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Selecting Policy Indicators And Developing Simulation Models for the National School Lunch and Breakfast Programs

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Selecting Policy Indicators And Developing Simulation Models for the National School Lunch and Breakfast Programs

Final Report

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GLOSSARY OF TERMS

BMI	body mass index
CCD	Common Core of Data
CN	Child Nutrition
CNPP	Center for Nutrition Policy and Promotion
CPS	Current Population Survey
DGA	Dietary Guidelines for Americans 2005
DOD	Department of Defense
FGLS	feasible generalized least squares
FNS	Food and Nutrition Service
HEI-2005	Healthy Eating Index 2005
IOM	Institute of Medicine
IV	instrumental variable
Kcal	calories
MATH®	Micro Analysis of Transfers to Households
MATH-SIPP	MATH Survey of Income and Program Participation
mg	milligrams
mcg RAE	micrograms Retinol Activity Equivalents
MPEs	MyPyramid Equivalents
NSLP	National School Lunch Program
OLS	ordinary least squares
OVS	offer versus serve
% kcal	percentage of calories
PIN	personal identification number
SBP	School Breakfast Program
SFA	school food authority
SLBCS-II	School Lunch and Breakfast Cost Study-II
SNDA-III	School Nutrition Dietary Assessment-III
SNDA-IV	School Nutrition Dietary Assessment-IV
SSBs	sugar-sweetened beverages
USDA	U.S. Department of Agriculture
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

EXECUTIVE SUMMARY

The U.S. Department of Agriculture (USDA) Food and Nutrition Service (FNS) administers the National School Lunch Program (NSLP) and School Breakfast Program (SBP). It is required by law to update program meal patterns and nutrient standards to reflect the most current dietary guidance, the 2005 Dietary Guidelines for Americans (DGA) (U.S. Department of Health and Human Services and USDA 2005), which incorporate the Dietary Reference Intakes and serve as a basis for the MyPyramid food guidance system (Guenther et al. 2007; USDA 2009). FNS requested that the Institute of Medicine (IOM) form an expert panel to recommend changes to the nutrient standards and menu-planning approaches used in the school meal programs since 1995. The panel has recently published its recommendations (IOM 2009b). While the panel was preparing that report, FNS also commissioned this study.

This report describes work using nationally representative 2005 data from the School Nutrition Dietary Assessment-III (SNDA-III) study to develop a simulation model to predict the potential implications of changes in policies or practices related to school meals and school food environments. The model focuses on three domains of outcomes: (1) the nutritional quality of reimbursable meals as served to (or selected by) students in the NSLP and SBP, (2) the nutritional quality of the breakfasts and lunches consumed by children who participate in these programs, and (3) student participation rates. The model was intended to assist FNS in assessing the effects of the IOM panel's recommendations and other possible changes in school meals and the school food environment.

School meal program policies may have a variety of anticipated and unanticipated effects on the nutritional quality of meals served and consumed and on program participation. For example, efforts by schools to reduce the fat content of the meals they offer could have both the intended consequence of improving the nutrient profile of the school meals served to or selected by students and the unintended consequence of reducing program participation. Sorting through the full set of outcomes resulting from the implementation of a particular policy change is challenging. Many of the outcomes are related, which makes it difficult to identify the mechanism through which the policy affects the outcome.

This study had two objectives. The first objective was to find characteristics of school meals and school food environments that are (1) associated with the nutritional quality of school meals and/or of children's diets and (2) are suitable targets for potential changes in policies and/or practices. The second objective was to use the identified school meal and environment characteristics to develop predictive models to estimate the effects of potential policy/practice changes on the three primary outcome domains listed above. These predictive models were then combined into a comprehensive simulation model that links not only a number of factors that influence the outcomes of interest, but that also links multiple outcomes—some of which influence each other—within a single framework. This type of comprehensive framework enables model users to estimate not only the anticipated effects of a particular policy but also the unintended consequences.

The work began by developing a conceptual framework in which changes in policies and practices affect the three outcome domains listed above. Next, food and nutrient outcomes of interest were selected based on foods and nutrients of concern in children's diets, as identified by IOM (IOM 2009a), with a focus on those for which policy options were represented in the SNDA-

III data. Table 1 shows the outcomes that were selected. "Target" outcomes were modeled explicitly. "Collateral outcomes" were not modeled as targets of policy action themselves, but were examined to determine if there would be unintended negative consequences related to these outcomes from policy/practice changes intended to affect one or more of the target outcomes.

Table 1. Outcome Measures

Type of Outcome Measure	NSLP Outcomes	SBP Outcomes
Student Participation	NSLP Participant on Recall Day	SBP Participant on Recall Day
Characteristics of Meals Served	Target Outcomes: Saturated fat (% kcal) Fluid milk servings Fruit servings (excluding juice) Vegetable servings Dark green & orange vegetable servings	Target Outcomes: Saturated fat (% kcal) Fluid milk servings Fruit servings (excluding juice)
Characteristics of Meals Consumed	Target Outcomes: Saturated fat (% kcal) Fluid milk (MPEs) Fruit (MPEs)[a] Vegetables (MPEs) Dark green & orange vegetables (MPEs) Collateral Outcomes: Calories (kcal) Saturated fat (grams) Total fat (% kcal) Sodium (mg) Vitamin A (mcg RAE) Potassium (mg) Magnesium (mg)	Target Outcomes: Saturated fat (% kcal) Fluid milk (MPEs) Fruit (MPEs)[a] Added sugars (MPEs) Collateral Outcomes: Calories (kcal) Saturated fat (grams) Total fat (% kcal) Sodium (mg) Vitamin A (mcg RAE) Potassium (mg) Magnesium (mg)

[a]MPEs of fruit refers to all fruit except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

kcal = calories; mcg RAE = micrograms Retinol Activity Equivalents; mg = milligrams; MPEs = MyPyramid equivalents; NSLP = National School Lunch Program; % kcal = percentage of calories; SBP = School Breakfast Program.

Variables describing features of meals as offered and the school environment that were possible avenues for policy/practice changes were then identified. For example, some of the meals-offered variables identified were whether whole milk is offered, the number of days per week that fresh fruit is offered, and the percentage of weekly entrees that are high in saturated fat. Examples of school environment variables include whether the school has an on-site kitchen where meals are prepared and whether any a la carte items (other than low-fat milk) are offered. Systematic procedures were used to assess which of these policy/practice variables had sufficient variation across schools/students within the data and also were associated with the nutritional quality of school meals and/or of children's diets. For example, bivariate correlations between each policy/practice variable and the outcome it was intended to affect were examined; variables with stronger correlations were selected for inclusion in the models. The final list of policy/practice variables included as independent variables in the models is shown in Tables IV.3 and IV.4.

Baseline models (models that show the relationships between policy/practice variables and outcomes in 2005) for each target outcome were then estimated. Models were also estimated for other important ("collateral") outcomes to test for unintended effects of policy/practice changes. An important feature of the statistical methods used to estimate the models was controlling for self-selection of students who took school meals by using instrumental variables (IV) methods.

The predictive models were combined into a simulation model that enables the user to predict the potential implications of changes in policies or practices on the nutritional quality of meals served and consumed and student participation rates. The user specifies a policy reform by making changes to one or more of the policy/practice variables. The model then calculates a predicted value of each outcome for each school/student, using the coefficients and error terms from the baseline models. Predicted values of outcomes are averaged across all schools or students and the results are automatically displayed in formatted tables.

Three examples of policy reforms were simulated: (1) Reform 1: Discontinue offering reduced-fat and whole milk at both lunch and breakfast; (2) Reform 2: Offer fresh fruit daily at both lunch and breakfast; and (3) Reform 3 (Lunch Only): A comprehensive reform that consists of the following policy/practice changes that apply only to lunch: (a) discontinue offering reduced-fat and whole milk, (b) offer french fries and similar potato products no more than one day per week, (c) offer fresh fruit daily, (d) no longer allow juice to be served, and (e) offer dark green or orange vegetables at least two days per week.

The simulation results can be summarized as follows. Reform 1 is predicted to decrease the percentage of calories from saturated fat in lunches and breakfasts served to or selected by students and to decrease the likelihood that fluid milk would be selected at breakfast. Reform 1 is also predicted to decrease participation of elementary school students at lunch and secondary school students at breakfast and to increase participation of elementary school students at breakfast. In addition, Reform 1 is predicted to decrease the percentage of calories from saturated fat in lunches consumed by elementary students and to increase the energy from saturated fat consumed by secondary students at lunch and by elementary students at breakfast.

Reform 2 is predicted to increase the frequency with which fruit is served or selected in elementary schools at lunch, but to decrease it in secondary schools at lunch (this is an unintended result). Reform 2 is also predicted to increase fruit servings at breakfast, to decrease participation at both lunch and breakfast, and to increase MyPyramid equivalents (MPEs) of fruit (excluding juice) consumed by elementary students.

Reform 3 is predicted to increase servings of fruit, vegetables (other than fried potatoes), and, specifically, dark green and orange vegetables. It is also predicted to decrease energy from saturated fat served, decrease participation, increase consumption of energy from saturated fat (an unintended result), decrease consumption of fluid milk (also unintended), and to increase consumption of fruit (excluding juice) and vegetables.

It is possible that some of the simulation results are not statistically significant. The simulation model could be enhanced by the addition of standard error calculations, enabling the user to determine whether simulation results are statistically significant. Resampling methods can be used to calculate the significance of simulated policy changes, but time and resource constraints in this study did not permit adaptation of these methods for the simulations. In addition to calculating standard

errors, the simulation model could also be enhanced by the following areas of future research: (1) adjusting for the large number of zeros in counts of servings of fruits and vegetables, (2) examining interactions between participation and the policy/practices variables, and (3) making revisions that would help simulate effects of the recommendations in the IOM report (IOM 2009b).

I. INTRODUCTION AND CONCEPTUAL FRAMEWORK

This report describes work using data from the School Nutrition Dietary Assessment-III (SNDA-III) study to develop a simulation model to predict the potential implications of changes in policies or practices related to school meals and school food environments. The model focuses on three primary domains of outcomes: (1) the nutritional quality of reimbursable meals served[1] in the National School Lunch Program (NSLP) and School Breakfast Program (SBP), (2) the nutritional quality of the breakfasts and lunches consumed by children who participate in these programs, and (3) student participation rates. This work was conducted under Option V of the School Nutrition Dietary Assessment-IV (SNDA-IV) study.

A. Motivation and Objectives

The prevalence of overweight remains high for virtually all groups of Americans, including school-aged children (Ogden et al. 2006; Flegal et al. 2010). Many observers believe that both federally subsidized school meals (provided through the NSLP and the SBP) and "competitive" foods offered through a la carte sales in cafeterias, vending machines, or other school activities may be important areas for policy changes to prevent childhood obesity (Koplan et al. 2005; Story et al. 2006; Peterson and Fox 2007). The Child Nutrition and WIC Reauthorization Act (PL 108-265) of 2004 required school districts participating in federal school meal programs to adopt school wellness

[1] Throughout this document, we use the following terms: (1) "meals offered" to refer to characteristics of meals as offered by schools; these characteristics serve as inputs into the simulation model, (2) "meals served" to refer to characteristics of meals as selected by students; these characteristics are outputs of the simulation model, and (3) "meals consumed" to refer to characteristics of meals as consumed by students; these characteristics are also outputs of the model. The data source for meals offered and for meals served is the Menu Survey collected in SNDA-III; these are school-level measures. The data for the characteristics of meals consumed are from 24-hour dietary recalls collected from students. "Meals served" are sometimes referred to as "meals selected," as in the IOM panel report, "School Meals: Building Blocks for Healthy Children" (IOM 2009b). We use the term "meals served" to be consistent with the SNDA-III report (Gordon et al. 2007a).

policies that set goals for nutrition education and physical activity, and to establish nutrition guidelines for all foods available at school, including competitive foods, by fall 2006.

The U.S. Department of Agriculture (USDA) Food and Nutrition Service (FNS) administers the school meal programs. It is required by law to update program meal patterns and nutrient standards to reflect the most current dietary guidance, reflected in the 2005 Dietary Guidelines for Americans (DGA) (U.S. Department of Health and Human Services and USDA 2005), which incorporate the Dietary Reference Intakes and serve as the basis for the MyPyramid food guidance system (Guenther et al. 2007; USDA 2009). FNS requested that the Institute of Medicine (IOM) form an expert panel to recommend changes to the nutrient standards and menu-planning approaches used in the school meal programs since 1995. The panel has recently published its recommendations (IOM 2009b). While the panel was preparing that report, FNS also commissioned this study in order to develop models based on nationally representative data from SNDA-III to simulate the effect of potential program changes on a variety of important outcomes, including nutritional quality of meals served to students, nutritional quality of meals consumed before or in school, and participation in the NSLP and SBP. These models were intended to assist FNS in assessing the effects of the IOM panel recommendations and other possible changes in school meals and the school food environment. School meal program policies may have a variety of anticipated and unanticipated effects on the nutritional quality of meals served and consumed, program participation, and program revenues and costs. For example, efforts by schools to reduce the fat content of the meals they offer could have both the intended consequence of lowering the amount of saturated fat in meals they serve to students (that is, meals selected by students) and the unintended consequence of reducing program participation.[2] This change could in turn result in

[2] See Chapter 2 for detailed definitions of meals offered and meals served.

lower meal program revenues and costs. Sorting through the full set of outcomes resulting from the implementation of a particular policy change is challenging. Many of the outcomes are related, which makes it difficult to identify the mechanism through which the policy affects the outcome.

This study had two objectives. The first objective was to find characteristics of school meals and school food environments that are (1) associated with the nutritional quality of school meals and/or of children's diets and (2) are suitable targets for potential changes in policies and/or practices. The second objective was to use the identified school meal and environment characteristics to develop predictive models to estimate the effects of potential policy/practice changes on the three primary outcome domains. These predictive models may be combined into a comprehensive model that links not only a number of factors that influence the outcomes of interest, but that also links multiple outcomes—some of which influence each other—within a single framework. One benefit of using a comprehensive model that includes multiple equations and simulated relationships is that it enables one to estimate not only the anticipated effects of a particular policy but also the unintended consequences.

B. Overview of Approach

To address the first study objective, characteristics of school meals (as offered) and school food environments that are associated with the nutritional quality of school meals and/or of children's diets were identified. To keep this task manageable, the study focused on a set of nutritional quality outcomes that are current topics of policy concern, and on school meal and school food environment characteristics most likely to affect those outcomes. Several methods were used to identify characteristics of school meals and school food environments that predict nutritional quality of school meals served and consumed. These included bivariate correlation, stepwise regression, and ranking policy and practice variables by their percentage contribution to certain outcome measures. Work on identifying indicators of nutritional quality drew upon the following research:

- ***Identifying foods that made the greatest contributions to NSLP and SBP participants' intakes of saturated fat and other nutrients of interest:*** The SNDA-III report (Gordon et al. 2007a, 2007b) and SNDA-II report (Fox et al. 2001) included information that helped us identify which food-based policy changes are most likely to affect specific characteristics of meals consumed, such as the percentage of calories that come from saturated fat.
- ***Identifying indicators of positive nutritional qualities in meals offered:*** Wemmerus, Fox, and Schirm (1995) used SNDA-I data to identify indicators of positive nutritional quality in meals offered. They used bivariate correlations to identify a set of "best indicators" and then used stepwise regression to determine which of these best indicators to include in their model of nutritional quality.
- ***Developing an index of the school environment:*** Finkelstein et al. (2008) developed an index variable to represent a school's food environment, health-related policies, and characteristics of NSLP lunches (as offered) and showed how this index varied by grade level and other school characteristics.

In addition, for outcome variables for which many possible indicators exist (such as the saturated fat content of school meals selected or consumed by students), principal components analysis was considered for use in developing one or more index variables that represent a set of meals-offered characteristics or school environment characteristics that work together to affect a target outcome.

To address the second study objective, predictive models were developed that estimate the likely effects of changes in school meal policies and practices on the three major domains of outcomes. Work on the second objective drew upon the following research:

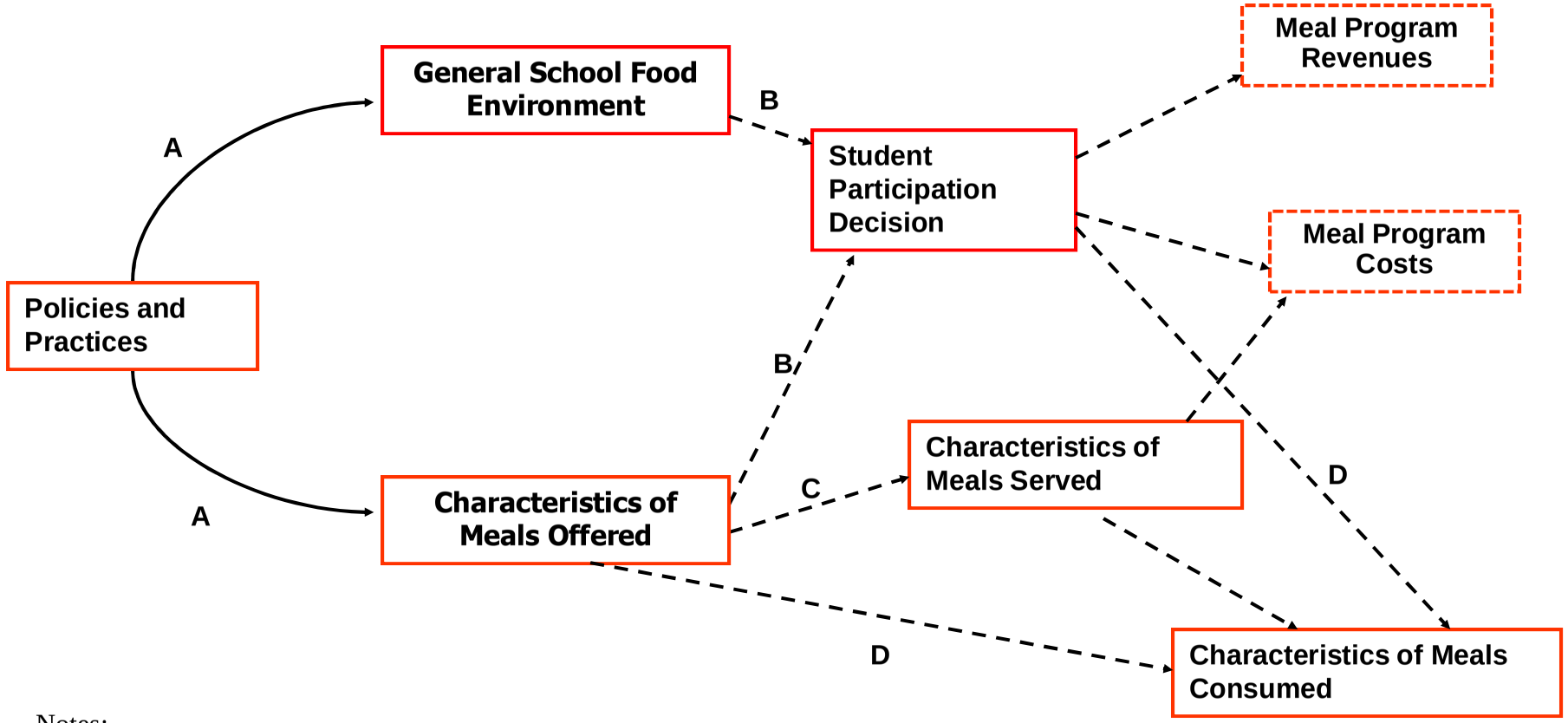
- ***Modeling program participation:*** Gleason (1996) examined the effect of student, school, and meal characteristics on participation in the NSLP and SBP using econometric models. He also described a simulation model that enables the user to forecast the effect of specific policy changes, such as requiring schools to serve low-fat meals, on the number of students participating in the NSLP and SBP. The participation model also draws on previous SNDA-III analyses of factors related to students' school meal participation choices (Gordon et al. 2007b).
- ***Modeling the effects of the school meal programs on children's diets:*** Both the SNDA-I and SNDA-III studies included multivariate models of children's intakes at breakfast and lunch (Devaney et al. 1993; Gordon et al. 2007b). These reports provided useful guidance in specifying the models for foods and nutrients consumed at breakfast and lunch.

C. Conceptual Framework

This section describes the conceptual framework that guided this study, in which changes in policies and practices affect each of the program outcomes sequentially. The framework, depicted in Figure I.1, focuses on the factors that link policies/practices with the outcomes of interest. Other factors—such as student characteristics or school demographics—are assumed to influence many of these relationships, but for simplicity those factors are not shown here. As the framework shows, four sets of relationships (labeled "A" through "D" in Figure I.1) need to be understood.

Modeling the first set of relationships (labeled "A" in Figure I.1)—the ways in which policies/practices are implemented via changes in the characteristics of meals offered and the school food environment—was the first research objective. Examples of characteristics of meals offered are the numbers of fruit and vegetable options offered in an average school lunch and whether the lunch menu includes french fries. The school food environment includes broader measures, such as the prices of meals and the availability of vending machines. These relationships were determined by assessing the characteristics of meals offered and school food environments that are relevant to current policy concerns (such as the fat content of milk, whether fresh fruit is offered, and the availability of vending machines), and determining, to the extent possible, which ones are most associated with student participation and dietary outcomes of interest. The relationship between policies/practices and the characteristics of meals offered is depicted as a solid line because this relationship is simulated mechanically. This means that the effects of policies/practices on the characteristics of meals offered are assumed to be known with certainty. In other words, for a given policy change, a reasonable set of assumptions were made regarding how schools would change their meals offered in response to that policy change. It is possible for model users to test the sensitivity of the overall simulation model results to this initial set of assumptions by changing the input parameters and rerunning the simulation model.

Figure I.1 Conceptual Framework for Analysis of Policy Effects on Participation, Meals Served, Meals Consumed, and Costs/Revenues



Notes:
Solid lines signify relationships that were simulated mechanically.
Dashed lines with letters signify relationships that were estimated.
Dashed lines without letters signify relationships not estimated.
Dashed line boxes indicate outcomes that were not modeled.

The three other sets of relationships depicted in the conceptual model relate to the second research objective: developing predictive models to estimate the effects of potential policy/practice changes on three primary domains of outcome measures. These outcome domains are

1. **Student Participation Rates.** The relationship of the characteristics of meals offered and of the school food environment to students' decisions to participate in the NSLP and SBP is represented by dashed lines labeled "B" in Figure I.1. Models of this relationship also control for individual-level differences in preferences and socioeconomic and demographic characteristics, which also affect a student's decision to participate in the NSLP or SBP.
2. **Nutritional Quality of Meals Served to Students.** The relationships between the characteristics of meals offered and the characteristics of meals served are indicated by the dashed line labeled "C" in Figure I.1. Certain characteristics of the general school food environment may also affect the characteristics of meals served, such as whether the school has an on-site kitchen, but they are not included in the final specification of the meals-served model because of sample size concerns and the need to be parsimonious when selecting variables. The sensitivity of the overall simulation results to this choice are investigated in Chapter VIII. Students' participation decisions also influence the characteristics of meals served, but this relationship is represented implicitly in the meals-offered/meals-served relationship. Meals served are described using school-level menu data; thus, the model cannot control for student-level characteristics, but school-level background information is included in the model.
3. **Nutritional Quality of Meals Consumed by Students.** The relationship of the characteristics of meals offered and the school food environment to the characteristics of meals consumed, as well as the relationship between student participation and the characteristics of meals consumed are depicted by dashed lines labeled "D" in Figure I.1. These two relationships are linked: although a student's participation decision affects the meals the student consumes, the characteristics of meals offered directly influence meals consumed mostly among participants.[3] Thus, these two relationships were modeled jointly.

As shown in Figure I.1, two further relationships would ideally be included in this modeling effort: (1) the relationship between student participation and meal program revenues; and (2) the relationship between the characteristics of meals served, total program participation, and meal program costs. Meal program revenues depend not just on the overall participation level, but on the

[3] An exception would be when foods offered as part of school meals are also available a la carte.

number of students participating at each certification level. These revenues also depend on the full and reduced prices charged at the school. Simulations of revenues could be added to the model, but were designated by FNS as a lower priority. The study team explored using data from the School Lunch and Breakfast Cost Study-II (SLBCS-II) to model the average cost of a school meal in each school as a function of the average characteristics of the meal as served. To do this, one would need to construct key characteristics of the meals served in both the SNDA-III data and the SLBCS-II data. However, constructing such variables would require resources beyond those available for this task, and, even with much effort, matches might not be of acceptable quality. For example, the SLBCS-II data do not include information on the nutrient content of foods, and the food codes are not comparable to those in SNDA-III for a large proportion of foods. Thus, this study did not pursue modeling of school meal costs. Instead, Chapter II considers the types of data that would need to be collected in a future cost study in order to make such linkages feasible. Revenues and costs are included in Figure I.1 (as boxes with dashed outlines) as markers of how the model could be expanded in the future, such as when other cost data become available.

D. Strengths, Limitations, and Caveats of the Approach

The research approach described above has both strengths and limitations. The study has the following set of core strengths:

- ***Model Breadth.*** The model has a wide range of components and examines a wide range of outcomes. This provides considerable breadth in the examination of possible implications of a given school meal policy. For example, this simulation model will enable analysts to examine the effects of an increase in price not only on participation, but also on the nutrition quality of meals consumed.
- ***Multiple Levels of Analysis.*** The model includes components and outcomes that examine both student- and school-level behavior. The characteristics of meals consumed and student participation decisions are student-level outcomes, whereas the characteristics of meals offered and served are school-level characteristics. Student-level analyses also include control variables defined at the school level; for example, school size is a control variable in the model of students' decisions to participate in the school meal programs.

- ***High Quality Data.*** The model is based on a high quality, nationally representative, comprehensive data set—SNDA-III—that has detailed information on meals offered and served by schools, meals consumed by students, and participation. It also allows the econometric models to control for a large number of school, student, and family background characteristics.
- ***Generalized Framework Based on Domains.*** In modeling each outcome, the characteristics of meals offered are broken into domains based on meal components traditionally used in menu planning for school meals: milk, meat and meat alternates, combination entrees (which are treated as units in the school menu data, although they include meat or meat alternates along with grains and/or vegetables), fruit, vegetables, bread/grains, and accompaniments—including sauces, salad dressings, and spreads—when linked to reimbursable items. The school food environment variables are also broken into three major domains: (1) competitive foods, (2) school nutrition policies and practices outside of the school foodservice, and (3) school foodservice operations. Even if proposed policies/practices cannot be described by the list of policy/practice variables in the simulation model, this generalized framework makes it easier to revise the model, as long as there are other variables in the data for these domains that do capture the policies.

This study faced a number of limitations and challenges that could not be fully addressed, including the following:

- ***Simplifying assumptions were needed.*** In particular, determining how schools respond to policy changes required ruling out certain possibilities. For example, a policy that involves one meal component could conceivably cause a school to entertain making changes to other meal components, but in general, it was assumed that this would not occur. In other words, the study was unable to check for unintended consequences of policies/practices on the characteristics of meals offered and the general school food environment, because it was assumed policies can be fully specified and have no unanticipated consequences for meals offered.
- ***The number of variables characterizing meals offered and served and school food environments were purposefully limited.*** The number of policy/practice variables had to be limited because of small sample sizes at the school level, the highly correlated nature of many potential policy/practice variables, and time and resource constraints. Thus, the choice of indicator variables used to simulate policy changes was a very important part of building the model. The goal of this process was to ensure that the characteristics selected would provide useful information for policy purposes.
- ***Policies/practices must be defined based on available variables.*** The models are unable to assess the effects of many key policy/practice areas of interest due to lack of variation in the data. For example, the model is unable to look at changes in servings of whole grain because whole-grain bread was rarely served, and information on the whole-grain content of other items is not available in the SNDA-III data.

- ***The model does not calculate the statistical significance of results.*** It might be possible to calculate the statistical significance of simulated policy changes using resampling methods, such as balanced repeated replication, as described in Zaslavsky and Thurston (1994). In the context of a multi-equation, multiple-outcome model, these methods are not straightforward to implement; they involve a significant amount of programming and require substantial computing time. Time and resource constraints in this study did not permit adaptation of these methods for the simulations.
- ***Certification decisions are not part of the model.*** Although students' participation decisions are included in several of the models, either as outcomes or independent variables, none of the models account for students' (or their parents') decisions to become certified for free or reduced-price school meals. For example, if some policies would make students more (or less) likely to become certified (affecting program revenues and potentially participation), this is not captured in the model. The reason for this is that SNDA-III does not include data on students' certification status.
- ***Policies implemented simultaneously are assumed not to interact.*** If two policy changes occur at the same time, the model can accommodate the analysis of each of them individually or in combination with one another; however, the model cannot separately identify the effects of each policy, so the effects are assumed to be additive. The model does not allow for interactions among the policies.
- ***Cross-sectional data are used to predict changes over time.*** Ideally, longitudinal (or panel) data would be used to predict changes in outcomes over time. However, in the absence of panel data, the SNDA-III cross-sectional data are the best available resource. One implication of using cross-sectional data is that feedback loops between inputs and outcomes are not modeled explicitly. Rather, a recursive model was assumed.[4] An example of a feedback loop would be if schools stop offering a particular food item because students are not selecting it.

Finally, model users should be aware of several caveats. First, the food and nutrient models simulate changes in means, rather than changes in distributions. The regression models used in the simulation were designed to assess how the average value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed.[5]

[4] In a recursive model, the causal flow of the model goes in only one direction; at a given point in time a variable cannot be both a cause and an effect of another variable.

[5] One reason for this is because only one day of intake data is available for most of the sample. Intakes for a given day have much greater variance than an average of intakes over time. The SNDA-III reports address this issue in detail (Gordon et al. 2007b).

One important implication of this approach is that the models are not designed to capture the effect of changes in policies/practices on the shape of the distribution of outcomes.

Second, although the simulation model includes a large number of control variables at the student and school levels, results may still be biased by the inability to control for unobserved variables. For example, if the study finds that fruit consumption decreases in response to a policy reform that requires fresh fruit to be offered daily, this might be because schools that tend to offer fruit daily also happen to offer fruit that is not cut up (which cannot be identified with SNDA-III data). If this type of fruit is less appealing to students, fruit consumption would be lower in these schools, but this does not necessarily imply that were other schools to implement this policy, fruit consumption at those schools would decrease.[6]

Third, the model should not be used to simulate the effects of policies that go beyond the range of the data. Because the econometric models that make up the overall simulation model rely on parametric assumptions, the model does not "crash" if an analyst tries to simulate a policy that goes beyond the range of the data. Thus, model users must be careful not to attempt to simulate the effects of policies that would lead to values of the variables in the model that venture substantially beyond the range of the actual SNDA-III data. For example, it would not be advisable to simulate reductions in the sodium content of lunches to recommended levels, since such levels are rarely found in the SNDA-III data.

E. Organization of the Report

The remainder of the report is organized as follows. Chapter II briefly describes the SNDA-III data and discusses the issue of linking SNDA-III data to cost data. Chapters III and IV describe the development of policy/practice indicators that were used to simulate changes targeted at specific

[6] Note this example is illustrative only and not based on data.

food and nutrient outcomes. Chapter III presents the list of outcome variables that were examined, including participation and specific characteristics of meals as served and as consumed. Chapter IV presents the initial list of meals-offered variables and school food environment variables that were considered as possible inputs into the models, describes the approach for determining which of these variables to include, and presents the final list of variables included in the models. Chapter V describes the development and estimation of predictive models for each of the three outcome domains. Relationships between a policy and a program outcome, or between two or more program outcomes, were specified using a rich set of econometric, statistical, and deterministic models. Chapter VI describes how the results of these predictive models were combined into a single simulation model that enables users to examine the consequences of alternative program policies or practices for the characteristics of meals served and consumed, and program participation. Chapter VII discusses the specification and simulation of three specific policy reforms and presents the simulation results. Chapter VIII describes a number of sensitivity analyses designed to test the robustness of the overall models and simulation results, and presents results from these analyses. Chapter IX summarizes the report and discusses avenues for future research.

II. DATA DESCRIPTION

This chapter provides a brief overview of the SNDA-III data used in this study. Volume III of the SNDA-III final report (Gordon et al. 2007c) contains a full description of sample design, data collection, and food and nutrient coding. This chapter also discusses the issue of linking SNDA-III to data on meal program costs as a possible avenue for future research.

A. SNDA-III Data

SNDA-III data are from 2005 (the latter part of the 2004–2005 school year). They are the best available data for accomplishing study objectives, as they are nationally representative (of public schools and their students) and provide recent, rich sources of data for exploring many aspects of school meal programs, including menu offerings, participation decisions, and foods and nutrients in students' diets. SNDA-III data provide information at several levels, including the school food authority (SFA), school, and student. SNDA-III provides data for 130 SFAs, 398 schools, and 2,314 students.

At the school level, SNDA-III provides food-level data (including food codes indicating the types of food offered, as well as nutrients offered), on school lunches and breakfasts; menu-level data on nutrients in the average lunch and/or breakfast offered; and school-level data, which is a simple average of nutrients in a week's worth of menus (usually five school days, but three or four days in a few schools).[1] The school-level files include information from several staff surveys, including surveys of the school foodservice managers and the principals.

[1] Analyses of SNDA-III menu data are based on food components (meat/meat alternate, grain/bread, fruit/vegetable, milk) in schools that used food-based menu-planning systems and on menu items (entrees, side dishes, and milk) in schools that used nutrient-standard menu planning. To calculate average nutrients in the meal *as offered*, nutrients in all the items offered that count for the same food component or menu item are averaged, and the average nutrients in each component or item are summed. To calculate average nutrients in meals *as served to or selected by* students, the nutrients in the different options are weighted by how frequently they were served or selected, and then weighted averages for each food component or type of menu item are summed.

At the student level, SNDA-III includes information from child and parent interviews and a student 24-hour dietary recall (completed with parent assistance for elementary students), as well as students' height and weight measurements. The child and parent interviews provide information on many student- and family-level characteristics, such as children's health and eating habits, parents' education level, and household income. The dietary recall data provides information at the student level for the entire 24-hour recall period, at the meal level for breakfast and lunch, and at the food level.

For this study, participation status is inferred from the foods the child reported consuming that were obtained from the school cafeteria, whether the food reported (or something similar) was listed in the menu survey for that school, and (for the NSLP) on whether the student reported eating a school lunch.[2] Similar approaches to defining participation were used in SNDA-I (Burghardt et al. 1993) and in Gleason and Suitor (2001).

Information about foods is reported in different ways for the school-level versus the student-level dietary recall data. At the school level, foods that included components or ingredients from multiple food groups were generally coded as whole items—combination entrees such as pizza and lasagna are examples. Menu foods are organized into groups used in school menu planning and in counting whether a student has selected a reimbursable meal (such as milk, fruits/vegetables, meats/meat alternates, grains/breads) and are then subcategorized according to other attributes (for example, vegetables are coded as either cooked or raw). At the student level, each food included in the 24-hour dietary recall file was linked to the MyPyramid Equivalents (MPEs) Database, version 1.0 for USDA Survey Food Codes, which was developed by USDA's Agricultural Research Service.

[2] The survey did not ask students if they ate a school breakfast on the recall day.

This database provides data on the number of equivalents (cups, ounces, grams, teaspoons) in a food for 32 database food groups. Thus, each food is broken down into its component parts.

B. Cost Data

As discussed in Chapter I, because of limited resources and other priorities, this study did not attempt to link SNDA-III data to the SLBCS-II cost data. Challenges included the fact that the SLBCS-II data do not include information on the nutrient content of foods. In addition, the food codes used are not comparable to those in SNDA-III for many foods. Since the decision to hold off on modeling costs was made early in this project, the IOM Panel developing new standards for school meals conducted some cost estimation; however, the report on this work was published too late to influence the work on this project (IOM 2009b).

This section considers the types of data that would need to be collected in a future cost study in order to make linkages between a future SNDA study's data and a future cost study's data feasible, as well as the matching methods that could be used to link the two data sources.

Linking individual foods across datasets would be time-consuming and may not be practical for many foods, even if both datasets used the same sets of USDA food codes. Foods created from recipes, for example, might be difficult to match. Linking menus for breakfast or lunch would be more practical, with the foods and nutrients served averaged across the week of the menu survey to create school-level estimates. Regression-based matching is one approach that could be used to link SNDA-III (or ultimately SNDA-IV) data to cost data. In this method, cost data would be used to estimate a regression in which the average cost of meals served at each school would be modeled as a function of school and meal characteristics measured in both data sets. The coefficients of this

model would be combined with the values of these school and meal characteristics in the SNDA data to impute the average cost for meals served for each school in the SNDA data[3].

Several key variables and features of the data are needed in order to link cost and nutrient data for school menus. First, key characteristics of schools and the school foodservice would need to be collected in both studies, and most related questions would need to be asked in the same or similar ways. In addition, the same general food coding scheme would need to be used in both data sources, even if not matching the data sets at the food level. Only if they are defined similarly would be it possible for the regression model to control for the specific types of food offered, the number of choices, and other food-level meal characteristics that are important for both cost and nutrient analysis. Without this type of food-level information, the two data sources could be matched only on general school and school foodservice characteristics, which would be less precise.

[3] It would also be desirable to impute a random error for the cost estimates, based on the distribution of the cost variable in the cost data.

III. OUTCOMES EXAMINED

Chapter I introduced a conceptual framework in which changes in policies and practices affect the following three outcome domains: the nutritional quality of reimbursable meals served in the NSLP and SBP, the nutritional quality of meals consumed by children who participate in these programs, and student participation rates. Because there are a wide range of food and nutrient outcomes included under the characteristics of meals served and consumed in schools—the two sets of dietary quality outcomes—the choice of the outcome variables to be used in the simulations requires care in several ways. First, it is important to ensure parsimony in modeling, in order to keep the models understandable and not place too many demands on the data. Second, because not all food and nutrient outcomes are of equal concern, it is important to limit the number of outcomes to represent the key aspects of meals served and consumed that are both important for children's health and amenable to policy changes. This chapter describes the specific outcomes analyzed, provides a rationale for their selection, lists data sources for the different types of outcomes, and discusses associated measurement issues.

This chapter begins by describing the nutrient and food group outcomes on which the model focuses, for both meals consumed and meals served. These outcomes are called "target" outcomes, because they are explicitly modeled. This chapter also introduces the idea of "collateral outcomes"—food groups and nutrients of concern that were not modeled as targets of policy action themselves, but were examined to determine if there would be unintended negative consequences related to these outcomes from policy/practice changes intended to affect one or more of the target outcomes. Lastly, this chapter discusses participation outcomes, which present some complex data and measurement issues. Table III.1 provides an overview of the outcomes examined.

A. Food and Nutrient Outcomes

In determining outcomes to examine, this study focused on nutrients and food groups targeted in the Dietary Guidelines for Americans 2005 (DGA) (USDHHS and USDA 2005). The guidelines apply to individuals' diets, which were the ultimate targets of this modeling effort. The DGA emphasize reducing saturated fat, trans fat, sodium, and intakes of discretionary fats and sugars.[1] They also recommend consuming more whole grains, fat-free and low-fat milk and milk products, fruits, and vegetables (particularly those not fried).

The DGA are the basis for the 2005 version of the Healthy Eating Index (HEI-2005), which is an index of 12 food and nutrient components. The HEI-2005 captures the ideas of the DGA through use of the MyPyramid food guidance system (Guenther et al. 2007). The HEI-2005 is intended as a tool for monitoring the quality of group intakes (but not the quantity). Each component is thus measured as either the number of food group servings per 1,000 calories (MyPyramid equivalents or MPEs), the number of grams per 1,000 calories (for oils and sodium), or the amount of the dietary component as a percentage of calories (for saturated fat). The HEI-2005 is typically used to describe a full day's intake, but could be adapted to apply to a particular meal, precisely because of its focus on nutrient density. The HEI-2005 was considered for use in this analysis, but this option was not pursued because the index includes a large number of components (12). To address all of the components within the available resources, the analysis would have been limited to one meal (probably lunch). Instead, the original plan of developing simulation models for both breakfast and lunch was maintained, while looking at a smaller number of outcomes for each meal. It is worth noting, however, that many of the outcomes examined in this analysis are HEI-2005 components. Thus, the model could be expanded at some point in the future to cover the entire HEI-2005.

[1] At the time SNDA-III data were coded, the USDA database did not include information on trans fat, so it could not be included as a simulation outcome.

Table III.1 Outcome Measures

Relationship in Figure I.1	Type of Outcome Measure	NSLP Outcomes	SBP Outcomes
B	Student participation	NSLP Participant on Recall Day	SBP Participant on Recall Day
C	Characteristics of meals served	Target Outcomes: Saturated fat (% kcal) Fluid milk servings Fruit servings (excluding juice) Vegetable servings Dark green & orange vegetable servings	Target Outcomes: Saturated fat (% kcal) Fluid milk servings Fruit servings (excluding juice)
D	Characteristics of meals consumed	Target Outcomes: Saturated fat (% kcal) Fluid milk (MPEs) Fruit (MPEs)[a] Vegetables (MPEs) Dark green & orange vegetables (MPEs) Collateral Outcomes: Calories (kcal) Saturated fat (grams) Total fat (% kcal) Sodium (mg) Vitamin A (mcg RAE) Potassium (mg) Magnesium (mg)	Target Outcomes: Saturated fat (% kcal) Fluid milk (MPEs) Fruit (MPEs)[a] Added sugars (MPEs)[b] Collateral Outcomes: Calories (kcal) Saturated fat (grams) Total fat (% kcal) Sodium (mg) Vitamin A (mcg RAE) Potassium (mg) Magnesium (mg)

[a]MPEs of fruit refers to all fruit except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

[b]For breakfast, added sugars were analyzed in place of vegetables, because the SNDA-III data showed that while vegetables were not commonly offered or consumed in SBP meals, added sugars were commonly offered and consumed. Added sugars were not analyzed as a meals-served outcome because the SNDA-III data do not include information on added sugars as served.

kcal = calories; mcg RAE = micrograms Retinol Activity Equivalents; mg = milligrams; MPEs = MyPyramid equivalents; NSLP = National School Lunch Program; % kcal = percentage of calories; SBP = School Breakfast Program.

In determining food and nutrient outcome measures, the preliminary report of the Institute of Medicine panel that reviewed the food and nutrient guidelines for school meals (IOM 2009a) was also consulted. The IOM panel identified food groups and nutrients of concern for students by age and gender (IOM 2009a, Table 4-12). In addition, the choices were based on the nutrients that could be explored in the SNDA-III data. For example, whole grains cannot be adequately examined in the

SNDA-III data because whole grains were rarely offered and/or were not distinguished in nutrient coding.

Finally, target outcomes were distinguished from collateral outcomes. The impact of changes in policy and/or practice on specific target outcomes (for example, children's consumption of saturated fat or fruits) was modeled. In contrast, the impact of policy/practice changes on collateral outcomes (such as total fat or vitamin A) was not explicitly modeled. However, the analysis did examine whether policy changes intended to affect the target outcomes would also affect collateral outcomes in a negative way.

1. Target Outcomes for Assessing the Impact of Policy/Practice Changes on the Dietary Quality of Meals Consumed

For the analysis of meals as consumed, the data source for outcome variables was the 24-hour dietary recalls completed by school-aged children. Based on a review of nutrients and food groups of policy concern, as well as consideration of what could best be measured in the SNDA-III data and what was feasible within the available resources, the following dietary quality outcomes for meals as consumed were identified. As shown, a slightly different set of outcomes for NSLP and SBP meals was used.

