a la carte items or adult lunches, or reimbursable and non-reimbursable meals. However, if a given menu item is taken as part of a reimbursable meal, its cost should be allocated to reimbursable meals. If the same menu item is taken as part of an a la carte lunch or an adult meal, its cost should be allocated to non-reimbursable meals.

Historically, SFAs have used a variety of indirect methods to allocate their costs between reimbursable and non-reimbursable meals (e.g. algorithms based on untested assumptions).<sup>1</sup> Similarly, researchers have used econometric methods to estimate per-meal costs in the NSLP and SBP. This study used an alternative approach, described in this chapter, which relied on direct measurement (through observation and detailed record reviews) of the costs attributable to specific SFA functions or activities.

Direct observation of portions served in reimbursable and non-reimbursable meals addresses the issue of the joint meal production and achieved the goal of feasible direct measurement. This type of observation could be used in other studies. It is also a type of data collection that could be replicated by SFAs for their own analyses of meal costs.

#### MEASURING THE FULL COST OF SFA OPERATIONS

##### *Definition of Full Costs*

As an organizational unit within a school district, an SFA may be viewed as a cost center for which school district management chooses to accumulate and report operating costs<sup>2</sup>. Full-cost accounting requires that the cost of all

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<sup>1</sup>Some elements of direct measurement are used by SFAs in Maryland to allocate labor, food and other costs to various SFA activities.

<sup>2</sup>Some SFAs include more than one school district.

**resources** used by the SFA be identified and attributed to SFA operations. These include costs incurred by and charged to the SFA (reported costs) as well as costs incurred by the school district for activities in support of SFA operations. These latter costs may or may not be charged to the SFA. Full-cost accounting also requires that the value of in-kind contributions (e.g., donated commodities and volunteer labor) be included as a cost of SFA operations.

Exhibit 2.1 illustrates the various components of the full cost of SFA operations. The full cost of SFA operations includes both those costs that are reported on annual financial statements and unreported costs which must be identified and measured.

### ***Procedure for the Determination of Costs***

A standardized and comprehensive cost reporting form was developed and used to measure total SFA costs. This form facilitated the identification of all cost elements, including those that appear on SFA or school district financial statements and those that do not. This form also allowed for uniform recording of cost elements across SFAs. Study staff reviewed SFA and school district financial records and audit reports, and when appropriate, reviewed purchase orders and invoices as part of an on-site visit to each of 18 SFAs. The use of a standard definition for each cost element enabled study staff to identify what is, and what is not, included in an SFA's reported costs.

Exhibit 2.2 identifies the major line-item categories that were used in the study. Each major line item is defined and discussed below. Where necessary, additional sub-items were used to collect information from those SFAs that maintained such detail.

### ***Labor Costs***

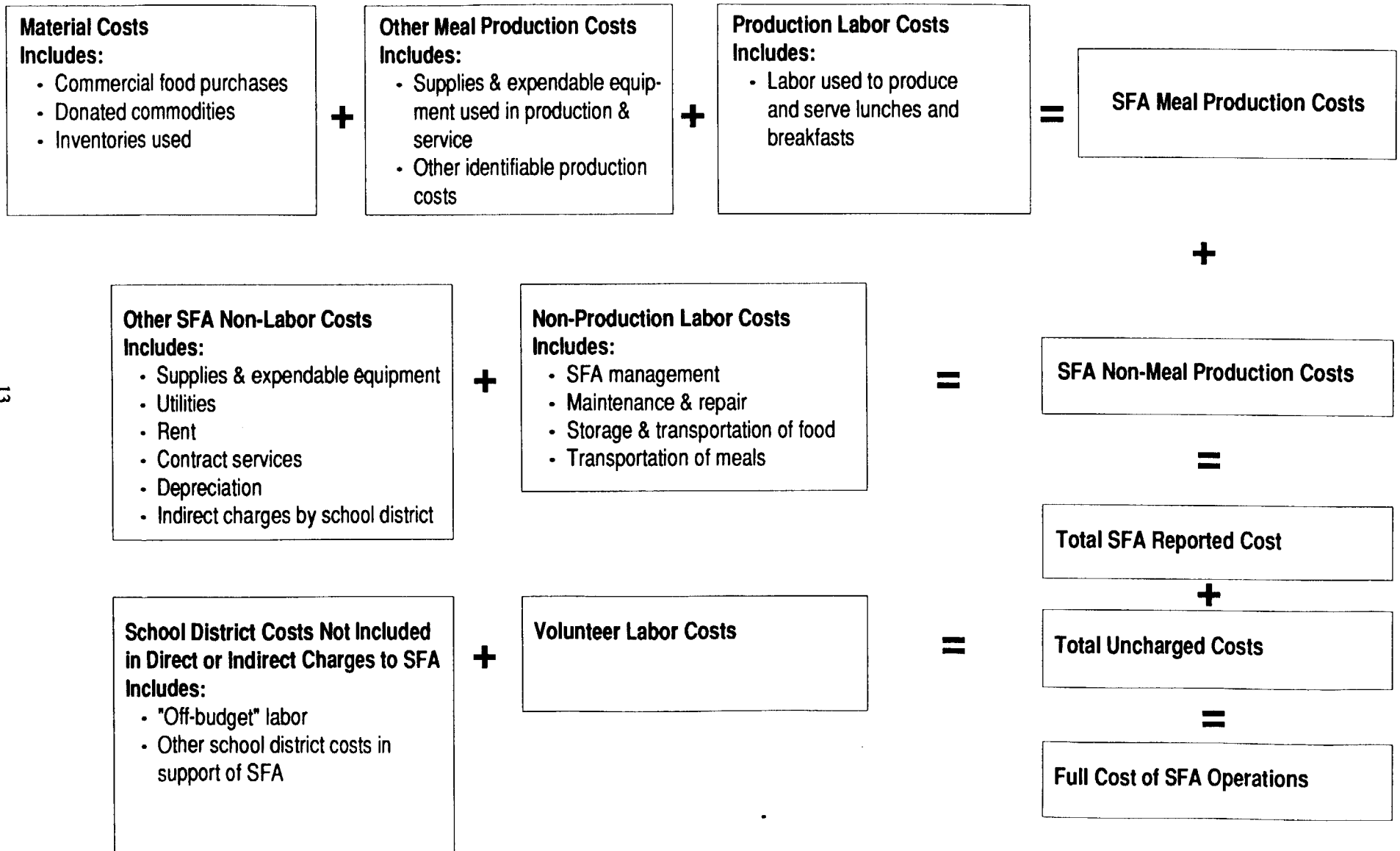
Labor costs are expenses associated with services provided by SFA employees and other school district employees. The major line items within this class of costs are:

1. Wages and salaries paid to employees.
2. Fringe benefits and payroll taxes, including benefits paid by the employer (such as health insurance) and payroll taxes (such as the employer's share of Social Security taxes).

These costs may appear on the SFA financial statement as direct labor costs or (in the case of school district staff) as part of an indirect rate charge. In some instances, the costs may not appear on the SFA statement at all and may instead be embedded in direct labor costs on the school district financial statement. For example, in many SFAs, the school district business manager is responsible for the preparation of bid specifications for SFA purchases (food, equipment, and supplies) and may also be responsible for contracting

Exhibit 2.1

Components of the Full Cost of SFA Operations



**Exhibit 2.2**

**Major Line-Item Categories**

**A. Labor**

1. Salaries and wages
2. Fringe benefits and payroll taxes

**B. Food**

1. Purchased food
2. Donated commodities
3. Inventory use/loss

**C. Other Direct Operating Costs**

1. Supplies and expendable equipment
2. Utilities
3. Rent
4. Contracted services and interagency payments
5. Other direct operating costs

**D. Other Reimbursable Costs**

1. Capital depreciation
2. Indirect costs

**E. Unallowable Costs**

1. Volunteer labor
2. Interest and financing
3. Other unallowable costs



for services. Thus, he or she may also function as the SFA business manager. A review of financial statements may reveal that:

- a) a portion of the business manager's salary has been directly charged to the SFA budget and has been included in the SFA's personnel line item;
- b) the school district business manager's salary is included in an indirect charge to the SFA; or
- c) the school district has absorbed and not charged to the SFA the cost of the business manager's time spent on SFA activities.

In case (a), the cost is reported and has been included in the appropriate cost element. No adjustment is necessary. In case (b), the cost is reported, but needs to be identified to make certain that it is counted. In case (c), the cost of the business manager's activities on behalf of the SFA is not included anywhere on the SFA's financial statement and therefore represents an uncharged cost.<sup>1</sup> It is therefore necessary to estimate the cost of this activity and add it to the reported costs for personnel. SFA and district staff were interviewed by study staff to identify off-budget staff and obtain professional estimates for the time they spent on SFA work, which was valued on the basis of documented salary and fringe rates.

### ***Food Costs***

Food costs include the following major line items:

1. Purchased food including all raw foods, prepared foods, oils, spices, condiments and other edible goods.
2. Donated commodities as valued by USDA plus charges for storage, delivery and administration of commodity distribution or processing.<sup>2</sup>

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<sup>1</sup>Among the 18 SFAs included in the Pilot Study, school district staff were never directly charged to the SFA account (case [a]). School district labor was always included in indirect cost when a district had indirect costs (case [b]). Thus if not included in indirect costs, school district staff costs were not charged to the SFA either directly or indirectly (i.e., these costs were absorbed by the school district).