NSLP Lunches as Consumed

- Percentage of calories from saturated fat
- MPEs of fluid milk
- MPEs of fruit[2]
- MPEs of vegetables other than french fries (or similar potato products)
- MPEs of dark green and/or orange vegetables

[2] MPEs of fruit refers to all fruit except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

SBP Breakfasts as Consumed

- Percentage of calories from saturated fat
- MPEs of fluid milk
- MPEs of fruit
- MPEs (teaspoons) of added sugars

Vegetables are included as outcomes for lunch but not breakfast because the SNDA-III data showed that vegetables were not commonly offered or consumed in SBP meals. An over-consumed macronutrient that is strongly related to risk of chronic disease (saturated fat) is included, as well as a particular food (fluid milk) that is a major source of an under-consumed mineral for adolescents critical to healthy growth (calcium). MPEs of fruit and vegetables at lunch were included; these food groups are under-consumed and identified as key targets in the 2005 Dietary Guidelines. Dark green vegetables and orange vegetables are two subgroups of vegetables that are particularly nutrient-dense, low in calories, and under-consumed by children. Finally, because MPEs of vegetables were not included as outcomes for breakfast, an additional outcome was chosen to be analyzed at breakfast; namely, MPEs of added sugars. This outcome was chosen because the SNDA-III data showed that added sugars were commonly offered and consumed in SBP meals. For each of the identified outcomes, the SNDA-III food sources of nutrients tables were used to identify the specific set of foods that tend to be major contributors for that outcome. All of these outcomes are considered in the HEI-2005.

This study did not include food energy as a target outcome for much the same reason that energy was not emphasized in the SNDA-III reports—concerns about measurement issues, both in reported energy intakes and in estimating energy requirements. Young children (and their parents) tend to over-report energy intakes, while adolescents (particularly girls) tend to under-report intakes (Devaney et al. 2005). Energy requirements vary according to age, gender, and body mass index

(BMI), which was observed, and physical activity levels, which SNDA-III did not measure (IOM 2002).

In addition, sodium was not included in the list of target outcomes (although it was examined as a collateral outcome). This is because SNDA-III found that the sodium content of meals was excessive at all levels—as offered, selected, and consumed.

The choice of fluid milk—a major source of calcium—is perhaps the least obvious; calcium; vitamins A, C, or E; magnesium; or potassium could have been chosen instead (IOM 2009a). However, requirements for vitamin E may be overstated, based on the work of Devaney et al. (2007). With the exception of magnesium, consumption of these nutrients is related to intakes of fruits and vegetables, which were measured in MPEs. Calcium, on the other hand, is fairly independent of fruit and vegetable intakes. (Although some dark green, leafy vegetables contain calcium, the concentration is relatively small and the foods are infrequently consumed.) Fluid milk servings were chosen instead of calcium because of the key role that milk has played in school meals in the past and the policy interest in reforms related to milk. In addition, milk provides a range of nutrients other than calcium, and the SNDA-III report found that consumption of fluid milk (and some associated nutrients) tended to show the largest differences between school meal participants and nonparticipants. For similar reasons, low-fat milk products are considered in the HEI-2005, but calcium is not.

Table III.2 lists the specific outcome measures that were modeled, along with their means and standard deviations. The numbers of servings consumed for key food groups are calculated using MPEs. Added sugars are measured in teaspoons.

2. Collateral Outcomes

As noted, the analysis was expanded to determine whether policy changes intended to affect the target outcomes have unintended consequences for other outcomes. The following nutrients of concern were included as collateral outcomes:

- Food energy, as measured by calories
- Grams of saturated fat
- Percentage of calories from total fat
- Sodium
- Vitamin A
- Potassium
- Magnesium

Table III.2 Means and Standard Deviations of Meals-Consumed Outcomes

	Elementary School Students N = 732 at lunch N = 630 at breakfast			Secondary School Students N = 1,578 at lunch N = 1,375 at breakfast		
	Mean	Standard Deviation	Percentage Equal to Zero	Mean	Standard Deviation	Percentage Equal to Zero
Lunch						
Percentage of calories from saturated fat	10.70	4.35	1.1	10.75	5.53	5.2
Fluid milk equivalents	0.61	0.51	31.8	0.37	0.54	63.3
Fruit equivalents	0.27	0.43	51.6	0.15	0.40	78.4
Vegetable equivalents	0.28	0.39	25.1	0.30	0.42	31.3
Dark green and orange vegetable equivalents	0.03	0.11	87.8	0.02	0.09	91.2
Breakfast						
Percentage of calories from saturated fat	8.48	5.86	8.3	7.11	6.65	20.4
Fluid milk equivalents	0.61	0.74	41.2	0.48	0.70	57.9
Fruit equivalents	0.12	0.42	76.7	0.08	0.30	86.1
Added sugars (teaspoon equivalents)[a]	4.47	5.18	14.6	4.13	5.60	29.2

Source: School Nutrition Dietary Assessment-III, 24-hour dietary recall, school year 2004-2005.

Note: Equivalents refer to MyPyramid equivalents. N = number of observations.

[a]For breakfast, added sugars were analyzed in place of vegetables, because the SNDA-III data showed that while vegetables were not commonly offered or consumed in SBP meals, added sugars were commonly offered and consumed. Added sugars were not analyzed as a meals-served outcome because the SNDA-III data do not include information on added sugars as served.

Calories and grams of saturated fat were included to help in understanding the mechanism of any changes in the percentage of calories from saturated fat. Over- or under-consumption is a particular concern for the other collateral outcomes.

3. Target Outcomes for Assessing the Effect of Policy/Practice Changes on the Dietary Quality of Meals Served

For the analysis of meals served, the data source was the school-level menu data. This data set includes data on the foods offered in school meals every day for a five-day period and the number of servings of each food that were taken by children as part of reimbursable meals. In developing target outcomes for these data, the study focused on outcomes that parallel those used in the analysis of meals consumed, whenever possible. An important limitation was that the MyPyramid serving equivalents data that were used to estimate consumption of fruit, vegetables, and added sugars in meals as consumed were not available for the school-level menu data.

Thus, for the analysis of food outcomes for meals served, the analysis relied on major and minor food groups (developed specifically for SNDA-III) to define food-based outcomes.[3] These food group classifications are based on whole (or distinct) foods and, therefore, do not consider contributions from mixed food items as do the MPEs data. Specifically, the average number of servings of the food group of interest included in a reimbursable meal was examined (for example, the total number of fruit and vegetable servings selected, as a proportion of the total number of reimbursable meals served). For nutrient outcomes, the average amount of each target nutrient selected in a reimbursable meal was examined (for example, the total amount of calcium from all foods served, divided by the total number of reimbursable meals served).

[3] Major and minor food group definitions can be found in the SNDA-III report (Gordon et al. 2007b, Appendix D). Major food groups are: milk, fruit, vegetables, combination entrees, meat/meat alternate, breads/grains, desserts, accompaniments, and other.

In summary, the following outcomes for analyses of meals served were examined (all outcomes were measured as the mean amount per reimbursable meal served):

NSLP Lunches

- Percentage of calories from saturated fat
- Number of distinct fluid milk servings (based on major/minor food codes)
- Number of distinct fruit servings, excluding juice (based on major/minor food codes)
- Number of distinct vegetable servings (other than french fries and similar potato products) (based on major/minor food codes)
- Number of distinct dark green and orange vegetable servings (based on major/minor food codes)

SBP Breakfasts

- Percentage of calories from saturated fat
- Number of distinct fluid milk servings (based on major/minor food codes)
- Number of distinct fruit servings, excluding juice (based on major/minor food codes)

The specific outcome measures modeled for school lunches and breakfasts served are listed in Table III.3, along with their means and standard deviations. All are means for the school over the Menu Survey week.

Collateral outcomes for meals served were not modeled. This might be an area for future work, particularly when SNDA-IV data, with a larger sample of schools (approximately 900), become available. At that time, it may also make sense to consider characteristics of meals served in more detail, based on their relationship to costs and the level of detail available in future cost data, such as the School Food Purchase Study-III data.

B. NSLP and SBP Participation

Changes in school meals and the school food environment can affect students' decisions to participate in the NSLP or SBP. This participation rate is an important intermediate outcome, potentially affecting both the nutrient content of meals consumed by students and revenues earned

Table III.3 Means and Standard Deviations of Meals-Served Outcomes

	Elementary Schools N = 144 at lunch N = 117 at breakfast		Secondary Schools N = 253 at lunch N = 208 at breakfast	
	Mean	Standard Deviation	Mean	Standard Deviation
Lunch				
Percentage of calories from saturated fat	10.79	1.31	11.04	1.34
Fluid milk servings	0.91	0.11	0.82	0.21
Fruit servings (excluding juice)	0.63	0.28	0.49	0.29
Vegetable servings (excluding fried potatoes)	0.73	0.43	0.69	0.45
Dark green and orange vegetable servings	0.13	0.14	0.09	0.15
Breakfast				
Percentage of calories from saturated fat	8.91	1.93	9.60	2.51
Fluid milk servings	0.89	0.16	0.83	0.19
Fruit servings (excluding juice)	0.17	0.27	0.11	0.19

Source: School Nutrition Dietary Assessment-III, Menu Survey, school year 2004-2005.

N = number of observations.

from school meals. It is also of considerable policy interest in itself, as it determines the costs of the programs and is an indicator of how well they meet their objectives. The dependent variables for the NSLP and SBP participation models are the student-level participation measures used in the SNDA-III report (Gordon et al. 2007b). These variables measure participation in the SBP (if available) and in the NSLP on the day covered by the student's 24-hour dietary recall. Participation status is inferred from the foods the child reported consuming that were obtained from the school cafeteria, whether the food reported (or something similar) was listed in the menu survey for that school, and (for the NSLP) on whether the student reported eating a school lunch.[4] Similar approaches to defining participation were used in SNDA-I (Burghardt et al. 1993) and in Gleason and Suitor (2001).

[4] The survey did not ask students if they ate a school breakfast on the recall day.

IV. INDEPENDENT VARIABLES

A key challenge in developing predictive models of meals served, participation, and meals consumed involved determining which characteristics of meals as offered and school food environments to include as independent variables. Two goals drove the choice of variables: maximizing the predictive power of the model and including independent variables that are likely candidates for legal or regulatory change and/or change in recommended practices. Because the school sample for SNDA-III is not large (398 schools), the number of independent variables were limited so that the model is as useful as possible.[1]

The multivariate models estimated include two types of independent variables: (1) policy and practice variables, which include characteristics of reimbursable meals offered and characteristics of the school environment that may be susceptible to policy changes (and are thus of interest for simulations); and (2) control variables, which include background characteristics of schools and students, to control for other differences between groups that may mask the effects of the policy/practice differences. Throughout this report, we use the term "policy/practice variables" to refer to the set of variables characterizing aspects of school meals and environments that may be susceptible to policy changes or changes in recommended practices.

This chapter is organized into three sections. Section A presents the meals-offered and school food environment variables that were considered as potential policy/practice variables for the model. Section B describes the exploratory analyses used to select the best indicators for the outcomes of interest and lists the policy/practice variables that were ultimately chosen for inclusion

[1]The number of independent variables, together with the sample size, determines the degrees of freedom for the model. In addition, it is important not to include multiple independent variables that are highly correlated. Multicollinearity will not reduce the predictive power of the model, but it will affect the precision of coefficients on individual predictors.

in the models. Section C lists the student- and school-level background characteristics included in the models.

A. Potential Policy and Practice Variables

1. Meals-Offered Characteristics

Meals offered in the NSLP and SBP can be characterized using either a food-based framework, in which the meal is described according to the types of foods that are or are not offered, or a nutrient-based framework, in which the meal is described according to the nutrient content of the typical meal offered. For example, one characteristic in a food-based framework might be whether fresh fruit is offered at lunch. One characteristic in a nutrient-based framework might be the vitamin C content of the typical lunch offered.

Although the model of the relationship between policies/practices and meals offered is at the school level, the overall conceptual framework is largely a model of student behavior. Thus, the characteristics of meals offered should be relevant for students as they decide whether to participate and what foods to eat. This consideration led to the selection of a food-based framework for characterizing meals offered. Students make their decisions about whether to participate and what to eat by looking at the foods on the menu and in the cafeteria, not by calculating nutrient content.

Table IV.1 presents the characteristics of meals offered in the NSLP and SBP that were examined as potential independent variables.[2] These variables are indicators of individual foods or groups of foods that may be associated with one of the target outcomes. For each outcome, characteristics of meals offered are organized into domains reflecting the reimbursable meal components examined in SNDA-III: milk; meat and meat alternates; combination entrees (which

[2]Larger initial lists of variables were reviewed by Child Nutrition (CN) staff of FNS for feasibility and policy interest. Some variables suggested by CN staff, such as measures of health and physical education requirements, are not available in the SNDA-III data.

Table IV.1 Potential Policy/Practice Variables for Meals Offered, by Lunch and Breakfast

Potential Policy/Practice Variables For Meals Offered: Lunch
Changes in practices hypothesized to increase fluid milk equivalents consumed
Milk:
Average number of flavored milk choices offered per day
Average number of milk choices offered per day
Alternative non-milk beverage not offered
Meat/Meat Alternate:
Yogurt offered as meat alternate
Changes in practices hypothesized to reduce consumption of saturated fat
Milk:
Fat-free milk offered
Only low-fat or fat-free milk offered
Whole milk not offered
Combination Entrees and/or Meat/Meat Alternate:
Fish or shellfish offered
Yogurt (low-fat or fat-free) offered as meat alternate
Vegetarian/meatless/cheeseless entrees offered[a]
Vegetarian/meatless entrees (non-cheese-based) offered[a]
High saturated fat[b] entree not offered
Number of days per week that high saturated fat[b] entrees are offered
Average number of high saturated fat[b] entrees offered per day
Number of high saturated fat[b] entrees offered per week
Percentage of weekly entrees that are high saturated fat[b]
Pizza not offered
Hamburgers not offered
Low saturated fat[c] hamburgers offered
Low saturated fat[c] pizza offered
Number of days per week that hamburgers are offered
Number of days per week that pizza is offered
Number of days per week that cheeseburgers are offered
Cheeseburgers offered no more than one day per week
Condiments/Spreads/Dressings:
No self-serve salad dressings offered
No high saturated fat[d,e] condiments or spreads offered
No high saturated fat[d,e] salad dressings offered
Desserts:
Dessert not offered
Changes in practices hypothesized to increase fruit equivalents consumed (excluding juice)
Fruit:
Average number of types of fruit offered per day
Fresh fruit offered
Number of days per week that fresh fruit is offered
Fruit offered daily
Fresh fruit offered daily
Average number of types of fresh fruit offered per day
Juice not offered
Juice offered no more than one time per week

Table IV.1 *(continued)*

Changes in practices hypothesized to increase vegetable equivalents consumed (excluding french fries and similar potato products)

Vegetables:
- French fries and similar potato products not offered
- Number of days per week that french fries or similar potato products are offered
- French fries or similar potato products offered no more than one day per week
- French fries or similar potato products offered no more than two days per week
- Raw vegetables offered
- Average number of vegetable options offered per day
- Side salad bar offered
- Number of days per week that side salad bar is offered

Combination Entrees and/or Meat/Meat Alternate:
- Vegetarian/meatless/cheeseless entrees offered[a]
- Vegetarian/meatless entrees (non-cheese-based) offered[a]
- Entree salad or salad bar offered

Condiments:
- Accompaniments offered with vegetables (dips, salsa, peanut butter)

Changes in practices hypothesized to increase dark green and orange vegetable equivalents consumed

Vegetables and/or Combination Entrees:
- Salad offered (including entree and side salads, and either salad or salad bar)
- Dark green and orange vegetables offered daily
- Number of days per week that dark green and orange vegetables are offered
- Average number of dark green and orange vegetable options offered per day
- Dark green and orange vegetable options offered at least one day per week
- Dark green and orange vegetable options offered at least two days per week

Potential Policy/Practice Variables For Meals Offered: Breakfast

Changes in practices hypothesized to increase fluid milk equivalents consumed

Milk:
- Average number of flavored milk choices offered per day
- Average number of milk choices offered per day
- Alternative non-milk beverage not offered
- Flavored milk offered
- Number of days per week that flavored milk is offered

Breads/Grains and/or Meat/Meat Alternate:
- Yogurt offered as meat alternate
- Cold cereals offered
- Number of days per week that unsweetened[f] cold cereal is offered
- Offer unsweetened[f] cold cereal at least one day per week

Changes in practices hypothesized to reduce consumption of saturated fat

Milk:
- Fat-free milk offered
- Only low-fat or fat-free milk offered
- Whole milk not offered

Breads/Grains, Combination Entrees, and/or Meat/Meat Alternate:
- Cold cereal offered daily
- Sausage or other high-fat meat not offered (includes sausage, hot dog, corn dog, frankfurters, and similar sausage sandwiches)
- Breakfast sandwich not offered
- Low saturated fat[g] breakfast sandwich offered
- High saturated fat[h] breakfast sandwich not offered

Table IV.1 *(continued)*

Pizza not offered
Low saturated fat[g] pizza offered
Yogurt offered as meat alternate
High saturated fat[h] entree not offered
Number of days per week that high saturated fat[h] entrees are offered
Average number of high saturated fat[h] entrees offered per day
Number of high saturated fat[h] entrees offered per week
Percentage of weekly entrees that are high saturated fat[h]
Condiments and Spreads:
High saturated fat[d,e] condiments not offered
Changes in practices hypothesized to increase fruit equivalents consumed (excluding juice)
Fruit:
Average number of types of fruit offered per day
Fresh fruit offered
Number of days per week that fresh fruit is offered
Fruit offered daily
Fresh fruit offered daily
Average number of types of fresh fruit offered per day
At least two different fruit options offered each day
Changes in practices hypothesized to reduce added sugars consumption
Milk:
Flavored milk not offered
Number of days per week that flavored milk is offered
Breads/Grains:
Average number of types of unsweetened[f] cold cereals offered per day
Number of days per week that unsweetened[f] cold cereals are offered
Average number of types of hot cereal offered per day
Number of days per week that hot cereal is offered
Average number of types of sweetened[f] cold cereals offered per day
Number of days per week that sweetened[f] cold cereals are offered
Sweet rolls/pastries/doughnuts not offered
Number of days per week that sweet rolls/pastries/doughnuts are offered

Source: SNDA-III Public Use File.

[a] Vegetarian/meatless/cheeseless entrees are defined as entrees with no meat or cheese. Vegetarian/meatless (non-cheese-based) entrees are defined as meatless entrees for which cheese is not the main ingredient.

[b] High saturated fat for lunch variables: > 12% calories from saturated fat or > 3g saturated fat per serving

[c] Low saturated fat for lunch variables: ≤ 12% calories from saturated fat and < = 3g saturated fat per serving

[d] Low saturated fat for condiments, spreads, and dressings: ≤ 12% calories from saturated fat and ≤ 1g saturated fat per serving

[e] High saturated fat for condiments, spreads, and dressings: > 12% calories from saturated fat or > 1g saturated fat per serving

[f] Sweetened cereals: ≥ 21.3 g of sugar per 100 grams (criteria used under the Women, Infants, and Children (WIC) program for defining "non-allowable" cereals)

[g] Low saturated fat for breakfast variables: ≤ 12% calories from saturated fat and < = 2g saturated fat per serving

[h] High saturated fat for breakfast variables: > 12% calories from saturated fat or > 2g saturated fat per serving

g = gram.

combine meat/meat alternates with grains and/or vegetables); fruit; vegetables; grains; accompaniments (sauces, garnishes, condiments, and spreads); and other foods (foods such as brownies or other desserts that do not count toward a reimbursable meal). Policies/practices related to meals offered may be restrictions on specific foods or food groups, requirements to introduce new foods, or encouragement to offer foods more frequently, as reflected in the list of variables. As discussed previously, specific changes may have positive effects on some target outcomes but negative, unintended effects on other outcomes. In order to make the interpretation of model results easier, to the extent possible, potential policy/practice changes were defined in ways that push all of the target outcomes in positive directions.

The definition of "low saturated-fat" foods was influenced by the food-labeling definition (fewer than 15% of total calories from saturated fat, and less than 1 gram of saturated fat per serving). Specifically, examining the saturated fat content of entrees with fewer than 15 percent of calories from saturated fat revealed that entrees and meat/meat alternates could contain up to three grams of saturated fat at lunch and two grams at breakfast and still have fewer than 15 percent of total calories from saturated fat. Furthermore, there seemed to be a natural break in the distribution around 12 percent of calories from saturated fat. Thus, the low saturated fat cutoff was set at 12 percent of total calories from saturated fat.

Many of the potential policy/practice variables are highly correlated. Because the domains used for meals-offered variables correspond to the meal component groups coded in the SNDA-III menu data, there is less correlation *between* domains than *within* domains. Section B of this chapter and Appendix A describe the methods used to select a small group of best indicators within each domain that capture the net effect of changes in policy/practice variables within that domain on the outcomes of interest.

2. School Food Environment Characteristics

School food environment variables reflect policies, practices, and venues for food outside of the control of the school foodservice, as well as those within the school foodservice. These variables are largely expected to affect participation, although they may also affect the foods served to and consumed by students. Table IV.2 lists the potential school food environment variables that were examined in exploratory analyses. In developing this list, three major domains were considered: (1) competitive foods, (2) school nutrition policies, and (3) school foodservice operations. Within the first domain, there are three subdomains: (1) vending machines, (2) a la carte options, and (3) school stores, snack bars, and other competitive food venues. The second domain does not have subdomains—it includes policies such as having an open campus, one in which some or all students may leave the school grounds during lunch. In the third domain, meal-price and meal-price-eligibility variables, which affect nutrition outcomes only through an effect on participation, are distinguished from other characteristics of foodservice operations that may affect meal choices directly.

Because the SNDA-III data offered a large number of potential school environment measures, simple index measures were constructed (similar to those used in Finkelstein et al. [2008] and Briefel et al. [2009]) for a subset of environmental variables. These groupings involved summing together indicator variables that arguably reflect different dimensions of the domains or subdomains. The composites examined in the exploratory analyses were:

- Nutrition education/information (*nedinfo*): Sum of three variables from the domain of school health and nutrition policies: (a) nutrition education offered in every grade, (b) school has a nutrition advisory council, and (c) school makes nutrient information available for school meals
- Food service characteristics related to nutrition (*fsnutr*): Sum of
  - Participates in Department of Defense (DOD) Fresh or farm-to-school program (programs that help schools obtain fresh fruits and vegetables)
  - Includes nutrient requirements in vendor specifications
  - Limits fat in vendor specifications

Table IV.2 Potential Policy/Practice Variables for School Food Environment

Changes in policies/practices hypothesized to increase NSLP and SBP participation and healthy food choices:

SCHOOL FOODSERVICE ENVIRONMENT
District in Department of Defense Fresh or farm-to-school program
District includes nutrient requirements in vendor specifications
District includes limits on total fat or saturated fat in vendor specifications
District includes requirements for protein, vitamin A, vitamin C, calcium, and iron in vendor specifications
School does not use offer versus serve (OVS) (elementary and middle only)
School has on-site or base kitchen where meals are prepared for serving on site
District menu planner is a registered dietitian, licensed nutritionist, or has nutrition master's degree
No foods offered from national chains
Food service nutrition composite variable
Earliest lunch period starts no earlier than 11:00 A.M.
Last lunch period starts no later than 12:30 P.M.
Lunch period duration > 20 minutes
Price of meal (interact with eligibility at student level)
Full price of meal
Cashier identifies students eligible for free/reduced-price meals via PIN or electronic card

SCHOOL HEALTH/NUTRITION POLICIES
Nutrition education offered in every grade
School has nutrition/health advisory council
School makes available nutrition information about menus
School has recess before lunch (elementary schools only)
No open-campus policy
Nutrition education/information composite variable

COMPETITIVE FOODS
Vending Machines:
Healthy foods offered in vending machines[a]
Has vending machines, but not available during mealtimes
Has vending machines, but not available during the school day
Has vending machines, but not in or near food service area (within 20 feet)
Has vending machines, but not in building, only outside on school grounds
Has vending machines, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold
Has vending machines, but no sugar-sweetened beverages (SSBs) are sold
No vending machines
No beverage machines
No snack machines
Number of vending machines is low (≤ 1 for elementary schools; ≤ 6 for secondary schools)
No pouring rights contract, defined as neither the SFA director nor the principal reported having a pouring rights contract[b]
Vending machine availability restricted (*vend_comp1*)[c]
Vending machine offerings restricted (*vend_comp2*)[d]
Vend_comp3 (sum of *vend_comp1* and *vend_comp2*)

A La Carte Choices:
No a la carte items sold, except low-fat milk
Healthy foods offered a la carte[a]
Has a la carte, and fruits and/or vegetables (except fries) are sold

Table IV.2 (continued)

Changes in policies/practices hypothesized to increase NSLP and SBP participation and healthy food choices:
Has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold
Has a la carte, but no french fries are sold
Has a la carte, but no fast-food-type entrees are sold
Has a la carte, but no entrees are sold
Has a la carte, but no SSBs are sold (other than milk, 50–100% juice)
A la carte offerings restricted (*a la carte_no*)
School Store or Snack Bar or Other:
Number of days per week school store or snack bar is open
Has school store or snack bar, but it is not open during lunch/breakfast period
Has school store or snack bar, but it is not open during school hours
No school store or snack bars selling food
No food-based fundraising activities
Restrictions on other competitive food sources (*othsource_no*)

Source: SNDA-III Public Use File.

[a]Healthy foods are defined as (1) water (including spring water, flavored water, mineral water, seltzer water, water with juices, sparkling water with juices); (2) low-fat and fat-free milk and flavored milk; (3) vegetables (excluding fried potatoes, vegetable soup, and entree salads); and (4) fruits (including canned, cooked, fresh, fruit salad, and dried), but not in desserts. This definition was based on the Tier 1 definition from the IOM Panel Phase I report (2009). The SNDA-III data do not include detailed information on entree salads offered a la carte and in vending machines (in contrast to the detailed descriptions and ingredient lists available for entree salads offered as part of the reimbursable meal). Because there was no way to identify whether these salads could be considered "healthy," they were excluded from the list of healthy foods.

[b]This is the same definition of "no pouring rights contract" used by Finkelstein et al. (2008).

[c]Vending machine availability restricted (*vend_comp1*) equals the sum of the following binary (0/1) variables: (1) vending machines not available during meals, (2) vending machines not available during the school day, (3) no vending machines in or near foodservice area, (4) no vending machines inside the school building, and (5) number of vending machines is fewer than six (secondary schools only).

[d]Vending machine offerings restricted (*vend_comp2*) equals the sum of the following binary (0/1) variables: (1) vending machines have only healthy snacks, (2) no sugar-sweetened beverages (SSBs) in vending machines, (3) no pouring rights contract, (4) no beverage machines, and (5) no snack machines.

NSLP = National School Lunch Program; PIN = personal identification number; SBP = School Breakfast Program; SFA = school food authority.

  - Includes requirements for protein, vitamin A, vitamin C, calcium, and iron (key nutrients monitored under current regulations) in vendor specifications
  - Menu planner has a nutrition degree
  - No foods from chain restaurants are offered
- Vending machine availability restricted (*vend_comp1*): Sum of
  - Vending machines not available during meals
  - Vending machines not available during the school day
  - No vending machines in or near foodservice area
  - No vending machines inside the school building
  - Number of vending machines is fewer than six (secondary schools only)
- Vending machine offerings restricted (*vend_comp2*): Sum of
  - Vending machines have only healthy snacks
  - No sugar-sweetened beverages (SSBs) in vending machines
  - No pouring rights contract
  - No beverage machines
  - No snack machines
- A la carte offerings restricted (*a la carte_no*): Sum of
  - Fruit and/or vegetables available
  - Salty snacks and desserts not available
  - French fries not available
  - Fast-food entrees not available[3]
  - Sugar-sweetened beverages not available
- Restrictions on other competitive food sources (*othsource_no*): Sum of
  - No open campus
  - No fundraisers involving food allowed
  - No school store or snack bar

V*end_comp2* was used only for secondary schools, because most elementary schools have at most one vending machine and it is almost always a beverage machine; *othsource_no* was also used

[3]The following items were considered fast-food entrees: hamburger, cheeseburger, chicken patty (breaded), hot dog (corn dog, franks and beans), pizza (with and without meat), Mexican food, Chinese food.

only for secondary schools for similar reasons. *Vend_comp3* is the sum of *vend_comp1* and *vend_comp2*. Because there are also indicators for no vending machines at all and no a la carte (other than milk), the composites reflect restrictions on vending machines among schools that have vending machines, and restrictions on a la carte among schools with a la carte.

B. Selecting Policy and Practice Variables

The process for selecting among the potential policy and practice variables involved several steps. First, the following methods were used simultaneously to narrow the list of potential policy/practice variables:

- Look at the prevalence of the policy or practice among the schools in the sample. If the policy/practice is present in only a few schools (or present in nearly all schools), there will not be enough variation to predict how it will affect meals served, student participation, and meals consumed when implemented more broadly. Cutoffs of 5 percent and 95 percent were used with unweighted data.[4] Thus, if fewer than 5 percent (or more than 95 percent) of schools followed a particular policy or practice, that variable was not used in the models of participation, meals served, or meals consumed.
- Examine the correlations of meals-offered variables in the same meal component group and related to the same outcome, to determine if some are so closely correlated that both could not be included in the models. For pairs of variables with correlations of more than 0.75, the variable that was less strongly related to the outcome was dropped. A similar process was used to examine correlations between school food environment variables in the same domain or subdomain.
- Rank the policy/practice variables that indicate the presence, absence, or prevalence of specific foods or food groups by their percentage contribution to the associated meals-consumed outcome, as reported in SNDA-III (Gordon et. al 2007b, Tables K.1 through K.20). For example, the combination entrees that were reported in SNDA-III as the major sources of saturated fat consumed were examined. Policy/practice variables that contributed less than 3% percent to the associated outcome were dropped.
- Examine bivariate correlations between each policy/practice variable and the related outcome and select those with the strongest correlations (as in Wemmerus, Fox, and Schirm [1995]).

[4] For the lunch program, 5 percent of schools equals about 7 elementary schools and about 13 secondary schools.

Next, stepwise regressions were used to determine which policy and practice variables were most important to the overall outcome, by determining which variables contributed most to explaining the variation in the outcome (also used in Wemmerus, Fox, and Schirm [1995]). Principal components analysis was then used to explore potential indices of policy/practice variables, but no further variables were dropped from the list or combined into an index based on the results of this method.[5] Finally, the set of meals-offered variables was adjusted to be more consistent for elementary and secondary schools, so that similar policies might be simulated for both kinds of schools. Appendix A describes the exploratory analyses in detail and lists the variables that were dropped at each step.

Table IV.3 lists the policy/practice variables that were ultimately chosen for inclusion in the meals-served model and presents the mean of each variable at the school level. Table IV.4 lists the policy/practice variables included in the participation and meals-consumed models, and shows means at the student and school levels. The school-level means in the two tables differ slightly because Table IV.3 includes all schools, but Table IV.4 includes only those schools with students who were interviewed.

Most of the policy/practice variables are binary (0/1) indicator variables. For example, the "onlyskim1per_offered" variable equals 1 if the school offered only fat-free and low-fat milk during the week, and equals 0 otherwise (for example, if the school ever offered reduced-fat or whole milk during the week). Thus, the mean of the variable tells us what proportion of schools currently follow

[5] Principal components analysis can be used to assess if a set of variables can best be represented by a smaller set of linear combinations of the variables which will be uncorrelated with one another. The number of principal components and the weights of specific variables within each component can provide useful insights for grouping variables. No additional policy or practice variables were excluded based on the principal components analysis, in part because the first principal component in these analyses tended to place similar weight on all the variables, thus not clearly indicating groups of variables that might be combined.

that policy; for example, 38% of elementary schools and 34% of secondary schools offer only fat-free or low-fat milk at lunch.

Other variables are defined in terms of the number of days per week that a particular item is offered. For example, the "fresh_fruit_daysperwk_offer" variable takes on values from 1 to 5, with the value indicating how many days per week that school offers fresh fruit. Finally, some variables are continuous, such as the percentage of weekly entrees that are high in saturated fat (pct_entrees_highsatfat), which takes on a value between 0 and 100. For example, a value of 53 means that 53% of the entrees offered by that school during the week were high in saturated fat.

Table IV.4 shows both school-level means (for schools whose students were interviewed) and student-level means. For example, 39% of elementary schools and 36% of secondary schools offer only fat-free or low-fat milk at lunch (these numbers differ slightly from the numbers in Table IV.3—38% of elementary schools and 34% of secondary schools—because Table IV.3 includes all schools, but Table IV.4 includes only schools with students who were interviewed), but 41% of elementary students and 38% of secondary students attend a school that offers only fat-free or low-fat milk at lunch.

Among the variables used in the baseline models, the amount of missing data on any single variable ranged from 0 percent to 7 percent. Because the proportions missing were low, missing values were imputed with the mean of each variable. Imputation flags were created to denote imputed values and were included in the baseline models.

C. School and Student Background Characteristics

Because of the need to be parsimonious, a limited set of school and student background characteristics were included in the models. The school background characteristics included were school size, region, urbanicity (at the school level, taken from the Common Core of Data [CCD]), poverty level (at the district-level, taken from the CCD), middle versus high school (in the secondary

Table IV.3 Means of Policy/Practice Variables Included in Baseline Models, Meals Served[a]

Variable Description	Variable Name	Variable Values	Mean for Elementary Schools[b]	Mean for Secondary Schools[b]	Mean for All Schools[b]
Lunch					
Only low-fat or fat-free milk offered	onlyskim1per_offered	0, 1	0.38	0.34	0.36
Whole milk not offered	whole_milk_not_offered	0, 1	0.68	0.66	0.67
Yogurt offered as meat alternate	yogurt_offered	0, 1	0.22	0.10	0.15
Percent of weekly entrees that are high saturated fat[c]	pct_entrees_highsatfat	0 to 100	85.44	89.16	87.81
No self-serve salad dressings offered	self_serve_dress_not_off	0, 1	0.68	0.58	0.61
No high saturated fat condiments or spreads offered	high_satfat_condt_not_off	0, 1	0.20	0.11	0.14
No high saturated fat salad dressings offered	high_satfat_dress_not_off	0, 1	0.33	0.24	0.27
Juice not offered	juice_not_offered	0, 1	0.52	0.56	0.54
Number of days per week that fresh fruit is offered[c]	fresh_fruit_daysperwk_offer	0, 1, 2, 3, 4, 5	2.67	3.38	3.12
Average number of vegetable options offered per day[c]	avg_veg_perday	0.00 to 10.60	1.53	2.08	1.88
Raw vegetables offered	raw_veggies_offered	0, 1	0.92	0.88	0.89
Side salad bar offered	side_salad_bar_offered	0, 1	0.08	0.13	0.11
French fries or similar potato products not offered	frenchfries_not_offered	0, 1	0.28	0.13	0.18
Number of days per week that French fries or similar potato products are offered[c]	frenchfries_daysperwk_offer	0, 1, 2, 3, 4, 5	1.04	2.52	1.98
Number of days per week that dark green and orange vegetables are offered[c]	darkveg_daysperwk_offer	0, 1, 2, 3, 4, 5	1.50	1.47	1.48
Sample Size			**144**	**253**	**397**
Breakfast					
Flavored milk offered	flavored_milk_offered	0, 1	0.74	0.88	0.83
Cold cereal offered daily	cereal_offered_daily	0, 1	0.50	0.63	0.58
Only low-fat or fat-free milk offered	onlyskim1per_offered	0, 1	0.44	0.35	0.38
Whole milk not offered	whole_milk_not_offered	0, 1	0.72	0.66	0.68
Number of days per week that high saturated fat entrees are offered[c]	hisatfat_entr_daysperwk_offer	0, 1, 2, 3, 4, 5	2.79	3.58	3.30
Number of days per week that fresh fruit is offered[c]	fresh_fruit_daysperwk_offer	0, 1, 2, 3, 4, 5	1.40	1.96	1.76
Average number of types of hot cereal offered per day[c]	avg_hotcereal_perday	0.00 to 3.00	0.04	0.10	0.08
Number of days per week that sweet rolls/pastries are offered[c]	pastry_daysperwk_offer	0, 1, 2, 3, 4, 5	1.06	2.17	1.77
Number of days per week that sweetened cold cereals are offered[c]	sweet_cereal_daysperwk_offer	0, 1, 2, 3, 4, 5	3.29	3.67	3.53
Average number of types of sweetened cold cereals offered per day[c]	avg_sweetcereal_perday	0.00 to 9.00	1.80	1.90	1.86
Number of days per week that unsweetened cold cereals are offered[c]	unsw_cereal_daysperwk_offer	0, 1, 2, 3, 4, 5	1.60	1.59	1.59
Sample Size			**117**	**208**	**325**

Source: SNDA-III Public Use File.

[a]Characteristics of meals as offered by schools serve as inputs into the simulation model. Characteristics of meals as selected by students (i.e., meals served) and characteristics of meals as consumed by students are outputs of the model. The data source for meals offered and for meals served is the Menu Survey collected in SNDA-III; these are school-level measures. The data for the characteristics of meals consumed are from 24-hour dietary recalls collected from students.

[b]The school-level means in tables IV.3 and IV.4 differ slightly because Table IV.3 includes all schools, but Table IV.4 includes only those schools with students who were interviewed. The means of binary (0/1) variables are equal to the proportion of schools with a value of 1.

[c]This variable is not a binary (0/1) indicator variable.

Table IV.4 Means of Policy/Practice Variables Included in Baseline Models, Participation and Meals Consumed[a]

Variable Description	Variable Name	Mean for Elementary Schools[b]	Mean for Secondary Schools[b]	Mean for All Schools[b]	Mean for Elementary Students	Mean for Secondary Students	Mean for All Students
Lunch							
Only low-fat or fat-free milk offered	onlyskim1per_offered	0.39	0.36	0.37	0.41	0.38	0.39
Whole milk not offered	whole_milk_not_offered	0.68	0.67	0.67	0.69	0.68	0.68
Yogurt offered as meat alternate	yogurt_offered	0.20	0.10	0.14	0.21	0.10	0.13
Percentage of weekly entrees that are high saturated fat[c]	pct_entrees_highsatfat	84.79	88.56	87.25	83.98	88.91	87.35
No self-serve salad dressings offered	self_serve_dress_not_off	0.69	0.58	0.62	0.70	0.59	0.62
No high saturated fat condiments or spreads offered	high_satfat_condt_not_off	0.23	0.12	0.16	0.22	0.12	0.15
No high saturated fat salad dressings offered	high_satfat_dress_not_off	0.36	0.22	0.27	0.38	0.22	0.27
Juice not offered	juice_not_offered	0.58	0.57	0.57	0.57	0.56	0.56
Number of days per week that fresh fruit is offered[c]	fresh_fruit_daysperwk_offer	2.51	3.35	3.06	2.40	3.38	3.07
Average number of vegetable options offered per day[c]	avg_veg_perday	1.48	2.04	1.85	1.49	2.07	1.88
Raw vegetables offered	raw_veggies_offered	0.90	0.88	0.89	0.91	0.88	0.89
Side salad bar offered	side_salad_bar_offered	0.08	0.12	0.11	0.10	0.11	0.11
French fries or similar potato products not offered	frenchfries_not_offered	0.26	0.13	0.18	0.31	0.14	0.19
Number of days per week that french fries or similar potato products are offered[c]	frenchfries_daysperwk_offer	1.17	2.54	2.06	1.11	2.55	2.09
Number of days per week that dark green and orange vegetables are offered[c]	darkveg_daysperwk_offer	1.49	1.43	1.45	1.46	1.46	1.46
District includes nutrient requirements in vendor specifications	dist_nutreq_vendorspecs_i	0.60	0.70	0.66	0.57	0.69	0.65
District includes limits on total fat or saturated fat in vendor specifications	lim_fat_vendorspecs_i	0.56	0.64	0.61	0.53	0.62	0.59
No foods offered from national chains	nochainfd_i	0.76	0.71	0.73	0.74	0.70	0.71
School has on-site or base kitchen	prep_onsite_i	0.67	0.74	0.71	0.67	0.73	0.71
No open-campus policy	no_open_campus_i	0.91	0.85	0.87	0.92	0.85	0.87
School has recess before lunch	recess_b4lunch_i	0.24	NA	0.10	0.25	NA	0.10
No pouring rights contract	nopour_i	0.45	0.26	0.33	0.45	0.25	0.31
No a la carte items, except low-fat milk	noalc_lfmilk_i	0.31	0.10	0.17	0.29	0.08	0.15
Healthy foods offered a la carte	ac_hlthy	0.67	0.87	0.80	0.70	0.89	0.83
Has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	alc_nounhlthy	0.29	0.10	0.17	0.29	0.10	0.16
Has a la carte, but no fast-food-type entrees are sold	alc_noffentree	0.48	0.25	0.33	0.50	0.25	0.33
Has a la carte, but no sweetened beverages (SSBs) are sold	alc_nossb	0.47	0.22	0.31	0.49	0.23	0.31
No school store or snack bars selling food	nobarstore_i	0.94	0.69	0.78	0.93	0.68	0.76
Number of days per week school store or snack bar open[c]	days_store_open_i	0.23	1.29	0.92	0.25	1.33	0.99
Has vending machines, but not available during mealtimes	no_vending_meal_i	0.14	0.38	0.30	0.16	0.39	0.32
Has vending machines, but not available during the school day	no_vending_day_i	0.10	0.26	0.20	0.10	0.27	0.21
Number of vending machines is low	low_vending	0.93	0.66	0.76	0.93	0.66	0.74
Sample Size		**99**	**185**	**284**	**732**	**1,578**	**2,310**

Table IV.4 *(continued)*

Variable Description	Variable Name	Mean for Elementary Schools[b]	Mean for Secondary Schools[b]	Mean for All Schools[b]	Mean for Elementary Students	Mean for Secondary Students	Mean for All Students
Breakfast							
Flavored milk offered	flavored_milk_offered	0.71	0.87	0.82	0.71	0.87	0.82
Cold cereal offered daily	cereal_offered_daily	0.50	0.62	0.58	0.51	0.63	0.59
Only low-fat or fat-free milk offered	onlyskim1per_offered	0.43	0.34	0.37	0.44	0.35	0.38
Whole milk not offered	whole_milk_not_offered	0.69	0.65	0.66	0.70	0.66	0.67
Number of days per week that high saturated fat entrees are offered[c]	hisatfat_entr_daysperwk_offer	2.66	3.52	3.22	2.60	3.53	3.23
Number of days per week that fresh fruit is offered[c]	fresh_fruit_daysperwk_offer	1.03	1.90	1.60	0.98	1.92	1.63
Average number of types of hot cereal offered per day[c]	avg_hotcereal_perday	0.04	0.10	0.08	0.04	0.10	0.08
Number of days per week that sweet rolls/pastries are offered[c]	pastry_daysperwk_offer	1.15	2.36	1.94	1.10	2.38	1.98
Number of days per week that sweetened cold cereals are offered[c]	sweet_cereal_daysperwk_offer	3.47	3.67	3.60	3.48	3.65	3.60
Average number of types of sweetened cold cereals offered per day[c]	avg_sweetcereal_perday	1.89	1.91	1.90	1.92	1.90	1.91
Number of days per week that unsweetened cold cereals are offered[c]	unsw_cereal_daysperwk_offer	1.44	1.66	1.58	1.47	1.67	1.61
District in DOD Fresh or farm-to-school program	dod_fresh_or_farm_i	0.51	0.63	0.59	0.51	0.63	0.59
District includes requirements for protein, vitamin A and C, calcium, and iron in vendor specifications	require5_vendorspecs_i	0.17	0.20	0.19	0.19	0.19	0.19
Nutrition education offered in every grade	nutr_ed_i	0.73	0.48	0.57	0.73	0.49	0.56
School makes available nutrition information about menus	nutr_content_avail_i	0.64	0.60	0.61	0.63	0.61	0.61
Has vending machines, but not in or near food service area (within 20 feet)	vending_notinSFA	0.14	0.43	0.33	0.14	0.43	0.34
Has vending machines, but not available during mealtimes	no_vending_meal_i	0.16	0.37	0.30	0.18	0.38	0.32
Has vending machines, but not available during the school day	no_vending_day_i	0.12	0.25	0.20	0.12	0.26	0.21
Has vending, but no sugar sweetened beverages (SSBs) are sold	nossb_vending_i	0.10	0.10	0.10	0.11	0.09	0.10
No a la carte itmes, except low-fat milk	noalc_lfmilk_i	0.34	0.10	0.18	0.30	0.09	0.15
Healthy foods offered a la carte	ac_hlthy	0.62	0.86	0.78	0.67	0.88	0.81
Has a la carte, and fruits and/or vegetables (except fries) are sold	alc_fruitveg	0.23	0.57	0.46	0.24	0.59	0.48
No food-based fundraising activities	nofoodfund_i	0.47	0.34	0.38	0.47	0.32	0.37
Sample Size		**86**	**164**	**250**	**630**	**1,375**	**2,005**

Source: SNDA-III Public Use File.