<sup>2</sup>Storage and transportation costs may be incurred at the state level. To the extent that such costs are not charged to the SFAs these represent hidden costs. This study did not attempt to measure such costs.

3. Inventory use or loss, equal to the value of the beginning inventory of purchased and donated foods minus the value of the ending inventory of purchased and donated food.

Commercial food purchases always appear as line items in the SFA financial statement. While the value of donated commodities may not appear on their financial statement, SFAs must maintain audit records of commodities received. USDA-assigned values for commodities were obtained from SFA records. Although there is variation across SFAs in how inventory records are kept, it was possible, at a minimum, to identify beginning and ending inventories for the school year.<sup>1</sup>

### ***Other Direct Operating Costs***

Other direct operating costs are those costs other than food and labor that can be directly traced to SFA operations. The major line items in this class of costs are:

1. Supplies and expendable equipment, including goods used directly in food production (e.g., disposable utensils) and goods used in support functions, such as cleaning products and gasoline for food delivery vehicles.
2. Utilities charged directly to the SFA or via the school district for services such as electricity, natural gas and water.
3. Rent paid for the use of equipment, buildings, and land.
4. Contracted services and interagency payments, which include fees for professional services (e.g., accounting), equipment repairs, storage, and other services provided by contractors or other school district agencies.
5. Other direct operating costs, such as communications, that are not included in the other direct operating cost line items.

Any or all of these items may appear on the SFA financial statement. For any that did not, an estimate of the value of the uncharged cost was obtained from the SFA and/or school district records.

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<sup>1</sup>Each district used its own procedure to value its inventory. The study did not obtain information on the methods used to calculate the value of inventory.

### ***Other Reimbursable Costs***

Other reimbursable costs are costs which are allowable under Federal regulations but are either non-operational (i.e., are not a current expense) or not directly traceable to specific food service activities (e.g., lunch production). The major line items in this class of costs are:

1. Capital depreciation, such as depreciation of kitchen equipment, vehicles, other equipment, and buildings.
2. Indirect costs attributable to food service operations, including SFA activities and support services provided by other district departments.

Capital depreciation may appear on the SFA financial statement as a direct charge, or be included in the indirect rate. If not included in the financial statement, it was imputed from information contained in equipment inventories.

### ***Unallowable Costs***

Unallowable costs are costs that are not eligible for Federal reimbursement but are part of the full cost of food services. In this class of costs, the major line items are:

1. Volunteer labor, including wages and fringe benefits that would be paid if employees performed tasks instead of volunteers.
2. Interest and other financing costs incurred to finance purchases of equipment, buildings and improvements.
3. Other unallowable costs, such as legal settlements, claims expense, and bad debt expenses.

Because these costs are unallowable, they rarely appear on the SFA financial statement, and must be identified through interviews with SFA staff. While interest and financing costs and other non-reimbursable costs such as legal settlements may not appear on an SFA's financial statement, some record of these costs was available at the school district level. Records are not maintained for volunteer labor. The use of volunteers was identified during the interviews with SFA managers.

## CHAPTER III RESULTS OF THE PILOT TEST

### OPERATIONAL RESULTS

#### *Identifying and Measuring Unreported Costs*

The process of identifying unreported costs involved reviewing the SFA's annual expense statement with the SFA director and/or SFA business manager. Where applicable, the process also involved reviewing the supporting documentation for the school district's indirect cost rate with the school district business manager. The objective of this review was to determine the inclusiveness of each line item on the expense statement-- did the reported cost include all of the cost attributable to food service operations? For each line item, this review also sought to determine if unreported or under-reported costs were included in the school district's indirect cost rate.

The review of SFA expense statements and school district indirect cost documentation identified those cost elements for which costs would have to be imputed. Respondents were asked to provide (or identify sources for) the information needed to impute the costs. With a few minor exceptions, respondents were both able to identify unreported costs and to provide the information needed to estimate their value.<sup>1</sup> There is no apparent relationship between the type of production system (i.e., on-site vs. satellite systems) and the elements of unreported costs.<sup>2</sup> We believe that the methodology is applicable in all of the types of SFAs that were included in the Pilot Study-- large/small, on-site/satellite, FSMC and vended meals, and very large SFAs.<sup>3</sup>

Major elements of unreported costs include:

- off-budget labor;
- space costs;

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<sup>1</sup>Although in most cases the information used to estimate unreported costs was taken from source documentation (e.g., equipment inventories), in some instances (e.g., off-budget labor) there is no test of the validity of the information provided by the respondents. In this regard, the pilot test should be viewed as a test of the completeness of the data provided on unreported costs not of the validity of the data.

<sup>2</sup>There was, however, a relationship between the cost reporting system used by a state and the use of indirect cost rates by SFAs. SFAs in states that provided guidelines for the calculation of indirect costs were more likely to use indirect cost rates.

<sup>3</sup>In SFAs that use FSMCs, the primary respondent is the FSMC manager rather than an SFA director.

- indirect costs that are **not** charged to the SFA budget;
- utilities; and
- equipment depreciation.

Taken together, these five cost elements accounted for an average of 98 percent of the unreported costs in all study sites.

### **Off-Budget Labor**

Off-budget labor includes both school district central staff and in-school personnel that spend some portion of their time working on food service activities. It does **not** include the time spent by teachers and other school personnel supervising students of breakfast and lunch. Respondents had no difficulty identifying these individuals. The key to the identification was a comprehensive list of food service activities. Respondents were simply asked to identify those individuals that were not charged to the SFA budget who were involved in performing these activities. SFA directors were well aware of the school district central staff that worked on food service activities. Similarly, school principals (or their designees) had no difficulty identifying the personnel in their school that worked on food service activities.

Respondents also had no difficulty in providing estimates of the amount of time off-budget staff spend working on food service activities. Quite often SFA directors were able to provide professional estimates of the amount of time school district central staff devoted to various food service activities. In cases where the SFA director could not provide such estimates, estimates were obtained directly from school district staff (or their supervisors). As an aid in constructing the estimates of time use, respondents were asked to think in terms of individual food service tasks (e.g., preparing bid specifications or picking up donated commodities). For each task they were asked to estimate how long it took to perform the task one time and the number of times per year the task was performed. Similarly, school principals were able to construct time-use estimates for school staff involved in food service activities.

### **Space Costs**

None of the 18 SFAs included in the pilot study were charged for the use of school district facilities such as kitchens and warehouse space. The information needed for imputing the value of school district facilities used by the SFA included: 1) the amount of school district space used by the SFA (i.e., square footage), and 2) the rental value of comparable space.

All school districts in the study were able to provide the area or dimensions for at least a representative sample of school kitchens and warehouses if applicable. In some cases, these data were obtained centrally from the school district facilities department, while in other cases the data were obtained directly from school principals.

Obtaining an estimate of the rental value for comparable space was more problematic. Study staff contacted local realtors and chambers of commerce to obtain the range for the rental value of comparable space. While in nine cases, an estimate of the rental value of commercial/industrial space in the vicinity of sample schools could be obtained, in the other nine cases the realtors indicated that there was simply no comparable space in the vicinity.

In cases where an estimate of the rental value of commercial/industrial space could not be obtained, an estimate of the construction cost for institutional kitchens was used. Nationally, estimated construction costs for institutional kitchens ranges from about \$120 to \$160 per square foot.<sup>1</sup> These costs include plumbing and electrical connections, but do not include kitchen equipment. The range in construction cost is due to type of materials used and regional differences in cost. Therefore, a cost of \$150 per square foot was amortized over a 30-year period (straight-line depreciation) to obtain an cost estimate of \$5 per square foot. In view of the difficulty of obtaining estimates of the rental value for comparable space, it is recommended that construction costs be used in future applications of this methodology.<sup>2</sup>

### **Equipment Depreciation**

Nationally, relatively few SFAs record equipment depreciation costs.<sup>3</sup> While it was anticipated that obtaining an estimate of equipment depreciation might be problematic, this proved not to be the case. All SFAs in the pilot study that did not report equipment depreciation were able to provide a comprehensive inventory of the equipment used by the SFA including kitchen, warehouse, and central office equipment. These inventories included date of acquisition and purchase price and often brand names.<sup>4</sup> These data were used to estimate the annual depreciation cost using a straight-line method for a 12-year period.<sup>5</sup>

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<sup>1</sup>Personal communication with Jackson Construction, Boston, Massachusetts.

<sup>2</sup>In a national study, it would be desirable to include a small survey of construction companies or architectural firms to obtain regional estimates of these construction costs. The annual construction cost index could then be used to update these estimates periodically.

<sup>3</sup>R. St.Pierre, et al **Evaluation of Alternatives to Commodity Donation in the NSLP: Study of Operating Costs, Student Benefits, and Administrative Feasibility (Vol. 4)**, (Cambridge, MA: Abt Associates, 1985).

<sup>4</sup>To the extent that equipment on the equipment inventory had been fully depreciated in prior years, then the estimate of depreciation based on the equipment reported on the inventory would overstate true depreciation costs.

<sup>5</sup>The 12-year period was specified by FNS in its guidelines for cost-based accounting in the NSLP. FNS(CN) Instruction 796-1 (June 26, 1978).

## Utilities

Post studies have found that SFAs are rarely charged directly for the cost of utilities. As a rule, school districts do not maintain separate meters to record the utilities used by school kitchens. Occasionally there is a direct charge for bottled gas used for cooking. Among the pilot study sites, all school districts that computed an indirect cost rate included the cost of utilities in indirect costs.<sup>1</sup> However, for nine of the 18 pilot study sites the cost of utilities were not included in reported costs. The cost of utilities for these nine SFAs had to be imputed.

All nine school districts were able to provide information on the district's total cost of utilities for SY 1989-90. While the business managers in these districts agreed that kitchen space used a disproportionate share of utilities, only a few would venture a guess about the proportion of utilities cost that should be allocated to food service. Those that did estimated that between 15 and 25 percent of the utilities costs should be allocated to food service. A rate of 20 percent of the district utilities cost was therefore used as the share attributable to food service. Across the SFAs in the study, imputed utilities costs represented an average of only 2.6 percent of the full cost of SFA operations. Thus, the estimate of the full cost of SFA operations should not be very sensitive to the proportion of a district's utilities allocated to food service.<sup>2</sup> In future studies one could allocate utilities using the proportion of the square footage in school district buildings used by food service.

## Indirect Costs

One-half of the school districts in the study compute indirect cost rates. Districts use a state-approved indirect cost rate to charge a portion of these costs to the food service program, enabling the district to recover them from federal and state reimbursements.

The items included in indirect costs varied among the school districts in the study. Each state has a different procedure for determining which costs can be included in the indirect rate. Differences in district accounting and organization also affected the composition of the indirect cost pool.

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<sup>1</sup>Note that some school districts compute the indirect costs that are attributable to food service but do not charge the SFA for these costs.

<sup>2</sup>See Appendix H for comments by food service consultant John M. Callahan regarding the assignment of space and utility costs. One could obtain a more precise estimate of the cost of utilities for school kitchens by using the manufacturers' estimate of the energy requirements for the kitchen equipment in a sample of schools in conjunction with estimates of the daily hours of operation and the number of operating days per year. Such a procedure does not appear to be cost effective -- the gains in precision would not be commensurate with the costs of obtaining the requisite data.

The following administrative and support functions were included in indirect costs in some or all of the districts that calculated indirect costs of the food service program:

- general administration -- Superintendent's office, Assistant Superintendent for Administration, etc.;
- accounting and finance, including budgeting, financial reporting, bookkeeping, payroll, purchasing, and accounts payable;
- central services, such as data processing and printing;
- personnel administration;
- warehousing and transportation of food and other supplies;
- physical plant operations, including custodial services, utilities, and waste removal;
- facilities acquisition and construction, including procurement, oversight, and other non-capital expenditures; and
- maintenance of plant and equipment.

Generally, the types or objects of expenditure charged as indirect costs are those that the district incurs to perform these functions. Salaries and employee benefits are the most common types of indirect expenses. Non-labor costs, such as materials and contracted services, are also included in many districts' indirect cost rates.

Some school districts compute the indirect costs attributable to food service, but do not charge the SFA for these costs or charge only for a portion of the indirect costs.<sup>1</sup> Where this occurred, the indirect costs that were not charged to the SFA were included as an unreported cost. Estimates of other elements of unreported costs were made only if these cost elements were not included in the school district's computation of indirect costs. As noted above, this was the case for utilities for all districts that computed indirect costs. In addition, some or all of the school district personnel that were identified as spending some portion of their time working on food service activities were included in indirect costs. Where this occurred, these individuals were not included in the study's estimate of off-budget labor costs as their cost had already been included in indirect costs.

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<sup>1</sup>Seven of the 18 study sites had such "uncharged" indirect costs. Five were in full-cost accounting states that provide SFAs guidance on the calculation of indirect costs but do not require school districts to charge these costs to food service operations.



***Allocating Food  
Costs to Breakfast  
and Lunch***

The process of identifying the cost of food used in breakfast and lunch production included the following activities:

- A review of menu and production records with kitchen managers to identify **all** food items produced for breakfast and lunch during a 5-day period. Serving size and number of servings produced, including leftovers, were recorded by locally-hired study staff "meal observers" on a Menu and Production Record.<sup>1</sup>
- A review of recipes used in the production of each food item with the kitchen manager to determine the quantity of the ingredients used in the production of each food item. Meal observers recorded the quantity of each ingredient used and whether the ingredient was a USDA donated commodity on a Recipe Cost Form.
- Obtaining the average unit price paid for each ingredient (or the USDA-assigned value for donated commodities). SFAs provided master price lists for all foods acquired. These prices were matched to the ingredients used during the 5-day study week by staff in Cambridge following the completion of data collection.<sup>2</sup>
- Obtaining counts of the number of NSLP lunches and SBP breakfasts served at each school in the study sample for the study week. These data were provided by the SFA director on a Meals Served by School Grid.

Data collectors were required to complete a separate Menu and Production Record for each meal for each day of the 5-day study period. On this form the data collector was required to list **all** food items that would be served at that meal including items that could be taken as part of the reimbursable meal, and items that were available only as a la carte or sold only to adults.

While data collectors and kitchen managers were able to accurately identify all of the reimbursable foods being served at breakfast and lunch as well as the non-reimbursable food items being served at breakfast, a review of the data

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<sup>1</sup>AAI hired local people to serve as meal observers during a 5-day observation period. These people were recruited for the study by the SFA directors in the participating school districts. A two-day training session was held in each SFA for the meal observers.

<sup>2</sup>See Appendix B for further instructions on how to identify the costs of ingredients used in meals for the sample week.

indicates that in many instances they failed to record some (or all) of the non-reimbursable food items served at lunch.

Reimbursable food items are usually listed on the planned menu for the day or week. While there are substitutions, these are usually noted on the kitchen manager's copy of the planned menu. In addition, kitchen managers are well aware of what is being prepared for the reimbursable meals and will readily identify substitutions when **probed** by the data collector. Non-reimbursable food items (i.e., items that are only available a la carte or sold only to adults) are usually **not** listed on the menu and require probing to be identified. In addition, because these data were collected by the kitchen managers in the non-observation schools, it is likely that in these schools the kitchen managers simply did not think of the a la carte items being served when they prepared the Menu and Production Records for this study. It is, however, unlikely that much (if any) a la carte food was omitted at breakfast. For the most part, breakfast consists of reimbursable items being served to children approved for free and reduced-price meals. The foods served to these children tend to be reimbursable items with very few strictly a la carte items available at breakfast. Non-reimbursable food costs at breakfast are almost entirely food items served to adults.

Many schools serve a large number of a la carte items at lunch. These items, which are available to both students and adults, may represent a large portion of the total food cost at lunch. Thus, the potential for missing a la carte food items is much greater at lunch than at breakfast. Analysis suggests that these a la carte items were not reliably recorded on the Menu and Production Records for lunch. The under-reporting of non-reimbursable food items served at lunch results in an over-estimate of breakfast food costs as a proportion of total food costs and an under-estimate of lunch food costs as a proportion of total food costs. It should, however, be emphasized that an awareness of the potential for under-reporting non-reimbursable lunch food costs can eliminate this problem in future applications of the methodology.

Appendix C illustrates how the under-reporting of non-reimbursable lunch food costs affects the study estimates. This Appendix also presents an alternative approach to estimating the cost per reimbursable breakfast and lunch which relies on parameters which were measured reliably in the pilot study, and eliminates the effect of the under-reporting of non-reimbursable lunch food costs. **This alternative approach was used to produce the estimates for the pilot study sites included in this report.**

*Allocating Food  
Costs Between  
Reimbursable and  
Non-reimbursable  
Meals*

The allocation of food costs between reimbursable and non-reimbursable meals is based on estimates of the cost of food that students actually take as part of reimbursable meals. To derive these estimates, meal observers recorded the food items selected by a sample of students taking reimbursable meals in the sample schools.

The meal observers used in each pilot study site were all either retired kitchen managers or substitute kitchen workers. Meal observers received one day of formal training by study staff from Cambridge and were monitored during their first day of meal observations. No significant difficulties were noted during the monitoring, nor in a de-briefing session held after the first day of observations.

Field staff were able to observe nearly all of the breakfasts served at their school each day. First, there was usually only one serving line to observe the relatively few breakfasts that are served at each school. Thus, observers did not have to divide their time among multiple lines as was the case for lunch at most schools. Second, there were usually relatively few choices available to students at breakfast which facilitated both the observation and recording of student food selections.

At lunch, observers divided their time equally among the different serving lines. Thus, the maximum number of lunches that could be observed on a given day was equal to the total number of reimbursable lunches served divided by the number of serving lines. In most instances the number of meal observations actually recorded approximated this maximum. While there were more food choices available at lunch, observers did not experience any difficulty observing and recording student food selections. Observers were trained to set up the observation form to reflect the likely combinations that would be taken by students based on discussions with the kitchen managers. This grouping of food items on the observation form greatly reduced the need to visually scan the page in search of the food items taken by students.

These data were used to reliably estimate the food cost for reimbursable meals, and thus the food cost per reimbursable breakfast and reimbursable lunch, for the observation week. Problems occurred, however, in using study week estimates of the **proportion of lunch and breakfast food costs that are reimbursable** to distribute total meal production costs between reimbursable and non-reimbursable meals. As discussed above, the food costs for non-reimbursable food items served at lunch were under-reported on the Menu and Production Record. This leads to an over-estimate of the proportion of lunch food costs that are reimbursable, but does not affect the estimate of the proportion of breakfast food costs that are reimbursable. The alternative approach discussed in Appendix A eliminates the effect of the parameter that was less reliably measured by replacing it with a more reliable alternative

estimate. The meal cost estimates presented in the next section are based on this alternative approach.