[a]Characteristics of meals as offered by schools serve as inputs into the simulation model. Characteristics of meals as selected by students (i.e., meals served) and characteristics of meals as consumed by students are outputs of the model. The data source for meals offered and for meals served is the Menu Survey collected in SNDA-III; these are school-level measures. The data for the characteristics of meals consumed are from 24-hour dietary recalls collected from students.

[b]The school-level means in tables IV.3 and IV.4 differ slightly because Table IV.3 includes all schools, but Table IV.4 includes only those schools with students who were interviewed.

[c]This variable is not a binary (0/1) indicator variable.

DOD = Department of Defense.

model only), day of the week, and a dummy variable for whether the school has a breakfast program (in the lunch model). A wide range of student and family background characteristics were initially examined, including basic demographics, eligibility for free or reduced-price meals (based on parent report of family income), and variables describing the child's health, appetite, and physical activity level. (This last set of variables was later dropped from the models because they were rarely significant and did not appear to affect the coefficients on the school-level policy/practice variables.) The student background characteristics ultimately chosen for the participation and meals consumed models were gender, race, and income eligibility level (free, reduced price, or full price). Chapter VIII examines the sensitivity of the overall simulation results to including more student-level characteristics.

V. ESTIMATING BASELINE MODELS

The main objective of this study is to model the effects of policies and practices on meals served, participation, and meals consumed in a way that enables model users to simulate the effects of a change in a particular practice or policy on these three sets of outcomes. These relationships were modeled separately for breakfast and lunch, and for elementary and secondary schools. Some relationships were modeled mechanically and some as statistical models. In the former case, it was assumed that there is no uncertainty, so that the outcome can be expressed as a direct function of known parameters. In many cases, however, the value of an outcome depends on choices of various actors, which in turn depend on a wide range of factors, of which only some can be observed. Thus, the study team used statistical modeling to estimate the probability of an outcome (or the change in a continuous outcome), given the observable factors. In these models, it is possible to predict the value of an outcome for an individual or school within a range defined by the confidence interval.

This chapter is organized into two sections. Section A describes the regression framework used to model each of the relationships depicted in Figure I.1. Section B describes the regression results from estimating these baseline models. Each modeling step is linked to one of the relationships described in the conceptual framework of Chapter I. Some of the models described in this chapter are school-level models and some are student-level models. All results are weighted using the appropriate sampling weights—either school- or student-level weights—so that the results are nationally representative. Chapter VI describes how these models are used to simulate the effects of specific changes in policy or practice.

A. Modeling Framework

This section describes the approach used to model the key relationships in Figure 1.1: (1) relating policies/practices to the characteristics of meals offered and the school food environment; (2) relating the characteristics of meals offered and the school food environment to the student

participation decision; (3) relating the characteristics of meals offered to the characteristics of meals served; and (4) relating the characteristics of meals offered, the characteristics of the school food environment, and student participation to the characteristics of meals consumed.

1. Linking Policies/Practices with the Characteristics of Meals Offered and the School Food Environment

The conceptual framework in Figure I.1 originates with a set of policies, practices, and regulations and the specification of two types of relationships (both marked "A" in the figure). The first describes the relationship between the specific policy or practice changes being examined and the relevant characteristics of the school's food environment; the second describes the relationship between the policies/practices and the characteristics of the meals offered. For example, policies that could be examined include

- No longer offering milk with fat content greater than 1 percent
- Offering fresh fruit daily
- Increasing the full price paid for a meal by $0.10

The simulation model accommodates the analysis of each of these policies individually or in combination with one another.

The relationships between policies/practices and both the school food environment and the characteristics of meals offered were assumed to be known with certainty. In most cases, it was assumed that the policy or practice change has only direct effects on the specific meals-offered characteristic it regulates and no effects on other foods offered.[1] That is, policy or practice changes were specified in terms of changes in the meals-offered variables and school environment variables in the models, implicitly assuming that they are fully implemented in all schools and that no other

[1] One exception occurred when simulating a policy reform that involved increasing the number of days per week that dark green and orange vegetables were offered; the analysis also increased the average number of vegetable options offered per day.

changes are made. It is possible for model users to test the sensitivity of the overall simulation model results to the initial set of assumptions by rerunning the model with a new set of input parameters. Furthermore, users need to specify any interactions between policies, because the model will not implement them automatically. For example, if a user believes that certain policy/practice variables that are not directly related to a particular policy will nonetheless be affected by the policy, the user must make changes to those variables when specifying the input parameters.

Assuming there are *K* relevant characteristics of meals offered and the school food environment, the simulation model has *K* meals-offered and food environment indicators. If this set of characteristics for school *j* is defined as O_{j1} through O_{jk}, then each of the *K* indicators is a function of the current set of policies and practices (*Pol*) such that $O_{jk} = f_k(Pol)$. The functions f_k are determined based on the assumptions made about the effects of the policies as described earlier. For example, to simulate the policy of no longer offering milk with fat content greater than 1 percent, the following two variables were set equal to 1 for all schools (that is, perfect policy implementation was assumed): "only low-fat or fat-free milk offered" and "whole milk not offered." Section A of Chapter VII outlines how each of the three example policies were specified. The explicit and implicit assumptions of how the meals-offered and school food environment characteristics, O_{jk}, are affected by the set of policies and practices (*Pol*) are also discussed.

2. The Relationship Between the Characteristics of Meals Offered and the Characteristics of Meals Served

The characteristics of meals served by schools are assumed to depend on the characteristics of the meals they offer, the participation levels of students at the schools, and the foods these students choose. This relationship is modeled with a school-level statistical model. The dependent variables are the key dimensions of meals served (described in Chapter III). In addition to the characteristics of the meals offered and the school food environment, the meals-served model controls for other school-level characteristics, such as the demographic characteristics of students at the school. A

measure of student participation is not explicitly included in the model because the focus is on foods selected by participants.

The meals-served model consists of a set of separate equations—one for each particular characteristic of the meal served (outcome). The structure of each equation is identical, with the same set of explanatory variables. This enables model users to test for unintended consequences of certain policies or practices related to one target outcome on other outcomes. For example, policies to restrict milks with fat content greater than 1 percent could have both the intended consequence of decreasing the saturated fat in the average meal served and the unintended consequence of decreasing fluid milk serving equivalents in the average meal served. To test for this type of unintended consequence, the meals-served model was estimated separately for each of the target outcomes specified in Chapter III. Note that the unintended consequences captured are only those that operate directly through one of the meals offered or food service characteristics influenced by the policy being simulated. In other words, the simulation model does not capture unintended consequences that operate through unexpected changes schools make to their school meals in response to the policy change.

Suppose there are K relevant characteristics of meals offered and the school food environment. The model estimated for each meals-served outcome, S_{jk}, includes as explanatory variables these K characteristics for school j, O_{j1} through O_{jk}, as well as other school-level characteristics (W_j), such as the total enrollment at the school:

$$(1)\ S_{jk} = W_j\gamma + O_{jk}\alpha + \mu_j$$

This equation includes a set of unobservable school-level factors represented by an error term, μ_j.

Because all of the meals-served outcome variables are continuous, ordinary least squares (OLS) was used to estimate these models. Another possible estimation method would be feasible generalized least squares (FGLS), which allows the error terms across different equations to be

correlated. However, when the equations are not simultaneous—meaning that none of the regressors appear as dependent variables in another equation—and the set of explanatory variables is identical for each dependent variable, then FGLS and OLS are identical and there is no advantage to using FGLS over OLS (Greene 2003).

3. The Relationship Between the Characteristics of Meals Offered, School Food Environments, and the Student Participation Decision

The relationship between meals offered, school food environments, and student participation is modeled at the student level. The dependent variable is a student's school meal participation status on a given day (for the sample, the recall day is used). Explanatory variables include student characteristics, meals-offered characteristics, and characteristics of the school and school food environment. Aspects of the school food environment included in this model were the price of the meal, availability of competitive foods, and broader school policies. These variables enter the model in much the same way as meals-offered characteristics.

The model is formalized as follows. A student's participation status on a given day is a binary variable. The factors affecting participation are modeled using a probit model:

$$(2)\ P_{ij}^{*} = X_{ij}\beta + Z_j\delta + O_{jk}\alpha + \varepsilon_{ij}$$

$$(3)\ P_{ij} = 1\ if\ P_{ij}^{*} > 0$$

$$= 0\ otherwise$$

where $P_{ij}^{*}$is the propensity of student *i* to obtain a school meal at school *j*. This is based on a set of student-level characteristics that influence participation, X_{ij}, a set of school-level characteristics that influence participation, Z_j, the set of characteristics of meals offered and the general food environment at school *j*, O_{jk} , and a set of unobservable factors represented by an error term, ε_{ij} (assumed to have a normal distribution in a probit model). It is assumed that students participate if $P_{ij}^{*} > 0$. Thus, P_{ij} is a binary indicator of whether student *i* obtains a school meal at school *j*.

4. Relating the Characteristics of Meals Offered, the Characteristics of the School Food Environment, and Student Participation to the Characteristics of Meals Consumed

This model examines the factors that influence the foods and nutrients students consume at breakfast and lunch on school days, whether at home or at school. Key explanatory variables in the model for the purpose of simulating the effects of policies are students' school meal participation, the characteristics of meals offered, and the school food environment. Unlike the meals-served model, the model of meals consumed by students is a student-level model. Also, although the meals-served analysis models only foods selected by school meal participants for breakfast and lunch, the meals-consumed analysis models foods consumed by all students, whether or not they participate in the meal programs.

As with the meals-served model, the meals-consumed model consists of a set of separate equations—one for each meals-consumed outcome—in which the structure of each equation is identical. That is, each equation includes the same set of explanatory variables. These identical specifications are required in order to test for unintended consequences of certain policies or practices on characteristics of meals consumed not targeted by the specific policy or practice. For example, efforts by schools to offer a salad bar as part of the school meal could have both the intended consequence of increasing vegetable equivalents consumed and the unintended consequence of increasing saturated fat consumption (through the consumption of high saturated fat salad dressings). To test for this type of unintended consequence, the meals-consumed models were estimated separately for each of the target and collateral outcomes specified in Chapter III.

a. Selection Bias and the Instrumental Variables Model

Participants and nonparticipants may differ in ways that are unobserved and these unobservable factors may cause differences in meals consumed, rather than participation in the NSLP or SBP or the various school-level variables in the models. For example, participants and nonparticipants may differ in their food preferences. Suppose that "fast-food lovers" choose to participate in the NSLP

and "fast-food haters" choose not to participate. If participants are found to have higher caloric intakes, it would not necessarily be due to the NSLP, but might simply be due to the fact that these individuals have a preference for eating energy-dense foods. In technical terms, this problem is called selection bias.

In order to minimize the risk of selection bias, the model controls as much as possible for both observed and unobserved factors that may cause differences in meals consumed between participants and nonparticipants. To control for observed factors, the model includes many school and student characteristics available in the data. To control for unobserved differences, an instrumental variables (IV) method was used. In this method, one first calculates a predicted value of participation for each student using one or more instruments. The instruments should be variables that are correlated with participation, but not with the ultimate outcome (the characteristics of meals consumed). The predicted value of participation is then used in place of actual participation status when modeling meals consumed. The instruments used for participation were interactions between meal price[2] and income, dummy variables for whether the cashier identifies students eligible for free or reduced-price meals via a PIN or electronic card, whether the school cafeteria has enough lines and seats during lunch, whether offer versus serve (OVS) is available, and a categorical variable for the time that each student's lunch period starts.

Formally, the IV model is as follows. A student's actual (observed) participation on a given day, P_{ij}, is a function of a set of student-level characteristics that influence participation and meals consumed, X_{ij}; a set of school-level characteristics that influence participation and meals consumed, Z_j^1; a set of school-level instrumental variables that influence participation but do not influence

[2] School foodservice managers reported full and reduced prices charged for breakfast and lunch; if multiple full prices were reported, the "standard" full price was used, as requested in the survey.

meals consumed, Z_j^2; the set of characteristics of meals offered and the general food environment at school *j*, O_{jk}; and a set of unobservable factors represented by an error term, ε_{ij}:

$$(4)\ P_{ij} = X_{ij}\beta + \mathrm{Z}_{\mathrm{j}}^{1}\delta^{1} + \mathrm{Z}_{\mathrm{j}}^{2}\delta^{2} + O_{jk}\alpha + \varepsilon_{ij}$$

A student's consumption of a particular nutrient or food, C_{ijk}, is a function of X_{ij}, Z_j^1, O_{jk}, predicted participation, $\widehat{P_{ij}}$, and a set of unobservable factors represented by an error term, e_{ij}:

$$(5)\ C_{ijk} = X_{ij}B + \mathrm{Z}_{\mathrm{j}}^{1}D + \widehat{P_{ij}} + O_{jk}\alpha + e_{ij}$$

Predicted participation is calculated using the coefficients estimated in Equation (4). Equation (5) is estimated using the "svy: ivregress" command in STATA, which is a two-staged least squares method (STATA version 10.1). The first-stage, Equation (4), is estimated using OLS.

b. Reduced-Form Model

An alternative method for dealing with the problem of selection bias is to estimate a reduced-form model for the meals-consumed outcomes that does not include participation as an independent variable. Meals-offered characteristics and the school food environment affect meals consumed both directly and indirectly (through the student participation decision). This type of reduced-form model examines the *overall* effect of meals offered and environment characteristics on meals consumed. As one of the sensitivity checks in Chapter VIII, a reduced-form model is estimated for each of the meals-consumed target outcomes.

c. Censored Observations

Some of the meals-consumed outcomes take on a positive value for only a small percentage of students and are zero for all other students. For example, 85 percent of elementary school students and 90 percent of secondary school students consume no dark green and orange vegetable equivalents at lunch; 47 percent of elementary students and 75 percent of secondary students

consume no fruit equivalents[3] at lunch; and 73 percent of elementary students and 85 percent of secondary students consume no fruit equivalents at breakfast. In cases such as these (in which the data are said to be "censored" at zero), it is not appropriate to model meals consumed using standard least squares regression methods (such as the IV method described earlier), because the model fails to account for the qualitative difference between positive values of the intake variable and censored (zero) values of the variable (Greene 2003). This is because the factors that affect the decision to consume *any* fruit may differ from the factors that affect *how much* fruit is consumed, given one consumes a positive amount. It is also possible that the same set of factors affects each of the two intake decisions (whether to consume and how much to consume), but affects them differently.

Applying a standard least squares regression model to either the full sample of students (with positive and zero values of an outcome variable) or the subsample of students with positive values only may result in biased coefficient estimates. If the proportion of censored observations in the sample is large, and if a variable affects the "whether to consume" and "how much to consume" decisions with drastically different magnitudes, then the degree of bias may be substantial. Any bias due to censoring tends to increase as the proportion of censored data increases.

A Tobit model is the most common method for handling this type of censoring, as it jointly estimates the two behavioral decisions, thus accounting for the qualitative difference between them (Greene 2003). However, it was not possible to estimate a Tobit model while simultaneously accounting for selection bias in the participation decision using an IV approach because no such "combination" methods exist in either SAS (version 9.1) or STATA (version 10.1) that allow for

[3] Fruit equivalents refer to all fruit consumed except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

discrete endogenous variables (such as participation status).[4] As a result, all of the preliminary meals-consumed models were run using the IV and reduced-form methods described earlier, and did not explicitly take censoring into account.

B. Regression Results

This section describes the results from estimating the baseline models of meals served, participation, and meals consumed.

1. Meals Served

The school-level meals-served models are based on a sample of 397 schools for lunch and 325 schools for breakfast (because not all sampled schools offer the SBP). The sample is nationally representative of public schools in school year 2004–2005.

Foods and nutrients in meals served are derived from the SNDA-III Menu Survey, in which school foodservice managers reported on all foods and beverages offered in reimbursable meals, and also estimated the number of servings of each item served to or selected by students as part of reimbursable meals for each meal, over the course of one school week. Average nutrients in meals *as served* were defined as a weighted average of the nutrients in each food served in the reimbursable school meal, weighted by the proportion of meals that contained that food. These averages were calculated for each day of the Menu Survey week and then an average of the daily averages was used as the school-level average. To give a concrete example, if the school lunch offered the choice of a hamburger or a grilled cheese sandwich, and 60 percent of NSLP participants took the hamburger and 40 percent took the grilled cheese sandwich, then the average meal served would include 60

[4] Woutersen (2006) provides a detailed explanation for why this is a difficult computational problem. STATA is capable of estimating a Tobit model with endogenous regressors, but constrains those regressors to be continuous. However, the endogenous regressor in the model is the participation variable, which is binary, preventing one from using the available estimation procedure.

percent of the nutrients in the hamburger and 40 percent of the nutrients in the grilled cheese sandwich. If the only fruit option was a fruit cup, and 46 percent of participants selected it, then the average meal served would include 46 percent of the nutrients in the fruit cup.

The average number of servings selected from key food groups is not calculated using MyPyramid equivalents (MPEs), as they were not used in coding the menu data.[5] Instead, the numbers of servings of foods from a specific food group, such as fruits and vegetables, per reimbursable meal were examined, counting only the number of distinct menu items that were fruits and vegetables (determined by meal component food group codes in the SNDA-III data, as described in Chapter II). For example, tomato sauce that was part of an entree is not counted among the vegetables. Side salads are counted as a serving of vegetables, even if other ingredients are included, but entree salads are not.[6] (In contrast, for the dietary recall data, MPEs were used to measure outcomes.)

The meals-served models were estimated using least squares regressions with standard errors adjusted for the complex sample design of SNDA-III, using SUDAAN software. There are five models for lunch in elementary schools (corresponding to five outcomes), five models for lunch in secondary schools, three models for elementary school breakfasts, and three models for secondary school breakfasts. Results from these models are shown in Tables B.1 through B.4.

Table V.1 summarizes the policy/practice variables with significant coefficients (p-values less than or equal to 0.05), and the sign of the estimated coefficients.

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[5] The MPE database organizes all of the foods in the USDA food and nutrient database into equivalent servings from more than 30 food groups and subgroups, by classifying foods at the ingredient level. The most recent version is used in constructing the 2005 Healthy Eating Index. However, SNDA-III school menu offerings have not been coded with MPEs. The MPEs have been added to the dietary recall data.

[6] Meals-served outcomes were based on the meal component food group codes in the SNDA-III data: milk, fruit, vegetables, combination entrees, meat/meat alternate, breads/grains, desserts, and accompaniments. Because entrée salads are coded as combination entrees rather than as vegetables, they were not included in the calculation of discrete vegetable servings.

Percentage of Calories from Saturated Fat. At lunch, for elementary students, saturated fat as a percentage of energy served was significantly higher when juice was not offered. For secondary school students, energy from saturated fat served was positively related to the percentage of entrees offered that were high in saturated fat and the number of days per week fresh fruit was offered. At the same time, other things equal, energy from saturated fat served was significantly lower when only fat-free or low-fat milk was offered, a side salad bar was offered, and when french fries were offered on a greater number of days per week. This last result may seem counterintuitive, but in fact, french fries contributed far more to calories and total fat than to saturated fat: in the SNDA-III data, on average, french fries and similar potato products contain 203 calories and 9.8 grams of total fat per 100 grams, but only 2.4 grams of saturated fat. Salad dressings are also often higher in total fat than in saturated fat.

At breakfast, elementary schools that offered only fat-free or low-fat milk and offered cereal daily served meals that were lower in the percentage of calories from saturated fat. For secondary school students, energy from saturated fat in breakfasts served was lower when flavored milk was offered. At both elementary and secondary schools, energy from saturated fat was positively related to the number of days per week that high saturated fat entrees were offered.

Fluid Milk Servings. At lunch, a number of variables were significantly related to fluid milk servings. Most notably, all else equal, fluid milk servings were higher in schools that did not offer juice and lower in secondary schools that offered only low-fat or fat-free milk. Thus, the lunch findings suggest a tension between reducing saturated fat and increasing fluid milk. One might think that the reason fluid milk servings were lower in schools that offered only low-fat or fat-free milk is because those schools were less likely to offer flavored milk. However, 99% of schools offered flavored milk at lunch, suggesting this was not the case. At breakfast, there were no significant predictors of fluid milk servings for either elementary or secondary students.

Fruit Servings (Excluding Juice). The average number of fruit servings per meal was low for many schools. Nonetheless, the number of servings of fruit was associated with several meals-offered characteristics that are directly related to fruit, as well as some that are not. At lunch, fruit servings for secondary students were negatively related to the number of days french fries were offered and to side salad bars being offered, but were positively related to juice not being offered.Thus, juice, side salad bars, and french fries appear to be substitutes for fruit. Factors related to fruit servings in elementary lunches were similar—fruit servings were lower if the weekly percentage of entrees that were high in saturated fat was higher, if a side salad bar was offered, or if juice was offered. The percentage of weekly entrees that are high in saturated fat may be an indicator of fewer healthy options in all food groups, or of the tendency to serve french fries with high saturated fat entrees.

At breakfast, fruit servings for both elementary and secondary students are positively associated with the number of days per week that fresh fruit is offered and negatively associated with cereal being offered daily. In addition, for secondary schools, fruit servings at breakfast are negatively associated with flavored milk being offered.

Vegetable Servings (Other than Fried Potatoes)—Lunch Only. At both elementary and secondary schools, juice and fresh fruit appear to be substitutes for vegetables, and offering a side salad bar is associated with an increase in vegetable servings. At elementary schools, vegetable servings are higher when raw vegetables are offered. At secondary schools, vegetable servings are higher as the number of vegetable options offered per day increases and the number of days per week that french fries are offered decreases.

Table V.1 Overview of Regression Results from Meals-Served Models

	Significant Predictors	
Meals-Served Outcome	Elementary Schools	Secondary Schools
Lunch		
Percentage of calories from saturated fat	Juice not offered (-)	Percentage of week's entrees high in saturated fat (+) Number of days per week fresh fruit offered (+) Only fat-free or low-fat milk offered (-) Side salad bar offered (-) Number of days per week french fries offered (-)
Fluid milk servings	Juice not offered (+) Number of days per week dark green/orange vegetables offered (+) High saturated fat condiments not offered (+) Number of days per week fresh fruit offered (-) Average number of vegetable options per day (-) Raw vegetables offered (-)	Percentage of week's entrees high in saturated fat (+) Juice not offered (+) Only fat-free or low-fat milk offered (-) Number of days per week french fries offered (-)
Fruit servings (excluding juice)	Juice not offered (+) Percentage of week's entrees high in saturated fat (-) Side salad bar offered (-)	Juice not offered (+) Number of days per week fresh fruit offered (-) Side salad bar offered (-) Number of days per week french fries are offered (-)
Vegetable servings (excluding fried potatoes)	Juice not offered (+) Side salad bar offered (+) Raw vegetables offered (+) Number of days per week fresh fruit offered (-)	Juice not offered (+) Side salad bar offered (+) Average number of vegetable options offered per day (+) Number of days per week fresh fruit offered (-) Number of days per week french fries are offered (-)
Dark green/orange vegetable servings	Juice not offered (+) Raw vegetables offered (+) Number of days per week dark green/orange vegetables offered (+) French fries not offered (+) Average number of vegetable options offered per day (-) Self-serve salad dressing not offered (-)	Number of days per week dark green/orange vegetables offered (+) High saturated fat condiment not offered (+) Number of days per week fresh fruit offered (-) Average number of vegetable options offered per day (-) Number of days per week french fries are offered (-)
Breakfast		
Percentage of calories from saturated fat	Number of days per week high saturated fat entrees offered (+) Only fat-free or low-fat milk offered (-) Whole milk not offered (-) Cereal offered daily (-)	Number of days per week high saturated fat entrees offered (+) Flavored milk offered (-)
Fluid milk servings	No significant predictors	No significant predictors
Fruit servings (excluding juice)	Number of days per week fresh fruit offered (+) Cereal offered daily (-)	Number of days per week fresh fruit offered (+) Flavored milk offered (-) Cereal offered daily (-)

Source: School Nutrition Dietary Assessment-III Public Use File, school year 2004-2005.

Dark Green/Orange Vegetable Servings—Lunch Only. Although they are not served in great quantities (particularly as separate items), factors related to servings of dark green and orange vegetables generally are those directly related to vegetables offered in the meals, and generally have effects that make sense from a theoretical standpoint. For example, at both elementary and secondary schools, servings of dark green and orange vegetables are higher as offerings of dark green and orange vegetables increase and offerings of french fries decrease, and servings are lower as the number of vegetable options increases (it seems that other vegetable options are preferred). At elementary schools, servings are higher when raw vegetables are offered, juice is not offered, and self-serve salad dressings are not offered. At secondary schools, servings are lower when fresh fruit is more available and are higher when high saturated fat condiments are less available. The last of these associations is somewhat unexpected, as cheese sauce for broccoli and ranch dressing for carrot sticks are often seen on school menus.

2. Participation

Previous research suggests that students' personal characteristics—particularly age, gender, and eligibility for free or reduced-price meals—are the predominant factors influencing participation decisions (Gordon et al. 2007b). A few school-level variables were also significantly associated with participation in earlier studies, particularly the price of the meal and whether OVS rules were used (Devaney et al. 1993; Gleason and Suitor 2001; Gordon et al. 2007b).

A range of participation models was estimated; the analysis found that, for the most part, the models were not sensitive to minor changes in variables included. Some characteristics of meals offered and the school environment were significantly associated with participation for both the NSLP and SBP, controlling for other factors; many of the expected demographic and economic variables were also statistically significant. Results were different for elementary and secondary school students, but generally in ways that made sense.

Based on SNDA-III data, in public schools in 2004–2005, 73 percent of elementary students and 51 percent of secondary students participated in the NSLP; 29 percent of elementary students and 14 percent of secondary students participated in the SBP (Gordon et al. 2007b). The student-level participation models are based on a sample of 2,310 students for lunch and 2,005 students for breakfast. These probit models were estimated using STATA, which allows estimation of such models with standard errors adjusted for the complex sample design. Results from these models are shown in Tables B.5 through B.8.

NSLP Participation. Among elementary school students, NSLP participation is positively related to nonwhite race/ethnicity, to whether the school also offers the SBP, to the poverty level of the school, and to four of the FNS regions (Mid West, North East, South East, and South West). Participation is not significantly related to the price of the meal (which is allowed to vary according to students' free or reduced-price eligibility), but is positively related to use of electronic systems to identify students' free or reduced-price status unobtrusively, and to the availability of enough seats in the cafeteria (as reported by the principal). Participation increases as the number of days the school store is open increases. Participation is positively related to the percentage of entrees that are high in saturated fat and the availability of dark green and orange vegetables, and is negatively related to the availability of fresh fruit, raw vegetables, french fries, and self-serve salad dressings. The fact that participation is negatively related to the availability of french fries seems a bit counterintuitive, but may be due to the fact that the indicator variables for whether french fries are offered and whether raw vegetables are offered are somewhat correlated (correlation coefficient of 0.35).

Secondary school students are more sensitive to the price of the school meal, and their participation in the NSLP is significantly lower among girls (other things equal). They are more likely to participate when payment is handled electronically, the school is located in the North East region, meals are prepared on site, there is no open-campus policy, the number of vending machines is low, no fast-food-like entrees are offered a la carte, whole milk is not offered, the percentage of entrees

high in saturated fat is greater, the number of vegetable options is greater, and dark green and orange vegetables are offered fewer days per week.

SBP Participation. Controlling for other factors, both elementary and secondary public school students participated more often in the SBP when the meal price they faced was lower, despite the fact that only 30 percent of SBP participants pay full price.[7] This may be because both full and reduced prices are significantly lower in high-poverty districts. Elementary school students are less likely to eat the school breakfast if they are female; if they live in a suburban area; if the school is in the Mountain, North East, South West, or West regions; if the cashier identifies students electronically; if nutrition education is offered in every grade; if vending machines are not available during the school day; if flavored milk is offered; and if sweetened cereal is offered more days per week. They are more likely to participate if the school participates in the DOD Fresh or farm-to-school program; if the district includes requirements for protein, vitamins A and C, calcium, and iron in vendor specifications; if cereal is offered daily; and if the number of hot cereal options is greater.

Among secondary school students, participation in SBP is higher, all else equal, for boys and black students. Students are more likely to participate if the cashier identifies students electronically, if the school does not participate in the DOD Fresh or farm-to-school program, if whole milk is not offered, and if high-saturated-fat entrees are offered on more days per week. Students are less likely to participate if the school is located in the Mountain region.

3. Meals Consumed

The meals-consumed models are student-level models, and include all students—not just NSLP and SBP participants. Foods and nutrients in meals consumed are derived from the SNDA-III 24-

[7] Students whose schools did not offer the SBP were not included in the sample.

hour dietary recall, in which children reported on all foods and beverages consumed in a single 24-hour period (with help from parents for elementary students). Foods and nutrients consumed were modeled at lunch and breakfast only, rather than across the entire 24-hour period.[8]

Regression results for the target outcomes are shown in Tables B.9 through B.26. Regression results for the collateral outcomes are shown in Tables B.27 through B.30. The standard errors are adjusted for the complex sample design of SNDA-III using STATA.

In general, the meals-consumed models did not fit as well as the meals-served models. This is to be expected because, although meals served are directly influenced by what is offered, meals consumed are potentially influenced through several channels, including what is offered, whether or not a student participates, and what other foods the student brings from home or obtains from an alternative source, such as a vending machine.

As with meals served, the analysis focused on the policy/practice variables that were significant with *p*-values less than or equal to 0.05; these variables are indicated by asterisks in the tables. Note that, as in the meals-served models, all of the policy/practice variables were included in the models for each target outcome, even those aimed at other target outcomes. Recall from Section A that this is necessary in order to test whether a particular policy affects other outcomes.

Percentage of Energy from Saturated Fat

- **Elementary School Students at Lunch:** Saturated fat intakes as a percentage of energy were significantly lower when only fat-free or low-fat milk was offered, a la carte options were healthier, high saturated fat condiments were not offered, no foods from national chains were offered, and when the district included nutrient requirements in vendor specifications. Energy from saturated fat was positively related to the percentage of weekly entrees that are high in saturated fat. Other statistically significant results are as

[8] Breakfast included the following foods: 1) all foods reported between 5:00 A.M. and 9:30 A.M., and 2) foods reported between 9:30 A.M. and 10:30 A.M. that were called "breakfast" by the student. Lunch included the following foods: 1) all foods reported between 10:00 A.M. and 2:00 P.M., unless reported as breakfast; 2) all foods reported between 9:30 A.M. and 10:00 A.M. that were reported as lunch, supper, or dinner; and 3) all foods reported between 2:00 P.M. and 3:30 P.M. that students reported as being part of lunch.

follows. Energy from saturated fat was significantly higher when fresh fruit was offered on more days per week. One possible explanation for this is that schools who offer fresh fruit on more days per week tend to offer high saturated fat condiments with the fruit, such as whipped cream. Another possible explanation is that larger schools tend to offer more of both fresh fruit and items that are high in saturated fat. Although the regressions control for school size, this variable is not interacted with the number of days per week that fresh fruit is offered. Finally, energy from saturated fat was significantly higher when french fries were not offered. As stated above, french fries contribute far more to calories and total fat than to saturated fat; thus, this result may be spurious.

- **Secondary School Students at Lunch:** Saturated fat intakes as a percentage of energy were significantly lower when a side salad bar was offered and when juice was not offered.
- **Elementary School Students at Breakfast:** Energy from saturated fat was significantly lower when a la carte options included fruits and/or vegetables and was significantly higher when high saturated fat entrees were offered on more days per week.
- **Secondary School Students at Breakfast:** No meals-offered characteristics or school environment characteristics were significantly related to saturated fat intakes as a percentage of energy. This may be because SBP participation by secondary students is low (14 percent).

Fluid Milk Equivalents

- **Elementary School Students at Lunch:** As one would expect, fluid milk consumption was significantly higher when no sugar-sweetened beverages (SSBs) were offered a la carte, because SSBs are a likely substitute for fluid milk. Fluid milk consumption was also higher when no fast-food-like entrees were offered a la carte and when self-serve salad dressings were not offered. Fluid milk consumption was significantly lower when high saturated fat condiments were not offered and when a la carte options were healthier. Recall that the lunch models do not include a variable indicating whether flavored milk is offered because there is not enough variation in the data; 99% of schools offer flavored milk at lunch.
- **Secondary School Students at Lunch:** As one would expect, fluid milk consumption was significantly higher when juice (a substitute for milk) was not offered. Fluid milk consumption was significantly lower when high saturated fat dressings were not offered, when the district included limits on total fat or saturated fat in vendor specifications, and when the percentage of weekly entrees high in saturated fat was higher.
- **Elementary School Students at Breakfast:** Fluid milk consumption was significantly higher when high saturated fat entrees were offered on more days per week and was significantly lower when there were no food-based fundraising activities. Notably, fluid milk consumption was not statistically significantly related to whether flavored milk was offered.
- **Secondary School Students at Breakfast:** No meals-offered characteristics or school environment characteristics were significantly related to fluid milk consumption. Again, this may be because SBP participation by secondary students is low (14 percent).

Fruit Equivalents (Excludes Juice)

- **Elementary School Students at Lunch:** Fruit equivalents consumed were significantly higher when there was no a la carte, when a la carte options were healthier, when no fast-food-like entrees were offered a la carte, when fresh fruit was offered more days per week, and when raw vegetables were offered. Fruit equivalents consumed were significantly lower when the district included nutrient requirements in vendor specifications.
- **Secondary School Students at Lunch:** Fruit equivalents consumed were significantly higher when vending machines were not available during the day and when there was no school store or snack bar selling food. Fruit equivalents consumed were significantly lower when vending machines were not available during mealtimes and when no foods from national chains were offered.
- **Elementary School Students at Breakfast:** Fruit equivalents consumed were significantly higher when a la carte options were healthier.
- **Secondary School Students at Breakfast:** No meals-offered characteristics or school environment characteristics were significantly related to fruit equivalents consumed.

Vegetable Equivalents (Excluding Fried Potatoes)—Lunch Only

- **Elementary School Students:** In general, the results for vegetable equivalents consumed by elementary school students run in the direction one would expect. In particular, vegetable equivalents consumed were significantly higher when the school had recess before lunch, a la carte options were healthier, a side salad bar was offered, and raw vegetables were offered. Vegetables equivalents consumed were also higher when fresh fruit was offered on a greater number of days per week. Vegetable equivalents consumed were significantly lower when no SSBs were offered a la carte.
- **Secondary School Students:** Vegetable equivalents consumed were significantly higher when no fast-food-like entrees were offered a la carte and when high saturated fat salad dressings were not offered. Vegetable equivalents consumed were significantly lower when meals were prepared on site, no foods from national chains were offered, vending machines were not available during mealtimes, no SSBs were offered a la carte, and high saturated fat condiments were not offered.

Dark Green and Orange Vegetable Equivalents—Lunch Only

- **Elementary School Students:** Dark green and orange vegetable equivalents consumed were significantly lower when the school had recess before lunch, no foods were offered from national chains, and only fat-free or low-fat milk was offered.
- **Secondary School Students:** Dark green and orange vegetable equivalents consumed were significantly higher when a side salad bar was offered, more vegetable options were offered, and dark green and orange vegetables were offered on more days per week; and the equivalents consumed were significantly lower when self-serve salad dressings were not offered. Other statistically significant results include dark green and orange vegetable equivalents consumed were significantly higher when the number of vending machines was low, no fast-food-like entrees were offered a la carte, there was no school store or

snack bar selling food, and whole milk was not offered; the equivalents consumed were significantly lower when only fat-free or low-fat milk was offered.

Added Sugars—Breakfast Only

- **Elementary School Students:** Added sugar teaspoons consumed were significantly higher when only fat-free or low-fat milk was offered and when nutrition education was offered in every grade. The latter result may be because larger schools tend to offer nutrition education in every grade and also tend to offer a larger range of breakfast options, including more options that are high in added sugars. Although the regressions control for school size, this variable is not interacted with the nutrition education variable. Another possible explanation is one of reverse causality: schools may introduce nutrition education in response to concerns over high obesity rates and to promote healthy food choices.
- **Secondary School Students:** Added sugar teaspoons consumed were significantly higher when flavored milk was offered and when whole milk was not offered, and were significantly lower when the district participated in the DOD Fresh or farm-to-school program.

In summary, a number of the meals-consumed findings presented here are statistically significant, but not all of the relationships make immediate sense from a theoretical standpoint. This could be because of collinearity among variables, bias from the censoring problem noted in Section A.4.c, or correlations between included variables and unobserved meal or school characteristics (in other words, the included variables could be correlated with unobserved factors whose effects are confounded with those of the policy or practice). Among the statistically significant findings, perhaps the most puzzling result is that energy from saturated fat consumed by elementary students was significantly higher when fresh fruit was offered on more days per week. As stated above, this may be because larger schools tend to offer more fresh fruit and more items that are high in saturated fat. Thus, one possible extension of the model would be to interact school size with certain policy/practice variables, such as the number of days per week that fresh fruit is offered.

Turning to the statistically significant findings that go in the direction one would expect, the following results are noteworthy. For elementary students at lunch, energy from saturated fat consumed was significantly lower when only fat-free or low-fat milk was offered, high saturated fat condiments were not offered, and when the district included nutrient requirements in vendor

specifications. At both lunch and breakfast, energy from saturated fat consumed by elementary students was positively related to the availability of high saturated fat entrees. Vegetable equivalents consumed by elementary school students were significantly higher when raw vegetables were offered. Dark green and orange vegetable equivalents consumed by secondary school students were significantly higher when a side salad bar was offered, more vegetable options were offered, and dark green and orange vegetables were offered on more days per week.

VI. OVERVIEW OF SIMULATION MODEL STEPS

The models introduced in the preceding chapter describe the interlocking relationships among school meal policies/practices, characteristics of the school environment, and various outcomes of the school meal programs. Each of the component parts of the overall simulation model involves either specifying a mechanical relationship or estimating a statistical model using data from SNDA-III. Assumptions about how changes in policy or practice influence characteristics of the meals offered and the school food environment trigger the overall model.

The process of conducting simulations consisted of the following steps:

1. ***Estimate the econometric models*** specified in Chapter V with SNDA-III data. The result for each equation was a set of coefficient estimates.
2. ***Generate estimates of the error terms in each model.*** This enables model users to simulate values of the outcome variables that have a distribution that matches the distribution of that outcome in the sample.
3. ***Conduct a baseline simulation*** that is used as a point of comparison in interpreting the simulation results.
4. ***Simulate a specific policy reform*** (or multiple reforms).

These steps are described in Sections A through D of this chapter.

A. Estimate Econometric Models

The results from estimating the econometric models in Chapter V were used to generate two sets of model quantities for use in the simulations. For each model, the first was a set of coefficient estimates for the independent variables. These coefficient estimates were then used to obtain a predicted value of the dependent variable in each estimated equation for each student or school based on the values of the model's independent variables for that student or school.

B. Generate Estimated Error Terms

The second set of quantities generated from the baseline models was the set of estimated error terms from each equation. For a given individual or school, the value of the error term represents

the influence of unobserved or random factors on the outcome (unobserved factors are factors not captured in the model's independent variables and thus not reflected in the predicted value for that individual). The purpose of simulating an error term for each individual in the data was to ensure that the variance of the simulated values of the outcome variable matches the variance of the actual values of that outcome in the sample.[1] Thus, the simulation model assumes that a policy change shifts the mean of the outcomes, but does not change the shape or spread of the outcome distributions. However, if the model relied simply on the predicted values of the outcomes in the simulation, the variance of the simulated values would likely be much smaller than the variance of the actual values.

In the case of models with continuous dependent variables that were estimated by ordinary least squares (OLS) or instrumental variables (IV) (that is, the meals-served and meals-consumed models), the difference between the actual value of the outcome variable for a given student or school and the predicted value of that variable was used as the estimate of the error term for that student or school. For example, using the same notation as in Chapter V, the error term from the estimation of the model that describes the relationship between the *K* characteristics of meals offered and the school food environment (O_{jk}) and a meals-served outcome (S_{jk}) was calculated as

(6) $\widehat{\mu_j} = S_{jk} - \widehat{S_{jk}} = S_{jk} - \left[W_j\hat{\gamma} + O_{jk}\alpha\right]$

where W_j are school characteristics.

For the participation outcome variable, which is a binary variable, a different procedure was used to simulate the error term, modeled after the one used in Gleason (1996). First, bounds were established on the possible values of the estimated error term, $\hat{\varepsilon}$, for each student, based on that student's observed participation decision. Specifically, if a student participated, then the participation

[1] For the instrumental variables (IV) models, the predicted participation value under the policy reform is used in the second stage to obtain predicted value estimates of the meals-consumed outcomes.

indicator (P_{ij}*) for that student is positive, implying that $\hat{\varepsilon}$ is greater than the negative of $X_{ij}\hat{\beta} + Z_j\hat{\delta} + O_{jk}\hat{\alpha}$. If a student did not participate, the opposite holds. Because the probit model assumes that the error term has a normal distribution, values of $\hat{\varepsilon}$ were then selected at random from a normal distribution. If the selected value was within the bounds implied by the student's actual participation status, it was kept as the final value of the error term. If it was not within the bounds, then a new value of the error term was selected at random. This process continued until the selected value was consistent with the student's observed participation status.