Again, it should be emphasized that an awareness of the potential for under-reporting non-reimbursable lunch food costs can eliminate this problem in future applications of the methodology. However, it is recommended that the alternative approach be used to obtain meal cost estimates as it eliminates the reliance on a parameter that may be less reliably measured.

***Identifying and Allocating  
Labor Costs to SFA  
Activities***

SFA labor costs were allocated to SFA activities based on the proportion of time devoted to each activity. A time study was used for kitchen staff to obtain estimates of the distribution of time across activities. Professional estimates made by SFA staff were used to obtain the distribution of time across activities for SFA staff not represented in the time study (e.g., central SFA staff). In practice, both procedures worked well. Those problems that were detected can easily be corrected in any future application of the methodology.

**Time Study**

SFA staff participating in the time study had to complete a Daily Time Record for a 5-day period. While these staff were not provided any training on how to complete these forms, instructions were provided along with a sample of a completed form. Staff completed a time record for a practice day and the completed forms were reviewed by study staff with feed-back provided as needed.

The Daily Time Record identified eight mutually exclusive and exhaustive activities:

- set up/make/serve breakfast;
- set up/make/serve lunch;
- baking for both breakfast and lunch;
- other work on both breakfast and lunch;
- set up/make/serve other meals;
- food service administration/other food service;
- non-food service activity; and
- breaks/non-assignable work.

Detailed definitions and examples were provided for each activity. Completion of the form required staff to make a vertical line starting at the time where an activity began and continuing to the time that an activity ended. In this way, all time from the start to the end of the work day would be properly recorded.

For the most part, people did not have any problems completing the form. However, review of the data indicated that there was confusion regarding the category "set up/make/serve other meals." This category was intended to include all meals **other than breakfast or lunch** requiring **separate preparation**, including such things as catering activities, and meals prepared for senior citizen centers. If separate preparation was not required, preparation/service of meals for other programs was to be included in the "breakfast" or "lunch" categories. For example, preparation of breakfasts for a Head Start center in the school was to be included in the "breakfast" category. It is clear from the amount of time that was allocated to the "other meals" category that many people interpreted "breakfast" and "lunch" to include only reimbursable meals. These people included the preparation time for a la carte items and any other item that was not part of the reimbursable meal in the "other meals" category.<sup>1</sup> Additional examples and/or training should eliminate this problem in future applications of the methodology.

#### **Central SFA Staff**

SFA directors had no difficulty in allocating the time of central food service staff across activities. In general these staff worked on a single activity such as administration or two or three readily identifiable activities. In a few exceptional cases, study staff needed to guide the SFA director through the construction of a time-allocation estimate using a "bottom-up" approach (identify the specific tasks performed, the amount of time it takes to perform the task once, and the number of times per year the task is performed).

#### ***Allocating "Other" Costs Between Breakfast and Lunch Production***

The study methodology directly measured the food and labor costs attributable to breakfast and lunch production. However, a share of the remaining costs had to be distributed to breakfast and lunch production to obtain the total reported cost of producing breakfasts and lunches. In a preliminary analysis, the sensitivity of the meal cost estimates to the method used to distribute these "other" costs between breakfast and lunch production was examined. Three alternative methods were tested:

- the proportion of **labor costs** used in breakfast and lunch production;

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<sup>1</sup>In the analysis, all food service time that was not included in the breakfast or lunch categories was allocated to breakfast and lunch in proportion to the time **directly** spent on breakfast and lunch production.

- the proportion of **food costs** used in breakfast and lunch production; and
- the proportion of **direct costs** (i.e., labor plus food costs) used in breakfast and lunch production.

Exhibit 3.1 presents the reported cost per reimbursable meal for each of the pilot study sites by the basis for allocating other costs to breakfast and lunch production. As expected, the estimates of reported cost per reimbursable meal are sensitive to the relative labor intensiveness of breakfast and lunch production. However, the breakfast estimates are far more sensitive to the allocation method used than the lunch estimates. On average, there are no significant differences in the reported cost per reimbursable lunch among the three allocation methods.

The average cost per reimbursable breakfast is significantly lower when the allocation is based on food costs than when the allocation is based on labor costs (\$1.024 vs. \$1.294).<sup>1</sup> This results from two factors. First, breakfast production tends to be far more labor intensive than lunch production.<sup>2</sup> The labor cost method therefore allocates proportionately more of other costs to breakfast than the food cost method. Second, because the breakfast program is substantially smaller than the lunch program, any given shift in the allocation of other costs between breakfast and lunch production will have a larger effect on the unit cost of breakfast than on the unit cost of lunch. As the total direct cost basis for allocating other costs avoids this problem, this method is recommended for use in future applications of the methodology. In the remainder of this report all further references to cost per reimbursable meal use estimates based on the total direct cost allocation method.

***Allocating Total Lunch and Breakfast Cost to Reimbursable and Non-Reimbursable Meals***

The previous steps result in total lunch and breakfasts costs for a sample week. Total meal costs (for both meals) were allocated to reimbursable and non-reimbursable meals based on the proportion of food costs attributable to each meal during the sample week. For further details on how to distribute total meal cost to reimbursable and non-reimbursable meals, see Appendix B.

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<sup>1</sup>Statistically significant at the .05 level.

<sup>2</sup>Observations made in this study indicate that the labor used in breakfast production is relatively fixed while the volume of food used varies with the number of servings produced. For example, a food service worker can just as easily prepare food for 100 breakfasts as for 50. Given the relatively small number of breakfasts produced at each school, labor cost per meal tend to be higher for breakfast than for lunch.

**Exhibit 3.1**

**Reported Cost Per Reimbursable Meal:  
By Basis for Allocating "Other" Costs**

SFA ID	Breakfast			Lunch		
	Allocation Basis					
	Direct Cost	Food Cost	Labor Cost	Direct Cost	Food Cost	Labor Cost
01	\$0.981	\$1.076	\$0.885	\$1.353	\$1.335	\$1.372
02	1.233	1.048	1.420	1.437	1.453	1.421
03	1.245	0.945	1.605	1.280	1.292	1.266
04	1.462	1.147	1.758	1.521	1.560	1.484
05	1.218	1.112	1.352	1.221	1.255	1.179
06	1.063	0.816	1.289	1.263	1.309	1.221
07	1.283	1.139	1.374	1.579	1.600	1.566
08	1.153	1.032	1.248	1.623	1.638	1.611
09	1.314	1.101	1.530	1.474	1.529	1.419
10	1.076	1.101	1.057	1.704	1.711	1.698
11	0.987	0.996	0.980	1.199	1.197	1.202
12	1.207	0.968	1.454	1.243	1.270	1.215
13	0.869	0.796	0.936	1.302	1.323	1.282
15*	N/A	N/A	N/A	N/A	N/A	N/A
16	0.683	0.856	0.530	1.484	1.424	1.537
17	1.492	1.253	1.765	1.435	1.466	1.400
18	1.383	0.848	2.291	1.034	1.088	0.942
19	0.922	1.178	0.523	1.288	1.220	1.394
Mean	1.151	1.024	1.294	1.379	1.392	1.365
Median	1.207	1.048	1.352	1.353	1.335	1.394
Std. Dev.	0.211	0.131	0.438	0.169	0.168	0.182
CV	0.183	0.128	0.339	0.123	0.121	0.133

\*SFA 15 operated a small breakfast program in SY 1989-90 but discontinued the program for SY 1990-91. The allocation ratios reflect SY 1990-91 operations and cannot be applied to the SY 1989-90 financial data.

## MEAL COST ESTIMATES FOR THE PILOT STUDY SITES

This section discusses the cost estimates obtained for the 18 SFAs included in the pilot study. It first examines the SFAs' reported costs and their components. This is followed by a discussion of the magnitude and composition of unreported costs. Finally, the meal cost estimates obtained from the direct measurement approach used in this study are compared with estimates obtained using indirect methods used in prior research studies.

### *Reported Costs*

#### **Reported Cost by Line Item**

Exhibit 3.2 presents the distribution of reported costs by major line item for each of the 18 SFAs included in the pilot study. Across the study sample, labor and food each accounted for an average of about 45 percent of total reported costs; other costs including supplies, utilities, and contract services, accounted for the remaining 10 percent. There is relatively little variation in the proportion of reported costs accounted for by each of the major line items. The coefficient of variation, (CV--the standard deviation divided by the mean) of the labor share of reported costs is only 0.16, while the CV of the food cost share is only 0.14.

#### **Reported Cost per Reimbursable Meal**

Among the pilot study sites, the range of reported costs per reimbursable lunch was \$1.034 to \$1.704 with a median cost of \$1.353 and from \$0.68 to \$1.492 with a median cost of \$1.207 for breakfast. The median cost per reimbursable lunch for the pilot study sites is somewhat lower than the most recent national estimate. Using indirect methods (see below), the Child Nutrition Program Operations (CNPO) study estimated that the median SFA incurred costs of \$1.44 per lunch equivalent in SY 1988-89. Part of the difference in estimated costs may be due to differences in methodology (direct vs. indirect measurement). However, it must be remembered that the 18 SFAs included in the pilot study were purposively selected to test the methodology in different types of school districts and do **not** constitute a nationally representative sample. Given that the pilot study sample is not nationally representative, one should not generalize the study estimates beyond these SFAs.

As one would expect, there was somewhat more variation across the sites in breakfast costs than lunch costs--the CV for breakfast was 0.19 compared to 0.13 for lunch. The relatively greater variability in the cost per reimbursable breakfast reflects the variability in unit labor costs for breakfast. As noted above, total breakfast labor costs in a school may be viewed as relatively fixed because of the small size of the breakfast program. Thus, as the number of



**Exhibit 3.2****Distribution of Reported Cost by Major Line Item**

SFA ID	Labor	Food	Other	Total
01	44.8%	44.4%	10.8%	100.0%
02	42.0	42.5	15.4	100.0
03	38.2	45.8	15.9	100.0
04	43.1	40.2	16.7	100.0
05	41.9	53.2	5.0	100.0
06	48.7	44.2	7.1	100.0
07	58.2	36.4	5.4	100.0
08	53.4	41.1	5.5	100.0
09	42.4	43.0	14.6	100.0
10	53.1	38.6	8.3	100.0
11	49.7	43.7	6.6	100.0
12	43.3	43.1	13.6	100.0
13	49.9	44.7	5.4	100.0
15	33.1	61.8	5.1	100.0
16	49.1	42.4	8.5	100.0
17	42.8	48.9	8.3	100.0
18	33.0	56.1	10.8	100.0
19	33.5	51.7	14.8	100.0
Mean	44.5	45.7	9.9	100.0
Median	43.2	44.0	8.4	100.0
Std. Dev.	7.0	6.2	4.1	0.0
CV	0.157	0.136	0.414	0.0

breakfasts served increases, the labor costs per breakfast may be expected to decrease.

### **Proportion of Food Costs that is Reimbursable**

As discussed above, the allocation of total breakfast and lunch costs between reimbursable and non-reimbursable meals is made on the basis of the proportion of food costs that are reimbursable. Exhibit 3.3 presents the percentage of breakfast and lunch food costs that are reimbursable for each of the pilot study sites. On average, 91 percent of breakfast food costs are reimbursable, while only 71 percent of lunch food costs are reimbursable. This reflects the fact that, for the most part, the breakfast program in schools consists of reimbursable meals being served to children approved for free and reduced-price meals.

### ***Uncharged Costs***

Exhibit 3.4 presents uncharged costs as a percentage of full cost by major line item for each of the SFAs included in the pilot study. Among the 18 pilot study sites the range of full cost of producing a reimbursable lunch was \$1.235 to \$2.236 with a median cost of \$1.698. Uncharged costs accounted for an average of 19 percent of the full cost of food service operations. While all food costs were included in the SFA's reported costs, off-budget labor accounted for an average of 12 percent of the full labor cost of food service operations. The majority of costs other than food and labor were not included in the SFAs' reported costs--on average, 61 percent of "other" costs were not reported.

Exhibit 3.5 presents the distribution of uncharged costs by line item for each of the 18 SFAs included in the pilot study. Three line items--space (31.7%), labor (26.6%), and "uncharged" indirect costs (20.9%)--accounted for an average of nearly 80 percent of the unreported costs in the pilot study sites.

### **Space**

None of the pilot study sites were charged for the kitchen or warehouse facilities used by the SFA. Consequently, the imputed value of the facilities used for food service almost always represented a substantial share of the total unreported costs. In two cases where imputed space costs account for a relatively small share of unreported costs (SFAs 01 and 10) space was valued at \$2-\$3/Square Foot using construction cost figures provided by the SFAs. This is considerably lower than the \$5/SQFT used in other SFAs. This highlights the need to obtain local or regional construction cost figures in future applications of the methodology.

Among the 18 SFAs included in the Pilot Study, relatively little meal production occurred in satellite kitchens. These satellite kitchens therefore

### Exhibit 3.3

#### Percentage of Food Costs Reimbursable

SFA ID	Breakfast	Lunch
01	91.4%	73.6%
02	76.5	60.9
03	98.4	52.9
04	84.7	59.5
05	98.6	69.2
06	94.2	73.2
07	95.3	82.2
08	97.2	80.5
09	94.0	68.6
10	90.2	78.3
11	89.0	73.7
12	93.6	62.8
13	89.0	98.5
15*	N/A	88.5
16	93.5	71.2
17	64.7	67.7
18	97.4	55.9
19	98.2	65.4
Mean	90.9	71.3
Median	93.6	70.2
Std. Dev.	8.6	11.2
CV	0.095	0.157

\*SFA 15 operated a small breakfast program in SY 1989-90, but discontinued the program for SY 1990-91. The allocation ratios reflect SY 1990-91 operations and cannot be applied to the SY 1989-90 financial data.

**Exhibit 3.4**

**Uncharged Costs as a Percentage of Full Cost  
by Major Line Item**

SFA ID	Labor	Food	Other	Total % of Full Costs Uncharged
01	2.1%	0.0%	72.2%	22.6%
02	10.4	0.0	48.3	16.2
03	10.3	0.0	23.7	8.5
04	11.5	0.0	19.2	8.7
05	17.3	0.0	86.1	28.3
06	3.2	0.0	68.4	14.5
07	1.3	0.0	69.5	11.6
08	5.1	0.0	65.4	11.8
09	1.7	0.0	47.6	12.3
10	4.0	0.0	64.1	14.6
11	2.5	0.0	87.8	33.5
12	7.5	0.0	56.4	17.5
13	13.1	0.0	74.7	19.0
15	37.5	0.0	81.8	29.9
16	44.0	0.0	61.3	34.0
17	22.4	0.0	47.6	16.6
18	11.2	0.0	59.1	16.5
19	11.9	0.0	62.8	22.8
Mean	12.1	0.0	60.9	18.8
Median	10.3	0.0	63.4	16.6
Std. Dev.	11.6	0.0	18.2	7.8
CV	0.959	0.0	0.299	0.415

**Exhibit 3.5**

**Distribution of Unreported Cost by Line Item**

SFA ID	Labor	Food	Other					Space	Other	Total
			Supplies	Utilities	Depreciation	Indirects				
01	3.4%	0.0%	0.0%	0.0%	8.6%	80.7%	7.4%	0.0%	100.0%	
02	25.2	0.0	0.0	0.0	0.0	0.0	74.8	0.0	100.0	
03	46.9	0.0	2.6	0.0	0.0	0.0	50.5	0.0	100.0	
04	58.3	0.0	0.0	0.0	0.0	0.0	41.7	0.0	100.0	
05	22.1	0.0	0.0	0.0	0.0	70.3	7.6	0.0	100.0	
06	9.6	0.0	0.0	16.6	17.0	27.6	29.2	0.0	100.0	
07	5.6	0.0	0.0	19.6	24.2	0.0	50.6	0.0	100.0	
08	21.4	0.0	0.0	0.0	2.2	41.3	35.1	0.0	100.0	
09	5.3	0.0	0.0	0.0	8.0	39.5	47.2	0.0	100.0	
10	13.0	0.0	0.0	0.0	4.8	71.9	10.3	0.0	100.0	
11	2.4	0.0	0.0	0.0	17.6	45.3	34.7	0.0	100.0	
12	16.6	0.0	1.8	41.1	12.9	0.0	24.6	3.0	100.0	
13	31.5	0.0	0.7	5.5	25.7	0.0	36.5	0.0	100.0	
15	46.3	0.0	0.0	33.8	4.4	0.0	15.5	0.0	100.0	
16	73.8	0.0	0.1	14.1	0.0	0.0	11.6	0.4	100.0	
17	62.0	0.0	0.5	12.3	0.0	0.0	23.2	2.0	100.0	
18	20.9	0.0	0.9	30.4	0.0	0.0	47.8	0.0	100.0	
19	15.2	0.0	0.0	42.0	5.4	0.0	22.4	15.0	100.0	
Mean	26.6	0.0	0.4	12.0	7.3	20.9	31.7	1.1	100.0	
Median	21.2	0.0	0.0	2.8	4.6	0.0	32.0	0.0	100.0	
Std. Dev.	21.2	0.0	0.7	14.9	8.4	28.7	17.8	3.5	0.0	
CV	0.797	0.0	1.750	1.242	1.151	1.373	0.562	3.182	0.0	

tended to be considerably smaller than base or central kitchens. SFAs with significant satellite operations therefore tended to have relatively lower imputed space costs than SFAs that primarily use on-site production. Similarly, the space costs for SFAs with vended meals would be relatively low.

### **Off-budget labor**

While in most cases off-budget labor represented a substantial share of total unreported costs, the proportion ranged from under 10 percent to over 70 percent. The variation appears to be attributable to two factors—the use of indirect cost rates in some SFAs, and explicit subsidies by the school district to pay for some portion of the food service labor costs.

The estimate of off-budget labor costs excludes those school district personnel that are included in the district's indirect cost rate, even if the SFA is not charged for indirect costs (see below). As a rule, school district indirect cost rates include all school district central administrative staff. Thus, in those pilot study school districts that compute indirect costs, the estimated cost of off-budget labor for the most part reflects only school-based personnel.

In some instances, off-budget labor costs include explicit school district subsidies to the SFA. For example, in one SFA the food service director's salary was charged to the school district rather than the food service budget; in another SFA, fringe benefits for food service staff were charged to the school district rather than food service budget.