C. Conduct the Baseline Simulation

With these two sets of quantities—the coefficient estimates and the estimated error terms—it is possible to generate estimates of the values of the outcome variables under the current policy conditions and under alternative policy conditions. By construction, the actual values (found in the SNDA-III data) of all outcome variables, including participation, are identical to what the model would simulate under the current policy regime. These are the values with which values of the outcomes simulated under alternative policy conditions will be compared.

D. Simulate a Specific Policy Reform

The first step in simulating a specific policy reform is to determine how the policy regimen being simulated could influence the characteristics of meals offered and the overall school food environment. Policy changes are specified by making changes to one or more policy or practice variables. After specifying assumptions regarding schools' responses to a particular policy, the new values for all the relevant policy and practice variables are plugged into the relevant models. As discussed in Chapter V, policy or practice changes were specified in terms of changes to the meals-offered and school environment variables in the models, implicitly assuming that they are fully

implemented in all schools and that no other changes are made. Chapter VII describes these implicit assumptions in more detail.

Next, the simulated value of participation status is calculated, using coefficient estimates from the econometric model along with the estimated value of the error term and the simulated values of the meals offered characteristics obtained in the first step:

(7) $P_{ij}^{SIM} = 1 \; if \; P_{ij}^{*SIM} = X_{ij}\hat{\beta} + Z_j\hat{\delta} + O_{jk}^{SIM}\hat{\alpha} + \widehat{\varepsilon_{ij}} > 0$

$= 0 \; otherwise$

When this value is calculated for all students in the SNDA-III sample, this step produces a simulated measure of how many students participate in the meal programs when the meals-offered (or school food environment) characteristics have changed.

The final step consists of using the simulated values of meals-offered characteristics and student participation to simulate the meals-served and meals-consumed characteristics, with the former simulated at the school level and the latter at the student level. The predicted values of each measure are:

(8) $S_{jk}^{SIM} = W_j\hat{\gamma} + O_{jk}^{SIM}\hat{\lambda} + \widehat{\mu_j}$

(9) $C_{ijk}^{SIM} = X_{ij}\hat{B} + Z_j^1\hat{D} + P_{ij}^{SIM} + O_{jk}^{SIM}\hat{g} + \widehat{e_{ij}}.$

Chapter VII illustrates how the models work in three policy-relevant simulations.

VII. THREE EXAMPLES OF POLICY REFORM SIMULATIONS

This chapter describes the three policy reforms used to test the simulation model and presents the simulation results.

A. Specifying Three Examples of Policy Changes

The three example policy reforms were specified by making the following changes to the policy/practice variables.

1. Reform 1: Discontinue Offering Reduced-Fat and Whole Milk at Both Lunch and Breakfast

- Set "only low-fat or fat-free milk offered" equal to 1 for all schools. (63 percent of elementary schools at lunch, 56 percent of elementary schools at breakfast, 66 percent of secondary schools at lunch, and 65 percent of secondary schools at breakfast are affected by this change. That is, they currently offer either reduced-fat or whole milk.)
- Set "whole milk not offered" equal to 1 for all schools. (32 percent of elementary schools at lunch, 28 percent of elementary schools at breakfast, 34 percent of secondary schools at lunch, and 34 percent of secondary schools at breakfast are affected by this change. That is, they currently offer whole milk.)

Specifying the first reform in this way implicitly assumes that all schools adhere to the policy. Furthermore, this specification implicitly assumes that schools do not change any other aspects of their meals in such a way as to influence the values of any other meals-offered or school environment variables in the model. For example, because the "juice not offered" variable is not changed, this reform implicitly assumes that schools who currently offer juice continue to do so, and schools that currently do not offer juice continue to not offer it. Similarly, schools that currently offer flavored milk continue to do so, and schools that currently do not offer flavored milk continue to not offer it.[1]

[1] "Flavored milk offered" is a policy variable included in the breakfast models, so this assumption could be changed or modified in the breakfast model. The lunch model does not include a variable for "flavored milk offered" because too many schools (99 percent) currently follow this policy.

Including both the "only low-fat or fat-free milk offered" variable and the "whole milk not offered" variable in the model allows the user to specify a policy in which reduced-fat milk is offered but whole milk is not offered (by setting "whole milk not offered" equal to 1 for all schools and "only low-fat or fat-free milk offered" equal to 0 for all schools). Although the IOM recommendations (IOM 2009b) do not call for such a policy, removing the "whole milk not offered" variable from the model should make little difference to the overall simulation results for Reform 1, because Reform 1 already simulates the extreme values for both variables (under Reform 1, "only low-fat or fat-free offered" =1 for all schools, and "whole milk not offered" =1 for all schools; under a reform that allows reduced-fat but not whole milk, "only low-fat or fat-free offered" =0 for all schools). In other words, including the "whole milk not offered" variable means the user has the flexibility to look at the latter policy. Currently, the breakfast models do not control for the fat content of flavored milk separately from the fat content of regular milk; this may be an avenue for future research, especially in light of the IOM recommendation (IOM 2009b) to offer flavored milk only as fat-free milk.

2. Reform 2: Offer Fresh Fruit Daily at Both Lunch and Breakfast

- Set "number of days per week that fresh fruit is offered" equal to 5 for all schools (76 percent of elementary schools at lunch, 87 percent of elementary schools at breakfast, 58 percent of secondary schools at lunch, and 73 percent of secondary schools at breakfast are affected by this change. That is, they currently offer fresh fruit on 4 or fewer days per week.)

Specifying the second reform in this way implicitly assumes that all schools adhere to the policy and that schools do not change any other aspects of their meals in such a way as to influence the values of any other meals-offered or school environment variables in the model. For example, because the "juice not offered" variable is not changed, this reform implicitly assumes that schools that currently offer juice continue to do so, and schools that currently do not offer juice continue to not offer it. In addition, the variables indicating whether raw vegetables are offered and the average

number of vegetable options offered per day are not changed, so it is assumed that schools who are affected by the policy do not substitute fruit juice for vegetables.

3. Reform 3: Comprehensive Reform (Lunch Only)

The third reform is a comprehensive reform that consists of the following policy/practice changes that apply only to lunch: (a) discontinue offering reduced-fat and whole milk, (b) offer french fries and similar potato products no more than one day per week, (c) offer fresh fruit daily, (d) no longer allow juice to be served, and (e) offer dark green or orange vegetables at least two days per week. The following changes were made to the policy/practice variables in the lunch models:

- Set "only low-fat or fat-free milk offered" equal to 1 for all schools (see Reform 1 for the percentage of schools affected by this change).
- Set "whole milk not offered" equal to 1 for all schools (see Reform 1 for the percentage of schools affected by this change).
- Set "number of days per week that fresh fruit is offered" equal to 5 for all schools (See Reform 2 for the percentage of schools affected by this change).
- Set "juice not offered" equal to 1 for all schools (48 percent of elementary schools and 44 percent of secondary schools are affected by this change. That is, they currently offer fruit juice at lunch.)
- For secondary schools, if "number of days per week that french fries or similar potato products are offered" equals 2 through 5, then set it equal to 1 (64 percent of secondary schools are affected by this change). No change for elementary schools, because the relevant variable in the model for elementary schools is "French fries or similar potato products not offered."
- If "number of days per week that dark green and orange vegetables are offered" equals 0 or 1, then set it equal to 2 (44 percent of elementary and 38 percent of secondary schools are affected by this change).[2] If "number of days per week that dark green and orange vegetables are offered" changes from 0 to 2, then increase "average number of vegetable

[2] The variable included in the model is the "number of days per week that dark green and orange vegetables are offered." Each school in the data has a value of 0, 1, 2, 3, 4, or 5. Because the policy being simulated in Reform 3 requires that schools offer dark green and orange vegetables at least two days per week, any school that currently offers dark green and orange vegetables fewer than two days per week (that is, schools with a baseline value of 0 or 1 for the "number of days per week that dark green and orange vegetables are offered" variable) was given a value of 2 under the reform. Schools that already offer dark green and orange vegetables on at least two days per week were left unchanged; for example, a school with a value of 3 at baseline was given a value of 3 under the reform.

> options offered per day" by 0.4 (2 days / 5 days). If "number of days per week that dark green and orange vegetables are offered" changes from 1 to 2, then increase "average number of vegetable options offered per day" by 0.2 (1 day / 5 days).

The implicit assumptions associated with this specification are as follows (each of these assumptions can be modified or changed by model users). First, all schools adhere to the policy. Second, schools that increase their offerings of dark green and orange vegetables also increase their total offerings of vegetables, rather than substituting dark green and orange vegetables for some other type of vegetable. Third, schools that currently offer raw vegetables continue to do so, and schools that currently do not offer raw vegetables continue to not offer them. Finally, schools do not change any other aspects of their meals in such a way as to influence the values of any other meals-offered or school environment variables in the model.

B. Simulation Results

Appendix Tables C.1 through C.3 show the simulation results for meals served (for all three reforms). Tables C.4 through C.9 show the simulation results for participation. Results for meals consumed are shown in Tables C.10 through C.12. A summary of the changes to all outcomes (meals served, participation, and meals consumed) under each reform can be found in Table VII.1. Note that the simulation results for "All Schools" and "All Students" are weighted averages of the results for elementary and secondary schools/students. The simulation did not include a separate model for all schools/students combined.

Table VII.1 Summary of Simulation Results

	Elementary			Secondary			All Students		
Outcome	Reform 1[a]	Reform 2[b]	Reform 3[c]	Reform 1[a]	Reform 2[b]	Reform 3[c]	Reform 1[a]	Reform 2[b]	Reform 3[c]
Lunch									
Meals Served									
Percentage of calories from saturated fat	-	+	-	-	+	-	-	+	-
Fluid milk servings	+	-	+	-	=	-	-	-	=
Number of discrete fruit servings (excluding juice)	=	+	++	++	--	++	+	=	++
Number of discrete vegetable servings[d]	-	--	+	+	--	++	=	--	+
Number of discrete dark green and orange vegetable servings	+	-	++	=	--	++	=	--	++
Participation	-	--	-	=	-	--	-	-	-
Meals Consumed – Target Outcomes									
Percentage of calories from saturated fat	-	+	+	+	+	+	-	+	+
MPEs of fluid milk	-	-	-	-	+	-	-	-	-
MPEs of fruit[e]	=	++	++	+	=	+	+	++	++
MPEs of vegetables[d]	++	++	++	+	+	+	++	++	++
MPEs of dark green and orange vegetables	=	=	=	=	=	=	=	=	=
Meals Consumed – Collateral Outcomes									
Calories	-	-	-	-	=	-	-	-	-
Grams of saturated fat	-	+	+	-	+	+	-	+	+
Percentage of calories from total fat	-	-	-	+	+	+	-	-	=
Sodium (mg)	-	+	-	=	+	+	-	+	+
Vitamin A (mcg RAE)	-	+	-	-	=	-	-	+	-
Potassium (mg)	-	+	+	=	=	-	=	+	+
Magnesium (mg)	=	+	+	=	+	=	=	+	+
Breakfast									
Meals Served									
Percentage of calories from saturated fat	--	-	NA	--	+	NA	--	-	NA
Fluid milk servings	-	+	NA	-	-	NA	-	+	NA
Number of discrete fruit servings (excluding juice)	++	++	NA	-	++	NA	++	++	NA

Table VII.1 *(continued)*

Outcome	Elementary			Secondary			All Students		
	Reform 1[a]	Reform 2[b]	Reform 3[c]	Reform 1[a]	Reform 2[b]	Reform 3[c]	Reform 1[a]	Reform 2[b]	Reform 3[c]
Participation	++	--	NA	--	-	NA	+	--	NA
Meals Consumed – Target Outcomes									
Percentage of calories from saturated fat	+	++	NA	=	-	NA	+	+	NA
MPEs of fluid milk	+	-	NA	++	+	NA	+	-	NA
MPEs of fruit[e]	++	++	NA	=	=	NA	+	+	NA
MPEs (teaspoons) of added sugars	++	--	NA	+	-	NA	+	--	NA
Meals Consumed – Collateral Outcomes									
Calories	+	--	NA	+	-	NA	+	--	NA
Grams of saturated fat	-	--	NA	+	-	NA	-	--	NA
Percentage of calories from total fat	+	+	NA	=	-	NA	+	=	NA
Sodium (mg)	=	--	NA	+	-	NA	+	--	NA
Vitamin A (mcg RAE)	+	=	NA	++	+	NA	+	+	NA
Potassium (mg)	+	--	NA	+	-	NA	+	--	NA
Magnesium (mg)	-	--	NA	+	-	NA	+	--	NA

Source: SNDA-III Public Use File.

Note: +, -, = indicate direction of change from baseline. See detailed tables for the magnitudes of the changes. = implies less than a 1 percent change. ++ and -- imply a change of greater than 10 percent. The simulation model does not calculate the statistical significance level of the results.

[a]Reform 1: Discontinue Offering reduced-fat and whole milk at both lunch and breakfast.

[b]Reform 2: Offer fresh fruit daily at both lunch and breakfast.

[c]Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served, and offer dark green or orange vegetables at least 2 days per week.

[d]Other than French fries and similar potato products.

[e]MPEs of fruit refers to all fruit except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

In general, the simulated changes in participation and in the characteristics of meals served and meals consumed under these reforms are small; Table VII.1 shows that, across all outcomes, the majority of simulated changes are not larger than 10 percent of the baseline mean for that particular outcome; this is indicated by the fact that few cells in the table contain either a ++ symbol or a – – symbol. This is in part because the results represent average changes; even if some schools/students are simulated to have large changes, the average change may still be small if many other schools/students are simulated to have no change in a particular outcome (or a change in another direction). It should also be noted that the meals consumed model includes both participants and nonparticipants; thus, the meals-consumed simulation results are averaged across participants and nonparticipants.

Currently, the simulation model does not calculate the statistical significance level of results.[3] It may be possible to calculate the significance of simulated policy changes using resampling methods, such as balanced repeated replication, as described in Zaslavsky and Thurston (1994). They developed standard errors for the Micro Analysis of Transfers to Households (MATH®) Current Population Survey (CPS) and MATH Survey of Income and Program Participation (MATH-SIPP) microsimulation models developed by Mathematica (Zaslavsky and Thurston 1996). Later versions of the microsimulation models have used other resampling approaches (Smith 2006). In the context of a multi-equation, multiple-outcome mode that simulates behavioral responses rather than changes in program rules that have well-defined effects, these methods are not straightforward to implement. They involve a significant amount of programming and require substantial computing time. (For example, each simulation would need to be rerun hundreds of times for different subsets of the

[3] This type of calculation enables the model user to know whether a given policy reform results in a statistically significant change in an outcome, as opposed to a change that may simply have resulted by chance, because the simulated values are calculated using a randomly drawn sample).

sample.). Unfortunately, time and resource constraints in this study did not permit adaptation of these methods for the simulations. Updating the simulation model to include calculations of the significance level of results could be an area for future research.[4]

The results discussed in the remainder of this chapter pertain to the target outcomes only, but Chapter 8 discusses simulation results for collateral outcomes as part of the sensitivity analyses.

1. Meals Served

Reform 1. The simulation results from Reform 1 (Table C.1) show that no longer offering reduced-fat and whole milk is simulated to lead to (1) a decrease in the percentage of calories from saturated fat in an average meal served, (2) a decrease in the fluid milk servings in an average breakfast served, (3) a decrease in the fluid milk servings in an average lunch served at secondary schools, and (4) an increase in the fluid milk servings in an average lunch served at elementary schools. The only changes that correspond to underlying coefficients that are statistically significant are the decreases in energy from saturated fat served by elementary schools at breakfast and by secondary schools at lunch, and the decrease in fluid milk servings for secondary schools at lunch. The magnitudes of these changes are fairly small (on the order of 1 to 23 percent of the baseline mean). For example, no longer offering reduced-fat and whole milk is simulated to lead to a decrease of 4.7 percent (from 10.88 to 10.37 percentage points) in the percentage of calories that come from saturated fat in an average lunch served.(This result is for all schools combined; the simulated decrease for elementary schools is from 10.79 to 10.52 and the simulated decrease for secondary schools is from 11.04 to 10.11.) The simulated decrease in the percentage of calories that come from

[4] For simulations that involve a change to only one policy/practice variable, the significance of the model coefficient on that variable is a useful indicator for whether the simulation results are statistically significant, but the significance of simulation results also depends on how prevalent the policy/practice is in the SNDA-III data.

saturated fat in an average breakfast served is from 9.17 to 8.00 for all schools, from 8.91 to 7.66 for elementary schools, and from 9.60 to 8.56 for secondary schools.

Reform 2. The simulation results from Reform 2 (Table C.2) show that offering fresh fruit daily is simulated to lead to (1) an increase of 6.4 percent in the number of discrete fruit servings (excluding juice) in an average lunch served at elementary schools (the underlying coefficient is not statistically significant), (2) a decrease of 12.2 percent (from 0.49 to 0.43) in the number of discrete fruit servings in an average lunch served at secondary schools, and (3) an increase in the number of discrete fruit servings in an average breakfast served at both elementary and secondary schools. In fact, the number of discrete fruit servings in an average breakfast served more than doubles. Furthermore, the underlying coefficients are statistically significant at the one-percent level. However, this does not necessarily imply that the changes in the outcomes are statistically significant.

The finding that fruit servings at secondary schools decrease in response to offering fresh fruit daily is somewhat puzzling. However, it is important to recall that meals *as served* represent what students select; unfortunately, no matter how often a school *offers* fresh fruit, students may still choose not to *select* it. As an example, schools that offer fresh fruit daily may also offer the fruit uncut and with skin, such as an apple or orange, rather that something that doesn't require any peeling or cutting on the part of the student, such as canned peaches. If secondary school students prefer fruit that is cut up, then fruit servings may be lower at schools where fresh (uncut) fruit is offered every day.

Reform 3. The simulation results from Reform 3 (Table C.3) show that the comprehensive reform is simulated to lead to increases of 19.1 percent, 2.7 percent, and 53.9 percent in the number of discrete fruit servings, vegetable servings, and dark green and orange vegetable servings at elementary schools. At secondary schools, the servings of fruit, vegetables, and dark green and orange vegetables are simulated to increase, by 16, 19, and 111 percent, respectively (the baseline

values for secondary schools are 0.49, 0.69, and 0.09, respectively). Reform 3 is also simulated to lead to a decrease in the percentage of calories from saturated fat in an average lunch served by both types of schools (2.5 percent at elementary schools and 4.7 percent at secondary schools). The results for fluid milk servings are mixed: they are simulated to increase by 1.1 percent at elementary schools and decrease by 1.2 percent at secondary schools. For each of these simulated changes, at least one of the underlying coefficients on a policy/practice variable affected by the reform is statistically significant. For example, in the model of fruit servings for elementary schools (shown in Table B.1), the coefficient on "juice_not_offered"—a variable affected by Reform 3—is statistically significant at the 0.01 level. However, this does not necessarily imply that the change in the outcome—fruit servings—is statistically significant.

2. Participation

Reform 1. Reform 1 (Table C.4) is simulated to lead to a decrease of 2.2 percent in the overall participation rate at lunch (from 61.8 to 60.4 percent), due to simulated decreases in participation rates at both elementary and secondary schools. Reform 1 is simulated to lead to an increase of 1.8 percent in the overall participation rate at breakfast (from 21.3 to 21.6 percent), due to a simulated decrease in the breakfast participation rate at secondary schools, which largely offsets a simulated increase in the breakfast participation rate at elementary schools. It should be noted that the changes in participation rates for elementary students correspond to coefficients on policy/practice variables that are not statistically significant.

Reform 2. At both lunch and breakfast, Reform 2—offer fresh fruit daily—is simulated to lead to a decrease in the overall participation rate at elementary and secondary schools (Table C.6). The magnitudes of these changes are as follows. The decrease in the overall lunch participation rate is from 72.6 to 63.3 percent (a 12.9 percent decrease) for elementary schools and from 50.6 to 49.6 percent for secondary schools (a 2 percent decrease). At breakfast, the decrease in the overall

participation rate is from 28.5 to 24.2 percent (a 14.9 percent decrease) for elementary schools and from 14.3 to 14.2 percent (a 1.1 percent decrease) for secondary schools. However, three of these changes are based on coefficients that are not statistically significant; the exception is for elementary students at lunch.

Reform 3. The overall lunch participation rate is simulated to decrease by 5 percent (from 72.6 to 69.0) at elementary schools and by 12.3 percent (from 50.6 to 44.4) at secondary schools (Table C.8). For both of these changes, multiple coefficients on policy/practice variables affected by the reform are statistically significant, but because so many independent variables were changed simultaneously, the significance of their coefficients does not indicate whether the simulated changes in participation are themselves statistically significant.

3. Meals Consumed

Reform 1. At lunch, Reform 1 (Table C.10) is simulated to lead to a decrease of 7.2 percent (from 10.70 to 9.93) in the percentage of calories from saturated fat consumed by elementary students, and an increase of 2.7 percent (from 10.75 to 11.04) in the percentage of calories from saturated fat consumed by secondary students (although the underlying coefficients responsible for this latter change are not statistically significant). The latter result may seem puzzling; however, it can be explained by the fact that both calories and grams of saturated fat consumed by secondary students are simulated to decrease. Thus, the percentage of calories from saturated fat consumed rises, even though the absolute amount (measured in grams) has fallen. The MyPyramid Equivalents (MPEs) of fluid milk consumed in an average lunch are simulated to decrease by 6.6 percent for elementary students and by 5.4 percent for secondary students (however, neither of these changes are based on coefficients that are statistically significant).

At breakfast, Reform 1 is simulated to lead to an increase in the average percentage of calories from saturated fat consumed by both elementary and secondary students (a 1.8 percent increase for

elementary students and a 0.98 percent increase for secondary students), but the changes are small and the underlying coefficients behind these changes are not statistically significant. Furthermore, the absolute amount of saturated fat consumed by elementary students (measured in grams) is simulated to decrease. The MPEs of fluid milk consumed in an average breakfast are also simulated to increase (by 3.3 percent for elementary school students and by 10.4 percent for secondary school students), but again, the underlying coefficients are not statistically significant.

Reform 2. MPEs of fruit consumed at lunch are simulated to increase by 41 percent for elementary students from a baseline amount of 0.27 (however, the underlying coefficient is not statistically significant), but remain unchanged (that is, change by less than 1 percent) for secondary students (Table C.11). [5] MPEs of fruit consumed at breakfast are also simulated to increase for elementary students but remain unchanged for secondary students. In addition, Reform 2 is simulated to lead to an increase in the average percentage of calories from saturated fat consumed at lunch by both elementary and secondary students (a 9.1 percent increase for elementary students and a 2.5 percent increase for secondary students). One possible explanation for this is that schools who offer fresh fruit on more days per week tend to offer high saturated fat condiments with the fruit, such as whipped cream. Another possible explanation is that larger schools tend to offer more of both fresh fruit and items that are high in saturated fat. Although the regressions control for school size, this variable is not interacted with the number of days per week that fresh fruit is offered. Yet a third possibility is that students may participate less in schools offering more fresh fruit but instead choose competitive foods high in saturated fat (recall that the meals-consumed models include all students, not just participants).

[5] MPEs of fruit consumed refers to all fruit except juice; it includes both fruit consumed as whole fruit and fruit consumed as part of mixed dishes.

Reform 3. Reform 3 (Table C.12) is simulated to lead to (1) increases of 6.5 percent and 7.1 percent in the energy from saturated fat consumed by elementary and secondary students, respectively; (2) decreases of 9.8 percent and 8.1 percent in the MPEs of fluid milk consumed by elementary and secondary students (although the underlying coefficients for elementary students are not statistically significant); (3) increases of 40.7 percent (from a baseline amount of 0.27) and 6.7 percent in the MPEs of fruit consumed by elementary and secondary students, respectively (although the underlying coefficients for secondary students are not significant); and (4) increases of 57.1 percent (from a baseline amount of 0.28) and 6.7 percent in the MPEs of vegetables consumed by elementary and secondary students (the underlying coefficients for secondary students are not statistically significant). MPEs of dark green and orange vegetables consumed change by less than 1 percent for both elementary and secondary students.

4. Summary of Simulation Results

The simulation results can be summarized as follows. Reform 1 (discontinue offering reduced-fat and whole milk at both lunch and breakfast) is predicted to decrease energy from saturated fat served (a desired result), decrease fluid milk servings (an unintended result), decrease participation (also unintended), and decrease energy from saturated fat consumed by elementary students (a desired result). Reform 2 (offer fresh fruit daily at both lunch and breakfast) is predicted to decrease fruit servings by secondary schools at lunch (this is an unintended result and may be because the policy/practice variable is correlated with something else that is unobserved), increase fruit servings at breakfast, decrease participation (an unintended result), and increase MPEs of fruit consumed by elementary students (a desired result). Reform 3 (comprehensive reform at lunch) is predicted to increase servings of fruit, vegetables other than fried potatoes, and dark green and orange vegetables; to decrease the percentage of energy from saturated fat served; to increase fluid milk servings at elementary schools; to decrease fluid milk servings at secondary schools (an unintended result); to

decrease participation (also unintended); and to increase consumption of energy from saturated fat (unintended), fluid milk, fruit, and vegetables.

Chapter VIII describes the analyses conducted to test the sensitivity of the overall simulation results to changes in the predictive models for meals served, participation, and meals consumed.

VIII. SENSITIVITY ANALYSES

It is important for model users and policymakers to understand how robust the simulation results are. If results remain stable across a number of different model specifications and estimation methods, then model users can be reasonably confident that the results obtained are illustrative of the probable effects of changes in policies/practices on the outcomes of interest. In contrast, if simulation results vary widely across different model specifications and methods, one's faith in the model's ability to produce reasonable estimates diminishes. This chapter is organized into two sections. Section A describes the analyses used to test the sensitivity of the overall simulation results to changes in the models of meals served, participation, and meals consumed. Section B presents regression and simulation results of these sensitivity analyses.

A. Sensitivity Tests

1. Meals Served

Only one sensitivity test was conducted for meals served, for the following reasons. First, the meals-served models generally fit well (that is, they have fairly large R-squared values) and give results that make sense from a theoretical standpoint. Second, the number of independent variables needs to be small because the precision of the coefficient estimates is limited by the relatively modest school sample size (398 schools). When more school-level data become available in SNDA-IV (with an intended sample size of 900 schools), it should be feasible to expand the meals-served models.

The sensitivity test involved adding three school food environment variables to the meals-served models. Specifically, an indicator variable for offer-versus-serve (OVS) was added to the models. Because the meals-served models focus on what students *select* rather than what they *consume*, it makes sense that OVS would have a direct effect on meals-served outcomes. Other school

foodservice variables added to the model were indicators for whether food is prepared on site and whether the district requires vendors to meet nutrient specifications.

2. Participation

Most of the simulation results presented in Chapter VII showed that the example policy reforms led to a simulated decrease in participation at lunch and breakfast that ranged from 0.1 to 9.4 percentage points (the baseline participation rates at lunch were 72.6 percent for elementary students and 50.6 percent for secondary students; the baseline participation rates at breakfast were 28.5 percent for elementary students and 14.3 percent for secondary students); the exception was that Reform 1 led to a simulated increase in School Breakfast Program (SBP) participation for elementary students. However, most of these simulated changes were based on changes in policy/practice variables that had coefficients in the participation models that were not statistically significant. Even a small predicted percentage decrease in participation could imply a decline in participation of hundreds of thousands of children that would thus be of concern to policymakers. Therefore, it is particularly important that the robustness of the modeling approach be investigated.

The following five sensitivity analyses were conducted for the participation model, each of which was investigated separately:

1. **S1: Add Demographics.** Add more student-level control variables, such as students' health and eating habits, to the participation models.
2. **S2: Drop Competitive Foods.** Drop all competitive foods variables from the participation models.
3. **S3: Drop OVS.** Drop the binary indicator variable for OVS from the participation models. This sensitivity test was also used for the meals-consumed models.
4. **S4: Drop Price.** Drop meal price variables (and interactions with eligibility status) from the participation models. This sensitivity test was also used for the meals-consumed models.
5. **S5: Drop All Instrumental Variables Except Price.** Drop all instrumental variables (IVs) except meal price (and interactions with eligibility status) from the participation models. This sensitivity test was also used for the meals-consumed models.

The specific variables that were dropped from the model for each sensitivity test are listed in Table VIII.1.

3. Meals Consumed

As discussed in Chapter V, desire to minimize possible selection bias led to modeling participation and meals consumed jointly, using an IV model. The sensitivity analyses for meals consumed can be grouped into two types: those that change the set of variables included in the model and those that change the statistical method used to estimate the model.

Three sensitivity analyses of the first type were conducted:

1. **S1: Drop OVS.** Drop the binary indicator variable for OVS from the first stage of the IV estimation (that is, from the participation equation).
2. **S2: Drop Price.** Drop meal price variables (and interactions with eligibility status) from the first-stage equation.
3. **S3: Drop All IVs Except Price.** Drop all IVs except meal price (and interactions) from the first-stage equation.

Two sensitivity analyses were conducted that involved using an ordinary least squares (OLS) model rather than an IV model:

1. **S4: Use Actual Participation.** Use actual, rather than predicted, participation in estimating models of nutrients and MyPyramid Equivalents (MPEs) consumed. This method assumes there is no selection bias.
2. **S5: Reduced Form.** Drop participation from the meals-consumed models. That is, estimate a reduced-form model that includes only the exogenous characteristics of meals offered and the school environment, as well as exogenous student-level characteristics.[1]

[1] In statistics, the reduced form of a system of equations is the result of solving the system for the endogenous variables. The reduced-form model gives the endogenous variables as a function of the exogenous variables. For example, a meals-consumed outcome (endogenous variable) is a function of participation (endogenous variable) and exogenous variables. In turn, participation is a function of other exogenous variables. By solving for participation and plugging into the meals-consumed model, one is left with the meals-consumed outcome as a function of exogenous variables only.

Table VIII.1 Sensitivity Analyses for the Participation Model

Number	Description	Abbreviation
1	Add the following student-level control variables to the model: pemp2_i (2 parents, one employed fulltime) pemp3_i (2 parents, neither employed fulltime) pemp4_i (1 parent, employed fulltime) pemp5_i (1 parent, not employed fulltime) hearty2_i (student eats about the same amount as others) hearty3_i (student eats less than others) hlth_gd_i (student in good health) hlth_vg_i (student in very good health) hlth_ex_i (student in excellent health) physact2_i (student about as physically active as others) physact3_i (student more physically active than others) physact4_i (student much more physically active than others) picky2_i (student somewhat picky eater) picky3_i (student not picky eater) p_ed2_i (highest level of parental education: some college) p_ed3_i (highest level of parental education: college or more) corresponding imputation flags	S1: Add Demographics
2	Drop the following competitive foods variables from the model: noalc_lfmilk_i ac_hlthy alc_nounhlthy alc_fruitveg alc_noffentree alc_nossb no_vending_meal_i no_vending_day_i vending_notinsfa low_vending nossb_vending_i no_open_campus_i nobarstore_i days_store_open_i nofoodfund_i corresponding imputation flags	S2: Drop Competitive Foods
3	Drop the no_ovs variable from the model.	S3: Drop OVS
4	Drop meal price (and interactions with eligibility status) from the model.	S4: Drop Price
5	Drop all instrumental variables from the model, except meal price (and interactions with eligibility status).	S5: Drop All IVs Except Price

Table VIII.2 lists the sensitivity analyses conducted for the meals-consumed models.

B. Results

The robustness of regression and simulation results was determined by looking at the sign, magnitude, and significance level of coefficients on policy/practice variables, and the direction and magnitude of simulated changes in outcomes. Specifically, if a coefficient or simulation result

Table VIII.2 Sensitivity Analyses for the Meals-Consumed Model

Number	Description	Abbreviation
1	Drop the no_ovs variable from the model.	S1: Drop OVS
2	Drop meal price (and interactions with eligibility status) from the model.	S2: Drop Price
3	Drop all instrumental variables from the model, except meal price (and interactions with eligibility status).	S3: Drop All IVs Except Price
4	Use actual, rather than predicted, participation. This method assumes there is no selection bias.	S4: Use Actual Participation
5	Drop participation and all instrumental variables from the model.	S5: Reduced-Form

changed in sign or changed by a magnitude of greater than 10 percent (compared with the original coefficient or simulation result), it was considered sensitive (not robust).

In general, the sensitivity analyses show that the regression and simulation results from the models of meals served, participation, and meals consumed are robust to changes in model specifications and estimation methods. However, a few caveats should be noted. First, the sensitivity tests were conducted using only the three example policy reforms outlined in Chapter VII, so they are subject to the same implicit assumptions regarding how policies are enacted within schools. Second, there are many possible sensitivity analyses that were not conducted. For example, the analyses discussed in this chapter deal with model specification error rather than sampling error (which could also be investigated). Other examples of sensitivity analyses that were not conducted are changing the way the policy/practice variables are defined and adding interaction terms to the model (such as an interaction between participation and meals-offered characteristics).

1. Meals Served

The regression results from the sensitivity analyses for meals served (shown in Tables B.1 through B.4) reveal different patterns for lunch and breakfast. For breakfast, adding the three additional school foodservice variables to the model changes almost nothing. The set of policy/practice variables with statistically significant coefficients changes very little. The sizes of the coefficients also do not change considerably (the largest change in magnitude is from -1.48 to -1.30 for the coefficient on the "flavored_milk_offered" variable in the model for percentage of calories

for the coefficient on the "flavored_milk_offered" variable in the model for percentage of calories from saturated fat served at secondary schools). Furthermore, the additional variables are rarely significant.

For lunch, the regression results change somewhat when the additional variables are added to the model. For about half of the outcomes, the significance levels stay the same for all policy/practice variables. For the other outcomes, some of the policy/practice variables that were not originally significant become significant and vice versa. In addition, the three new school foodservice variables are occasionally significant.

The simulation results for meals served (Tables D.1 through D.3) show that there are few simulated changes in meals-served outcomes that go in different directions from the original simulation results. For Reform 1, only two of the simulation results in Table D.1 are directionally different from the original simulation results in Table C.1: fluid milk servings and the number of dark green and orange vegetable servings for elementary schools at lunch remain constant, rather than rising (as they did in the original simulation). For Reform 2, the only directional change is that the number of dark green and orange vegetable servings for secondary schools at lunch remains constant, rather than falling. For Reform 3, there are no directional changes in the simulation results. For all three reforms, the magnitudes of simulated changes in the characteristics of meals served are very similar to the magnitudes of changes from the original simulation.

In summary, the meals-served models appear to be robust to including key characteristics of the school food environment, because few coefficients on the policy/practice variables and few simulation results change in sign/direction or significance level; those that change remain small in magnitude.

2. Participation

The regression results from the sensitivity analyses for participation are shown in Tables B.5 through B.8. Across the five sensitivity analyses, the set of policy/practice variables that are statistically significant remains fairly constant. However, the sizes of the coefficients sometimes change by a large amount; for example, the coefficient on "raw_veggies_offered" in the lunch model for elementary students ranges from -0.78 to -1.13 across the different sensitivity analyses.

The simulation results for participation are shown in Tables D.4 (for lunch) and D.5 (for breakfast). For Reform 1, the only simulated change in participation that goes in a different direction from the original simulation results is in the fifth sensitivity analysis (Drop All IVs Except Price), in which participation by secondary students at lunch rises rather than falls (as it did in the original simulation of Reform 1; see Table C.4). Although the underlying coefficient on one of the policy/practice variables affected by Reform 1 ("whole_milk_not_offered") is statistically significant (in both the original regression results and the sensitivity analysis regression results), the simulated changes in participation in the original model and the sensitivity analysis are quite small (a 0.4 percentage point decrease in the original results (not shown in table; calculated as 50.6 – 50.2 from Table C.4), and a 0.8 percentage point increase in the sensitivity analysis simulation results (not shown in table; calculated as 51.4 – 50.6 from Table D.4)).

For Reform 2, the only directional changes in the simulation results are in the fourth sensitivity analysis (Drop Price) and the fifth sensitivity analysis (Drop All IVs Except Price), in which participation by secondary students at breakfast rises instead of falls. In terms of magnitudes, however, the participation results are less stable than the meals-served sensitivity results. For example, participation of elementary students at lunch is simulated to fall by 9.3 percentage points (not shown in table; calculated as 72.6 – 63.3 from Table C.6) in the original simulation, but by 13.3 percentage points in the fifth sensitivity analysis (not shown in table; calculated as 72.6 – 59.3 from

Table D.4). To state this another way, the simulated decrease in participation by elementary students at lunch is a 12.9 percent decrease in the original simulation, but an 18.3 percent decrease in the fifth sensitivity analysis. As another example, across the five sensitivity analyses, the simulated fall in participation of elementary students at breakfast ranges from 0.7 to 11.1 percentage points (from a baseline participation rate of 28.5 percent). To put it another way, the simulated fall in participation by elementary students at breakfast ranges from a 2.2 percent decrease to a 38.9 percent decrease across the five sensitivity analyses. For Reform 3, there are no directional changes across the sensitivity analyses compared with the original simulation results.

In summary, the participation models appear to be robust to including additional student-level characteristics, dropping competitive foods variables, and dropping the binary indicator for OVS, because few coefficients on the policy/practice variables and few simulation results change in sign/direction or significance level. However, the participation model does appear sensitive to the choice of IVs. This is demonstrated by the fact that the fourth and fifth sensitivity analyses (Drop Price and Drop All IVs Except Price) result in several directional changes in the simulation results. Notably, it appears that other school-level characteristics (besides price) matter for the student participation decision, such as whether the cashier electronically identifies students eligible for free or reduced-price meals and whether the school cafeteria has enough seats during lunch.

3. Meals Consumed

The regression results from the sensitivity analyses for meals consumed are shown in Tables B.9 through B.26. The simulation results for meals consumed are shown in Tables C.19 through C.23. For all target outcomes, the first two sensitivity analyses cause very little change with regard to which policy/practice variables are statistically significant. The last three sensitivity analyses cause larger changes in which policy/practice variables are significant, but under these models, the number of statistically significant variables tends to increase, rather than decrease. For the fourth and fifth

sensitivity analyses, this could imply that selection bias is present; controlling for this bias reduces the number of variables that are statistically significant only because they are acting as a proxy for some unobserved variable.

For Reform 1 (discontinue offering reduced-fat and whole milk at both lunch and breakfast) (Table C.19 for lunch and Table C.22 for breakfast), there are only 11 simulated changes in meals-consumed outcomes at lunch that go in a different direction from the original simulation results (out of 120 total simulated changes across all outcomes and sensitivity analyses for Reform 1 at lunch). In the first sensitivity analysis (Drop OVS), potassium and magnesium consumption by secondary students falls instead of rises; in the second sensitivity analysis (Drop Price), magnesium consumption by elementary students falls instead of rises; MPEs of fruit consumed by elementary students rise in the first and third sensitivity analyses (Drop OVS and Drop ALL IVs Except Price) and fall in the fourth and fifth sensitivity analyses (Use Actual Participation and Reduced Form), rather than remaining constant (as in the original simulation); in the third sensitivity analysis (Drop All IVs Except Price), MPEs of fluid milk consumed by secondary students remain constant rather than falling and sodium consumption by secondary students rises instead of falls; and in the fourth and fifth sensitivity analyses (Use Actual Participation and Reduced Form), MPEs of fruit consumed by elementary students fall rather than rise.

There are only 5 simulated changes at breakfast that are directionally different from the original results (out of 110 total simulated changes across all outcomes and sensitivity analyses for Reform 1 at breakfast): in the second sensitivity analysis (Drop Price), sodium consumption for elementary students falls instead of rises, and energy consumption and vitamin A consumption for elementary students fall instead of rise; and in the second and third sensitivity analyses, percentage of calories from total fat consumed by secondary students rises instead of falls.

For Reform 2 (Table C.20 for lunch and Table C.23 for breakfast), there are only 3 simulated changes in meals-consumed outcomes at lunch that are directionally different from the original simulation results (out of 120 total simulated changes across all sensitivity analyses for Reform 2 at lunch): in the first, second, and fifth sensitivity analyses, energy consumption by secondary students falls rather than rises. There are only 3 simulated changes at breakfast that are directionally different from the original results (out of 110 total simulated changes across all sensitivity analyses for Reform 2 at breakfast): in the first sensitivity analysis, vitamin A consumption by elementary students rises rather than falls; in the fourth and fifth sensitivity analyses, MPEs of fluid milk consumed by secondary students remain constant (that is, change by less than 1 percent compared with the baseline amount) rather than rising.

For Reform 3 (Table C.21), there are only 6 simulated changes in meals-consumed outcomes at lunch that are directionally different from the original simulation results (out of 120 total simulated changes across all outcomes and sensitivity analyses for Reform 3): in the first sensitivity analysis, magnesium consumption by secondary students falls rather than rises; in the third, fourth, and fifth sensitivity analyses, grams of saturated fat consumed by elementary students fall instead of rise; and in the fourth and fifth sensitivity analyses, MPEs of fluid milk consumed by secondary students remain constant rather than rising.

In summary, the meals-consumed models appear to be robust to dropping the binary indicator for OVS, dropping price, and dropping all IVs except price, because few coefficients on the policy/practice variables change in sign or significance level and few simulation results change in direction or change in magnitude by more than 10 percent (compared with the original simulation results). Furthermore, the meals-consumed models are robust to changes in the estimation method. When using actual instead of predicted participation (which assumes there is no selection bias) and when dropping participation from the model altogether (that is, using a reduced-form model), the

coefficients on policy/practice variables and the simulation results are largely unchanged in terms of sign and significance level. Thus, although the participation model is somewhat sensitive to which IVs are included, the meals-consumed models appear to be largely unaffected by selection bias.

4. Summary of Results from Sensitivity Analyses

For the most part, the regression and simulation results from the sensitivity analyses show that the models of meals served, participation, and meals consumed are robust to changes in the set of independent variables used in the models. An exception is that the participation models appear to be sensitive to the choice of IVs. Despite this finding, the meals-consumed models seem robust to changes in the set of IVs and changes in estimation methods. As noted earlier, the results here are for three specific policy reforms only. There are many possible sensitivity analyses that were not conducted, including defining policy/practice variables differently and adding interaction terms to the models.

IX. CONCLUSION

The goals of this study were to use data from the third School Nutrition Dietary Assessment Study (SNDA-III) to (1) identify characteristics of school meals and school food environments that are associated with the nutritional quality of school meals and/or of children's diets; and (2) develop a simulation model to predict the potential effects of policy/practice changes on student participation rates in the National School Lunch Program (NSLP) and School Breakfast Program (SBP), and the nutritional quality of meals served and consumed. This chapter summarizes this modeling effort and the main findings from simulating three example policy reforms. It also considers directions for future research.

A. Summary of Work

The Option V work has proceeded through the following five steps:

1. ***Selecting Outcomes.*** Priority was given to outcomes in the areas of foods and nutrients served in reimbursable meals (based on school-level menu data), participation in the SBP and NSLP by students, and foods and nutrients consumed by students on school days. Food and nutrient outcomes were selected based on foods and nutrients of concern in children's diets, as identified by the Institute of Medicine (IOM 2009a), with a focus on those for which policy options were represented in the SNDA-III data.
2. ***Selecting Policy/Practice Indicators.*** Variables describing features of meals as offered and the school environment that were possible avenues for policy or practice changes were identified. These variables were grouped into domains and variables within each domain that were associated with each target outcome were examined. Systematic procedures were used to assess which variables had sufficient variation across schools/students within the data and also were associated with the nutritional quality of school meals and/or of children's diets. A list of these variables is provided in Tables IV.3 and IV.4. Control variables at the school and student level were also specified.
3. ***Estimating Baseline Models.*** When baseline models were estimated, an important feature of the statistical methods used was an effort to control for selection bias by using instrumental variables (IV) methods. However, the estimation procedures assume linear relationships, which may lead to biased estimates for certain outcomes, given the large proportion of observations at the lower bound of zero (particularly MyPyramid Equivalents [MPEs] of vegetables and of fruit other than juice consumed at breakfast and lunch).