### **Uncharged Indirect Costs**

As discussed above, some school districts compute the indirect costs that are attributable to the SFA but do not charge the SFA for these costs (or charge for only a portion of the costs). This occurred in seven of the 18 pilot study sites. For these sites the uncharged indirect costs was included as an unreported cost. No separate estimates were made for those otherwise unreported costs that are included in the uncharged indirect costs. For these seven pilot study sites, these costs represented an average of 54 percent of total unreported costs.

### ***Comparison to Indirect Estimates of Meal Costs***

The methodology tested in this study differs in two major respects from the approach used in previous studies of meal costs. First, the approach used in this study, whenever feasible, relied on the direct measurement of the costs attributable to specific SFA functions (or activities) through observations and detailed record reviews. By contrast, previous studies have used indirect methods to estimate per-meal costs in the NSLP and SBP. These studies have usually used econometric techniques to allocate costs among the various types of meals produced by SFAs. Second, this study estimated the full cost of

SFA operations, whereas previous studies have almost always used only the costs reported by SFAs.

While the meal cost estimates derived from the direct measurement methods used in this study are considered to be more reliable than those obtained from the indirect methods, the direct measurement methodology requires a relatively expensive data collection effort. Because the resource requirements of the direct measurement approach may make it infeasible for use in a large-scale study of meal costs, it is useful to know how well the indirect methods approximate the results that are obtained from the direct measurement approach used in the Meal Cost Methodology Study.

### **Lunch-Equivalent Approach**

Perhaps the most commonly used indirect allocation method is the conversion of breakfasts, adult meals, and a la carte sales into NSLP-lunch equivalents (LEQs). A variety of techniques have been used by SFAs and researchers to construct an LEQ measure. Researchers have usually relied on econometric modelling of the joint production process to construct an algorithm that can be used across SFAs to estimate the number of LEQs produced. This method entails nothing more than solving for the number of reimbursable NSLP-lunches (L) necessary to result in the same predicted cost as the configuration of lunches, breakfasts (B) and other revenues (OR) actually produced by a particular SFA. Suppose that SFA cost is written as a function of lunches, breakfasts, and other revenue as  $C = f(L, B, OR)$ . If this function is estimated econometrically, then expected cost is known once L, B, and OR are known. If a particular SFA produced  $L^*$  lunches,  $B^*$  breakfasts and generated  $OR^*$  in other revenue, expected cost would be given as:

$$C^* = f(L^*, B^*, OR^*).$$

The number of lunch equivalents is now defined as the number of lunches required to produce the **same** expected cost,  $C^*$ , given that **no** breakfasts or other revenue were produced. That is, the number of LEQs for a hypothetical SFA is given by the solution to  $C^* = f(LEQ, 0, 0)$ .

Since  $L^*$ ,  $B^*$ , and  $OR^*$  are known,  $C^*$  is known, therefore solving for LEQ is straightforward. Notice that if an SFA does not produce breakfasts or generate other revenue, LEQ is automatically equal to the number of lunches produced.

This is the approach that was used in the recent Child Nutrition Program Operations (CNPO) study.

## Comparison of Meal Cost Estimates

Appendix D presents the econometric model that was used to estimate LEQs in the CNPO study. The estimated parameters of this model were used with the data collected from the 18 SFAs included in the pilot study to obtain an estimate of the number of LEQs produced by each of these SFAs. This measure was then compared to reported cost per reimbursable lunch and to the full cost per reimbursable lunch obtained through the direct measurement approach. Appendix E presents a comparison of the direct and indirect meal cost estimates by type of SFA.

Reported cost per LEQ appears to be a reasonably good proxy for reported cost per reimbursable lunch. Across the 18 pilot study sites, the correlation between the direct measure of reported cost per reimbursable lunch and the indirect measure of reported cost per LEQ is 0.65. In addition, the average ratio of the two measures is not significantly different from one (mean = 0.96, t-statistic = 0.85).

The indirect approach relies on SFA reported costs obtained through a mail/telephone survey and does not reflect the full cost of food service operations. As discussed above, among the SFAs included in the pilot study, unreported costs represented an average of 19 percent of the full cost of food service operations. While variation in unreported costs as a proportion of full cost (standard deviation = 8%) does affect the correlation between the direct measure of full cost per reimbursable and the indirect measure of reported cost per LEQ, the two measures are still reasonably well correlated ( $r = 0.56$ ). However, the average ratio of the two measures is significantly different from one (mean = 1.17, t-statistic = 2.23).

This suggests that the indirect LEQ approach may be viewed as a cost-effective alternative for the more expensive (yet more precise) direct measurement approach. The indirect LEQ approach could be used in a relatively large sample of SFA, with the more expensive direct measurement approach used in a small subsample of SFAs. The direct measurement subsample would be used to scale the estimates obtained from the indirect approach. This is discussed in more detail in Chapter IV.



## **CHAPTER IV**

### **SAMPLE DESIGN CONSIDERATIONS FOR FUTURE APPLICATIONS OF THE STUDY METHODOLOGY**

The primary objective of the Meal Cost Methodology Study was to identify the best practical approach to measuring the full cost of meal production in the National School Lunch and School Breakfast Programs. The results of the pilot test indicate that the study methodology can be used to:

- identify and measure costs that are attributable to food service operations that are not reported on the SFA's financial statements; and
- distribute the full cost of food service operations between breakfast and lunch production and between reimbursable and non-reimbursable meals.

In particular, the direct measurement approach developed in this study is suitable for use in a national study designed to estimate the average cost of producing reimbursable meals in the NSLP and SBP and for use by individual SFAs that desire reliable meal cost information for management and policy decisions.

This chapter discusses the design considerations for each of these applications of the study methodology. The discussion is intended primarily for a technical audience. The first section discusses sample design issues for a national study of meal costs. Given the relatively large difference in data collection costs between the direct and indirect approaches, the most cost-effective design for a national study uses a two-phase sampling approach that relies on indirect measurement (i.e., the LEQ approach) in a nationally-representative sample of SFAs coupled with direct measurement in a sub-sample of these SFAs.

The second section discusses the sample size requirements needed to obtain reliable meal cost estimates for an individual SFA. It discusses the number of schools that need to be included in the sample and the number of reimbursable meals that need to be observed at each sample school.

### **DESIGN CONSIDERATIONS FOR GENERALIZABLE ESTIMATES OF MEAL COSTS**

This study has developed a methodology that allows one to estimate, at the SFA level, the mean cost per reimbursable meal, and the proportion of food costs that are reimbursable. This methodology can be extended to national estimates based on a probability sample of SFAs. Before discussing the sample design and sample size requirements for carrying this out, the structure of the estimators is presented.

For a simple random sample of  $i = 1, \dots, n$  SFAs, the national estimate of the mean cost per reimbursable meal equals:

$$\frac{\sum W_i \hat{y}_i}{\sum W_i}$$

where  $W_i$  is the weight assigned to the  $i$ -th sample SFA, and  $\hat{y}_i$  is the estimated average cost per reimbursable meal for the  $i$ -th sample SFA. As discussed later,  $\hat{y}_i$  is an SFA-level estimate derived from a sample of schools drawn from each SFA. Alternatively, one could select a two-stage sample of schools (SFAs and schools within SFAs) and form the national estimate directly from the sample schools. In other words, it is not necessary to have SFA-level estimates to form the national estimate.

For a simple random sample of  $i = 1, \dots, n$  SFAs, the national proportion of food costs that are reimbursable can be written as:

$$\frac{\sum W_i \hat{p}_i}{\sum W_i}$$

where  $\hat{p}_i$  equals the average proportion of food costs that are reimbursable in the  $i$ -th SFA. As discussed later,  $\hat{p}_i$  is estimated from a sample of schools selected from each sample SFA. Again, one could also select a two-stage sample of schools and form the national estimate using the sample schools.

The Meal Cost Methodology Study has developed a data collection procedure that allows one to estimate these two means at the SFA level. It involves the sampling of schools and reimbursable meals taken within schools during a one week period. While this direct measurement approach involves extensive on-site primary data collection, this approach could be applied at a national sample of schools.

As discussed in Chapter IV, the indirect measurement approach provides a reasonable alternative to the direct measurement approach. The LEQ is an analytic estimator (based on a statistical model) of mean reported cost per reimbursable lunch. The data required to build the statistical model can be obtained from an SFA-level mail survey. As the data collection costs for the LEQ approach are considerably lower than for the direct measurement approach, if one is interested in a national estimate of the mean reported cost per reimbursable lunch, then it would be most cost-effective to use the indirect LEQ approach. However, this indirect measurement approach does not provide any information on the **full cost** of SFA operations. The direct

measurement approach tested in this study provides the information on unreported costs necessary to estimate the full cost of SFA operations.

This suggests a two-phase (double) sampling approach whereby one draws a national probability sample of SFAs and applies the indirect approach to measure the cost per LEQ. At a subsample,  $n'$ , of this national sample the direct measurement data collection approach is carried out at a sample of schools in order to yield **SFA-level estimates** of the mean cost per reimbursable lunch. One can then use a ratio or regression estimator to estimate the national mean cost per reimbursable lunch. The general regression estimator can be written as:

$$\bar{y}'_{REG} = \bar{y}' + \hat{\beta} (\overline{LEQ} - \overline{LEQ}') \quad (1)$$

where  $\bar{y}'_{REG}$  is the regression estimator of mean cost per reimbursable lunch,  $\bar{y}'$  is the sample mean cost per reimbursable lunch,  $\overline{LEQ}$  and  $\overline{LEQ}'$  are the sample means of the LEQ variable obtained respectively, from the first-phase sample of  $n$  SFAs and the second-phase sample of  $n'$  SFAs, and  $\hat{\beta}$  is an estimator of  $\beta$ , the regression coefficient of  $y$  on  $LEQ$  using the second-phase sample.