4. ***Developing Simulations.*** Simulations of three examples of policy reforms were conducted as examples and "reality checks" for the models. Standard table formats for presenting the results were developed. Procedures were also developed for running further simulations without programmer involvement; this enables model users to simulate additional policy reforms (as long as those reforms involve making changes to policy/practice variables currently included in the models).
5. ***Sensitivity Analysis.*** Finally, the sensitivity of the baseline models and the simulation results to changes in the set of policy/practice variables included and to changes in estimation methods was assessed. In general, the meals-served model results were not sensitive (in terms of magnitude or direction) to model changes. Meals-consumed results were not sensitive to procedures used to control for selection bias, in general, although the coefficients on the participation variables were sensitive. The participation models were more sensitive, suggesting that modeling of participation might be worthy of further exploration.

B. Main Findings

The work to identify characteristics of school meals and school food environments that are associated with nutritional quality of school meals and/or of children's diets resulted in a list of policy/practice variables that were included as independent variables in the models of meals served, participation, and meals consumed. These variables serve as inputs into the simulation model; their values can be changed by model users in order to simulate specific policy reforms. After these variables were identified, a simulation model was developed to predict the potential effects of policy/practice changes on student participation rates and the characteristics of meals served and consumed. Three specific policy reforms were used to test the models:

1. Reform 1: Discontinue offering reduced-fat and whole milk at both lunch and breakfast.
2. Reform 2: Offer fresh fruit daily at both lunch and breakfast.
3. Reform 3 (Lunch Only): A comprehensive reform that consists of the following policy/practice changes that apply only to lunch: (a) discontinue offering reduced-fat and whole milk, (b) offer french fries and similar potato products no more than one day per week, (c) offer fresh fruit daily, (d) no longer allow juice to be served, and (e) offer dark green or orange vegetables at least two days per week.

The simulation results can be summarized as follows:

- ***Reform 1*** is predicted to decrease energy from saturated fat served, decrease fluid milk servings at breakfast, decrease participation of elementary students at lunch and secondary students at breakfast, increase participation of elementary students at breakfast, decrease energy from saturated fat consumed by elementary students at lunch, and increase energy from saturated fat consumed by secondary students at lunch and elementary students at breakfast. The decrease in fluid milk servings is an unintended result, but this change is small (ranging from 2 to 9 percent across meals—lunch and breakfast—and school types—elementary and secondary). Furthermore, this result this might be because schools that offered only low-fat and/or fat-free milk in 2005 differed in other unobservable ways from schools that offered reduced-fat or whole milk, and does not necessarily imply that if other schools were to implement this policy, fluid milk servings at those schools would decrease.
- ***Reform 2*** is predicted to increase fruit servings (excluding juice) by elementary schools at lunch, but decrease fruit servings by secondary schools at lunch (this is an unintended result and may be because the policy/practice variable affected by the reform is correlated with something else that is unobserved, such as preferences for foods that can be eaten quickly--for example, fruit that is cut up). Reform 2 is also predicted to increase fruit servings at breakfast, to decrease participation, and to increase MPEs of fruit (excluding juice) consumed by elementary students but not secondary students.
- ***Reform 3*** is predicted to increase servings of fruit, vegetables, and dark green and orange vegetables, decrease energy from saturated fat served, decrease participation, increase consumption of energy from saturated fat (an unintended result), decrease consumption of fluid milk (also unintended), and increase consumption of fruit and vegetables. Although all three reforms are predicted to decrease participation, the sizes of these decreases are small (ranging from 0.1 to 9.4 percentage points) and are sometimes tied to model coefficients that are not statistically significant (see Chapter VII for details).

In light of the fact that several simulated changes go in an unexpected (and unintended) direction, what messages should we take away from this research? First, it is possible that unobserved aspects of school meals associated with certain policies are biasing some results. To mitigate this problem, it would be helpful to have more detailed information on the preparation and presentation of particular food items, such as whether milk is available in multiple flavors and whether fruit is served cut up. This type of information may help explain why the number of discrete fruit servings selected by secondary students decreases in response to Reform 2.

Second, the models would likely benefit from the addition of interaction terms. For example, the interaction between school size and certain policy/practice variables, such as the number of days per week that fresh fruit is offered, may help shed light on some of the puzzling findings, such as the simulated increase in saturated fat served and consumed in response to Reform 2. In addition, interacting participation status with meals-offered variables may result in more sensible findings (see Section C for further details).

Finally, it is possible that some of the results (both expected and unexpected) are not statistically significant. Thus, we believe the simulation model would benefit most from the addition of standard error calculations, allowing the user to determine whether simulation results are statistically significant. It may be possible to calculate the significance of simulated policy changes using resampling methods, but in the context of a multi-equation, multiple-outcome model, these methods are not straightforward to implement; they involve a significant amount of programming and require substantial computing time. Unfortunately, time and resource constraints in this study did not permit adaptation of these methods for the simulations.

C. Potential Areas for Future Research

This section describes potential areas for future research to strengthen the models of how policies and practices affect student participation in school meals, foods and nutrients in meals served, and foods and nutrients in meals consumed. First, possible areas for additional work on the models based on the SNDA-III data are described. Second, issues and opportunities for extending the models to additional outcomes and future data are considered.

The following refinements of the SNDA-III-based models might be of interest:

- ***Standard Errors for Simulation Estimates.*** The simulation results presented in this report do not include standard errors, but the precision of the estimates is clearly of considerable importance in interpreting the policy implications of the results. Mathematica's MATH® models use re-sampling methods such as bootstrapping (Zaslavsky and Thurston 1996) to estimate standard errors, but further investigation is needed to determine the types of errors that could be simulated in the SNDA-III models and the best estimator to use. It might be possible to use the replicate weights developed for bootstrapping standard errors of statistics on usual dietary intakes in the SNDA-III study, as they are included in the public use files.
- ***Adjusting for Censoring of Food Group Variables.*** Consumption of foods from particular food groups at breakfast and/or lunch is zero for many children. The large number of zeros for some food groups in the data may bias the estimates of the effects of policy on the amount eaten if a linear model is assumed. This issue is referred to as "censoring." A number of statistical models, such as the Tobit model, can be used to adjust for censoring. The current study focused on adjusting for selection bias; it is difficult to adjust for both simultaneously. The key issue would be whether the model predictions are sensitive to the specification used.
- ***Additional Sensitivity Analyses.*** Other sensitivity analyses of interest would include estimation of separate meals-consumed models for participants and nonparticipants, possibly also estimating the participation model simultaneously (sometimes known as a "switching regressions" model). Characteristics of meals offered could be assumed not to affect nonparticipants' consumption, for example.
- ***Revisions in Response to the IOM Report.*** To simulate the effects of specific changes recommended in the *School Meals: Building Blocks for Healthy Children* report (IOM 2009b), it might be possible to change the policy/practice variables in the model to some extent (for example, it might be possible to simulate the more specific rules about types of vegetables offered). However, changes not represented in the SNDA-III data (such as changes in portion sizes) cannot be simulated without making very strong assumptions.

Ultimately, it would be of interest to consider extending the model to additional outcomes, particularly school meal revenues and costs. In addition, updating the model with more current data could be useful. Data for SNDA-IV, for example, will be collected in 2010. Key areas for expansion would be:

- ***Adding Revenue as an Outcome.*** It would be possible to simulate revenues using SNDA-III student data, including each sample member's predicted NSLP/SBP participation status, eligibility status (free, reduced-price, or paid), and relevant meal price charged by his or her school. SNDA-IV will collect only school-level data but will have a sample of about 900 schools. It thus might be feasible to use SNDA-IV data to estimate a school-level participation model and predict school-level revenues accordingly.

- ***Adding Meal Cost as an Outcome.*** This expansion may be most fruitful when meals offered and served data from SNDA-IV are available, given the potential for matching with data from the School Food Purchase Study-III, which will include both cost and nutrition-related data (nutrients and MPEs) for the 2009-2010 school year. Alternatively, it might be worth exploring the use of software and methods developed by Iowa State University to match food items from a subset of SNDA-III menus to food cost data from the School Lunch and Breakfast Cost Study-II. This work was recently completed for the purpose of estimating the cost implications of menu changes that reflect the IOM recommendations for new school meal requirements (IOM 2009b).
- ***Adapting Current Models for Future Rounds of SNDA.*** SNDA-IV will collect only school-level data, including a detailed menu survey similar to those used in the previous SNDA studies. It should thus be straightforward to adapt the meals served models used with these data to the new dataset. At the same time, it might be possible to use additional school-level information, given the larger sample size of SNDA-IV. Previous items in this section noted the possible use of SNDA-IV data to estimate participation, revenues, and costs. Updating the meals-consumed models will have to await a future round of SNDA that collects student-level data.

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APPENDIX A

DETAILS AND RESULTS OF EXPLORATORY ANALYSES TO SELECT POLICY AND PRACTICE VARIABLES

This appendix describes the exploratory analyses used to select policy and practice variables to be included as independent variables in the predictive models of meals served, participation, and meals consumed. The analyses proceeded through several steps (described in Chapter IV). Sections A through D describe the results of the first four methods—which were used simultaneously—for the meals offered variables. Section A examines lunch for elementary schools, Section B examines breakfast for elementary schools, Section C examines lunch for secondary schools, and Section D examines breakfast for secondary schools. The four methods used were: looking at the prevalence of policies/practices, examining correlations between policy/practice variables in the same domain, ranking variables by their percentage contribution to the outcome measure, and examining correlations between each policy/practice variable and the related outcome. Section E describes the results of using stepwise regressions to further narrow the list of meals offered variables. Section F describes the results of similar exploratory analyses for the school food environment variables. Section G describes the results of exploratory analyses used to select which of the variables that were designed to affect added sugars consumption would be included in the meals-consumed model (added sugars was not available as a meals-served outcome, so none of these variables were included in the meals-served models). Section H describes further refinements to the list of policy/practice variables included in the models.

The exploratory analyses presented in this appendix focus on calcium as one of the outcomes of interest. This outcome was later changed to fluid milk because fluid milk is more important in terms of policy. The exploratory analyses were not rerun using fluid milk in place of calcium because these outcomes are closely related; thus, it is expected that the policy/practice variables influence them in similar ways. Furthermore, calcium was not examined for elementary school students because the IOM panel did not consider calcium to be a "nutrient of concern" for younger children.

The selection of meals offered variables was based on Tables A.1 and A.2. In general, binary variables were dropped from the list if fewer than 5% or greater than 95% of schools followed that particular policy or practice (shown in Table A.1).[1] In general, variables were kept on the list if they were "good" predictors of the meals-served outcome, defined as having a correlation with the associated meals-served outcome of greater than +/-0.10 (shown in Table A.2). However, for certain outcomes, such as calcium for secondary students at breakfast, there were few policy/practice variables which met this cutoff, so some variables which had correlations with the associated outcome of less than 0.10 were kept on the list and included in the stepwise regressions. We do not present full correlation matrices showing the correlations between policy/practice variables in the same domain because they are large and cumbersome to display. However, for certain outcomes, such as fruit, we present the correlations between a few selected policy/practice variables.

A. Lunch for Elementary schools

This section presents exploratory analyses of policies/practices in elementary schools potentially related to foods and nutrients in lunches served. The results discussed in this section are shown in Tables A.1 and A.2.

1. Percentage of Energy from Saturated Fat

- "Only low-fat or fat-free milk offered" and "whole milk not offered" are both good predictors of the outcome (correlations with the outcome are -0.28 and -0.13, respectively). The correlation between them is 0.46, so both were included.
- The following variables are good predictors of the outcome, but not enough schools follow these policies: "low saturated fat hamburgers offered" and "low saturated fat pizza offered."

[1] For categorical variables, such as the number of days per week a particular item is offered, the variation in the variable across the school week was examined. If any category contained fewer than 5% or greater than 95% of schools, that variable was not used in the models. Continuous variables, such as the percent of weekly entrees that are high in saturated fat, were examined on a case-by-case basis and were dropped if the variation across schools was low (see section H for more details).

TABLE A.1 POTENTIAL MEALS OFFERED VARIABLES: PERCENT OF SCHOOLS THAT FOLLOW THE POLICY/PRACTICE

Policy/Practice Variables	Percent of elementary schools who follow the policy (or range: min, max)	Percent of secondary schools who follow the policy (or range: min, max)
LUNCH		
Outcome: calcium		
Average number of flavored milk choices offered per day	0.2, 3	0, 4
Average number of milk choices offered per day	1.2, 6	1, 6
Alternative non-milk beverage not offered	46.5%	45.8%
Yogurt offered as meat alternate	22.2%	10.3%
Outcome: saturated fat		
Fat-free milk offered	55.6%	60.1%
Only low-fat or fat-free milk offered	37.5%	34.4%
Whole milk not offered	68.1%	66.0%
Fish or shellfish offered	16.0%	21.0%
Number of days per week that cheeseburgers are offered	0, 3	0, 5
Low saturated fat hamburgers offered	3.5%	7.5%
Low saturated fat pizza offered	2.1%	8.0%
Yogurt (low-fat or fat-free) offered as meat alternate	21.5%	9.9%
Vegetarian/meatless/cheeseless entrees offered	2.8%	1.2%
Vegetarian/meatless entrees (non cheese-based) offered	4.2%	1.2%
No self-serve salad dressings offered	68.1%	57.7%
No high saturated fat condiments or spreads offered	20.1%	10.7%
No high saturated fat salad dressings offered	33.3%	23.7%
High saturated fat entrée not offered	0.0%	0.0%
Number of days per week that high saturated fat entrees are offered	2, 5	2, 5
Average number of high saturated fat entrees offered per day	0.6, 14.2	0.6, 19
Number of high saturated fat entrees offered per week	3, 71	3, 96
Percent of weekly entrees that are high saturated fat	27%, 100%	41%, 100%
Hamburgers not offered	50.7%	33.6%
Pizza not offered	16.7%	8.7%
Number of days per week that hamburgers are offered	0, 5	0, 5
Number of days per week that pizza is offered	0, 5	0, 5
Cheeseburgers offered no more than 1 day per week	95.8%	52.6%
Dessert not offered	25.0%	29.3%
Outcome: fruit equivalents (excluding juice)		
Average number of types of fruit offered per day	0, 7.8	0, 10
Fresh fruit offered	88.2%	87.4%
Number days per week that fresh fruit is offered	0, 5	0, 5
Fruit offered daily	67.4%	71.9%
Fresh fruit offered daily	23.6%	42.3%
Average number of types of fresh fruit offered per day	0, 4.6	0, 5.6
Juice not offered	52.1%	55.7%
Juice offered no more than 1 time per week	66.0%	63.2%
Outcome: vegetable equivalents (excluding French fries and similar potato products)		
French fries and similar potato products not offered	28.5%	12.6%
Number of days per week that French fries or similar potato products are offered	0, 4	0, 5
French fries or similar potato products offered no more than 1 day per week	75.7%	36.0%
French fries or similar potato products offered no more than 2 days per week	93.1%	53.8%

Policy/Practice Variables	Percent of elementary schools who follow the policy (or range: min, max)	Percent of secondary schools who follow the policy (or range: min, max)
Raw vegetables offered	91.7%	88.1%
Average number of vegetable options offered per day	0, 4.4	0.2, 10.6
Side salad bar offered	7.6%	13.4%
Number of days per week that side salad bar is offered	0, 5	0, 5
Entrée salad or salad bar offered	47.2%	74.7%
Vegetarian/meatless/cheeseless entrees offered	2.8%	1.2%
Vegetarian/meatless entrees (non cheese-based) offered	4.2%	1.2%
Accompaniments offered with vegetables (dips, salsa, peanut butter)	6.3%	2.8%
Outcome: dark green and orange vegetable equivalents		
Salad offered (including entrée and side salads, and either salads or salad bars)	100.0%	100.0%
Dark green and orange vegetables offered daily	3.5%	5.1%
Number of days per week that dark green and orange vegetables are offered	0, 5	0, 5
Average number of dark green and orange vegetable options offered per day	0, 2	0, 2.6
Dark green and orange vegetable options offered at least 1 day per week	77.8%	71.1%
Dark green and orange vegetable options offered at least 2 days per week	43.8%	37.5%
BREAKFAST		
Outcome: calcium		
Average number of flavored milk choices offered per day	0, 3	0, 3.4
Average number of milk choices offered per day	0.2, 5.8	1, 7
Alternative non-milk beverage not offered	7.7%	1.9%
Flavored milk offered	74.4%	88.0%
Number of days per week that flavored milk is offered	0, 5	0, 5
100% fruit juice offered	92.3%	97.1%
Cold cereals offered	95.7%	93.8%
Number of days per week that unsweentened cold cereal is offered	0, 5	0, 5
Yogurt offered as meat alternate	34.2%	33.2%
Offer unsweetened cold cereal at least one day per week	49.6%	45.2%
Outcome: saturated fat		
Fat-free milk offered	44.4%	53.4%
Only low-fat or fat-free milk offered	44.4%	34.6%
Whole milk not offered	71.8%	66.3%
Cold cereal offered daily	50.4%	62.5%
Sausage or other high-fat meat not offered	33.3%	25.0%
Breakfast sandwich not offered	57.3%	51.0%
Low saturated fat breakfast sandwich offered	3.4%	2.4%
Pizza not offered	63.2%	54.3%
Low saturated fat pizza offered	0.0%	1.0%
Yogurt offered as meat alternate	34.2%	33.2%
High saturated fat entrée not offered	10.3%	7.2%
Number of days per week that high saturated fat entrees are offered	0, 5	0, 5
Average number of high saturated fat entrees offered per day	0, 2.8	0, 10
Number of high saturated fat entrees offered per week	0, 14	0, 50
Percent of weekly entrees that are high saturated fat	0%, 100%	0%, 100%
High saturated fat breakfast sandwich not offered	60.7%	51.4%
High saturated fat condiments not offered	64.1%	51.9%

Policy/Practice Variables	Percent of elementary schools who follow the policy (or range: min, max)	Percent of secondary schools who follow the policy (or range: min, max)
Outcome: fruit equivalents (exluding juice)		
Average number of types of fruit offered per day	0.6, 5.7	0.2, 7.5
Fresh fruit offered	45.3%	52.9%
Number days per week that fresh fruit is offered	0, 5	0, 5
Fruit offered daily	79.5%	85.1%
Fresh fruit offered daily	12.8%	27.4%
Average number of types of fresh fruit offered per day	0, 4	0, 4.6
At least 2 different fruit options offered each day	37.6%	51.0%
Outcome: added sugars		
Flavored milk not offered	25.6%	12.0%
Number of days per week that flavored milk is offered	0, 5	0, 5
Average number of types of unsweetened cold cereals offered per day	0, 2.8	0, 6
Number of days per week that unsweetened cold cereals are offered	0, 5	0, 5
Average number of types of hot cereal offered per day	0, 0.75	0, 3
Number of days per week that hot cereal is offered	0, 3	0, 5
Average number of types of sweetened cold cereals offered per day	0, 6.6	0, 9
Number of days per week that sweetened cold cereals are offered	0, 5	0, 5
Sweet rolls/pastries not offered	43.6%	25.5%
Number of days per week that sweet rolls/pastries are offered	0, 5	0, 5

Source: SNDA-III Public Use File.

Definitions:

Low saturated fat for lunch variables: <=12% cals from saturated fat and <=3g saturated fat per serving

Low saturated fat for breakfast variables: <=12% cals from saturated fat and <=2g saturated fat per serving

Low saturated fat for condiments, spreads, and dressings: <=12% cals from saturated fat and <=1g saturated fat per serving

High saturated fat for lunch variables: >12% calories from saturated fat or >3g saturated fat per serving

High saturated fat for breakfast variables: >12% calories from saturated fat or >2g saturated fat per serving

High saturated fat for condiments, spreads, and dressings: >12% calories from saturated fat or >1g saturated fat per serving

Sweetened cereals: >= 21.3 g of sugar per 100 grams (criteria used under the WIC program for defining "non-allowable" cereals)

TABLE A.2 POTENTIAL MEALS OFFERED VARIABLES: CORRELATIONS WITH OUTCOMES

Policy/Practice Variables	Correlation with outcome served: elementary schools	Correlation with outcome served: secondary schools	Correlation with outcome consumed at that meal: elementary schools	Correlation with outcome consumed at that meal: secondary schools	Correlation with outcome consumed at meal, participants only: elementary schools	Correlation with outcome consumed at meal, participants only: secondary schools	Correlation with participation: elementary schools	Correlation with participation: secondary schools
LUNCH								
Outcome: calcium								
Average number of flavored milk choices offered per day	N/A	−0.05	N/A	0.05	N/A	−0.01	0.03	0.07
Average number of milk choices offered per day	N/A	0.02	N/A	0.04	N/A	0.02	0.04	0.04
Alternative non-milk beverage not offered	N/A	0.10	N/A	0.02	N/A	0.03	0.13	0.02
Yogurt offered as meat alternate	N/A	0.20	N/A	0.00	N/A	0.07	−0.07	−0.06
Outcome: saturated fat								
Fat-free milk offered	−0.02	−0.03	−0.03	−0.02	−0.02	0.01	0.11	0.03
Only low-fat or fat-free milk offered	−0.28	−0.35	−0.12	0.01	−0.12	−0.06	−0.06	−0.07
Whole milk not offered	−0.13	−0.24	−0.08	0.01	−0.09	0.00	−0.07	0.02
Fish or shellfish offered	−0.18	0.06	−0.07	0.03	−0.02	−0.01	0.00	0.00
Number of days per week that cheeseburgers are offered	−0.07	0.13	−0.09	−0.02	−0.08	−0.09	−0.04	−0.08
Low saturated fat hamburgers offered	−0.15	0.03	0.08	−0.05	0.11	−0.07	0.03	0.08
Low saturated fat pizza offered	−0.14	−0.01	−0.01	0.03	0.03	−0.03	−0.07	0.00
Yogurt (low-fat or fat-free) offered as meat alternate	−0.09	−0.01	−0.01	0.02	−0.07	0.05	−0.09	−0.05
Vegetarian/meatless/cheeseless entrees offered	−0.04	−0.06	0.03	−0.06	0.05	−0.05	0.00	−0.06
Vegetarian/meatless entrees (non cheese-based) offered	0.00	−0.06	0.03	−0.06	0.05	−0.05	0.00	−0.06
No self-serve salad dressings offered	0.03	−0.15	−0.06	0.00	−0.09	0.00	0.07	0.06
No high saturated fat condiments or spreads offered	−0.09	−0.12	−0.06	−0.03	−0.05	−0.01	0.01	−0.04
No high saturated fat salad dressings offered	0.00	−0.17	−0.07	0.01	−0.06	−0.03	0.00	0.02
High saturated fat entrée not offered	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of days per week that high saturated fat entrees are offered	0.04	0.07	0.01	0.04	0.01	0.00	−0.01	0.00
Average number of high saturated fat entrees offered per day	0.24	0.07	0.03	−0.05	0.02	−0.10	0.03	−0.05
Number of high saturated fat entrees offered per week	0.21	0.07	0.02	−0.05	0.01	−0.11	0.04	−0.05
Percent of weekly entrees that are high saturated fat	0.28	0.18	0.08	−0.02	0.10	−0.07	0.08	0.10
Hamburgers not offered	−0.17	0.04	−0.04	0.00	−0.11	0.06	−0.03	−0.05
Pizza not offered	−0.13	−0.02	0.00	0.05	−0.01	0.13	−0.04	0.07
Number of days per week that hamburgers are offered	0.18	0.02	0.02	−0.02	0.05	−0.09	0.08	0.07
Number of days per week that pizza is offered	−0.07	0.03	0.01	−0.07	0.00	−0.17	0.06	0.02
Cheeseburgers offered no more than 1 day per week	−0.13	−0.12	−0.13	−0.15	0.00	0.07	0.01	0.09
Dessert not offered	0.08	−0.04	−0.02	−0.01	0.00	−0.01	−0.08	−0.01

Policy/Practice Variables	Correlation with outcome served: elementary schools	Correlation with outcome served: secondary schools	Correlation with outcome consumed at that meal: elementary schools	Correlation with outcome consumed at that meal: secondary schools	Correlation with outcome consumed at meal, participants only: elementary schools	Correlation with outcome consumed at meal, participants only: secondary schools	Correlation with participation: elementary schools	Correlation with participation: secondary schools
Outcome: fruit equivalents (excluding juice)								
Average number of types of fruit offered per day	−0.03	−0.20	−0.03	−0.02	−0.01	−0.04	−0.11	−0.04
Fresh fruit offered	0.09	−0.24	−0.02	0.02	−0.04	0.01	−0.05	−0.10
Number days per week that fresh fruit is offered	0.10	−0.34	0.01	−0.03	0.00	−0.07	−0.01	−0.08
Fruit offered daily	0.24	0.10	−0.03	0.03	−0.05	0.05	−0.06	0.03
Fresh fruit offered daily	0.07	−0.22	−0.01	−0.04	−0.03	−0.07	−0.03	−0.03
Average number of types of fresh fruit offered per day	0.04	−0.28	0.02	−0.02	0.02	−0.04	0.00	−0.01
Juice not offered	0.36	0.17	0.06	−0.02	0.07	0.05	0.13	0.05
Juice offered no more than 1 time per week	0.32	0.18	0.05	−0.01	0.03	0.02	0.16	0.04
Outcome: vegetable equivalents (excluding French fries and similar potato products)								
French fries and similar potato products not offered	0.04	0.21	0.00	−0.03	0.00	−0.02	0.09	−0.08
Number of days per week that French fries or similar potato products are offered	−0.16	−0.36	0.03	−0.05	−0.01	−0.07	−0.05	0.05
French fries or similar potato products offered no more than 1 day per week	0.23	0.24	−0.08	0.06	0.02	0.06	−0.02	−0.02
French fries or similar potato products offered no more than 2 days per week	0.09	0.31	−0.21	0.04	−0.02	0.05	0.05	−0.07
Raw vegetables offered	0.27	0.27	0.08	0.05	0.13	0.07	−0.05	0.03
Average number of vegetable options offered per day	0.33	0.22	0.06	0.06	0.14	0.05	0.02	0.05
Side salad bar offered	0.48	0.24	−0.02	−0.03	−0.02	−0.05	−0.02	0.01
Number of days per week that side salad bar is offered	0.49	0.27	−0.02	−0.05	−0.03	−0.07	−0.02	0.01
Entrée salad or salad bar offered	−0.24	−0.16	0.07	−0.03	0.09	−0.09	0.10	−0.07
Vegetarian/meatless/cheeseless entrees offered	−0.10	−0.02	−0.04	−0.04	−0.05	−0.02	0.00	−0.06
Vegetarian/meatless entrees (non cheese-based) offered	−0.12	−0.02	−0.04	−0.04	−0.05	−0.02	0.00	−0.06
Accompaniments offered with vegetables (dips, salsa, peanut butter)	0.09	−0.07	0.00	0.03	−0.02	0.09	0.04	−0.05
Outcome: dark green and orange vegetable equivalents								
Salad offered (including entrée and side salads, and either salads or salad bars)	N/A	N/A	N/A	N/A	N/A	N/A	0.02	0.01
Dark green and orange vegetables offered daily	0.24	−0.16	0.00	0.01	0.03	−0.01	−0.06	−0.01
Number of days per week that dark green and orange vegetables are offered	0.55	0.59	0.10	−0.01	0.16	−0.02	0.04	−0.03
Average number of dark green and orange vegetable options offered per day	0.51	0.52	0.07	−0.02	0.12	−0.03	0.00	−0.01
Dark green and orange vegetable options offered at least 1 day per week	0.55	0.44	0.06	0.02	0.07	0.02	0.02	0.03

Policy/Practice Variables	Correlation with outcome served: elementary schools	Correlation with outcome served: secondary schools	Correlation with outcome consumed at that meal: elementary schools	Correlation with outcome consumed at that meal: secondary schools	Correlation with outcome consumed at meal, participants only: elementary schools	Correlation with outcome consumed at meal, participants only: secondary schools	Correlation with participation: elementary schools	Correlation with participation: secondary schools
Dark green and orange vegetable options offered at least 2 days per week	0.48	0.48	0.12	−0.04	0.18	−0.05	0.08	−0.03
BREAKFAST								
Outcome: calcium								
Average number of flavored milk choices offered per day	N/A	0.07	N/A	−0.02	N/A	0.05	−0.09	−0.02
Average number of milk choices offered per day	N/A	−0.03	N/A	−0.01	N/A	0.02	−0.08	−0.03
Alternative non-milk beverage not offered	N/A	−0.13	N/A	0.00	N/A	N/A	−0.06	−0.05
Flavored milk offered	N/A	0.10	N/A	−0.01	N/A	0.01	−0.06	−0.05
Number of days per week that flavored milk is offered	N/A	0.11	N/A	−0.01	N/A	0.02	−0.04	−0.05
100% fruit juice offered	N/A	0.15	N/A	0.00	N/A	0.07	0.06	0.05
Cold cereals offered	N/A	0.06	N/A	−0.05	N/A	0.03	−0.07	−0.01
Number of days per week that unsweentened cold cereal is offered	N/A	−0.04	N/A	0.02	N/A	−0.10	−0.09	0.00
Yogurt offered as meat alternate	N/A	−0.05	N/A	0.03	N/A	−0.05	−0.06	−0.02
Offer unsweetened cold cereal at least one day per week	N/A	−0.03	N/A	0.02	N/A	−0.11	−0.07	0.00
Outcome: saturated fat								
Fat-free milk offered	−0.21	−0.14	0.03	−0.02	−0.02	−0.02	0.01	−0.02
Only low-fat or fat-free milk offered	−0.51	−0.23	−0.06	0.05	−0.21	−0.08	−0.01	−0.03
Whole milk not offered	−0.37	−0.34	−0.05	−0.01	−0.10	−0.01	−0.01	0.03
Cold cereal offered daily	−0.24	0.08	0.04	−0.01	0.08	0.14	−0.06	−0.02
Sausage or other high-fat meat not offered	−0.02	−0.20	−0.06	−0.06	−0.22	0.00	−0.05	−0.02
Breakfast sandwich not offered	0.04	0.31	−0.05	0.00	−0.08	−0.03	0.03	0.04
Low saturated fat breakfast sandwich offered	0.14	−0.03	0.04	0.02	0.08	−0.04	0.11	0.00
Pizza not offered	−0.15	−0.18	−0.08	−0.05	−0.16	0.03	0.00	−0.03
Low saturated fat pizza offered	N/A	0.05	N/A	−0.02	N/A	0.03	N/A	0.05
Yogurt offered as meat alternate	−0.11	−0.05	−0.07	0.03	−0.14	−0.01	−0.06	−0.02
High saturated fat entrée not offered	−0.09	−0.18	−0.10	−0.01	−0.19	−0.07	0.01	−0.05
Number of days per week that high saturated fat entrees are offered	0.25	0.40	0.13	−0.03	0.31	0.07	0.01	0.00
Average number of high saturated fat entrees offered per day	0.24	0.47	0.12	0.01	0.21	0.03	−0.04	−0.02
Number of high saturated fat entrees offered per week	0.23	0.47	0.11	0.01	0.22	0.02	−0.02	−0.03
Percent of weekly entrees that are high saturated fat	0.18	0.07	0.11	0.02	0.21	−0.05	0.04	−0.01
High saturated fat breakfast sandwich not offered	0.00	−0.31	−0.04	0.01	−0.05	−0.03	0.06	0.03
High saturated fat condiments not offered	−0.05	−0.13	0.10	0.05	0.11	−0.03	0.03	−0.03

Policy/Practice Variables	Correlation with outcome served: elementary schools	Correlation with outcome served: secondary schools	Correlation with outcome consumed at that meal: elementary schools	Correlation with outcome consumed at that meal: secondary schools	Correlation with outcome consumed at meal, participants only: elementary schools	Correlation with outcome consumed at meal, participants only: secondary schools	Correlation with participation: elementary schools	Correlation with participation: secondary schools
Outcome: fruit equivalents (excluding juice)								
Average number of types of fruit offered per day	-0.13	0.20	0.07	0.04	0.04	0.22	-0.12	-0.04
Fresh fruit offered	0.63	0.55	-0.05	0.02	0.05	-0.04	-0.01	-0.01
Number days per week that fresh fruit is offered	0.59	0.51	-0.05	0.04	0.03	-0.06	-0.10	-0.03
Fruit offered daily	0.01	0.03	0.00	0.03	0.12	0.08	0.05	-0.01
Fresh fruit offered daily	0.19	0.28	-0.02	0.02	N/A	-0.08	-0.11	0.01
Average number of types of fresh fruit offered per day	0.43	0.41	-0.04	0.04	0.04	-0.01	-0.12	-0.02
At least 2 different fruit options offered each day	-0.20	-0.06	0.08	0.08	0.04	0.10	-0.10	-0.05
Outcome: added sugars								
Flavored milk not offered	N/A	N/A	-0.04	-0.12	-0.11	-0.14	0.06	0.05
Number of days per week that flavored milk is offered	N/A	N/A	0.06	0.12	0.14	0.13	-0.04	-0.05
Average number of types of unsweetened cold cereals offered per day	N/A	N/A	0.03	-0.01	0.05	-0.10	-0.10	0.00
Number of days per week that unsweetened cold cereals are offered	N/A	N/A	0.01	0.03	0.04	-0.14	-0.09	0.00
Average number of types of hot cereal offered per day	N/A	N/A	0.10	0.00	0.27	0.03	-0.06	-0.02
Number of days per week that hot cereal is offered	N/A	N/A	0.10	0.00	0.26	0.03	-0.05	-0.02
Average number of types of sweetened cold cereals offered per day	N/A	N/A	0.10	0.05	0.15	0.21	-0.13	0.03
Number of days per week that sweetened cold cereals are offered	N/A	N/A	0.13	0.00	0.19	0.11	-0.17	-0.02
Sweet rolls/pastries not offered	N/A	N/A	-0.02	0.08	-0.03	0.07	0.03	0.02
Number of days per week that sweet rolls/pastries are offered	N/A	N/A	0.06	-0.04	0.23	-0.04	-0.04	-0.04

Source: SNDA-III Public Use File.

Definitions:

Low saturated fat for lunch variables: <=12% cals from saturated fat and <=3g saturated fat per serving

Low saturated fat for breakfast variables: <=12% cals from saturated fat and <=2g saturated fat per serving

Low saturated fat for condiments, spreads, and dressings: <=12% cals from saturated fat and <=1g saturated fat per serving

High saturated fat for lunch variables: >12% calories from saturated fat or >3g saturated fat per serving

High saturated fat for breakfast variables: >12% calories from saturated fat or >2g saturated fat per serving

High saturated fat for condiments, spreads, and dressings: >12% calories from saturated fat or >1g saturated fat per serving

Sweetened cereals: >= 21.3 g of sugar per 100 grams (criteria used under the WIC program for defining "non-allowable" cereals)

- "Hamburgers not offered" and "pizza not offered" were included because they are fairly well correlated with the outcome (correlations with the outcome are -0.17 and -0.13, respectively).
- "Average number of high saturated fat entrees offered per day," "number of high saturated fat entrees offered per week," and "percent of weekly entrees that are high saturated fat" are all good predictors. The correlation between the first and second is 0.99, between the first and third is 0.21, and between the second and third is 0.23, so both the first and third were included, as the first is a better predictor than the second. These variables are not highly correlated with the "only low-fat or fat-free milk offered" and "whole milk not offered" variables.
- "Yogurt offered as meat alternate" and "no high saturated fat condiments or spreads offered" are somewhat good predictors (correlations with the outcome are both -0.09), so both were included.

2. Fruit Servings (Excluding Juice)

- "Juice not offered" and "juice offered no more than 1x per week" are the best predictors (correlations with outcome are 0.36 and 0.32, respectively), but they are highly correlated (0.75), so only "juice not offered" was included.
- "Fruit offered daily," and "number of days per week that fresh fruit is offered" are the next best predictors (correlations with outcome are 0.24 and 0.10, respectively), and they are not highly correlated with each other or with "juice not offered" (correlations with "juice not offered" are -0.07 and 0.01, respectively), so both of them were included.

3. Vegetable Servings (Excluding French Fries and Similar Potato Products)

- "Number of days per week that French fries or similar potato products are offered" is a good predictor (correlation with outcome is -0.16). However, "French fries or similar potato products offered no more than 1 day per week" has a higher correlation with the outcome (0.23), so it was included instead.
- "Raw vegetables offered" is a good predictor (correlation with outcome is 0.27), but 92% of schools follow this policy. This is below the 95% cutoff, so this variable was included. Its correlation with "French fries or similar potato products offered no more than 1 day per week" is 0.12.
- "Side salad bar offered" and "number of days per week that side salad bar is offered" have a correlation of 0.99, so both variables could not be included. The distribution of "number of days per week that side salad bar is offered" is as follows: 92% of schools never offer a side salad bar, 3% of schools offer a side salad bar 4 days per week, and 5% of schools offer a side salad bar 5 days per week. Only "side salad bar offered" was included because it is almost as predictive of the outcome as the "number of days per week" variable (correlations with the outcome are 0.48 and 0.49, respectively), and because there is not sufficient variation in the "number of days per week" variable.

- "Average number of vegetable options offered per day" is also a good predictor (correlation with outcome is 0.33), and its correlation with the above variables is not high, so it was included.

4. Dark Green and Orange Vegetable Servings

- 100% of schools follow the policy "any salad offered" and only 3.5% of schools follow the policy "dark green and orange vegetables offered daily," so these variables were not included.
- "Number of days per week that dark green and orange vegetables are offered" and "average number of dark green and orange vegetable options offered per day" are highly correlated (0.95), so only the first of these two variables was included, as it is more correlated with the outcome (0.55 vs. 0.51). The following variables did not have correlations with the outcome greater than 0.55, so they were not included: "dark green and orange vegetable options offered at least 1 day per week" and "dark green and orange vegetable options offered at least 2 days per week."

B. Breakfast for Elementary Schools

This section presents exploratory analyses of policies/practices in elementary schools potentially related to foods and nutrients in breakfasts served. The results discussed in this section are shown in Tables A.1 and A.2.

1. Saturated Fat

- "Fat-free milk offered," "only low-fat or fat-free milk offered," and "whole milk not offered" are all good predictors (correlations with outcome are -0.21, -0.51, and -0.37, respectively). The correlation between the first and second is -0.26, between the first and third is -0.13, and between the second and third is 0.50, so the first and second were included, as they are not highly correlated with each other, and the second is a better predictor than the third.
- "Number of days per week that high saturated fat entrees are offered," "average number of high saturated fat entrees offered per day," and "number of high saturated fat entrees offered per week" are all good predictors, but highly correlated with each other (correlations with each other range from 0.87 to 0.99), so only the first variable was included, because it has the highest correlation with the outcome (0.25). "Percent of weekly entrees that are high saturated fat" is also a good predictor (correlation with outcome is 0.18), and it is not highly correlated with "number of days per week that high saturated fat entrees are offered," (correlation is 0.42) so it was also included.
- "Cold cereal offered daily" is a good predictor (correlation with outcome is -0.24), and is not highly correlated with the other variables mentioned above, so it was included.

- "Pizza not offered" and "yogurt offered as meat alternate" are somewhat good predictors (correlations with outcome are -0.15 and -0.11, respectively), so both were included.

2. Fruit Servings (Excluding Juice)

The following four variables are all good predictors, but most are highly correlated with each other (see Table A.3 below for selected correlations): "fresh fruit offered," "number days per week that fresh fruit is offered," "fresh fruit offered daily," and "average number of types of fresh fruit offered per day." "Fresh fruit offered" was included because it has the highest correlation with the outcome (0.63). "Fresh fruit offered daily" was included because it is not highly correlated with "fresh fruit offered."

C. Lunch for Secondary Schools

This section presents exploratory analyses of policies/practices in secondary schools potentially related to foods and nutrients in lunches served. The results discussed in this section are shown in Tables A.1 and A.2.

1. Calcium

"Yogurt offered as meat alternate" was included because it is most strongly correlated with the outcome (correlation with the meals-served outcome is 0.20). "Alternative non-milk beverage not offered" was not included because it is too highly correlated with "juice not offered" (correlation between them is 0.93), which was included because its correlation with fruit servings served is 0.17 (see details below).

Table A.3 Correlations for Selected "Fresh Fruit" Policy/Practice Variables—LUNCH

Policy/practice variable (correlation with outcome in parentheses)	Fresh Fruit Offered	Number Days Per Week That Fresh Fruit Is Offered	Fresh Fruit Offered Daily	Average Number of Types of Fresh Fruit Offered Per Day
Fresh fruit offered (0.63)	1.00			
Number days per week that fresh fruit is offered (0.59)	0.85	1.00		
Fresh fruit offered daily (0.19)	0.38	0.70	1.00	
Average number of types of fresh fruit offered per day (0.43)	0.70	0.89	0.73	1.00

Source: SNDA-III Public Use File.

2. Saturated Fat

- "Only low-fat or fat-free milk offered" and "whole milk not offered" are both good predictors (correlations with outcome are -0.35 and -0.24, respectively) and the correlation between them is 0.41, so both were included.
- "Number of days per week that cheeseburgers are offered" is a somewhat good predictor (correlation with outcome is 0.13), so it was included. "Cheeseburgers offered no more than 1 day per week" does not have a correlation with the outcome greater than +/-0.13, so it was not included.
- "Low saturated fat hamburgers offered" and "low saturated fat pizza offered" were not very common among schools, so they were not included.
- None of the following variables had correlations with the outcome greater than +/-0.10, so they were not included: "hamburgers offered," "pizza offered," "number of days per week that hamburgers are offered," and "number of days per week that pizza is offered."
- "No self-serve salad dressings offered," "no high saturated fat condiments or spreads offered," and "no high saturated fat salad dressings offered" are all somewhat good predictors (correlations with outcome are -0.15, -0.12, and -0.17, respectively), and they are not highly correlated with each other (correlations between them range from 0.14 to 0.27), so all of them were included.
- Most of the "high saturated fat" variables are not good predictors. This is probably because they don't vary much across schools—all schools offer many high saturated fat entrees. However, "percent of weekly entrees that are high saturated fat" has some predictive power (correlation with outcome is 0.18), so it was included.

3. Fruit Servings (Excluding Juice)

- All of the "fresh fruit" variables have negative correlations with the outcome, which is unexpected. "Average number of types of fruit offered per day" also has a negative correlation with the outcome (-0.20). This may be because schools that offer more fresh fruit may also offer it a la carte. Alternatively, the schools that offer more fresh fruit may be higher (or lower) income schools, or schools with some other characteristic that is related to low fresh fruit consumption.

- "Fruit offered daily" was included because it has a positive correlation with the outcome (0.10).
- "Juice not offered" and "juice offered no more than 1x per week" are somewhat good predictors (correlations with outcome are 0.17 and 0.18, respectively), but they are highly correlated (0.86), so only "juice not offered" was included, to match what was included for elementary schools.

4. Vegetable Servings (Excluding French Fries and Similar Potato Products)

- "Entrée salad or salad bar offered" has a negative correlation with the outcome (-0.16), which is unexpected. These variables may be acting as a proxy for something else, such as school income level, as described above.
- "French fries and similar potato products not offered" and "number of days per week that French fries or similar potato products are offered" are both good predictors (correlations with outcome are 0.21 and -0.36, respectively), but they are somewhat highly correlated with each other (-0.56), so only "number of days per week that French fries or similar potato products are offered" was included. The following variables were not included because they did not have correlations with the outcome greater than +/- 0.36: "French fries or similar potato products offered no more than 1 day per week" and "French fries or similar potato products offered no more than 2 days per week."
- "Raw vegetables offered" is a good predictor (correlation with outcome is 0.27); only 88% of schools follow this policy, so it was included. Its correlation with "number of days per week that French fries or similar potato products are offered" is -0.14.
- "Side salad bar offered" and "number of days per week that side salad bar is offered" have a correlation of 0.97, so both could not be included. The distribution of "number of days per week that side salad bar is offered" is as follows: 87% of schools never offer a side salad bar, 4% of schools offer a side salad bar 4 days per week, and 9% of schools offer a side salad bar 5 days per week. Thus, only "side salad bar offered" was included because it is almost as predictive of the outcome as the "number of days per week" variable (0.24 vs. 0.27), and because there is not sufficient variation in the "number of days per week" variable.
- "Average number of vegetable options offered per day" is also a good predictor (correlation with outcome is 0.22), and its correlation with the above variables is not high, so it was included.

5. Dark Green and Orange Vegetable Servings

- 100% of schools follow the policy "any salad offered" and only 5% of schools follow the policy "dark green and orange vegetables offered daily" (and the correlation of this variable with the outcome is in an unexpected direction), so these variables were not included.

- "Number of days per week that dark green and orange vegetables are offered" and "average number of dark green and orange vegetable options offered per day" are highly correlated (0.92), so both could not be included. The first of these two variables was included because it is more correlated with the outcome (0.59 vs. 0.52). The following variables were not included because their correlations with the outcome were not larger than 0.59: "dark green and orange vegetable options offered at least 1 day per week" and "dark green and orange vegetable options offered at least 2 days per week."

D. Breakfast for Secondary Schools

This section presents exploratory analyses of policies/practices in secondary schools potentially related to foods and nutrients in breakfasts served. The results discussed in this section are shown in Tables A.1 and A.2.

1. Calcium

- Only 2% of secondary schools follow the policy "alternative non-milk beverage not offered," so this variable was not included.
- "Flavored milk offered" was included because it had a correlation with the outcome of 0.10 and there was not much variation in the "number of days per week that flavored milk is offered" variable.
- "Cold cereals offered" is not a very strong predictor (correlation with outcome is 0.06). However, "offer unsweetened cold cereal at least 1x per week" has a negative correlation with the outcome (-0.03), so we decided to include only "cold cereals offered" instead.
- "100% fruit juice offered" is true in 97% of schools, so this variable was not included.

2. Saturated Fat

- "Fat-free milk offered," "only low-fat or fat-free milk offered," and "whole milk not offered" are all good predictors (correlations with outcome are -0.14, -0.23, and -0.34, respectively). The correlation between the first and second is -0.22, between the first and third is 0.06, and between the second and third is 0.41, so both the second and third were included, as they had higher correlations with calcium served.
- "Sausage or other high-fat meat not offered" and "pizza not offered" are both good predictors (correlations with outcome are -0.20 and -0.18, respectively), and are not highly correlated with each other or with the milk variables, so both were included.
- "Average number of high saturated fat entrees offered per day" and "number of high saturated fat entrees offered per week" are both good predictors (correlations with outcome are both 0.47), but highly correlated with each other (0.99), so only "number of high saturated fat entrees offered per week" was included.

- "High saturated fat entrée not offered" and "high saturated fat condiments not offered" were both included (correlations with outcome are -0.18 and -0.13, respectively). These variables are not highly correlated with the other included variables, with the exception of the correlation between "high saturated fat entrée not offered" and "sausage or other high-fat meat not offered" (correlation is 0.49).
- "High saturated fat breakfast sandwich not offered" was included (correlation with outcome is -0.31).

3. Fruit Servings (Excluding Juice)

The following five variables are all good predictors, but most are highly correlated with each other (see Table A.4 below for selected correlations): "average number of types of fruit offered per day," "fresh fruit offered," "number days per week that fresh fruit is offered," "fresh fruit offered daily," and "average number of types of fresh fruit offered per day." "Fresh fruit offered" was included because it has the highest correlation with the outcome (0.55), and "fresh fruit offered daily" was included because it is somewhat correlated with the outcome (0.28) and not too highly correlated with "fresh fruit offered" (0.50).

E. Results from Stepwise Regressions

Stepwise regressions drop variables that contribute little to the fit (R^2 statistic) of the model, in order of their contribution to the R^2, until a specified threshold is reached. Based on the results from step-wise regressions, some additional variables were excluded from the meals-served models. This section provides reasons for these decisions.

Table A.4 Correlations for selected "fresh fruit" policy/practice variables—Breakfast

Policy/practice variable (correlation with outcome in parentheses)	Average Number of Types of Fruit Offered Per Day	Fresh Fruit Offered	Number Days Per Week That Fresh Fruit Is Offered	Fresh Fruit Offered Daily	Average Number of Types of Fresh Fruit Offered Per Day
Average number of types of fruit offered per day (0.20)	1.00				
Fresh fruit offered (0.55)	0.39	1.00			
Number days per week that fresh fruit is offered (0.51)	0.58	0.80	1.00		
Fresh fruit offered daily (0.28)	0.59	0.50	0.82	1.00	
Average number of types of fresh fruit offered per day (0.41)	0.71	0.64	0.89	0.83	1.00

Source: SNDA-III Public Use File.

1. Lunch for Elementary Schools

The following variables are not significant in the model for the outcome they are expected to affect, but are significant in the model for some other outcome. However, in each of these cases, no good theoretical reason exists for why these variables should enter the models of outcomes they are not expected to affect. The fact that these variables are statistically significant suggests that they are proxying for other unobserved factors, and that the resulting estimates of their effects on the outcomes are biased. Therefore, these variables were not included in the meals-served models.

- "Whole milk not offered" is not significant in the model for saturated fat served, but is significant in the models for vegetable servings and dark green and orange vegetable servings, with a negative coefficient in both models.
- "Yogurt (low-fat or fat-free) offered as meat alternate" is not significant in the model for saturated fat, but is significant in the models for fruit servings and vegetable servings, with a negative coefficient in both models.

2. Breakfast for Elementary Schools

The following variables are not significant in any of the stepwise regressions, so they were not included in the meals-served models: "percent of weekly entrees that are high saturated fat," "pizza not offered," and "yogurt offered as meat alternate."

3. Lunch for Secondary Schools

"No high saturated fat condiments or spreads offered" is not significant in the model for saturated fat, but is significant in the models for fruit servings (with a negative coefficient) and dark green and orange vegetable servings (with a positive coefficient). However, there is no apparent theoretical reason for why this variable should have a negative effect on fruit servings or a positive effect on dark green and orange vegetable servings, so it was not included in the meals-served models.

4. Breakfast for Secondary Schools

The following variables are not significant in the model for the outcome they are expected to affect, but are significant in the model for some other outcome. However, in neither case is there a good theoretical reason for why the variable should enter the model of an outcome it is not expected to affect, so neither of these variables was included in the meals-served models.

- "Average number of flavored milk choices offered per day" is not significant in the model for calcium, but is significant in the model for fruit servings, with a positive coefficient.
- "Pizza not offered" is not significant in the model for saturated fat, but is significant in the model for fruit servings, with a positive coefficient.

F. Results of Exploratory Analyses to Select School Food Environment Variables

This section describes the results of exploratory analyses to select school food environment variables for inclusion in the participation and meals consumed models. School food environment variables were selected using the same methods used to select meals offered variables: looking at the prevalence of policies/practices in the SNDA-III data, examining correlations between policy/practice variables in the same domain, and examining correlations between each policy/practice variable and the related outcome(s). Because lunch and breakfast indicators were analyzed separately, this resulted in some differences between variables used for lunch and breakfast models. Table A.5 shows the percentage of schools that follow each policy or practice. Tables A.6 and A.7 show the correlations of school food environment variables with the participation and meals consumed outcomes, for lunch and breakfast, respectively. We do not present full correlation matrices showing the correlations between policy/practice variables in the same domain because they are large and cumbersome to display

TABLE A.5 POTENTIAL SCHOOL FOOD ENVIRONMENT VARIABLES: PERCENT OF SCHOOLS THAT FOLLOW THE POLICY/PRACTICE

Policy/Practice Variables	Percent of elementary schools who follow the policy (or range: min, max)	Percent of secondary schools who follow the policy (or range: min, max)
Foodservice Environment		
District in DOD Fresh or farm-to-school program	50.5%	63.7%
District includes nutrient requirements in vendor specifications	59.2%	69.6%
District includes limits on total fat or saturated fat in vendor specifications	54.6%	62.6%
District includes requirements for protein, vitamin A and C, calcium, and iron in vendor specifications	17.0%	19.3%
School does not use OVS (elementary and middle only)	10.1%	1.1%
School has on-site or base kitchen	66.7%	73.7%
District menu planner has RD, is a licensed nutrionist, or has nutrition MS	47.4%	52.5%
No foods offered from national chains	75.5%	71.4%
Food service nutrition composite variable	0,6	0,6
Earliest lunch per starts no earlier than 11am	64.0%	57.4%
Last lunch period starts no later than 12:30pm	74.4%	64.4%
Lunch per duration > 20 minutes	85.9%	96.4%
Price of meal (interacted with eligibility at student level)	0,2.25	0,3
Full price of meal	0,2.25	0,3
Cashier identifies free/reduced students via PIN number or electronic card	75.0%	85.3%
School Health/Nutrition Policies		
Nutrition education offered in every grade	73.7%	47.8%
School has nutrition or health advisory council	23.0%	23.0%
School makes available nutrition information about menus	64.2%	61.1%
School has recess before lunch (elementary only)	25.0%	N/A
No open-campus policy	90.3%	84.8%
Nutrition information composite variable	0,3	0,3
Vending Machines		
Healthy foods offered in vending machines, snack bar, or school store	22.2%	85.0%
Has vending machines, but not available during mealtimes	14.9%	39.0%
Has vending machines, but not available during the school day	10.3%	26.1%
Has vending machines, but not in or near food service area (within 20 feet)	13.1%	43.0%
Has vending machines, but not in building, only outside on school grounds	3.0%	5.4%
Has vending, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	21.1%	35.2%
Has vending, but no sugar sweetened beverages (SSBs) are sold	9.5%	10.4%
No vending machines	75.5%	7.6%
No beverage machines	81.0%	14.0%

Policy/Practice Variables	Percent of elementary schools who follow the policy (or range: min, max)	Percent of secondary schools who follow the policy (or range: min, max)
No snack machines	97.4%	41.7%
Number of vending machines is low	93.0%	66.1%
No pouring rights contract	45.9%	26.0%
Vending machine availability restricted (*vend_comp1*)	0,3	0,5
Vending machine offerings restricted (*vend_comp2*)	0,4	0,5
Vend_comp3 (sum of *vend_comp1* and *vend_comp2*)	0,6	1,7
A La Carte Options		
No a la carte items sold, except low fat milk	31.6%	9.7%
Healthy foods offered a la carte	66.7%	87.1%
Has a la carte, and fruits and/or vegetables (except fries) are sold	23.2%	59.1%
Has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	29.3%	9.7%
Has a la carte, but no French fries are sold	55.6%	40.3%
Has a la carte, but no fast-food-type entrees are sold	48.5%	24.7%
Has a la carte, but no entrees are sold	44.9%	16.2%
Has a la carte, but no sweetened beverages (SSBs) are sold	47.5%	22.0%
A la carte composite variable	0,5	0,4
School Store or Snack Bar or Other		
Number of days per week school store or snack bar open (define another var for limited later)	0,5	0,5
Has school store or snack bar, but it is not open during lunch/breakfast period	4.5%	10.1%
Has school store or snack bar, but it is not open during school hours	1.3%	5.9%
No school store or snack bars selling food	93.9%	68.7%
No food-based fundraising activities	50.0%	32.6%
Other sources of food composite variable	0,3	0,3

Source: SNDA-III Public Use File.

TABLE A.6 POTENTIAL SCHOOL FOOD ENVIRONMENT VARIABLES: CORRELATIONS WITH LUNCH OUTCOMES

Policy/Practice Variables	Correlation with participation: elementary students	Correlation with participation: secondary students	Correlation with calcium consumed: secondary students	Correlation with saturated fat consumed: elementary students	Correlation with saturated fat consumed: secondary students	Correlation with fruit consumed: elementary students	Correlation with fruit consumed: secondary students	Correlation with vegetables consumed: elementary students	Correlation with vegetables consumed: secondary students	Correlation with dark green and orange vegetables consumed: elementary students	Correlation with dark green and orange vegetables consumed: secondary students
Foodservice Environment											
District in DOD Fresh or farm-to-school program	0	-0.03	0.03	0.01	-0.07	0.05	0.03	0.08	0.01	-0.01	0.02
District includes nutrient requirements in vendor specifications	**0.16**	0.04	**-0.11**	-0.01	-0.02	-0.06	0.01	**0.15**	-0.08	0.00	-0.05
District includes limits on total fat or saturated fat in vendor specifications	**0.11**	0.03	**-0.10**	-0.03	-0.02	-0.06	0.01	**0.16**	-0.05	0.00	-0.03
District includes requirements for protein, vitamin A and C, calcium, and iron in vendor specifications	0.04	0.03	-0.05	0.00	0.02	-0.04	-0.07	0.04	-0.06	-0.02	-0.05
School does not use OVS (elementary and middle only)	**-0.16**	0.01	0.01	-0.02	0.00	0.08	-0.01	-0.09	-0.02	0.02	-0.01
School has on-site or base kitchen	0.06	**0.14**	-0.03	0.01	0.01	-0.03	0.03	0.08	0.00	0.03	-0.02
District menu planner has RD, is a licensed nutrionist, or has nutrition MS	0.1	-0.01	-0.02	-0.09	-0.02	0.04	-0.05	0.01	-0.04	0.00	-0.01
No foods offered from national chains	-0.02	**0.11**	-0.02	0.05	0.03	**0.10**	-0.06	0.00	-0.04	0.01	0.00
Food service nutrition composite variable	**0.11**	0.07	-0.09	-0.03	-0.03	0.01	-0.04	**0.14**	-0.09	0.00	-0.03
Earliest lunch per starts no earlier than 11am	**-0.17**	0.05	0.02	0.01	0.00	-0.06	0.02	**-0.13**	0.03	0.01	0.05
Last lunch period starts no later than 12:30pm	0.02	-0.06	-0.02	-0.05	0.01	0.00	0.00	-0.05	0.00	-0.08	0.00
Lunch per duration > 20 minutes	0.02	0.09	-0.03	**0.12**	0.03	-0.01	-0.06	-0.08	0.03	0.05	-0.03
Price of meal (interacted with eligibility at student level)	-0.3	-0.2	-0.04	-0.07	-0.03	-0.03	0.08	-0.05	0.00	-0.02	0.01
Full price of meal	**-0.14**	**-0.12**	0.02	-0.01	0.00	0.08	0.07	-0.06	0.04	0.00	0.05
Cashier identifies free/reduced students via PIN number or electronic card	0.09	0.1	-0.03	-0.01	0.02	0.02	-0.07	**0.10**	-0.01	0.06	-0.01
School Health/Nutrition Policies											
Nutrition education offered in every grade	-0.02	0.09	0.02	-0.02	0.00	-0.04	0.05	0.05	0.03	-0.02	0.03
School has nutrition or health advisory council	-0.06	-0.03	0.00	0.06	0.04	0.05	0.02	-0.03	0.06	-0.04	0.02
School makes available nutrition information about menus	0.09	-0.05	-0.02	-0.07	0.00	-0.09	-0.06	0.04	-0.03	-0.03	-0.02
School has recess before lunch (elementary only)	-0.07	N/A	N/A	-0.06	N/A	-0.07	N/A	0.02	N/A	**-0.10**	N/A
No open-campus policy	0.06	**0.16**	0.03	0.08	0.04	0.00	-0.05	-0.05	-0.01	-0.02	0.00
Nutrition information composite variable	0.01	0	-0.01	-0.01	0.02	-0.04	0.01	0.04	0.03	-0.04	0.02
Vending Machines											
Healthy foods offered in vending machines, snack bar, or school store	0.00	-0.06	-0.05	-0.06	-0.03	-0.05	0.00	0.03	-0.01	0.02	0.00
Has vending machines, but not available during mealtimes	-0.04	**0.11**	0.02	-0.02	0.01	0.07	-0.07	0.03	-0.03	-0.06	0.02
Has vending machines, but not available during the school day	-0.07	**0.13**	0.08	0.01	0.02	0.03	0.02	-0.05	0.04	-0.07	0.02
Has vending machines, but not in or near food service area (within 20 feet)	-0.03	-0.03	-0.05	-0.07	-0.03	0.05	-0.08	0.05	-0.01	0.01	0.01
Has vending machines, but not in building, only outside on school grounds	0.08	**-0.10**	**-0.10**	0.01	-0.02	0.05	-0.05	**0.11**	-0.06	0.01	-0.06
Has vending, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	0.03	0.06	0.06	-0.06	-0.01	-0.03	-0.03	0.02	-0.07	-0.02	0.01
Has vending, but no sugar sweetened beverages (SSBs) are sold	-0.03	0.00	0.00	-0.01	-0.05	0.07	0.02	-0.02	0.03	-0.06	0.01
No vending machines	0.00	-0.03	-0.04	0.05	-0.03	-0.01	0.03	0.00	-0.04	0.02	0.02
No beverage machines	-0.02	-0.04	-0.05	0.04	-0.03	-0.01	0.01	-0.04	-0.02	-0.03	0.01
No snack machines	0.00	0.01	0.04	0.00	-0.03	0.04	-0.02	0.07	-0.07	-0.01	0.01
Number of vending machines is low	-0.02	**0.13**	0.07	0.03	-0.02	0.02	0.06	-0.07	0.00	0.01	0.03

Policy/Practice Variables	Correlation with participation: elementary students	Correlation with participation: secondary students	Correlation with calcium consumed: secondary students	Correlation with saturated fat consumed: elementary students	Correlation with saturated fat consumed: secondary students	Correlation with fruit consumed: elementary students	Correlation with fruit consumed: secondary students	Correlation with vegetables consumed: elementary students	Correlation with vegetables consumed: secondary students	Correlation with dark green and orange vegetables consumed: elementary students	Correlation with dark green and orange vegetables consumed: secondary students
No pouring rights contract	**-0.10**	-0.07	0.01	0.03	-0.04	0.04	0.01	-0.03	-0.03	-0.05	0.03
Vending machine availability restricted (*vend_comp1*)	-0.04	0.10	0.02	-0.03	-0.01	0.07	-0.04	0.03	-0.02	-0.04	0.02
Vending machine offerings restricted (*vend_comp2*)	**-0.11**	-0.06	-0.02	0.02	-0.06	0.05	0.00	-0.01	-0.06	-0.07	0.03
Vend_comp3 (sum of *vend_comp1* and *vend_comp2*)	-0.06	0.05	0.01	-0.03	-0.05	0.06	-0.04	0.01	-0.02	-0.05	0.02
A La Carte Options											
No a la carte items sold, except low fat milk	0.03	0.01	0.00	**0.10**	0.02	**0.10**	-0.02	0.01	0.02	0.00	0.02
Healthy foods offered a la carte	**-0.11**	-0.02	0.00	-0.07	0.01	-0.04	0.00	0.05	-0.03	0.02	-0.02
Has a la carte, and fruits and/or vegetables (except fries) are sold	-0.04	-0.07	0.01	0.01	0.03	0.00	-0.02	0.01	0.00	-0.04	-0.04
Has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	0.02	0.03	-0.01	**-0.16**	0.04	-0.04	0.02	-0.01	0.06	0.07	0.00
Has a la carte, but no French fries are sold	-0.02	0.08	0.00	-0.08	0.01	**-0.11**	-0.01	0.00	0.03	0.05	0.04
Has a la carte, but no fast-food-type entrees are sold	-0.04	**0.17**	0.06	**-0.10**	0.04	-0.06	0.07	-0.03	**0.14**	0.06	**0.10**
Has a la carte, but no entrees are sold	-0.01	**0.15**	0.04	-0.09	-0.01	-0.05	0.05	-0.02	**0.10**	0.06	0.07
Has a la carte, but no sweetened beverages (SSBs) are sold	-0.02	**0.18**	0.06	**-0.14**	0.03	-0.06	0.04	**-0.13**	0.01	-0.03	-0.01
A la carte composite variable	-0.03	**0.15**	0.05	**-0.15**	0.06	-0.08	0.04	-0.05	0.09	0.04	0.04
School Store or Snack Bar or Other											
Number of days per week school store or snack bar open (define another var for limited later)	0.05	-0.07	-0.04	0.00	0.01	-0.01	0.00	**0.13**	0.01	**0.12**	-0.02
Has school store or snack bar, but it is not open during lunch/breakfast period	N/A	0.04	-0.05	N/A	-0.02	N/A	-0.04	N/A	0.00	N/A	0.02
Has school store or snack bar, but it is not open during school hours	-0.02	0.04	-0.01	-0.03	-0.04	-0.01	-0.05	0.07	-0.01	**0.19**	0.02
No school store or snack bars selling food	-0.06	**0.10**	0.08	0.00	0.02	0.00	0.03	**-0.20**	0.02	**-0.12**	0.05
No food-based fundraising activities	-0.08	0.04	-0.03	-0.01	-0.07	0.00	-0.07	-0.05	0.01	-0.02	-0.03
Other sources of food composite variable	**-0.10**	**0.14**	0.02	0.03	-0.01	0.04	-0.04	**-0.13**	0.00	-0.08	0.01

Source: SNDA-III Public Use File.

Note: Correlations greater than or equal to 0.10 are in bold.

TABLE A.7 POTENTIAL SCHOOL FOOD ENVIRONMENT VARIABLES: CORRELATIONS WITH BREAKFAST OUTCOMES

Policy/Practice Variables	Correlation with participation: elementary students	Correlation with participation: secondary students	Correlation with calcium consumed: secondary students	Correlation with saturated fat consumed: elementary students	Correlation with saturated fat consumed: secondary students	Correlation with fruit consumed: elementary students	Correlation with fruit consumed: secondary students	Correlation with added sugars consumed: elementary students	Correlation with added sugars consumed: secondary students
Foodservice Environment									
District in DOD Fresh or farm-to-school program	0.07	-0.07	**-0.10**	0.04	0.01	0.01	0.07	**-0.11**	-0.06
District includes nutrient requirements in vendor specifications	0.06	-0.01	0.00	0.08	-0.05	-0.06	0.02	-0.04	-0.02
District includes limits on total fat or saturated fat in vendor specifications	-0.01	-0.01	0.00	0.07	-0.09	-0.06	0.02	-0.03	0.00
District includes requirements for protein, vitamin A and C, calcium, and iron in vendor specifications	**0.14**	0.00	0.01	-0.06	-0.01	-0.01	-0.01	-0.03	-0.04
School does not use OVS (elementary and middle only)	**-0.11**	-0.04	0.06	-0.09	-0.01	0.05	0.01	0.09	-0.01
School has on-site or base kitchen	0.03	0.03	0.04	0.07	-0.04	0.02	-0.01	0.08	0.04
District menu planner has RD, is a licensed nutrionist, or has nutrition MS	0.05	-0.02	-0.09	0.06	0.03	0.00	-0.03	-0.08	0.02
No foods offered from national chains	0.01	0.04	-0.01	-0.01	-0.03	-0.05	-0.03	-0.01	0.01
Food service nutrition composite variable	0.07	-0.02	-0.06	0.07	-0.05	-0.05	0.02	-0.09	-0.03
Earliest lunch per starts no earlier than 11am	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Last lunch period starts no later than 12:30pm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lunch per duration > 20 minutes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Price of meal (interacted with eligibility at student level)	**-0.11**	**-0.13**	0.05	-0.08	**-0.10**	0.08	0.08	0.04	**0.12**
Full price of meal	**-0.27**	**-0.18**	0.05	-0.07	0.00	**0.16**	**0.10**	0.04	0.03
Cashier identifies free/reduced students via PIN number or electronic card	0.02	0.07	-0.02	0.05	0.02	-0.01	-0.06	-0.07	**-0.10**
School Health/Nutrition Policies									
Nutrition education offered in every grade	-0.06	0.03	-0.01	**0.10**	0.04	-0.05	0.01	0.00	-0.02
School has nutrition or health advisory council	-0.01	0.01	-0.02	0.02	-0.09	0.03	0.09	-0.02	0.01
School makes available nutrition information about menus	-0.06	-0.02	**-0.11**	**0.12**	0.08	-0.01	-0.03	-0.05	-0.04
School has recess before lunch (elementary only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
No open-campus policy	0.09	0.05	-0.05	0.03	0.06	0.03	-0.08	-0.05	0.00
Nutrition information composite variable	-0.07	0.00	-0.07	**0.13**	0.02	0.00	0.03	-0.04	-0.04
Vending Machines									
Healthy foods offered in vending machines, snack bar, or school store	-0.03	-0.02	-0.02	0.04	-0.07	-0.05	0.04	0.05	0.04
Has vending machines, but not available during mealtimes	-0.06	0.02	**0.10**	-0.07	-0.03	0.08	-0.02	0.08	-0.01
Has vending machines, but not available during the school day	-0.05	0.02	**0.10**	**-0.10**	-0.02	0.08	0.01	0.09	-0.03
Has vending machines, but not in or near food service area (within 20 feet)	-0.06	-0.01	**0.14**	-0.05	-0.04	0.08	0.01	0.08	0.00
Has vending machines, but not in building, only outside on school grounds	0.06	-0.03	-0.04	0.00	-0.03	0.01	0.09	0.01	-0.01
Has vending, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	0.03	-0.01	0.07	-0.03	-0.04	0.03	0.00	0.07	-0.08
Has vending, but no sugar sweetened beverages (SSBs) are sold	0.00	0.02	**0.12**	-0.06	0.07	**0.10**	-0.01	0.05	-0.06
No vending machines	0.00	-0.04	-0.04	-0.03	0.02	-0.02	0.04	-0.02	0.01
No beverage machines	0.00	-0.03	0.00	-0.05	0.00	0.03	0.02	0.06	-0.02
No snack machines	-0.02	-0.03	-0.01	**-0.13**	-0.04	0.03	0.01	0.09	-0.07
Number of vending machines is low	0.07	0.00	0.01	-0.07	0.03	0.04	-0.01	-0.05	-0.03

Policy/Practice Variables	Correlation with participation: elementary students	Correlation with participation: secondary students	Correlation with calcium consumed: secondary students	Correlation with saturated fat consumed: elementary students	Correlation with saturated fat consumed: secondary students	Correlation with fruit consumed: elementary students	Correlation with fruit consumed: secondary students	Correlation with added sugars consumed: elementary students	Correlation with added sugars consumed: secondary students
No pouring rights contract	0.03	−0.03	−0.05	−0.01	0.05	−0.05	0.00	−0.02	0.02
Vending machine availability restricted (*vend_comp1*)	−0.05	0.01	**0.11**	−0.08	−0.03	0.08	0.01	0.09	−0.03
Vending machine offerings restricted (*vend_comp2*)	−0.04	−0.03	0.00	−0.07	−0.01	0.01	0.02	0.07	−0.02
Vend_comp3 (sum of *vend_comp1* and *vend_comp2*)	−0.03	0.01	0.06	−0.03	−0.02	0.04	0.01	0.06	−0.02
A La Carte Options									
No a la carte items sold, except low fat milk	**0.16**	0.07	0.01	0.00	0.01	−0.02	−0.05	0.00	−0.03
Healthy foods offered a la carte	**−0.20**	−0.06	0.05	−0.05	0.01	0.04	0.03	0.04	−0.01
Has a la carte, and fruits and/or vegetables (except fries) are sold	**−0.13**	−0.08	0.06	**−0.10**	0.01	**0.10**	0.06	0.05	−0.03
Has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold	−0.08	−0.02	−0.06	0.01	0.06	−0.03	−0.03	−0.03	0.06
Has a la carte, but no French fries are sold	**−0.11**	−0.02	−0.01	0.05	0.04	0.00	0.00	−0.03	−0.04
Has a la carte, but no fast-food-type entrees are sold	**−0.11**	0.01	−0.04	0.06	−0.04	−0.05	−0.03	−0.05	0.06
Has a la carte, but no entrees are sold	−0.09	0.02	−0.06	**0.11**	0.01	−0.05	−0.03	−0.07	0.06
Has a la carte, but no sweetened beverages (SSBs) are sold	−0.08	0.04	0.03	−0.03	−0.01	0.06	−0.05	−0.02	0.06
A la carte composite variable	**−0.15**	−0.03	0.00	0.00	0.01	0.02	−0.01	−0.02	0.03
School Store or Snack Bar or Other									
Number of days per week school store or snack bar open (define another var for limited later)	−0.04	0.05	0.01	0.01	0.01	−0.06	0.08	0.08	−0.02
Has school store or snack bar, but it is not open during lunch/breakfast period	0.08	0.01	0.00	0.02	0.04	−0.05	−0.04	0.09	−0.03
Has school store or snack bar, but it is not open during school hours	N/A	0.04	0.02	N/A	0.02	N/A	−0.04	N/A	−0.03
No school store or snack bars selling food	N/A	0.09	−0.01	0.01	0.02	0.05	−0.09	−0.05	0.03
No food-based fundraising activities	−0.03	0.09	−0.07	**−0.12**	0.01	−0.02	−0.05	−0.04	−0.01
Other sources of food composite variable	−0.01	0.05	−0.07	−0.07	0.05	0.03	**−0.12**	−0.08	0.01

Source: SNDA-III Public Use File.

Note: Correlations greater than or equal to 0.10 are in bold.

1. Lunch for Elementary School Students

Below is a list of the school environment variables that have a correlation of larger than +/-0.10 with at least one outcome (either participation, or one of the meals-consumed outcomes). Some of these variables were not included in the models even though they have correlations greater than +/-0.10; in each of these cases, reasons for why the variable was excluded are provided in parentheses. The results discussed in this section are shown in Tables A.5 and A.6.

- District includes nutrient requirements in vendor specifications
- District includes limits on total fat or saturated fat in vendor specifications (Excluded: This variable is highly correlated with the previous variable (0.91) and has a smaller correlation with participation than the previous variable.)
- School does not use OVS (This variable was used as an instrumental variable; see Chapter V.)
- No foods offered from national chains
- Food service nutrition composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has a smaller correlation with certain outcomes (participation and vegetables consumed) than one of the variables included in the composite: "district includes nutrient requirements in vendor specifications.")
- Earliest lunch per starts no earlier than 11am (Excluded: This variable has negative correlations with participation and vegetables consumed, which may just reflect school size or age of students.)
- Lunch period duration > 20 minutes (Excluded: This variable is positively correlated with saturated fat consumption, and 86% of elementary schools follow this policy.)
- School has recess before lunch
- Has vending machines, but not in building, only outside on school grounds (Excluded: Only 3% of elementary schools follow this policy.)
- No pouring rights contract
- No a la carte items sold, except low fat milk
- Healthy foods offered a la carte[2]

[2] Healthy foods are defined as: (1) water (including spring water, flavored water, mineral water, seltzer water, water with juices, sparkling water with juices), (2) milk (low fat and fat free), (3) vegetables (excluding fried potatoes, vegetable soup, and entrée salads), and (4) fruits (including canned, cooked, fresh, fruit salad, and dried), but not in desserts. This definition was based on the Tier 1 definition from the IOM Panel Phase I report (2009a).

- Has a la carte, but no "unhealthy" foods are sold[3]
- Has a la carte, but no French fries are sold (Excluded: This variable is negatively correlated with fruit consumed and highly correlated with the next variable (0.82).)
- Has a la carte, but no fast-food-type entrees are sold
- Has a la carte, but no sweetened beverages (SSBs) are sold
- A la carte composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has a smaller correlation with saturated fat consumed than one of the variables included in the composite: "has a la carte, but no candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, high-fat frozen desserts are sold.")
- Number of days per week school store or snack bar is open and selling food
- Has a school store or snack bar, but it is not open during school hours (Excluded: Only 1.3% of elementary schools follow this policy.)
- No school store or snack bar selling food (Excluded: 94% of elementary schools follow this policy.)
- Other sources of food composite variable (None of the other variables which make up this composite have correlations larger than +/-0.10 with any of the outcomes. However, this variable was dropped to make the lunch model for elementary students consistent with the lunch model for secondary students—see below.)

2. Breakfast for Elementary School Students

The following school environment variables have a correlation of larger than +/-0.10 with at least one outcome (either participation, or one of the meals-consumed outcomes). Reasons for excluding some of these variables are provided in parentheses. The results discussed in this section are shown in Tables A.5 and A.7.

- District in DOD Fresh or farm-to-school program
- District includes requirements for protein, vitamin A and C, calcium, and iron in vendor specifications
- School does not use OVS (This variable was used as an instrumental variable; see Chapter V.)
- Nutrition education offered in every grade

[3] "Unhealthy" foods include candy, pastries, high-fat chips, high-fat cookies, high-fat cake-type desserts, and high-fat frozen desserts.

- School makes available nutrition information about menus
- Nutrition information composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has a correlation with saturated fat consumed that is similar in size to the correlations of the previous two variables with saturated fat consumed.)
- Has vending machines, but not available during the school day
- Has vending machines, but no sugar sweetened beverages (SSBs) are sold
- No a la carte items sold, except low fat milk
- Healthy foods offered a la carte
- Has a la carte, and fruits and/or vegetables (except fries) are sold
- Has a la carte, but no French fries are sold (Excluded: French fries are not often served at breakfast.)
- Has a la carte, but no fast-food-type entrees are sold (Excluded: Fast-food-type entrees are not often served at breakfast.)
- Has a la carte, but no entrees are sold (Excluded: This variable is positively correlated with saturated fat consumption.)
- A la carte composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has smaller correlations with saturated fat consumed and fruit consumed than one of the variables included in the composite: "has a la carte, and fruits and/or vegetables (except fries) are sold.")
- No food-based fundraising activities

3. Lunch for Secondary School Students

The following school environment variables have a correlation of larger than +/-0.10 with at least one outcome (either participation, or one of the meals-consumed outcomes). Reasons for excluding some of these variables are provided in parentheses. The results discussed in this section are shown in Tables A.5 and A.6.

- District includes nutrient requirements in vendor specifications
- District includes limits on total fat or saturated fat in vendor specifications
- School has on-site or base kitchen
- No foods offered from national chains
- No open-campus policy

- Has vending machines, but not available during mealtimes
- Has vending machines, but not available during the school day
- Has vending machines, but not in building, only outside on school grounds (Excluded: Only 5% of secondary schools follow this policy.)
- Number of vending machines is low
- Has a la carte, but no fast-food-type entrees are sold
- Has a la carte, but no entrees are sold (Excluded: This variable is highly correlated with the previous variable (0.75) and has smaller correlations with participation, vegetables consumed, and dark green and orange vegetables consumed than the previous variable.)
- Has a la carte, but no sweetened beverages (SSBs) are sold
- A la carte composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has smaller correlations with participation, vegetables consumed, and dark green and orange vegetables consumed than one of the variables included in the composite: "has a la carte, but no fast-food-type entrees are sold.")
- Has school store or snack bar, but it is not open during lunch/breakfast period (Excluded: This variable is highly correlated with next two variables (correlations with the next two variables are 0.89 and 0.73, respectively), and has smaller correlations with meals-consumed outcomes than does the "no school store or snack bars selling food" variable.)
- Has school store or snack bar, but it is not open during school hours (Excluded: This variable is highly correlated with the next variable (0.82) and has smaller correlations with the meals-consumed outcomes than does the next variable.)
- No school store or snack bars selling food
- Other sources of food composite variable (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has a smaller correlation with participation than one of the variables included in the composite: "no open-campus policy," and has smaller correlations with the meals-consumed outcomes than another of the variables included in the composite: "no school store or snack bars selling food.")

4. Breakfast for Secondary School Students

The following school environment variables have a correlation of larger than +/-0.10 with at least one outcome (either participation, or one of the meals-consumed outcomes). Reasons for excluding some of these variables are provided in parentheses. The results discussed in this section are shown in Tables A.5 and A.7.

- District in DOD Fresh or farm-to-school program
- School makes available nutrition information about menus
- Has vending machines, but not available during mealtimes
- Has vending machines, but not available during the school day
- Has vending machines, not in or near food service area (within 20 feet)
- Has vending machines, but no sugar sweetened beverages (SSBs) are sold
- Vending machine availability restricted (Excluded: Composite variables cannot be included simultaneously with the variables which make up the composite. This composite variable has a smaller correlation with calcium consumed than two of the variables included in the composite: "has vending machines, not in or near food service area" and "no sugar sweetened beverages (SSBs) sold in vending machines.")
- Other sources of food composite variable (Excluded: None of the variables which make up this composite have correlations larger than +/-0.10 with any of the outcomes. This variable was dropped to make the breakfast model for secondary students consistent with the breakfast model for elementary students.)

G. Results of Exploratory Analyses to Select Policy and Practice Variables Designed to Affect Added Sugars

Added sugars were not modeled as a meals-served outcome, but were modeled as a meals-consumed outcome. This section describes the results of exploratory analyses used to select which of the variables that were designed to affect added sugars consumption to include in the meals-consumed model. The results discussed here are shown in Table A.2.

1. Breakfast for Elementary Schools

- When looking at participants only, the best predictors are "average number of types of hot cereal offered per day" and "number of days per week that hot cereal is offered," but they are highly correlated with each other (0.99). The first variable was included in the model, as it is more strongly correlated with the outcome.
- The next best predictor is "number of days per week that sweet rolls/pastries are offered." It is not highly correlated with "average number of types of hot cereal offered per day" (correlation between them is -0.19), so it was included.
- "Average number of types of sweetened cold cereals offered per day" and "number of days per week that sweetened cold cereals are offered" are also somewhat good predictors (correlations with the outcome are 0.15 and 0.19, respectively), but are highly correlated with each other (0.77). The second variable was included, as it is more strongly correlated with the outcome. It is also not highly correlated with the other two variables that were included (correlation with "average number of types of hot cereal

offered per day" is 0.23, and correlation with "number of days per week that sweet rolls/pastries are offered" is 0.08).

2. Breakfast for Secondary Schools

- "Average number of types of sweetened cold cereals offered per day" is the best predictor (correlation with outcome is 0.21), so it was included.
- "Flavored milk not offered" and "number of days per week that flavored milk is offered" are highly correlated with each other (-0.97). In fact, "flavored milk offered" was already chosen to be included, as it is expected to affect the calcium outcome, so there was no need to include either of these variables.
- "Average number of types of unsweetened cold cereals offered per day" and "number of days per week that unsweetened cold cereals are offered" are highly correlated with each other (0.83). The second variable was included, as it is more strongly correlated with the outcome among participants (correlations with the outcome among participants are -0.10 and -0.14, respectively). Furthermore, this variable is not highly correlated with either "flavored milk offered" or "average number of types of sweetened cold cereals offered per day".

H. Further Refinements

Principal components analysis was used to explore potential indices of the remaining policy/practice variables expected to affect the percentage of energy from saturated fat served. Principal components analysis is an approach used to reduce the dimensionality of a set of related variables using orthogonal linear combinations of the variables. These "principal components" sometimes can be interpreted as indices of particular tendencies in the data. On average, the first principal component explained about 25% of the variation in the input variables, and the first 3-4 principal components explained about 55-77% of the variation. No additional policy or practice variables were excluded based on the principal components analysis, in part because the first principal component in these analyses tended to place similar weight on all the variables, thus not clearly indicating groups of variables that might be combined. Instead, a single variable was chosen for each meal (breakfast and lunch) to capture the information regarding high saturated fat entrees offered at that meal. The choice of these variables was based on the extent to which they varied across schools (variables with little or no variation will not perform well in the model) and on the

correlations of these variables with saturated fat served and consumed. For lunch, the "percentage of weekly entrees that are high in saturated fat" variable was included in the models, and for breakfast, the "number of days per week that high saturated fat entrees are offered" variable was included.

The set of meals offered variables was further refined to be more consistent for elementary and secondary schools, so that similar policies might be simulated for both kinds of schools. However, one exception was the variable for the frequency with which French fries are offered. For elementary schools, "French fries or similar potato products not offered" was included, and for secondary schools, the "number of days per week that French fries or similar potato products are offered" was included for reasons reflecting the variation in these variables across the school week (elementary schools were much less likely to serve French fries 3 or more times per week than secondary schools) and the correlations of these variables with the targeted outcomes (number of discrete vegetable servings and MPEs of vegetables consumed).