The sampling variance of the regression estimator of the mean cost per reimbursable lunch is approximately equal to:

$$\begin{aligned} Var(\bar{y}'_{REG}) &= \frac{S_{y'}^2 \cdot r^2}{n} + \frac{S_{y'}^2 \cdot (1 - r^2)}{n'} \\ &= \frac{S_{y'}^2}{n'} \left[ 1 - r^2 \left( 1 - \frac{n'}{n} \right) \right] \end{aligned} \quad (2)$$

where  $r$  is the correlation between the direct and indirect measures of cost per reimbursable lunch and  $S_{y'}^2$  is the element variance of the direct measure of the mean food cost per reimbursable lunch.

The optimal value of  $n'$  equals:

$$n' = n \sqrt{\frac{1 - r^2}{r^2} \cdot \frac{c_1}{c_2}} = nk \quad (3)$$

where  $c_1$  is the data collection cost per SFA for the LEQ (indirect) approach and  $c_2$  is the data collection cost per SFA for the on-site (direct) approach. Substituting  $nk$  for  $n'$  in equation (2) yields:

$$\text{Var} (\bar{y}'_{REG}) = \frac{S_{y'}^2}{nk} [1 - r^2 (1 - k)] \quad (4)$$

Using data from the pilot test the following set of input parameters were developed for reported costs to be used in the above equations:

- Mean reported cost per reimbursable lunch = \$1.379
- Element variance = 0.0286
- Element coefficient of variation = 0.1226
- Desired coefficient of variation at the 95% confidence level = 0.05 (i.e., the chances are 95 out of 100 that the true population mean is within 5% of the sample mean). This C.V. yields a value of  $\text{Var} (\bar{y}'_{REG})$  of 0.00124
- $c_1 / c_2 = 0.02^1$
- $r = 0.65$

Solving for the optimal value of  $n'$  yields  $n(.16534)$ . Solving for  $n$  for lunches yields  $n = 90$  and  $n' = 15$ . Thus we would need a sample of 90 SFAs for the indirect measurement approach and a subsample of 15 SFAs for the direct measurement approach. The sample sizes for estimating the mean reported cost per lunch is relatively small because the element coefficient of variation is small.

Similarly, the input parameters for the sample size needed for estimating the mean full cost per lunch are:

- Mean full cost per reimbursable lunch = \$1.683
- Element variance = 0.0458
- Element coefficient of variation = 0.1272
- Desired coefficient of variation at the 95% confidence level = 0.05 (i.e., the chances are 95 out of 100 that the true population mean is within 5% of the sample mean). This C.V. yields a value of  $\text{Var} (\bar{y}'_{REG})$  of 0.00184
- $c_1 / c_2 = 0.02^2$
- $r = 0.56$

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<sup>1</sup>This ratio is based on the data collection experience of the CNPO Study ( $C_1$ ) and the Meal Cost Methodology Study ( $C_2$ ).

<sup>2</sup>This ratio is based on the data collection experience of the CNPO Study ( $C_1$ ) and the Meal Cost Methodology Study ( $C_2$ ).

Again, solving for the optimal value of  $n'$  yields  $n(2092)$ . Solving for  $n$  yields  $n = 89$  and  $n' = 19$ . Since the C.V.s are virtually the same, the total sample size needed for estimating the mean full cost per lunch is comparable to that needed for estimating the mean reported cost. However, the sub-sample size for estimating the mean full cost per lunch is somewhat larger than the sample needed for the estimate of the mean reported cost per lunch because of the lower correlation for the full cost measure.

These sample sizes should be viewed as the minimum needed in a national study of meal costs. If one is interested in separate estimates for sub-groups of SFAs (e.g. size classes or type of production system used) then the recommended sample sizes would apply to each subgroup. Thus if one wanted to separate national estimates for each of the four subgroups used in the pilot study, then a national sample of  $n = 360$  and  $n' = 60$  would be needed for estimates of reported costs and a sample of  $n = 356$  and  $n' = 76$  would be needed for full cost estimates.

With regard to the sample design, it is recommended that SFAs be selected with probability proportional to size sampling. If sub-group estimates are to be made, then SFAs within each subgroup should also be selected with probability proportional to size.

There is also the issue of how many schools and reimbursable meals to sample from each SFA in the subsample. It is preferable to have a precise estimate of the mean cost per reimbursable lunch, because the above calculations assume this is a constant for each SFA in the subsample. Below, the procedure for the sampling of schools and reimbursable meals is discussed to yield precise SFA-level estimates that can be used as a guideline in determining the amount of within-SFA sampling required.

### **SAMPLE DESIGN AND SAMPLE SIZE RECOMMENDATIONS FOR USE BY INDIVIDUAL SFAS**

Although the indirect (LEQ) approach may provide a reliable estimate of the average reported cost per reimbursable lunch, the approach is not suitable for use by an individual SFA to estimate its cost per reimbursable lunch. The correlation of 0.65 between the direct and indirect measures of reported cost per reimbursable meals suggests that for any individual SFA the estimates obtained from the two approaches might differ, even though means obtained for a sample of SFAs are not significantly different. It is therefore recommended that SFAs use the direct measurement approach to obtain reliable estimates of their costs per reimbursable meal.

Estimating cost per reimbursable meal for an SFA requires the sampling of reimbursable breakfasts and lunches and the observation of food items taken on those meals. Although one would like an estimate that represents the entire school year this is typically not feasible. Rather, a study week is selected on a non-random basis, and reimbursable meal sampling takes place at all or a sample of schools in the SFA for each of the days during the study week. The selected week should therefore not be atypical.<sup>1</sup>

*Sample of Schools with  
Complete Enumeration of  
Reimbursable Meals at Each  
School*

At a given school one can sample reimbursable meals or observe all reimbursable meals. While a complete enumeration is preferable to sampling, this approach may not be feasible because of the time required to carry out and record the meal observation. However, to begin the sample size calculations it is assumed a complete enumeration of reimbursable meals is taken. Under this assumption one has an element sample of schools. That is, the school is both the sampling and estimation unit.

One could sample schools with equal probability. Keep in mind, however, that schools will vary with respect to the number of reimbursable meals taken. One therefore cannot take the simple average of the food costs per reimbursable meal across the sample schools, as this would yield a biased estimate for the SFA. The average needs to be weighted by the number of reimbursable meals in each sample school. An alternative selection procedure would involve drawing schools with probability proportional to size sampling. The ideal measure of size would be the number of reimbursable meals. One can then compute the simple average of the food costs per reimbursable meal across the sample schools to get an unbiased estimate for the SFA.

The use of total reimbursable meals as the measure of size may not be optimal given that an SFA may wish to separately estimate mean food cost for reimbursable breakfasts and lunches. Some schools in an SFA may not serve breakfast. Other schools may serve a large number of lunches but only a small number of breakfasts. Because of the variation in participation in the lunch and breakfast programs among schools within an SFA, it would be better to have separate samples of lunch and breakfast schools. If one can obtain counts of reimbursable breakfasts and lunches for each school in an SFA, two separate sample of schools could be drawn. The first sample would use reimbursable breakfasts as the measure of size and would be used to estimate the mean food cost per reimbursable breakfast. The second sample would use reimbursable lunches as the measure of size and would be used to estimate the mean food cost per reimbursable lunch. It is of course likely that the two samples could overlap in terms of the schools selected.

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<sup>1</sup>If an SFA uses a two-week menu cycle, it would be desirable to use a two-week study period (resources permitting).

### **Sample Size for Breakfast Schools**

For the 16 pilot SFAs with two or more sample schools where mean cost per reimbursable breakfast was computed, SFA level means, standard deviations, and element coefficients of variation were computed for this variable. The element coefficients of variation varied from a low of 0.001 to a high of 0.235, indicating a low degree of variability of schools within SFAs. Across all 16 SFAs the average element coefficient of variation was 0.073. The average mean food cost per reimbursable breakfast across the 16 SFAs equalled 0.454.

The sample size needed to obtain a given level of precision is given by:

$$\left( \frac{\textit{element coefficient of variation}}{\textit{desired sample coefficient of variation}} \right)^2$$

The desired sample coefficient of variation equals the standard error of the sample mean divided by the sample mean.

If the desirable level of precision is that the chances are 95 out of 100 that the true mean cost per reimbursable breakfast is within 5 percent of the observed sample mean, then ignoring the finite population correction, a sample size of 8.5 schools is needed. This calculation uses the average element coefficient of variation of 0.073. It also assumes a very large number of schools in the SFA. If being within 10 percent of the observed sample mean is sufficient then the sample size declines to 2.1 schools. It is recommended that the larger sample size be used, because SFAs with a higher element coefficient of variation than the average of 0.073 will still end up with a reasonable level of precision. For example, an SFA with an element coefficient of variation of 0.235, the highest observed in the pilot test, would have a 95 out of 100 chance of the true cost per reimbursable breakfast being within 16 percent of the sample mean.

Exhibit 4.1 presents the desired sample size for the sample incorporating a finite population correction.