APPENDIX B

REGRESSION RESULTS FOR BASELINE MODELS AND SENSITIVITY ANALYSES

Table B.1 Meals Served Regression Results: Lunch for Elementary Schools

	Percent of Calories from Saturated Fat				Fluid Milk Servings				Fruit Servings				Vegetable Servings				Dark Green and Orange Vegetable Servings			
	Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
INTERCEPT	9.17	**	9.34	**	0.96	**	1.07	**	0.77	**	0.89	**	0.07		0.23		−0.03		0.07	
SCHL_SIZE2	−0.14		−0.12		0.04		0.06	*	0.03		0.05		−0.02		0.01		0.01		0.03	
SCHL_SIZE3	−0.79		−0.87		0.02		0.04		−0.08		−0.08		−0.17		−0.15		−0.06		−0.03	
POV2	0.28		0.33		0.00		0.01		0.07		0.08		0.19	**	0.22	**	0.04		0.05	*
POV3	−0.52		−0.48		0.00		0.02		0.14		0.17		0.15		0.18	*	0.06		0.08	*
REG_MT	−1.58	**	−1.53	**	0.06		0.07	*	0.44	**	0.45	**	0.14		0.13		−0.04		−0.05	
REG_MW	−0.69		−0.65		0.00		−0.02		0.24	**	0.23	**	0.04		0.03		−0.02		−0.03	
REG_NE	−0.42		−0.82	*	0.07		0.03		0.22	**	0.14		−0.12		−0.25	*	−0.02		−0.05	
REG_SE	−0.84	*	−0.80	*	−0.01		−0.02		0.19	**	0.19	*	0.08		0.06		0.03		0.01	
REG_SW	−0.79		−0.83	*	0.01		0.00		0.14		0.12		0.18		0.16		0.02		0.01	
REG_WS	−1.11	*	−1.25	*	−0.03		−0.05		0.13		0.09		−0.28	*	−0.35	**	−0.13	**	−0.16	**
URB0405_2	0.67	*	0.66	*	0.04		0.05	*	−0.01		0.00		0.09		0.09		0.02		0.03	
URB0405_3	0.66	*	0.56		0.00		0.00		0.04		0.04		0.21	**	0.20	**	0.02		0.02	
ONLYSKIM1PER_OFFERED	−0.46		−0.52	*	0.01		0.00		0.04		0.03		0.00		−0.02		0.01		0.00	
WHOLE_MILK_NOT_OFFERED	0.14		0.10		−0.01		−0.01		−0.08		−0.09		−0.07		−0.07		0.00		0.00	
PCT_ENTREES_HIGHSATFAT	0.02		0.02	**	0.00		0.00		0.00	**	0.00	**	0.00		0.00		0.00		0.00	
JUICE_NOT_OFFERED	−0.24	**	−0.20		0.05	**	0.05	**	0.17	**	0.17	**	0.26	**	0.27	**	0.05	**	0.05	*
FRESH_FRUIT_DAYSPERWK_OFFER	0.06		0.11		−0.01	*	−0.01	*	0.01		0.02		−0.05	**	−0.03		−0.01		−0.01	
SIDE_SALAD_BAR_OFFERED	−0.61		−0.50		0.05		0.04		−0.28	**	−0.27	**	0.61	**	0.63	**	0.02		0.01	
AVG_VEG_PERDAY	−0.06		−0.16		−0.02	*	−0.02	*	−0.02		−0.03		0.02		0.00		−0.10	**	−0.09	**
RAW_VEGGIES_OFFERED	0.36		0.33		−0.11	*	−0.14	*	−0.05		−0.07		0.35	**	0.32	**	0.11	**	0.09	*
DARKVEG_DAYSPERWK_OFFER	−0.03		0.01		0.02	*	0.02	*	0.01		0.01		0.03		0.04		0.09	**	0.09	**
FRENCHFRIES_NOT_OFFERED	0.03		0.17		0.02		0.02		0.03		0.05		0.07		0.09		0.05	*	0.04	*
SELF_SERVE_DRESS_NOT_OFF	−0.06		−0.11		0.02		0.01		0.03		0.03		−0.09		−0.10		−0.08	**	−0.08	**
HIGH_SATFAT_CONDT_NOT_OFF	−0.13		−0.22		0.06	**	0.04	**	0.08		0.05		−0.01		−0.04		0.04		0.03	
HIGH_SATFAT_DRESS_NOT_OFF	0.23		0.28		−0.04		−0.05		−0.11		−0.11		0.05		0.06		0.04		0.03	
NO_OVS	N/A		0.69	*	N/A		0.02		N/A		0.09		N/A		0.13		N/A		−0.02	
PREP_ONSITE_I	N/A		−0.11		N/A		−0.07		N/A		−0.07		N/A		−0.07		N/A		−0.05	
DIST_NUTREQ_VENDORSPECS_I	N/A		−0.26		N/A		−0.03		N/A		−0.06		N/A		−0.13	*	N/A		−0.05	**
R-SQUARED	0.36		0.40		0.29		0.35		0.45		0.48		0.68		0.71		0.60		0.63	
N	144		144		144		144		144		144		144		144		144		144	
N (WEIGHTED)	58614		58614		58614		58614		58614		58614		58614		58614		58614		58614	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.2 Meals Served Regression Results: Lunch for Secondary Schools

	Percent of Calories from Saturated Fat				Fluid Milk Servings				Fruit Servings				Vegetable Servings				Dark Green and Orange Vegetable Servings			
	Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
INTERCEPT	8.18	**	8.75	**	1.07	**	1.10	**	0.89	**	0.93	**	0.71	**	0.68	**	0.14		0.12	
SCHL_SIZE2	0.40	*	0.42	*	-0.02		-0.02		-0.15	**	-0.15	**	-0.13		-0.14	*	0.01		0.01	
SCHL_SIZE3	-0.07		0.04		-0.04		-0.04		-0.10		-0.10		-0.14	*	-0.18	**	0.01		-0.01	
POV2	-0.02		0.04		-0.06		-0.06		0.10		0.11	*	0.11	*	0.11	*	-0.02		-0.01	
POV3	0.12		0.14		0.08		0.07		0.05		0.06		0.23		0.28	*	0.00		0.02	
REG_MT	-0.30		-0.38		0.20	**	0.20	**	0.17		0.17		0.07		0.08		0.00		0.01	
REG_MW	-0.22		-0.26		0.19	**	0.20	**	0.15		0.15		0.09		0.08		0.01		0.00	
REG_NE	0.25		0.09		0.08		0.07		0.17		0.17		0.17	*	0.22	**	0.03		0.05	
REG_SE	-0.77	**	-0.95	**	0.01		0.01		0.11		0.11		0.13		0.17	*	-0.01		0.01	
REG_SW	-0.45		-0.53		-0.05		-0.05		0.10		0.10		0.21		0.24	*	0.05		0.06	
REG_WS	0.30		0.19		0.05		0.05		0.05		0.04		-0.05		-0.06		-0.01		-0.02	
URB0405_2	0.32		0.40		-0.02		-0.03		-0.04		-0.04		0.12	*	0.13	*	0.02		0.02	
URB0405_3	0.06		0.15		-0.08	*	-0.08	*	-0.02		-0.01		0.23	**	0.24	**	0.07	*	0.07	**
HIGH	-0.11		-0.21		0.01		0.01		-0.03		-0.03		0.10	*	0.13	**	0.03		0.04	
ONLYSKIM1PER_OFFERED	-1.07	**	-1.10	**	-0.08	*	-0.08	*	0.08		0.07		0.10		0.08		-0.01		-0.02	
WHOLE_MILK_NOT_OFFERED	-0.43		-0.48		-0.03		-0.03		0.01		0.01		-0.07		-0.04		0.02		0.03	
YOGURT_OFFERED	0.23		0.29		0.06		0.06		0.05		0.05		-0.02		-0.03		0.00		0.00	
PCT_ENTREES_HIGHSATFAT	0.04	**	0.03	**	0.00	*	0.00	*	0.00		0.00		0.00		0.00		0.00		0.00	
JUICE_NOT_OFFERED	0.08		0.06		0.06	*	0.07	*	0.10	*	0.10	*	0.18	**	0.16	**	0.03		0.02	
FRESH_FRUIT_DAYSPERWK_OFFER	0.12	*	0.13	*	0.00		0.00		-0.03	*	-0.03		-0.06	**	-0.06	**	-0.01	*	-0.01	
SIDE_SALAD_BAR_OFFERED	-0.74	*	-0.78	*	-0.05		-0.05		-0.16	*	-0.17	*	0.37	**	0.38	**	0.02		0.03	
AVG_VEG_PERDAY	0.10		0.07		-0.03		-0.03		-0.03		-0.03		0.08	*	0.07	*	-0.04	**	-0.04	**
RAW_VEGGIES_OFFERED	0.09		0.16		0.06		0.05		0.05		0.05		0.09		0.10		-0.02		-0.01	
DARKVEG_DAYSPERWK_OFFER	-0.06		-0.06		0.01		0.01		0.01		0.01		0.07		0.07	*	0.09	**	0.09	**
FRENCHFRIES_DAYSPERWK_OFFER	-0.11	*	-0.09		-0.02	*	-0.03	*	-0.03	**	-0.03	**	-0.06	**	-0.06	**	-0.02	**	-0.02	**
SELF_SERVE_DRESS_NOT_OFF	-0.12		-0.11		-0.01		-0.01		-0.06		-0.05		-0.08		-0.07		-0.03		-0.03	
HIGH_SATFAT_CONDT_NOT_OFF	-0.06		-0.01		0.05		0.04		-0.10		-0.11		-0.03		-0.04		0.06	*	0.06	**
HIGH_SATFAT_DRESS_NOT_OFF	-0.29		-0.34		0.00		0.00		0.01		0.01		0.01		0.01		-0.04		-0.03	
NO_OVS	N/A		-1.65	**	N/A		0.14	*	N/A		0.03		N/A		0.12		N/A		-0.02	
PREP_ONSITE_I	N/A		-0.03		N/A		0.02		N/A		-0.02		N/A		-0.17	*	N/A		-0.07	*
DIST_NUTREQ_VENDORSPECS_I	N/A		-0.32		N/A		-0.02		N/A		-0.03		N/A		0.03		N/A		0.02	
R-SQUARED	0.36		0.39		0.42		0.43		0.42		0.42		0.59		0.60		0.59		0.61	
N	253		253		253		253		253		253		253		253		253		253	
N (WEIGHTED)	34262		34262		34262		34262		34262		34262		34262		34262		34262		34262	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.3 Meals Served Regression Results: Breakfast for Elementary Schools

	Percent of Calories from Saturated Fat				Fluid Milk Servings				Fruit Servings			
	Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
INTERCEPT	10.32	**	10.3	**	0.98	**	0.98	**	0.00		0.00	
SCHL_SIZE2	-0.22		-0.21		0.04		0.04		0.02		0.01	
SCHL_SIZE3	-1.22		-1.2		-0.04		-0.03		-0.15		-0.17	
POV2	0.36		0.35		0.03		0.02		0.01		0.01	
POV3	-0.34		-0.35		0.10	*	0.10		0.21		0.21	*
REG_MT	-0.41		-0.36		0.07		0.07		0.09		0.06	
REG_MW	0.05		0.04		-0.06		-0.05		0.12		0.13	
REG_NE	0.98		0.9		0.00		-0.04		-0.05		0.00	
REG_SE	0.87		0.89		0.01		0.01		0.13		0.11	
REG_SW	0.07		0.07		0.06		0.06		0.14		0.15	
REG_WS	0.26		0.24		-0.11		-0.12		0.19	*	0.21	*
URB0405_2	0.13		0.13		-0.01		-0.01		0.04		0.04	
URB0405_3	-0.39		-0.38		-0.02		-0.03		0.04		0.04	
ONLYSKIM1PER_OFFERED	-1.71	**	-1.71	**	-0.02		-0.03		0.04		0.03	
WHOLE_MILK_NOT_OFFERED	-0.75	*	-0.76	*	-0.04		-0.04		0.03		0.03	
FLAVORED_MILK_OFFERED	-0.80		-0.82		-0.03		-0.04		-0.01		0.00	
CEREAL_OFFERED_DAILY	-1.61	**	-1.59	**	-0.03		-0.02		-0.11	**	-0.12	**
HISATFAT_ENTR_DAYSPERWK_OFFER	0.49	**	0.49	**	-0.02		-0.02		-0.02		-0.02	
FRESH_FRUIT_DAYSPERWK_OFFER	-0.13		-0.12		0.02		0.02		0.10	**	0.10	**
NO_OVS	N/A		0.13		N/A		0.07		N/A		-0.06	
PREP_ONSITE_I	N/A		-0.06		N/A		0.00		N/A		0.05	
DIST_NUTREQ_VENDORSPECS_I	N/A		0.06		N/A		-0.01		N/A		-0.03	
R-SQUARED	0.57		0.57		0.18		0.20		0.57		0.58	
N	117		117		117		117		117		117	
N (WEIGHTED)	46853		46853		46853		46853		46853		46853	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.4 Meals Served Regression Results: Breakfast for Secondary Schools

	Percent of Calories from Saturated Fat				Fluid Milk Servings				Fruit Servings			
	Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis		Original Model		Sensitivity Analysis	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
INTERCEPT	10.35	**	10.75	**	0.81	**	0.79	**	0.20	**	0.17	*
SCHL_SIZE2	-0.56		-0.57		-0.06	*	-0.06	*	0.03		0.03	
SCHL_SIZE3	-0.41		-0.38		-0.08		-0.09	*	0.02		0.04	
POV2	-0.72		-0.59		0.07		0.06	*	0.00		-0.01	
POV3	-0.73		-0.48		0.13	**	0.12	**	0.03		0.00	
REG_MT	-1.55		-1.71	*	-0.06		-0.04		-0.02		-0.02	
REG_MW	-0.05		-0.07		0.06		0.07		-0.06		-0.06	
REG_NE	0.11		0.19		0.10		0.11		0.02		-0.01	
REG_SE	-0.74		-0.90		0.00		0.02		-0.02		-0.04	
REG_SW	-1.05		-1.15		0.03		0.05		-0.01		-0.02	
REG_WS	-0.99		-1.12		-0.02		0.00		0.04		0.04	
URB0405_2	1.02		1.11		0.06		0.06		-0.10	**	-0.10	**
URB0405_3	0.70		0.75		0.08	*	0.08	**	0.01		0.01	
HIGH	-0.22		-0.27		0.01		0.01		-0.02		-0.03	
ONLYSKIM1PER_OFFERED	-1.02		-1.05		-0.07		-0.06		-0.03		-0.03	
WHOLE_MILK_NOT_OFFERED	-0.95		-0.93		0.02		0.02		0.01		0.00	
FLAVORED_MILK_OFFERED	-1.48	*	-1.30	*	0.01		0.01		-0.13	*	-0.13	*
CEREAL_OFFERED_DAILY	-0.13		-0.12		0.00		0.00		-0.05	*	-0.05	
HISATFAT_ENTR_DAYSPERWK_OFFER	0.75	*	0.80	**	-0.01		-0.01		0.00		0.00	
FRESH_FRUIT_DAYSPERWK_OFFER	0.08		0.07		-0.01		-0.01		0.05	**	0.05	**
NO_OVS	N/A		-1.25		N/A		-0.14		N/A		-0.15	*
PREP_ONSITE_I	N/A		-0.53		N/A		-0.01		N/A		0.08	**
DIST_NUTREQ_VENDORSPECS_I	N/A		-0.46		N/A		0.04		N/A		-0.01	
R-SQUARED	0.42		0.43		0.23		0.24		0.42		0.45	
N	208		208		208		208		208		208	
N (WEIGHTED)	28614		28614		28614		28614		28614		28614	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.5 Participation Model – Lunch for Elementary Students

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-2.18	*	-1.74		-1.75		-2.20	*	-1.66	*	-0.81	
lfullpriceinc_i	-0.14		-0.18		-0.22		-0.15		N/A		-0.07	
lredpriceinc_i	0.20		0.27		0.05		0.21		N/A		0.22	
seat_lun_i	1.12	**	1.15	**	1.10	**	1.15	**	1.04	**	N/A	
lines_lun_i	-0.20		-0.18		-0.20		-0.21		-0.30		N/A	
ltime_cat	0.01		0.02		0.01		0.01		0.01		N/A	
no_ovs	-0.16		-0.03		-0.17		N/A		-0.07		N/A	
ident_frp_pin_i	0.55	*	0.60	*	0.63	*	0.53	*	0.31		N/A	
female	-0.01		-0.04		-0.01		-0.01		-0.04		-0.05	
black_i	0.12		0.11		0.11		0.12		0.09		0.05	
othrace_i	-0.22		-0.23		-0.26		-0.23		-0.32		-0.28	
white_i	-0.48	*	-0.40		-0.49	*	-0.48	*	-0.56	**	-0.48	*
tue	-0.03		-0.16		0.00		-0.04		-0.08		-0.03	
wed	-0.08		-0.26		-0.07		-0.10		-0.13		0.07	
thu	0.39		0.17		0.39		0.37		0.40		0.53	*
fri	0.21		0.15		0.22		0.22		0.19		0.35	
elig1_i	0.45		0.37		0.36		0.43		0.68	**	0.57	
elig2_i	0.34		0.15		0.34		0.32		0.60	*	0.38	
schsize2_i	-0.15		-0.27		-0.02		-0.16		-0.12		-0.20	
schsize3_i	-0.38		-0.58		-0.30		-0.39		-0.62		-0.49	
pov2_i	-0.61	*	-0.60	*	-0.69	**	-0.60	*	-0.37		-0.36	
pov3_i	-0.61	*	-0.55		-0.67	*	-0.60	*	-0.33		-0.61	*
reg_mt	0.45		0.82		0.24		0.48		0.64		0.84	
reg_mw	1.03	*	1.19	*	0.80	*	1.05	*	1.19	**	0.96	*
reg_ne	1.18	**	1.21	**	1.00	**	1.10	**	1.05	**	0.60	
reg_se	1.56	**	1.85	**	1.16	**	1.56	**	1.60	**	1.89	**
reg_sw	1.35	**	1.44	**	1.12	**	1.37	**	1.30	**	1.51	**
reg_we	0.71		1.10	*	0.30		0.74		0.80		1.16	**
schl_sbp	0.74	**	0.61	*	0.72	**	0.75	**	0.71	**	0.67	*
urb0405_2	-0.21		-0.31		-0.20		-0.21		-0.02		-0.17	
urb0405_3	-0.27		-0.34		-0.15		-0.28		-0.04		-0.25	
dist_nutreq_vendorspecs_i	-0.11		-0.06		-0.12		-0.09		0.11		0.20	
nochainfd_i	-0.02		-0.12		-0.04		-0.02		0.04		0.01	
recess_b4lunch_i	-0.09		-0.34		-0.02		-0.08		-0.14		-0.14	
nopour_i	-0.29		-0.47	*	-0.34		-0.28		-0.41	*	-0.34	*
noalc_lfmilk_i	-0.07		-0.06		N/A		-0.12		-0.46		0.02	
ac_hlthy	0.09		0.32		N/A		0.07		-0.04		-0.03	
alc_nounhlthy	-0.05		-0.22		N/A		-0.04		-0.04		-0.01	

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	-0.37		-0.59	*	N/A		-0.37		-0.52	*	-0.31	
alc_nossb	0.32		0.51		N/A		0.30		0.20		0.52	
days_store_open_i	0.17	*	0.15		N/A		0.17	*	0.13	*	0.20	**
onlyskim1per_offered	0.02		-0.12		0.09		0.03		0.12		-0.17	
whole_milk_not_offered	-0.32		-0.23		-0.37		-0.31		-0.44		-0.19	
pct_entrees_highsatfat	0.02	**	0.02	**	0.02	**	0.02	**	0.01	**	0.01	**
juice_not_offered	0.35		0.31		0.24		0.37		0.38	*	0.42	*
fresh_fruit_daysperwk_offer	-0.16	**	-0.10		-0.13	*	-0.16	**	-0.16	**	-0.19	**
side_salad_bar_offered	0.02		0.04		0.03		0.02		0.00		-0.32	
avg_veg_perday	-0.09		-0.16		-0.17		-0.11		-0.20		0.04	
raw_veggies_offered	-1.11	*	-1.05		-0.89	*	-1.11	*	-0.78		-1.13	*
darkveg_daysperwk_offer	0.25	**	0.21	*	0.30	**	0.24	**	0.26	**	0.14	
frenchfries_not_offered	0.68	**	0.86	**	0.54	*	0.72	**	0.63	**	0.69	**
self_serve_dress_not_off	0.46	*	0.40		0.45	*	0.46	*	0.40		0.32	
high_satfat_condt_not_off	0.22		0.22		0.19		0.19		0.15		-0.10	
high_satfat_dress_not_off	-0.26		-0.29		-0.19		-0.26		-0.09		-0.10	
pemp2_i	N/A		-0.40	*	N/A		N/A		N/A		N/A	
pemp3_i	N/A		0.18		N/A		N/A		N/A		N/A	
pemp4_i	N/A		0.38		N/A		N/A		N/A		N/A	
pemp5_i	N/A		-0.77	*	N/A		N/A		N/A		N/A	
hearty2_i	N/A		0.44	*	N/A		N/A		N/A		N/A	
hearty3_i	N/A		0.32		N/A		N/A		N/A		N/A	
hlth_gd_i	N/A		-0.15		N/A		N/A		N/A		N/A	
hlth_vg_i	N/A		-0.27		N/A		N/A		N/A		N/A	
hlth_ex_i	N/A		-0.15		N/A		N/A		N/A		N/A	
physact2_i	N/A		-0.31		N/A		N/A		N/A		N/A	
physact3_i	N/A		-0.09		N/A		N/A		N/A		N/A	
physact4_i	N/A		-0.55		N/A		N/A		N/A		N/A	
picky2_i	N/A		0.08		N/A		N/A		N/A		N/A	
picky3_i	N/A		0.26		N/A		N/A		N/A		N/A	
p_ed2_i	N/A		-0.01		N/A		N/A		N/A		N/A	
p_ed3_i	N/A		-0.72	**	N/A		N/A		N/A		N/A	
R-squared	0.28		0.35		0.28		0.28		0.27		0.27	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Note: Imputation flags were included in the models except when they were collinear with other variables.

Table B.6 Participation Model – Lunch for Secondary Students

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	−3.92	**	−3.58	**	−2.97	**	−3.92	**	−4.40	**	−2.47	**
lfullpriceinc_i	−0.32	*	−0.33	*	−0.29	*	−0.32	*	N/A		−0.42	**
lredpriceinc_i	−0.15		−0.20		−0.16		−0.16		N/A		−0.12	
seat_lun_i	0.35		0.36		0.38		0.35		0.35		N/A	
lines_lun_i	0.35		0.36		0.33	*	0.35	*	0.40	*	N/A	
ltime_cat	0.02		0.02		0.05		0.02		0.02		N/A	
no_ovs	0.04		−0.03		0.32		N/A		−0.13		N/A	
ident_frp_pin_i	0.52	*	0.54	*	0.40	*	0.52	*	0.48	*	N/A	
female	−0.31	**	−0.33	**	−0.31	**	−0.31	**	−0.29	**	−0.33	**
black_i	0.03		0.06		0.12		0.03		0.02		0.05	
othrace_i	0.00		0.03		0.02		0.00		−0.03		0.02	
white_i	0.00		0.02		0.00		0.00		−0.03		0.02	
tue	0.16		0.17		0.26		0.16		0.17		0.19	
wed	0.14		0.15		0.20		0.14		0.10		0.20	
thu	0.33		0.34		0.46	*	0.33		0.30		0.32	*
fri	−0.36		−0.37		−0.38		−0.36		−0.36		−0.29	
elig1_i	−0.01		−0.08		0.02		−0.01		0.52	**	−0.15	
elig2_i	0.13		0.07		0.17		0.13		0.60	**	−0.03	
schsize2_i	−0.02		−0.03		−0.15		−0.02		−0.04		0.08	
schsize3_i	0.20		0.19		−0.06		0.20		0.15		0.17	
pov2_i	0.03		0.01		0.10		0.03		0.10		0.07	
pov3_i	−0.09		−0.10		0.06		−0.09		0.09		0.00	
reg_mt	0.03		0.09		−0.06		0.03		0.12		0.04	
reg_mw	−0.05		0.00		−0.03		−0.04		−0.05		0.07	
reg_ne	0.73	*	0.75	*	0.40		0.73	*	0.67	*	0.47	
reg_se	0.06		0.08		0.04		0.06		0.10		0.11	
reg_sw	−0.24		−0.21		−0.43		−0.24		−0.25		−0.20	
reg_we	0.14		0.20		−0.13		0.14		0.09		0.01	
schl_sbp	−0.11		−0.13		−0.08		−0.12		−0.16		−0.06	
urb0405_2	−0.22		−0.22		−0.16		−0.22		−0.18		−0.09	
urb0405_3	0.19		0.20		0.23		0.19		0.21		0.29	
high	−0.21		−0.20		−0.51	**	−0.21		−0.25		−0.24	
dist_nutreq_vendorspecs_i	0.22		0.22		0.16		0.22		0.13		0.34	
lim_fat_vendorspecs_i	−0.28		−0.29		−0.12		−0.28		−0.14		−0.34	
prep_onsite_i	0.33	*	0.36	*	0.30	*	0.33	**	0.38	**	0.35	**
nochainfd_i	0.08		0.07		0.17		0.08		0.11		0.04	
no_open_campus_i	0.41	*	0.40	*	N/A		0.41	**	0.41	*	0.27	
no_vending_meal_i	−0.02		−0.04		N/A		−0.02		0.00		0.03	
no_vending_day_i	0.30		0.32		N/A		0.30		0.26		0.32	
low_vending	0.29	*	0.29	*	N/A		0.29	*	0.24		0.28	*
alc_noffentree	0.36	*	0.34	*	N/A		0.36	*	0.27		0.32	*

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_nossb	0.05		0.05		N/A		0.05		0.07		0.15	
nobarstore_i	0.04		0.06		N/A		0.04		0.09		-0.02	
onlyskim1per_offered	-0.22		-0.20		-0.16		-0.22		-0.23		-0.14	
whole_milk_not_offered	0.40	**	0.36	*	0.29		0.40	**	0.42	**	0.38	**
yogurt_offered	-0.10		-0.08		-0.03		-0.10		-0.04		-0.11	
pct_entrees_highsatfat	0.02	**	0.02	**	0.02	*	0.02	**	0.02	**	0.02	*
juice_not_offered	0.01		0.01		-0.07		0.01		0.05		0.00	
fresh_fruit_daysperwk_offer	-0.02		-0.02		-0.04		-0.02		-0.03		-0.02	
side_salad_bar_offered	-0.21		-0.23		-0.15		-0.21		-0.07		-0.13	
avg_veg_perday	0.15	*	0.16	*	0.20	**	0.15	*	0.12	*	0.16	**
raw_veggies_offered	0.25		0.25		0.41	*	0.25		0.20		0.12	
darkveg_daysperwk_offer	-0.10	*	-0.10		-0.12	*	-0.10	*	-0.08		-0.12	*
frenchfries_daysperwk_offer	0.04		0.04		0.01		0.04		0.05		0.08	*
self_serve_dress_not_off	-0.01		-0.01		0.05		-0.01		0.01		-0.03	
high_satfat_condt_not_off	-0.34		-0.33		-0.33		-0.34		-0.13		-0.26	
high_satfat_dress_not_off	0.13		0.10		0.16		0.13		0.13		0.16	
pemp2_i	N/A		0.08		N/A		N/A		N/A		N/A	
pemp3_i	N/A		-0.10		N/A		N/A		N/A		N/A	
pemp4_i	N/A		0.12		N/A		N/A		N/A		N/A	
pemp5_i	N/A		-0.04		N/A		N/A		N/A		N/A	
hearty2_i	N/A		0.01		N/A		N/A		N/A		N/A	
hearty3_i	N/A		0.08		N/A		N/A		N/A		N/A	
hlth_gd_i	N/A		-0.53	*	N/A		N/A		N/A		N/A	
hlth_vg_i	N/A		-0.36		N/A		N/A		N/A		N/A	
hlth_ex_i	N/A		-0.37	*	N/A		N/A		N/A		N/A	
physact2_i	N/A		0.07		N/A		N/A		N/A		N/A	
physact3_i	N/A		-0.06		N/A		N/A		N/A		N/A	
physact4_i	N/A		-0.07		N/A		N/A		N/A		N/A	
picky2_i	N/A		0.04		N/A		N/A		N/A		N/A	
picky3_i	N/A		0.02		N/A		N/A		N/A		N/A	
p_ed2_i	N/A		-0.02		N/A		N/A		N/A		N/A	
p_ed3_i	N/A		-0.14		N/A		N/A		N/A		N/A	
R-squared	0.19		0.20		0.18		0.19		0.19		0.18	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Note: Imputation flags were included in the models except when they were collinear with other variables.

Table B.7 Participation Model – Breakfast for Elementary Students

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	1.70	**	1.19		1.25		1.67	**	1.01		1.41	*
bfullpriceinc_i	-1.21	**	-1.15	*	-1.25	**	-1.24	**	N/A		-1.20	**
bredpriceinc_i	-1.35	*	-1.06		-1.42	*	-1.36	*	N/A		-1.16	
ident_frp_pin_i	-0.48	*	-0.13		-0.33		-0.52	*	-0.36		N/A	
no_ovs	-0.34		-0.38		-0.40		N/A		-0.24		N/A	
female	-0.39	*	-0.42	**	-0.36	*	-0.39	*	-0.32	*	-0.37	*
black_i	0.07		0.01		0.27		0.08		0.06		0.04	
othrace_i	0.41		0.42		0.48		0.40		0.30		0.39	
white_i	-0.08		-0.01		0.08		-0.08		-0.02		-0.11	
tue	0.14		0.14		0.23		0.13		0.09		0.15	
wed	-0.25		-0.20		-0.14		-0.27		-0.19		-0.33	
thu	0.03		0.00		0.12		0.01		0.06		-0.11	
fri	0.01		-0.06		0.03		0.02		0.03		-0.04	
elig1_i	-0.40		-0.41		-0.40		-0.43		0.52	**	-0.40	
elig2_i	0.03		-0.01		0.08		0.01		0.55	*	-0.01	
schsize2_i	0.33		0.13		0.21		0.30		0.25		0.25	
schsize3_i	0.09		-0.03		0.24		0.11		-0.01		0.03	
pov2_i	0.41		0.32		0.27		0.45		0.15		0.30	
pov3_i	0.49		0.41		0.52		0.55		0.33		0.31	
reg_mt	-1.20	*	-0.97		-0.93		-1.21	*	-1.50	*	-1.14	*
reg_mw	-0.36		-0.50		-0.64		-0.35		-0.97	*	-0.24	
reg_ne	-1.23	*	-1.41	*	-1.39	*	-1.45	**	-0.89		-0.78	
reg_se	-0.55		-0.58		-0.49		-0.59	*	-0.81	**	-0.46	
reg_sw	-0.69	*	-0.98	*	-0.65	*	-0.74	*	-0.89	*	-0.66	
reg_we	-0.91	*	-1.06	*	-0.73	*	-0.97	*	-1.49	**	-1.05	*
urb0405_2	-0.48	*	-0.57	*	-0.36		-0.56	*	-0.61	*	-0.63	**
urb0405_3	-0.02		0.18		0.08		-0.06		-0.07		-0.06	
dod_fresh_or_farm_i	0.44	*	0.34		0.28		0.46	*	0.23		0.45	*
require5_vendorspecs_i	0.99	**	0.76	*	0.68	**	1.06	**	0.73	**	0.98	**
nutr_ed_i	-0.51	*	-0.71	**	-0.55	**	-0.55	**	-0.52	**	-0.61	**
nutr_content_avail_i	-0.23		0.01		-0.15		-0.18		0.12		-0.19	
no_vending_day_i	-0.68	**	-0.26		N/A		-0.73	**	-0.47		-0.54	*
nossb_vending_i	0.25		-0.31		N/A		0.21		-0.39		-0.24	
noalc_lfmilk_i	0.19		0.35		N/A		0.22		0.38		0.23	
ac_hlthy	0.12		0.06		N/A		0.17		0.23		0.14	
alc_fruitveg	-0.03		-0.40		N/A		-0.06		-0.32		-0.09	
nofoodfund_i	-0.12		0.04		N/A		-0.09		0.08		-0.21	
onlyskim1per_offered	0.44		0.67		0.15		0.44		0.24		0.67	*

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
whole_milk_not_offered	-0.33		-0.22		0.15		-0.34		-0.20		-0.56	
flavored_milk_offered	-0.58	*	0.03		-0.30		-0.56	*	-0.47		-0.53	*
cereal_offered_daily	1.08	**	0.72	**	0.77	**	1.18	**	0.87	**	0.98	**
hisatfat_entr_daysperwk_offer	0.06		0.19	*	0.09		0.07		0.06		0.14	*
fresh_fruit_daysperwk_offer	-0.04		-0.08		-0.08		-0.03		-0.09		-0.01	
avg_hotcereal_perday	2.14	*	1.83		1.02	*	2.16	*	2.01	*	2.31	**
pastry_daysperwk_offer	-0.12		-0.25	**	-0.21	**	-0.11		-0.10		-0.10	
sweet_cereal_daysperwk_offer	-0.31	**	-0.26	**	-0.27	**	-0.33	**	-0.30	**	-0.32	**
pemp2_i	N/A		-0.23		N/A		N/A		N/A		N/A	
pemp3_i	N/A		-0.27		N/A		N/A		N/A		N/A	
pemp4_i	N/A		0.07		N/A		N/A		N/A		N/A	
pemp5_i	N/A		0.01		N/A		N/A		N/A		N/A	
hearty2_i	N/A		-0.11		N/A		N/A		N/A		N/A	
hearty3_i	N/A		-0.15		N/A		N/A		N/A		N/A	
hlth_gd_i	N/A		-0.14		N/A		N/A		N/A		N/A	
hlth_vg_i	N/A		-0.27		N/A		N/A		N/A		N/A	
hlth_ex_i	N/A		-0.23		N/A		N/A		N/A		N/A	
physact2_i	N/A		0.02		N/A		N/A		N/A		N/A	
physact3_i	N/A		-0.06		N/A		N/A		N/A		N/A	
physact4_i	N/A		-0.15		N/A		N/A		N/A		N/A	
picky2_i	N/A		0.12		N/A		N/A		N/A		N/A	
picky3_i	N/A		0.21		N/A		N/A		N/A		N/A	
p_ed2_i	N/A		-0.02		N/A		N/A		N/A		N/A	
p_ed3_i	N/A		-0.26		N/A		N/A		N/A		N/A	
R-squared	0.24		0.24		0.22		0.24		0.21		0.23	
N	630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Note: Imputation flags were included in the models except when they were collinear with other variables.

Table B.8 Participation Model – Breakfast for Secondary Students

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-1.34	**	-1.55	*	-1.35	**	-1.34	**	-1.73	**	-1.04	*
bfullpriceinc_i	-0.62	**	-0.61	**	-0.63	**	-0.62	**	N/A		-0.66	**
bredpriceinc_i	0.30		0.38		0.22		0.30		N/A		0.31	
ident_frp_pin_i	0.42		0.40		0.40		0.42		0.52	*	N/A	
no_ovs	-		-		-		N/A		-		N/A	
female	-0.45	**	-0.45	**	-0.44	**	-0.45	**	-0.42	**	-0.45	**
black_i	0.54	**	0.49	*	0.54	**	0.54	**	0.47	*	0.54	**
othrace_i	0.20		0.09		0.21		0.20		0.11		0.21	
white_i	0.03		-0.04		0.04		0.03		-0.04		0.05	
tue	0.10		0.11		0.13		0.10		0.07		0.08	
wed	0.30	*	0.31	*	0.31	*	0.30	*	0.27		0.30	*
thu	0.34		0.34		0.31		0.34		0.36		0.33	
fri	0.12		0.17		0.14		0.12		0.07		0.12	
elig1_i	0.02		-0.03		0.01		0.02		0.54	**	-0.01	
elig2_i	-0.36		-0.36		-0.36		-0.36		0.26		-0.40	
schsize2_i	-0.09		-0.08		-0.09		-0.09		-0.10		0.00	
schsize3_i	-0.33		-0.34		-0.30		-0.33		-0.34		-0.26	
pov2_i	0.07		0.10		0.08		0.07		0.17		0.13	
pov3_i	0.18		0.22		0.14		0.18		0.28		0.23	
reg_mt	-0.97	**	-0.93	**	-0.88	**	-0.97	**	-0.81	*	-1.11	**
reg_mw	-0.27		-0.25		-0.21		-0.27		-0.30		-0.19	
reg_ne	0.36		0.39		0.26		0.36		0.40		0.16	
reg_se	-0.12		-0.10		-0.16		-0.12		-0.12		-0.15	
reg_sw	-0.19		-0.15		-0.10		-0.19		-0.23		-0.21	
reg_we	0.05		0.06		0.14		0.05		-0.16		0.00	
urb0405_2	-0.01		-0.01		-0.04		-0.01		-0.03		0.08	
urb0405_3	0.21		0.25		0.22		0.21		0.18		0.30	*
high	-0.25		-0.25		-0.23		-0.25		-0.27	*	-0.22	
dod_fresh_or_farm_i	-0.28	*	-0.24		-0.29	*	-0.28	*	-0.29	*	-0.25	*
nutr_content_avail_i	0.06		0.07		0.03		0.06		0.01		0.04	
no_vending_meal_i	0.08		0.09		N/A		0.08		0.05		0.05	
no_vending_day_i	-0.06		-0.08		N/A		-0.06		-0.03		-0.06	
vending_notinsfa	0.12		0.10		N/A		0.12		0.10		0.12	
nossb_vending_i	-0.27		-0.29		N/A		-0.27		-0.27		-0.24	
onlyskim1per_offered	-0.45	**	-0.46	**	-0.42	*	-0.45	**	-0.38	*	-0.37	*
whole_milk_not_offered	0.50	*	0.53	*	0.44	*	0.50	*	0.42	*	0.51	*
flavored_milk_offered	-0.13		-0.17		-0.08		-0.13		-0.21		-0.20	
cereal_offered_daily	-0.23		-0.24		-0.24		-0.23		-0.22		-0.18	

	Original Model		S1: Add Demographics		S2: Drop Competitive Foods		S3: Drop OVS		S4: Drop Price		S5: Drop All IVs Except Price	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
hisatfat_entr_daysperwk_offer	0.11	**	0.10	*	0.11	**	0.11	**	0.10	*	0.10	*
fresh_fruit_daysperwk_offer	-0.01		-0.01		-0.01		-0.01		0.01		0.00	
avg_sweetcereal_perday	0.05		0.05		0.06		0.05		0.05		0.05	
unsw_cereal_daysperwk_offer	0.03		0.02		0.03		0.03		0.01		0.02	
pemp2_i	N/A		-0.08		N/A		N/A		N/A		N/A	
pemp3_i	N/A		0.32		N/A		N/A		N/A		N/A	
pemp4_i	N/A		-0.01		N/A		N/A		N/A		N/A	
pemp5_i	N/A		0.22		N/A		N/A		N/A		N/A	
hearty2_i	N/A		0.01		N/A		N/A		N/A		N/A	
hearty3_i	N/A		0.06		N/A		N/A		N/A		N/A	
hlth_gd_i	N/A		-0.05		N/A		N/A		N/A		N/A	
hlth_vg_i	N/A		-0.08		N/A		N/A		N/A		N/A	
hlth_ex_i	N/A		-0.02		N/A		N/A		N/A		N/A	
physact2_i	N/A		0.02		N/A		N/A		N/A		N/A	
physact3_i	N/A		0.02		N/A		N/A		N/A		N/A	
physact4_i	N/A		0.11		N/A		N/A		N/A		N/A	
picky2_i	N/A		0.18		N/A		N/A		N/A		N/A	
picky3_i	N/A		0.20		N/A		N/A		N/A		N/A	
p_ed2_i	N/A		0.13		N/A		N/A		N/A		N/A	
p_ed3_i	N/A		0.02		N/A		N/A		N/A		N/A	
R-squared	0.15		0.16		0.14		0.15		0.13		0.14	
N	1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Note: Imputation flags were included in the models except when they were collinear with other variables.

A dash (-) indicates that the variable was dropped because of collinearity.