### **Sample Size for Lunch Schools**

For food cost per reimbursable lunch, there are 17 SFAs in the pilot test with two or more sample schools. Across these 17 SFAs, the average food cost per reimbursable lunch is 0.632. The average element coefficient of variation equals 0.055. It ranged from a low of 0.004 to a high of 0.140. If again, it is specified that the chances be 95 out of 100 that the true mean food cost per reimbursable lunch be within 5 percent of the observed sample mean, then a sample size of 4.8 schools is needed if the finite population correction is ignored. Because the average element coefficient of variation for food cost

**Exhibit 4.1**

**Recommended Sample Size for Sample of Breakfast Schools  
by Desired Level of Precision\***

Number of Breakfast Schools in the SFA	Sample Size of Breakfast Schools	
	5% Precision	10% Precision
50+	8	2
30-49	7	2
15-29	6	2
10-14	5	2
6-9	4	2
4-5	3	2
2-3	2	2
1	1	1

\*Assumes a complete enumeration of all reimbursable breakfasts in each sample school.  
A minimum sample size of two schools is need to compute a standard error.



per reimbursable lunch is smaller than that of breakfast, the desired sample size for lunch schools is smaller than that for breakfast schools. If being within 10 percent of the observed sample mean is sufficient then the sample size declines to 1.2 schools.

Exhibit 4.2 presents the desired sample size for the sample of lunch schools after incorporating the finite population correction.

***Sample of Schools with a  
Sample of Reimbursable  
Meals at Each School***

Sample size calculations have assumed that all reimbursable breakfasts or lunches within a sample school are enumerated during the selected study week. As noted above, this may not be feasible. The alternative is random sampling of reimbursable meals within schools. The reimbursable meal becomes the second stage sampling unit, with the school serving as the first stage sampling unit. For this type of two-stage cluster sample one uses the sample of meals as the basis for forming the SFA-level estimate. A cluster sample will, hence, result in a larger standard error than an estimate based on a sample random sample. This is typically measured by the square root of the design effect (Deff):  $Deff = 1 + \rho(\bar{b} - 1)$ , where  $\bar{b}$  is the mean number of sample reimbursable breakfasts per sample school, and  $\rho$  equals the intraclass correlation.

**Sample Size for Breakfast Schools**

Looking at breakfasts first, there is a pilot study mean of 0.454. This implies that we need to achieve a standard error of 0.01158 to have the 5 percent desired level of relative precision used above. Assuming a high degree of homogeneity of food cost per reimbursable breakfast (i.e.,  $\rho = .10$ ) yields a Deff. value of 5.09. This calculation uses a cluster size of 250 sample reimbursable breakfasts per sample school for the study week. If next it is assumed that food costs per reimbursable breakfast in an SFA are normally distributed, then a sample size of 4,260 reimbursable breakfasts is required to achieve the 5 percent desired level of precision. With 250 sample breakfasts per school (an average of 50 per day), this implies 17.0 sample schools in total. These calculations assume a large number of reimbursable breakfasts during the study week and a large number of schools per SFA. Exhibit 4.3 presents the desired sample sizes for the number of breakfasts to be observed and the number of schools in the sample after incorporating the finite population correction.

The sample size of schools given above assumes about 250 sample reimbursable breakfasts per sample school. For districts with a small number of schools one could include **all** schools in the sample<sup>1</sup>. When this is the

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<sup>1</sup>In this situation the schools represent strata and not clusters.

**Exhibit 4.2**

**Recommended Sample Size of Lunch Schools  
by Level of Precision\***

Number of Lunch Schools in the SFA	Sample Size of Lunch Schools	
	5% Precision	10% Precision
75+	5	2
15-74	4	2
6-14	3	2
2-5	2	2
1	1	1

\*Assumes a complete enumeration of all reimbursable lunches in each sample school.  
A minimum sample size of two schools is needed to compute a standard error.

**Exhibit 4.3**

**Recommended Sample Size of "Breakfast" Schools  
at the Five Percent Level of Precision<sup>a</sup>**

Number of Reim- bursable Break- fasts During the Study Week	Sample Size of Reimbursable Breakfasts	Sample Size of Schools
50000+	3926	16
20000-49999	3798	15
15000-19999	3406	14
10000-14999	3144	13
9000-9999	2941	12
8000-8999	2838	11
7000-7999	2717	11
6000-6999	2573	10
5000-5999	2400	10
4000-4999	2188	9
3000-3999	1921	8
2000-2999	1575	6
1000-1999	1109	4
500-999	638	3
400-499	407	2 <sup>b</sup>
300-399	323	2 <sup>b</sup>
200-299	236	2 <sup>b</sup>
100-199	145	2 <sup>b</sup>
1-99	49	2 <sup>b</sup>

<sup>a</sup>Assuming a sample of breakfasts is observed at each school.

<sup>b</sup>Assumes that at least two schools in the SFA serve breakfast.

case, the total sample size of reimbursable breakfasts for the SFA need only be:

<u>Reimbursable Breakfasts During the Study Week</u>	<u>Sample Size of Reimbursable Breakfasts</u>
500-999	136
400-499	121
300-399	113
200-299	100
100-199	79
1-99	38

The sample size shown above would be allocated to the schools in the SFA.

#### **Sample Size for Lunch Schools**

The much higher volume of lunches served in the typical SFA make it feasible to sample 1,000 reimbursable lunches per school during the one-week sample period. Holding rho constant at 0.10 to reflect a high degree of homogeneity of food costs per reimbursable lunch with schools yields a Deff value of 10.04. If it is assumed that food costs per reimbursable lunch in an SFA are normally distributed then a sample size of 16,867 reimbursable lunches is required to achieve the 5 percent desired level of precision. With 1,000 sample meals per school, this implies 16.9 sample schools in total. These calculations assume a large number of reimbursable lunches during the study week and a large number of schools per SFA. Exhibit 4.4 presents the desired sample sizes after incorporating the finite population correction.

If **all** schools are included in the sample the sample size of reimbursable lunches declines to:

#### Exhibit 4.4

#### Recommended Sample Size of "Lunch" Schools at the Five Percent Level of Precision\*

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Total Number of Reimbursable Lunches During the Study Week	Sample Size of Reimbursable Lunches	Number of Sample Schools
50000+	12,612	13
20000-49999	11,382	12
15000-19999	8,588	9
10000-14999	7,179	8
9000-9999	6,077	7
8000-8999	5,652	6
7000-7999	5,192	6
6000-6999	4,692	5
5000-5999	4,148	5
4000-4999	3,552	4
3000-3999	2,898	3
2000-2999	2,177	3
1000-1999	1,377	2
500-999	718	2
400-499	438	2
300-399	342	2
200-299	246	2
100-199	148	2
1-99	49	2

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\*Assuming a sample of lunches is observed at each school.

<u>Reimbursable Lunches During the Study Week</u>	<u>Sample Size of Reimbursable Lunches</u>
500-999	136
400-499	122
300-399	113
200-299	100
100-199	79
1-99	38

### **Summary**

Estimating the cost per reimbursable meal for an SFA requires the sampling of reimbursable breakfasts and lunches and the observation of food items taken on those meals. To determine the sample sizes needed to estimate lunch and breakfast costs, an SFA must identify:

- the number of meals that needs to be observed during the study week in order to achieve the desired level of precision for the meal cost estimates;
- the number of meals to be observed at each sample school; and
- the number of schools to be included in the sample.

These design elements are interrelated. For example, the more meals that are observed at each school, the fewer schools that need to be included in the sample.

### **Enumeration of Reimbursable Meals at Each School**

In the simplest case, one would observe **all** of the reimbursable meals served in a sample of schools during the study week. In this case, the number of schools that needs to be included in the sample simply depends on the number of schools in the SFA that serve each type of meal (i.e., breakfast or lunch) and the desired level of precision. Exhibit 4.1 presents the recommended sample size for a sample of breakfast schools. For example, for an SFA with a total of five schools that serve breakfast, a sample of three of the five breakfast schools would be needed to achieve a five percent level of precision. Exhibit 4.2 presents the recommended sample size for a sample of lunch schools. The smaller recommended sample sizes for lunch schools reflects the fact that there is less variation among schools in food costs per reimbursable lunch than reimbursable breakfast.

### **Sample of Reimbursable Meals at Each School**

In most schools it will not be feasible to observe all of the reimbursable meals served during the study week. Rather, it will be necessary to select a random sample of reimbursable meals served at each school. In this more complex case, the number of schools that needs to be included in the sample depends on: 1) the total number of reimbursable breakfasts and lunches served in the SFA during study week, 2) the number of meals sampled at each school, 3) the degree of homogeneity of food costs per reimbursable meal within each sample school, and 4) the desired level of precision.

Exhibit 4.3 presents the recommended sample size for a sample of breakfast schools at the five percent level of precision, assuming that 250 reimbursable breakfasts (an average of 50 per day) will be observed during the study week at each school included in the sample. For example, in SFAs that serve between 2,000 and 2,999 reimbursable breakfasts each week we would need to observe a sample of 1,575 reimbursable breakfasts during the study week. With a sample of 250 breakfasts per school we would need to include a sample of six breakfast schools.

Exhibit 4.4 presents the recommended sample size for a sample of lunch schools at the five percent level of precision, assuming that 1,000 reimbursable lunches (an average of 250 per day) will be observed at each sample school during the study week.

Exhibits 4.3 and 4.4 may be used as a guide by individual SFAs planning a meal cost study using the direct measurement approach. SFAs need only determine the average number of reimbursable breakfasts and lunches served in the district each week and read across the appropriate row to determine the number of sample schools that need to be included in the study.