Table B.9 Meals Consumed Model – Lunch for Elementary Students

Target Outcome: Percentage of Calories from Saturated Fat

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	6.70	**	6.76	**	6.94	**	6.51	**	6.46	**	6.76	**
c_nslp	0.29		0.01		-0.90		1.25		1.52	**	N/A	
female	-0.28		-0.29		-0.29		-0.28		-0.28		-0.29	
black_i	1.39	*	1.40	*	1.42	*	1.36		1.35	*	1.40	*
othrace_i	0.77		0.74		0.67		0.85		0.87		0.74	
white_i	0.99		0.95		0.84		1.11		1.14	*	0.95	
tue	-0.10		-0.11		-0.13		-0.08		-0.07		-0.11	
wed	0.53		0.53		0.53		0.53		0.53		0.53	
thu	0.57		0.60		0.71		0.45		0.41		0.60	
fri	-0.54		-0.52		-0.45		-0.61		-0.63		-0.52	
elig1_i	0.68		0.72		0.87		0.53		0.49		0.72	
elig2_i	1.02	*	1.06	*	1.19	**	0.88		0.84	*	1.06	**
schsize2_i	-0.38		-0.41		-0.47		-0.31		-0.29		-0.41	
schsize3_i	-0.14		-0.20		-0.38		0.04		0.09		-0.20	
pov2_i	2.11	**	2.10	**	2.07	**	2.15	**	2.16	**	2.10	**
pov3_i	0.70		0.68		0.61		0.78		0.80		0.68	
reg_mt	0.06		0.13		0.35		-0.17		-0.23		0.13	
reg_mw	-0.48		-0.40		-0.15		-0.75		-0.82		-0.40	
reg_ne	0.11		0.13		0.19		0.04		0.02		0.13	
reg_se	-2.34	*	-2.22		-1.83		-2.74		-2.86	**	-2.21	*
reg_sw	-1.76		-1.66		-1.35		-2.08		-2.17	*	-1.66	
reg_we	1.32		1.39		1.62		1.08		1.01		1.40	
schl_sbp	0.60		0.66		0.87		0.38		0.32		0.66	
urb0405_2	1.11	*	1.12	*	1.13	*	1.10	*	1.09	*	1.12	*
urb0405_3	2.16	**	2.15	**	2.13	**	2.19	**	2.19	**	2.15	**
dist_nutreq_vendorspecs_i	-1.25	**	-1.23	**	-1.16	*	-1.33	**	-1.35	**	-1.23	**
nochainfd_i	-1.72	**	-1.71	**	-1.70	**	-1.73	**	-1.73	**	-1.71	**
recess_b4lunch_i	-1.12		-1.14		-1.18		-1.08		-1.06	*	-1.14	*
nopour_i	0.47		0.44		0.33		0.58		0.62		0.44	
noalc_lfmilk_i	-0.56		-0.58		-0.66		-0.49		-0.46		-0.59	
ac_hlthy	0.00		0.00		-0.01		0.02		0.02		0.00	
alc_nounhlthy	-2.14	**	-2.15	**	-2.17	**	-2.12	**	-2.11	**	-2.15	**
alc_noffentree	-0.55		-0.57		-0.67		-0.45		-0.42		-0.58	
alc_nossb	-0.23		-0.20		-0.11		-0.32		-0.35		-0.20	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	-0.18		-0.17		-0.14		-0.21		-0.22		-0.17	
onlyskim1per_offered	-1.65	**	-1.65	**	-1.65	**	-1.65	**	-1.65	**	-1.65	**
whole_milk_not_offered	0.48		0.45		0.34		0.60		0.63		0.45	
pct_entrees_highsatfat	0.03	*	0.03	*	0.03	*	0.03		0.03	*	0.03	*
juice_not_offered	0.74		0.77		0.87		0.63		0.60		0.77	
fresh_fruit_daysperwk_offer	0.36	*	0.35	*	0.31		0.40	*	0.41	**	0.35	**
side_salad_bar_offered	-1.32		-1.36		-1.51		-1.16		-1.12		-1.36	
avg_veg_perday	-0.68		-0.69		-0.70		-0.67		-0.67		-0.69	
raw_veggies_offered	1.50		1.46		1.36		1.60		1.63		1.46	
darkveg_daysperwk_offer	0.33		0.34		0.38		0.29		0.28		0.34	
frenchfries_not_offered	2.31	**	2.36	**	2.50	**	2.16	**	2.11	**	2.36	**
self_serve_dress_not_off	-0.38		-0.35		-0.24		-0.50		-0.53		-0.35	
high_satfat_condt_not_off	-1.85	**	-1.86	**	-1.89	**	-1.82	**	-1.81	**	-1.86	**
high_satfat_dress_not_off	-0.12		-0.10		-0.02		-0.21		-0.23		-0.10	
R-squared	0.21		0.20		0.17		0.22		0.22		0.20	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.10 Meals Consumed Model – Lunch for Elementary Students

Target Outcome: Fluid Milk Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-0.23		-0.23		-0.24		-0.24		-0.29		-0.19	
c_nslp	0.18		0.17		0.21		0.24		0.50	**	N/A	
female	-0.12	**	-0.12	**	-0.12	**	-0.12	**	-0.12	**	-0.12	**
black_i	0.00		0.00		0.00		0.00		-0.01		0.01	
othrace_i	0.13		0.13		0.14		0.14		0.16		0.12	
white_i	-0.01		-0.01		0.00		0.00		0.03		-0.03	
tue	-0.03		-0.03		-0.03		-0.03		-0.02		-0.04	
wed	0.05		0.05		0.05		0.05		0.05		0.05	
thu	0.06		0.06		0.06		0.05		0.02		0.08	
fri	0.00		0.00		0.00		0.00		-0.02		0.02	
elig1_i	0.08		0.08		0.07		0.07		0.03		0.11	*
elig2_i	0.07		0.08		0.07		0.07		0.03		0.10	
schsize2_i	-0.07		-0.07		-0.07		-0.06		-0.04		-0.08	
schsize3_i	0.09		0.09		0.09		0.10		0.15		0.05	
pov2_i	0.10		0.10		0.10		0.10		0.11		0.09	
pov3_i	0.04		0.04		0.04		0.04		0.06		0.03	
reg_mt	0.35	*	0.35	*	0.34	*	0.33	*	0.27	*	0.39	**
reg_mw	0.30	*	0.31	*	0.29	*	0.29		0.21	*	0.35	**
reg_ne	0.17		0.17		0.17		0.17		0.15		0.19	
reg_se	0.32	*	0.32	*	0.30	*	0.29		0.18	*	0.39	**
reg_sw	0.27	*	0.28	*	0.26		0.25		0.16	*	0.33	**
reg_we	0.25		0.25		0.24		0.23		0.16		0.29	*
schl_sbp	0.07		0.07		0.06		0.05		-0.01		0.10	
urb0405_2	0.08		0.08		0.08		0.08		0.07		0.08	
urb0405_3	0.02		0.02		0.02		0.02		0.03		0.01	
dist_nutreq_vendorspecs_i	0.00		0.00		-0.01		-0.01		-0.03		0.01	
nochainfd_i	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
recess_b4lunch_i	0.08		0.08		0.08		0.08		0.10		0.07	
nopour_i	0.06		0.06		0.06		0.07		0.10	*	0.04	
noalc_lfmilk_i	0.21		0.21		0.21		0.21		0.23	*	0.19	
ac_hlthy	-0.02		-0.02		-0.02		-0.02		-0.02		-0.03	
alc_nounhlthy	-0.19	*	-0.19	*	-0.19	*	-0.19	*	-0.18	*	-0.19	*
alc_noffentree	0.17	*	0.17	*	0.18	*	0.18	*	0.21	**	0.16	*
alc_nossb	0.23	*	0.23	*	0.23	*	0.23	*	0.20		0.25	*

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	0.04		0.04		0.04		0.04		0.03		0.05	*
onlyskim1per_offered	-0.07		-0.07		-0.07		-0.07		-0.07		-0.07	
whole_milk_not_offered	-0.03		-0.03		-0.02		-0.02		0.01		-0.05	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	-0.02		-0.02		-0.02		-0.03		-0.06		0.00	
fresh_fruit_daysperwk_offer	-0.02		-0.02		-0.01		-0.01		0.00		-0.02	
side_salad_bar_offered	-0.12		-0.12		-0.12		-0.11		-0.07		-0.15	
avg_veg_perday	-0.04		-0.04		-0.04		-0.04		-0.03		-0.04	
raw_veggies_offered	-0.02		-0.03		-0.02		-0.02		0.01		-0.04	
darkveg_daysperwk_offer	0.03		0.03		0.03		0.03		0.01		0.04	
frenchfries_not_offered	0.10		0.10		0.09		0.09		0.05		0.13	*
self_serve_dress_not_off	0.19	**	0.19	**	0.19	*	0.18	*	0.15	**	0.21	**
high_satfat_condt_not_off	-0.12	*	-0.12	*	-0.12	*	-0.12	*	-0.11	*	-0.13	*
high_satfat_dress_not_off	0.03		0.03		0.03		0.02		0.00		0.04	
R-squared	0.24		0.24		0.26		0.26		0.30		0.16	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.11 Meals Consumed Model – Lunch for Elementary Students

Target Outcome: Fruit Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-0.31		-0.31		-0.28		-0.41		-0.20		-0.20	
c_nslp	0.53	*	0.56	**	0.37		1.05		0.00		N/A	
female	0.01		0.01		0.01		0.02		0.01		0.01	
black_i	-0.06		-0.06		-0.05		-0.07		-0.04		-0.04	
othrace_i	-0.03		-0.03		-0.05		0.01		-0.08		-0.08	
white_i	-0.04		-0.04		-0.06		0.02		-0.11		-0.11	
tue	-0.03		-0.03		-0.03		-0.01		-0.04		-0.04	
wed	-0.02		-0.01		-0.02		-0.01		-0.02		-0.02	
thu	-0.13		-0.13		-0.11		-0.19		-0.06		-0.06	
fri	-0.04		-0.04		-0.03		-0.08		0.00		0.00	
elig1_i	-0.04		-0.05		-0.02		-0.12		0.04		0.04	
elig2_i	-0.09		-0.10		-0.07		-0.17		-0.02		-0.02	
schsize2_i	0.10	*	0.11	*	0.09	*	0.14		0.06		0.06	
schsize3_i	0.17		0.18		0.14		0.27		0.07		0.07	
pov2_i	-0.11		-0.11		-0.12		-0.09		-0.14	*	-0.14	*
pov3_i	-0.17	*	-0.16	*	-0.18	**	-0.13		-0.21	**	-0.21	**
reg_mt	-0.22		-0.23		-0.19		-0.35		-0.10		-0.10	
reg_mw	-0.26	*	-0.26	*	-0.21		-0.40	*	-0.11		-0.11	
reg_ne	-0.19		-0.19		-0.18		-0.23		-0.16		-0.16	
reg_se	-0.21		-0.22	*	-0.14		-0.43		0.02		0.02	
reg_sw	-0.28	**	-0.29	**	-0.23		-0.45	*	-0.10		-0.10	
reg_we	-0.23	*	-0.24	*	-0.19		-0.36		-0.10		-0.10	
schl_sbp	0.05		0.04		0.09		-0.06		0.17	**	0.17	**
urb0405_2	-0.17	**	-0.17	**	-0.17	**	-0.18	*	-0.16	**	-0.16	**
urb0405_3	-0.07		-0.07		-0.07		-0.06		-0.08		-0.08	
dist_nutreq_vendorspecs_i	-0.17	**	-0.17	**	-0.16	**	-0.21	**	-0.13	**	-0.13	**
nochainfd_i	0.02		0.02		0.02		0.01		0.02		0.02	
recess_b4lunch_i	0.01		0.01		0.00		0.04		-0.02		-0.02	
nopour_i	0.08		0.08		0.06		0.14		0.01		0.01	
noalc_lfmilk_i	0.49	**	0.49	**	0.48	**	0.53	**	0.45	**	0.45	**
ac_hlthy	0.22	**	0.22	**	0.22	**	0.22	**	0.21	**	0.21	**
alc_nounhlthy	-0.02		-0.02		-0.03		-0.01		-0.04		-0.04	
alc_noffentree	0.15	*	0.15	*	0.13	*	0.20		0.10		0.10	
alc_nossb	0.06		0.05		0.07		0.01		0.11		0.11	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	-0.02		-0.02		-0.01		-0.03		0.00		0.00	
onlyskim1per_offered	-0.03		-0.03		-0.03		-0.03		-0.03		-0.03	
whole_milk_not_offered	0.07		0.08		0.05		0.14		0.01		0.01	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	-0.03		-0.04		-0.02		-0.09		0.03		0.03	
fresh_fruit_daysperwk_offer	0.05	**	0.05	**	0.04	**	0.07	*	0.03	*	0.03	*
side_salad_bar_offered	0.13		0.13		0.10		0.21		0.04		0.04	
avg_veg_perday	-0.02		-0.02		-0.02		-0.01		-0.03		-0.03	
raw_veggies_offered	0.22	*	0.22	*	0.20	*	0.27		0.16	*	0.16	*
darkveg_daysperwk_offer	0.00		0.00		0.01		-0.02		0.02		0.02	
frenchfries_not_offered	-0.12		-0.13		-0.10		-0.20		-0.04		-0.04	
self_serve_dress_not_off	-0.06		-0.06		-0.04		-0.12		0.01		0.01	
high_satfat_condt_not_off	-0.09		-0.09		-0.09		-0.07		-0.10	*	-0.10	*
high_satfat_dress_not_off	0.03		0.03		0.04		-0.02		0.08		0.08	
R-squared	0.10		0.10		0.11		0.06		0.12		0.12	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.12 Meals Consumed Model – Lunch for Elementary Students

Target Outcome: Vegetable Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-0.28		-0.29		-0.23		-0.36		-0.18		-0.16	
c_nslp	0.61	*	0.63	**	0.33		0.98	*	0.10	*	N/A	
female	-0.01		-0.01		-0.01		0.00		-0.01		-0.01	
black_i	0.08		0.07		0.08		0.06		0.09		0.09	
othrace_i	0.02		0.02		0.00		0.05		-0.02		-0.03	
white_i	0.12		0.12	*	0.09		0.17	*	0.06		0.04	
tue	-0.01		-0.01		-0.02		0.00		-0.02		-0.03	
wed	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
thu	-0.16	*	-0.16	*	-0.13	*	-0.21	*	-0.10		-0.09	
fri	-0.07		-0.07		-0.05		-0.10		-0.03		-0.02	
elig1_i	-0.07		-0.07		-0.03		-0.13		0.01		0.03	
elig2_i	-0.08		-0.08		-0.04		-0.13		0.00		0.01	
schsize2_i	0.06		0.06		0.04		0.09		0.02		0.01	
schsize3_i	0.02		0.02		-0.04		0.09		-0.08		-0.10	
pov2_i	0.00		0.00		-0.01		0.02		-0.02		-0.02	
pov3_i	0.06		0.06		0.04		0.09		0.02		0.01	
reg_mt	-0.14		-0.15		-0.07		-0.23		-0.02		0.00	
reg_mw	-0.19		-0.19		-0.11		-0.29		-0.05		-0.02	
reg_ne	-0.04		-0.05		-0.03		-0.07		-0.01		0.00	
reg_se	-0.28	*	-0.29	*	-0.16		-0.44	*	-0.07		-0.02	
reg_sw	-0.11		-0.11		-0.01		-0.23		0.07		0.10	
reg_we	-0.23		-0.23		-0.15		-0.32		-0.10		-0.07	
schl_sbp	-0.09		-0.10		-0.03		-0.18		0.02		0.04	
urb0405_2	0.05		0.05		0.06		0.05		0.06		0.06	
urb0405_3	0.14	*	0.14	*	0.13	*	0.15	*	0.13	*	0.13	*
dist_nutreq_vendorspecs_i	0.03		0.03		0.05		0.00		0.07	*	0.08	*
nochainfd_i	0.00		0.00		0.00		-0.01		0.00		0.00	
recess_b4lunch_i	0.11	*	0.12	*	0.10	*	0.13	*	0.09	*	0.08	
nopour_i	0.07		0.07		0.03		0.11		0.01		0.00	
noalc_lfmilk_i	-0.02		-0.02		-0.04		0.01		-0.06		-0.07	
ac_hlthy	-0.03		-0.03		-0.03		-0.03		-0.04		-0.04	
alc_nounhlthy	0.15	*	0.15	*	0.14	*	0.16	*	0.14	*	0.14	*
alc_noffentree	0.03		0.04		0.01		0.07		-0.02		-0.03	
alc_nossb	-0.19	*	-0.19	*	-0.16	*	-0.23	*	-0.14	*	-0.13	*

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	-0.03		-0.03		-0.02		-0.04		-0.01		-0.01	
onlyskim1per_offered	0.04		0.04		0.04		0.04		0.04		0.04	
whole_milk_not_offered	0.11		0.11		0.07		0.15		0.04		0.03	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	-0.08		-0.08		-0.05		-0.12	*	-0.02		-0.01	
fresh_fruit_daysperwk_offer	0.06	**	0.06	**	0.05	**	0.08	**	0.04	**	0.04	**
side_salad_bar_offered	0.24	*	0.24	*	0.19	*	0.30	*	0.16		0.14	
avg_veg_perday	-0.04		-0.04		-0.05		-0.04		-0.05		-0.05	
raw_veggies_offered	0.28	**	0.28	**	0.25	**	0.32	**	0.22	**	0.21	**
darkveg_daysperwk_offer	0.00		-0.01		0.01		-0.02		0.02		0.02	
frenchfries_not_offered	-0.06		-0.06		-0.01		-0.12		0.02		0.04	
self_serve_dress_not_off	-0.10		-0.10		-0.06		-0.14	*	-0.04		-0.02	
high_satfat_condt_not_off	-0.02		-0.02		-0.03		-0.01		-0.03		-0.04	
high_satfat_dress_not_off	-0.06		-0.06		-0.04		-0.09		-0.02		-0.01	
R-squared	0.11		0.11		0.09		0.08		0.13		0.12	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.13 Meals Consumed Model – Lunch for Elementary Students

Target Outcome: Dark Green and Orange Vegetable Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	-0.04		-0.04		-0.05		-0.03		-0.05		-0.04	
c_nslp	0.00		0.00		0.02		-0.04		0.02		N/A	
female	0.02		0.02		0.02		0.02		0.02		0.02	
black_i	0.01		0.01		0.01		0.02		0.01		0.01	
othrace_i	0.00		0.00		0.00		0.00		0.00		0.00	
white_i	0.00		0.00		0.00		-0.01		0.00		0.00	
tue	0.00		0.00		0.00		0.00		0.00		0.00	
wed	0.04		0.04		0.04		0.04		0.04		0.04	
thu	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
fri	0.02		0.02		0.02		0.03		0.02		0.03	
elig1_i	0.01		0.01		0.01		0.02		0.01		0.01	
elig2_i	0.01		0.01		0.01		0.02		0.01		0.01	
schsize2_i	0.03	*	0.03	*	0.03	*	0.02		0.03	*	0.02	*
schsize3_i	0.05	*	0.05	*	0.05	*	0.04		0.05	*	0.05	*
pov2_i	0.00		0.00		0.00		0.00		0.00		0.00	
pov3_i	-0.01		-0.01		-0.01		-0.02		-0.01		-0.01	
reg_mt	0.00		0.00		0.00		0.01		0.00		0.00	
reg_mw	-0.03		-0.03		-0.03		-0.01		-0.03		-0.03	
reg_ne	-0.03		-0.03		-0.03		-0.03		-0.03		-0.03	
reg_se	-0.06		-0.06		-0.06		-0.04		-0.06	**	-0.05	**
reg_sw	-0.04		-0.04		-0.04		-0.02		-0.04	*	-0.04	
reg_we	-0.04		-0.04		-0.04		-0.03		-0.04		-0.04	
schl_sbp	0.01		0.01		0.01		0.02		0.00		0.01	
urb0405_2	0.00		0.00		0.00		0.00		0.00		0.00	
urb0405_3	0.03		0.03		0.03		0.03		0.03		0.03	
dist_nutreq_vendorspecs_i	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
nochainfd_i	-0.04	*	-0.04	*	-0.04	*	-0.04	*	-0.04	*	-0.04	*
recess_b4lunch_i	-0.03	*	-0.03	*	-0.03	*	-0.03	*	-0.03	*	-0.03	*
nopour_i	0.00		0.00		0.01		0.00		0.01		0.00	
noalc_lfmilk_i	0.03		0.03		0.03		0.03		0.03		0.03	
ac_hlthy	0.03		0.03		0.03		0.03		0.03		0.03	
alc_nounhlthy	0.00		0.00		0.00		0.00		0.00		0.00	
alc_noffentree	0.02		0.02		0.02		0.02		0.02		0.02	
alc_nossb	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	0.00		0.00		0.00		0.00		0.00		0.00	
onlyskim1per_offered	-0.04	**	-0.04	**	-0.04	**	-0.04	**	-0.04	**	-0.04	**
whole_milk_not_offered	0.03		0.03		0.04		0.03		0.04	*	0.03	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	-0.01		-0.01		-0.01		0.00		-0.01		-0.01	
fresh_fruit_daysperwk_offer	0.00		0.00		0.00		0.00		0.00		0.00	
side_salad_bar_offered	0.00		0.00		0.00		-0.01		0.00		0.00	
avg_veg_perday	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
raw_veggies_offered	0.04		0.04		0.04		0.04		0.04		0.04	
darkveg_daysperwk_offer	0.01		0.01		0.01		0.02		0.01		0.01	*
frenchfries_not_offered	0.00		0.01		0.00		0.01		0.00		0.01	
self_serve_dress_not_off	0.01		0.01		0.01		0.02		0.01		0.01	
high_satfat_condt_not_off	-0.01		-0.01		-0.01		-0.01		0.00		-0.01	
high_satfat_dress_not_off	0.02		0.02		0.02		0.02		0.01		0.02	
R-squared	0.15		0.15		0.15		0.10		0.15		0.14	
N	732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.14 Meals Consumed Model – Lunch for Secondary Students

Target Outcome: Percentage of Calories from Saturated Fat

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	9.87	**	9.90	**	9.56	**	9.79	**	9.62	**	8.37	**
c_nslp	2.76		2.81		2.19		2.61		2.29	**	N/A	
female	0.12		0.12		0.06		0.10		0.07		-0.15	
black_i	-0.83		-0.83		-0.83		-0.83		-0.83		-0.83	
othrace_i	0.15		0.15		0.15		0.15		0.15		0.13	
white_i	0.01		0.01		0.01		0.01		0.01		-0.01	
tue	-1.04	*	-1.04	*	-1.01	*	-1.03		-1.01	*	-0.87	
wed	0.14		0.13		0.16		0.14		0.16		0.27	
thu	-0.63		-0.63		-0.57		-0.61		-0.58		-0.34	
fri	-0.37		-0.36		-0.43		-0.38		-0.42		-0.66	
elig1_i	-0.34		-0.35		-0.24		-0.31		-0.26		0.15	
elig2_i	-0.87		-0.88		-0.75		-0.84		-0.77		-0.29	
schsize2_i	0.10		0.10		0.11		0.10		0.11		0.17	
schsize3_i	-0.10		-0.10		-0.07		-0.09		-0.08		0.02	
pov2_i	0.55		0.55		0.58		0.56		0.58		0.72	
pov3_i	0.42		0.41		0.45		0.43		0.45		0.60	
reg_mt	1.08		1.08		1.11		1.09		1.10		1.21	
reg_mw	0.51		0.51		0.52		0.51		0.52		0.57	
reg_ne	0.83		0.83		0.91		0.85		0.90		1.20	
reg_se	-0.39		-0.39		-0.36		-0.38		-0.37		-0.25	
reg_sw	2.31	*	2.31	*	2.27	*	2.30	*	2.28	*	2.10	*
reg_we	-0.22		-0.22		-0.25		-0.23		-0.25		-0.35	
schl_sbp	-0.98	*	-0.98	*	-1.00	*	-0.99	*	-1.00	*	-1.08	*
urb0405_2	0.92		0.93		0.91		0.92		0.92		0.87	
urb0405_3	0.18		0.18		0.24		0.20		0.23		0.43	
high	0.56		0.56		0.50		0.54		0.51		0.30	
dist_nutreq_vendorspecs_i	1.14		1.14		1.18		1.15		1.17		1.31	
lim_fat_vendorspecs_i	-1.33		-1.32		-1.35	*	-1.33		-1.35	*	-1.46	*
prep_onsite_i	0.20		0.20		0.28		0.23		0.27		0.59	
nochainfd_i	0.63		0.63		0.65		0.63		0.64		0.71	
no_open_campus_i	-0.05		-0.05		0.00		-0.04		-0.01		0.19	
no_vending_meal_i	0.15		0.15		0.16		0.16		0.16		0.19	
no_vending_day_i	-0.37		-0.37		-0.31		-0.35		-0.32		-0.08	
low_vending	0.22		0.22		0.27		0.23		0.26		0.43	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	0.36		0.36		0.41		0.37		0.40		0.58	
alc_nossb	0.27		0.26		0.30		0.28		0.30		0.44	
nobarstore_i	0.17		0.17		0.17		0.17		0.17		0.19	
onlyskim1per_offered	0.58		0.58		0.55		0.57		0.55		0.43	
whole_milk_not_offered	-0.18		-0.19		-0.10		-0.16		-0.12		0.18	
yogurt_offered	-0.13		-0.13		-0.14		-0.13		-0.14		-0.16	
pct_entrees_highsatfat	-0.01		-0.01		-0.01		-0.01		-0.01		0.00	
juice_not_offered	-0.79	*	-0.79	*	-0.78	*	-0.78	*	-0.78	*	-0.73	
fresh_fruit_daysperwk_offer	0.18		0.18		0.18		0.18		0.18		0.16	
side_salad_bar_offered	-1.47	*	-1.47	*	-1.46	*	-1.47	*	-1.46	*	-1.44	*
avg_veg_perday	-0.35		-0.35		-0.33		-0.35		-0.33		-0.24	
raw_veggies_offered	0.07		0.07		0.08		0.07		0.08		0.13	
darkveg_daysperwk_offer	0.19		0.19		0.17		0.19		0.18		0.11	
frenchfries_daysperwk_offer	-0.14		-0.14		-0.13		-0.14		-0.13		-0.07	
self_serve_dress_not_off	0.35		0.35		0.36		0.35		0.36		0.37	
high_satfat_condt_not_off	0.65		0.65		0.63		0.64		0.63		0.57	
high_satfat_dress_not_off	-0.60		-0.60		-0.57		-0.59		-0.57		-0.45	
R-squared	0.09		0.09		0.09		0.09		0.09		0.06	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.15 Meals Consumed Model – Lunch for Secondary Students

Target Outcome: Fluid Milk Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.92	**	0.92	**	0.80	**	1.15	**	0.69	**	0.44	*
c_nslp	0.87	**	0.88	**	0.66	**	1.30	**	0.46	**	N/A	
female	-0.10	**	-0.10	**	-0.12	**	-0.05		-0.14	**	-0.18	**
black_i	-0.01		-0.01		-0.01		-0.02		-0.01		-0.01	
othrace_i	0.09		0.09		0.09		0.09		0.09		0.08	
white_i	0.04		0.04		0.04		0.04		0.04		0.03	
tue	-0.06		-0.06		-0.05		-0.09		-0.03		-0.01	
wed	0.01		0.01		0.02		-0.01		0.03		0.05	
thu	-0.05		-0.06		-0.03		-0.10		-0.01		0.04	
fri	0.18	*	0.18	*	0.16		0.23	*	0.14		0.09	
elig1_i	-0.05		-0.05		-0.02		-0.13		0.02		0.10	*
elig2_i	0.02		0.02		0.07		-0.07		0.11	*	0.20	**
schsize2_i	-0.07		-0.07		-0.06		-0.08		-0.06		-0.04	
schsize3_i	-0.09		-0.09		-0.08		-0.11		-0.07		-0.05	
pov2_i	-0.09		-0.09		-0.08		-0.12	*	-0.07		-0.04	
pov3_i	-0.10		-0.10		-0.08		-0.13		-0.07		-0.04	
reg_mt	-0.04		-0.04		-0.03		-0.06		-0.02		0.00	
reg_mw	0.13		0.13		0.13	*	0.12		0.14	*	0.15	*
reg_ne	0.04		0.04		0.07		-0.02		0.09		0.15	
reg_se	-0.11		-0.11		-0.10		-0.13		-0.09		-0.07	
reg_sw	-0.01		-0.01		-0.03		0.02		-0.04		-0.08	
reg_we	0.02		0.02		0.01		0.04		0.00		-0.02	
schl_sbp	0.00		0.00		-0.01		0.02		-0.01		-0.03	
urb0405_2	0.03		0.03		0.02		0.04		0.02		0.01	
urb0405_3	0.03		0.03		0.05		-0.01		0.07		0.11	*
high	0.03		0.03		0.01		0.07		-0.01		-0.05	
dist_nutreq_vendorspecs_i	0.03		0.03		0.04		0.00		0.05		0.08	
lim_fat_vendorspecs_i	-0.16	*	-0.16	*	-0.17	*	-0.14		-0.18	**	-0.20	**
prep_onsite_i	-0.07		-0.07		-0.04		-0.13		-0.01		0.05	
nochainfd_i	-0.05		-0.05		-0.04		-0.06		-0.03		-0.02	
no_open_campus_i	-0.05		-0.05		-0.03		-0.09		-0.01		0.03	
no_vending_meal_i	-0.04		-0.04		-0.03		-0.04		-0.03		-0.02	
no_vending_day_i	0.05		0.04		0.07		0.00		0.09		0.13	*
low_vending	-0.05		-0.05		-0.03		-0.08		-0.02		0.02	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	-0.05		-0.05		-0.03		-0.09		-0.02		0.02	
alc_nossb	0.07		0.07		0.08		0.04		0.10	*	0.12	**
nobarstore_i	0.04		0.04		0.05		0.04		0.05		0.05	
onlyskim1per_offered	-0.08		-0.08		-0.09	*	-0.06		-0.10	**	-0.13	**
whole_milk_not_offered	-0.02		-0.02		0.01		-0.07		0.04		0.10	*
yogurt_offered	-0.06		-0.06		-0.06		-0.05		-0.06		-0.07	
pct_entrees_highsatfat	-0.01	**	-0.01	**	-0.01	**	-0.01	**	0.00	**	0.00	
juice_not_offered	0.07	*	0.07	*	0.08	**	0.07		0.08	**	0.09	**
fresh_fruit_daysperwk_offer	0.01		0.01		0.01		0.01		0.01		0.00	
side_salad_bar_offered	-0.01		-0.01		-0.01		-0.01		-0.01		0.00	
avg_veg_perday	-0.01		-0.01		0.00		-0.03		0.01		0.02	
raw_veggies_offered	-0.01		-0.01		-0.01		-0.02		0.00		0.01	
darkveg_daysperwk_offer	0.00		0.00		0.00		0.02		-0.01		-0.02	
frenchfries_daysperwk_offer	-0.02		-0.02		-0.02		-0.03	*	-0.01		0.00	
self_serve_dress_not_off	0.01		0.01		0.01		0.01		0.01		0.01	
high_satfat_condt_not_off	0.07		0.07		0.06		0.08		0.06		0.05	
high_satfat_dress_not_off	-0.09	*	-0.09	*	-0.08	*	-0.12	*	-0.07	*	-0.05	
R-squared	0.21		0.21		0.30		0.15		0.33		0.19	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.16 Meals Consumed Model – Lunch for Secondary Students

Target Outcome: Fruit Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.19		0.19		0.22		0.13		0.13		0.15	
c_nslp	0.07		0.07		0.13		-0.04		-0.03		N/A	
female	0.00		0.00		0.01		-0.01		-0.01		-0.01	
black_i	-0.04		-0.04		-0.04		-0.04		-0.04		-0.04	
othrace_i	-0.08	*	-0.08	*	-0.08	*	-0.08	*	-0.08	*	-0.08	*
white_i	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
tue	-0.04		-0.04		-0.04		-0.03		-0.03		-0.03	
wed	0.00		0.00		0.00		0.01		0.01		0.01	
thu	0.01		0.01		0.00		0.02		0.02		0.02	
fri	0.08		0.08		0.09		0.07		0.07		0.07	
elig1_i	-0.03		-0.03		-0.05		-0.02		-0.02		-0.02	
elig2_i	-0.01		-0.01		-0.03		0.01		0.01		0.00	
schsize2_i	-0.07	*	-0.07	*	-0.07	*	-0.07		-0.07	*	-0.07	*
schsize3_i	-0.08		-0.08		-0.09		-0.08		-0.08		-0.08	
pov2_i	-0.10	*	-0.10	*	-0.10	*	-0.09	*	-0.09	*	-0.09	*
pov3_i	-0.04		-0.04		-0.04		-0.03		-0.03		-0.04	
reg_mt	0.01		0.01		0.01		0.02		0.02		0.02	
reg_mw	0.01		0.01		0.01		0.01		0.01		0.01	
reg_ne	0.14	**	0.14	**	0.13	*	0.16	*	0.16	**	0.15	**
reg_se	0.06		0.06		0.06		0.07		0.07		0.07	
reg_sw	0.02		0.02		0.02		0.01		0.01		0.01	
reg_we	0.05		0.05		0.05		0.04		0.04		0.04	
schl_sbp	0.11	**	0.11	**	0.11	**	0.11	**	0.11	**	0.11	**
urb0405_2	0.02		0.02		0.02		0.02		0.02		0.02	
urb0405_3	0.02		0.02		0.01		0.03		0.03		0.02	
high	0.07		0.07		0.08		0.06		0.06		0.06	
dist_nutreq_vendorspecs_i	0.11		0.11		0.11		0.12	*	0.12	*	0.12	*
lim_fat_vendorspecs_i	-0.11		-0.11		-0.11		-0.12	*	-0.12	*	-0.12	*
prep_onsite_i	-0.02		-0.02		-0.03		-0.01		-0.01		-0.01	
nochainfd_i	-0.11	**	-0.11	**	-0.11	**	-0.10	**	-0.10	**	-0.10	**
no_open_campus_i	-0.06		-0.06		-0.07		-0.05		-0.05		-0.06	
no_vending_meal_i	-0.08	*	-0.08	*	-0.08	*	-0.08	**	-0.08	**	-0.08	**
no_vending_day_i	0.10	**	0.10	**	0.09	**	0.11	**	0.11	**	0.10	**
low_vending	0.03		0.03		0.02		0.04		0.04		0.03	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	0.03		0.03		0.02		0.04		0.04		0.03	
alc_nossb	0.03		0.03		0.03		0.04		0.04		0.04	
nobarstore_i	0.06	*	0.06	*	0.06	*	0.06	*	0.06	*	0.06	*
onlyskim1per_offered	0.01		0.01		0.01		0.00		0.00		0.00	
whole_milk_not_offered	0.01		0.01		0.00		0.02		0.02		0.02	
yogurt_offered	-0.04		-0.04		-0.04		-0.04		-0.04		-0.04	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	0.04		0.04		0.04		0.05		0.05	*	0.05	
fresh_fruit_daysperwk_offer	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
side_salad_bar_offered	0.05		0.05		0.05		0.05		0.05		0.05	
avg_veg_perday	-0.01		-0.01		-0.01		0.00		0.00		0.00	
raw_veggies_offered	-0.03		-0.03		-0.04		-0.03		-0.03		-0.03	
darkveg_daysperwk_offer	0.02		0.02		0.02	*	0.02		0.02		0.02	
frenchfries_daysperwk_offer	0.00		0.00		0.00		0.00		0.00		0.00	
self_serve_dress_not_off	0.00		0.00		0.00		0.00		0.00		0.00	
high_satfat_condt_not_off	0.01		0.01		0.01		0.01		0.01		0.01	
high_satfat_dress_not_off	-0.06		-0.06		-0.06		-0.05		-0.05		-0.06	
R-squared	0.06		0.06		0.03		0.07		0.07		0.07	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.17 Meals Consumed Model – Lunch for Secondary Students

Target Outcome: Vegetable Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.31	**	0.31	**	0.39	**	0.11		0.32	*	0.23	
c_nslp	0.15		0.15		0.30	*	-0.22		0.16	**	N/A	
female	-0.05		-0.05		-0.03		-0.08	*	-0.05	*	-0.06	**
black_i	0.02		0.02		0.02		0.02		0.02		0.02	
othrace_i	-0.08		-0.08		-0.08		-0.08		-0.08		-0.08	
white_i	-0.03		-0.03		-0.03		-0.03		-0.03		-0.03	
tue	-0.07	*	-0.07	*	-0.07	**	-0.04		-0.07	*	-0.06	*
wed	-0.01		-0.01		-0.01		0.01		-0.01		0.00	
thu	-0.03		-0.03		-0.04		0.01		-0.03		-0.01	
fri	-0.02		-0.02		0.00		-0.06		-0.02		-0.03	
elig1_i	-0.01		-0.01		-0.03		0.06		-0.01		0.02	
elig2_i	0.04		0.04		0.01		0.11		0.03		0.07	
schsize2_i	0.01		0.01		0.00		0.02		0.01		0.01	
schsize3_i	-0.03		-0.03		-0.04		-0.02		-0.03		-0.03	
pov2_i	0.02		0.02		0.01		0.04		0.02		0.03	
pov3_i	0.04		0.04		0.03		0.07		0.04		0.05	
reg_mt	-0.04		-0.04		-0.05		-0.02		-0.04		-0.03	
reg_mw	-0.09		-0.09		-0.09	*	-0.08		-0.09		-0.09	
reg_ne	-0.03		-0.03		-0.05		0.02		-0.03		-0.01	
reg_se	0.00		0.00		-0.01		0.02		0.00		0.01	
reg_sw	-0.04		-0.04		-0.03		-0.07		-0.04		-0.05	
reg_we	-0.03		-0.03		-0.02		-0.05		-0.03		-0.04	
schl_sbp	-0.03		-0.03		-0.02		-0.04		-0.03		-0.03	
urb0405_2	0.07	*	0.07	*	0.07	*	0.06		0.07	*	0.06	*
urb0405_3	0.03		0.03		0.02		0.06		0.03		0.04	
high	0.16	**	0.16	**	0.17	**	0.13	**	0.16	**	0.15	**
dist_nutreq_vendorspecs_i	-0.10		-0.10		-0.10		-0.07		-0.10		-0.09	
lim_fat_vendorspecs_i	0.09		0.09		0.10		0.07		0.09		0.08	
prep_onsite_i	-0.07	*	-0.07	*	-0.09	*	-0.02		-0.07	*	-0.05	
nochainfd_i	-0.06	*	-0.06	*	-0.07	*	-0.05		-0.06	*	-0.06	*
no_open_campus_i	0.02		0.02		0.01		0.05		0.02		0.03	
no_vending_meal_i	-0.06	*	-0.06	*	-0.06	*	-0.05		-0.06	*	-0.05	
no_vending_day_i	0.06		0.06		0.05		0.10	*	0.06		0.08	*
low_vending	0.06		0.06		0.05		0.08	*	0.06		0.07	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	0.14	**	0.14	**	0.13	**	0.17	**	0.14	**	0.15	**
alc_nossb	-0.08	*	-0.08	*	-0.09	**	-0.06		-0.08	*	-0.07	*
nobarstore_i	0.02		0.02		0.02		0.02		0.02		0.02	
onlyskim1per_offered	-0.02		-0.02		-0.01		-0.04		-0.02		-0.03	
whole_milk_not_offered	0.07		0.07		0.05		0.12		0.07		0.09	*
yogurt_offered	0.02		0.02		0.02		0.01		0.02		0.01	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00		0.00	
juice_not_offered	0.04		0.04		0.04		0.05		0.04		0.04	
fresh_fruit_daysperwk_offer	0.01		0.01		0.01		0.00		0.01		0.00	
side_salad_bar_offered	0.02		0.02		0.02		0.02		0.02		0.02	
avg_veg_perday	-0.01		-0.01		-0.01		0.01		-0.01		0.00	
raw_veggies_offered	0.02		0.02		0.02		0.03		0.02		0.02	
darkveg_daysperwk_offer	-0.01		-0.01		0.00		-0.02		-0.01		-0.01	
frenchfries_daysperwk_offer	-0.01		-0.01		-0.01		0.00		-0.01		-0.01	
self_serve_dress_not_off	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
high_satfat_condt_not_off	-0.10	**	-0.10	**	-0.09	*	-0.11	*	-0.10	**	-0.10	*
high_satfat_dress_not_off	0.07	*	0.07	*	0.06	*	0.09	*	0.07	**	0.08	**
R-squared	0.10		0.10		0.08		0.07		0.10		0.08	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.18 Meals Consumed Model – Lunch for Secondary Students

Target Outcome: Dark Green and Orange Vegetable Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.05		0.05		0.05		0.04		0.08		0.07	
c_nslp	-0.04		-0.04		-0.03		-0.06		0.01		N/A	
female	0.00		0.00		0.00		0.00		0.00		0.00	
black_i	0.01		0.01		0.01		0.01		0.01		0.01	
othrace_i	0.00		0.00		0.00		0.00		0.00		0.00	
white_i	0.01	*	0.01	*	0.01	*	0.01	*	0.01	*	0.01	*
tue	0.00		0.00		0.00		0.00		0.00		0.00	
wed	0.00		0.00		0.00		0.00		0.00		0.00	
thu	0.00		0.00		0.00		0.00		-0.01		0.00	
fri	-0.02	*	-0.02	*	-0.02	*	-0.03	*	-0.02		-0.02	*
elig1_i	0.01	*	0.01	*	0.01		0.02	*	0.01		0.01	
elig2_i	0.02		0.02		0.02		0.03		0.01		0.01	
schsize2_i	0.00		0.00		0.00		0.00		0.00		0.00	
schsize3_i	0.00		0.00		0.00		0.00		0.00		0.00	
pov2_i	0.00		0.00		0.00		0.00		0.00		0.00	
pov3_i	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
reg_mt	0.01		0.01		0.01		0.01		0.01		0.01	
reg_mw	0.01		0.01		0.01		0.01		0.01		0.01	
reg_ne	-0.01		-0.01		-0.01		-0.01		-0.02		-0.02	
reg_se	0.02		0.02		0.02		0.02		0.01		0.02	
reg_sw	0.00		0.00		0.00		0.00		0.00		0.00	
reg_we	0.01		0.01		0.01		0.01		0.02		0.02	
schl_sbp	0.00		0.00		0.00		0.00		0.01		0.01	
urb0405_2	-0.02	**	-0.02	**	-0.02	**	-0.02	**	-0.01	*	-0.02	**
urb0405_3	-0.01		-0.01		-0.01		-0.01		-0.02	**	-0.02	**
high	0.01		0.01		0.01		0.01		0.01	*	0.01	
dist_nutreq_vendorspecs_i	0.00		0.00		0.00		0.00		-0.01		-0.01	
lim_fat_vendorspecs_i	0.01		0.01		0.01		0.01		0.02	*	0.01	
prep_onsite_i	0.00		0.00		0.00		0.00		-0.01		-0.01	
nochainfd_i	0.00		0.00		0.00		0.00		0.00		0.00	
no_open_campus_i	0.00		0.00		0.00		0.00		0.00		0.00	
no_vending_meal_i	0.00		0.00		0.00		0.00		0.00		0.00	
no_vending_day_i	0.01		0.01		0.01		0.01		0.01		0.01	
low_vending	0.01	*	0.01	*	0.01	*	0.01	*	0.01		0.01	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	0.03	**	0.03	**	0.03	**	0.03	**	0.03	**	0.03	**
alc_nossb	-0.01		-0.01		-0.01		-0.01		-0.01	*	-0.01	*
nobarstore_i	0.01	**	0.01	**	0.01	**	0.01	*	0.01	**	0.01	**
onlyskim1per_offered	-0.02	**	-0.02	**	-0.02	**	-0.02	**	-0.02	**	-0.02	**
whole_milk_not_offered	0.02	*	0.02	*	0.02	*	0.02	*	0.01		0.01	*
yogurt_offered	0.00		0.00		0.00		0.00		0.00		0.00	
pct_entrees_highsatfat	0.00		0.00		0.00		0.00		0.00	*	0.00	*
juice_not_offered	0.00		0.00		0.00		0.00		0.00		0.00	
fresh_fruit_daysperwk_offer	0.00		0.00		0.00		0.00		0.00		0.00	
side_salad_bar_offered	0.01	*	0.01	*	0.01	*	0.01		0.01		0.01	*
avg_veg_perday	0.01	*	0.01	*	0.01	*	0.01	*	0.00		0.00	
raw_veggies_offered	-0.01		-0.01		-0.01		-0.01		-0.01		-0.01	
darkveg_daysperwk_offer	0.00	*	0.00	*	0.00	*	-0.01	*	0.00		0.00	
frenchfries_daysperwk_offer	0.00		0.00		0.00		0.00		0.00	**	0.00	**
self_serve_dress_not_off	-0.01	*	-0.01	*	-0.01	*	-0.01	*	-0.01	*	-0.01	*
high_satfat_condt_not_off	0.00		0.00		0.00		0.00		0.00		0.00	
high_satfat_dress_not_off	0.01		0.01		0.01		0.01		0.01		0.01	
R-squared	0.05		0.05		0.01		0.05		0.06		0.06	
N	1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.19 Meals Consumed Model – Breakfast for Elementary Students
Target Outcome: Percentage of Calories from Saturated Fat

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	12.43	**	12.67	**	10.19	*	13.28	**	8.92	**	9.40	**
c_sbp	-4.29		-4.63		-1.12		-5.48		0.68		N/A	
female	-1.19		-1.23		-0.91		-1.30		-0.75		-0.81	
black_i	0.09		0.09		0.04		0.11		0.02		0.03	
othrace_i	1.00		1.02		0.79		1.07		0.67		0.72	
white_i	-0.08		-0.09		-0.04		-0.10		-0.02		-0.03	
tue	-1.41		-1.40		-1.53		-1.36		-1.59		-1.57	
wed	-0.39		-0.41		-0.21		-0.46		-0.10		-0.14	
thu	0.17		0.17		0.16		0.17		0.16		0.16	
fri	-0.20		-0.21		-0.15		-0.22		-0.12		-0.13	
elig1_i	0.68		0.73		0.20		0.86		-0.07		0.04	
elig2_i	0.90		0.95		0.41		1.09		0.13		0.24	
schsize2_i	0.40		0.41		0.28		0.45		0.21		0.23	
schsize3_i	-0.01		-0.02		0.12		-0.06		0.19		0.16	
pov2_i	0.22		0.21		0.28		0.20		0.31		0.30	
pov3_i	-0.80		-0.79		-0.85		-0.77		-0.88		-0.87	
reg_mt	-4.25	*	-4.38	*	-3.06		-4.70	*	-2.39	**	-2.64	**
reg_mw	-3.51	*	-3.57	*	-2.97	*	-3.72	*	-2.66	*	-2.78	**
reg_ne	-3.17		-3.20		-2.90		-3.28		-2.74		-2.80	
reg_se	-2.63		-2.69		-2.06		-2.85		-1.74		-1.86	
reg_sw	-4.82	**	-4.90	**	-4.12	*	-5.09	**	-3.71	**	-3.87	**
reg_we	-4.76	*	-4.90	*	-3.52		-5.23	*	-2.81	*	-3.08	*
urb0405_2	-1.65		-1.71		-1.13		-1.85		-0.83		-0.94	
urb0405_3	-0.59		-0.61		-0.43		-0.65		-0.33		-0.37	
dod_fresh_or_farm_i	0.46		0.49		0.15		0.58		-0.03		0.04	
require5_vendorspecs_i	0.88		0.96		0.17		1.15		-0.23		-0.08	
nutr_ed_i	0.13		0.09		0.54		-0.02		0.78		0.69	
nutr_content_avail_i	0.85		0.86		0.77		0.88		0.72		0.74	
no_vending_day_i	-1.48		-1.53		-0.97		-1.67		-0.69		-0.80	
nossb_vending_i	-0.02		-0.07		0.45		-0.20		0.72		0.61	
noalc_lfmilk_i	0.44		0.46		0.19		0.53		0.05		0.10	
ac_hlthy	-0.62		-0.60		-0.75		-0.57		-0.83		-0.80	
alc_fruitveg	-3.05	**	-3.09	**	-2.69	**	-3.19	**	-2.48	**	-2.56	**
nofoodfund_i	-0.51		-0.52		-0.48		-0.52		-0.46		-0.47	
onlyskim1per_offered	0.99		1.04		0.57		1.15		0.34		0.43	
whole_milk_not_offered	-1.08		-1.13		-0.70		-1.23		-0.47		-0.56	
flavored_milk_offered	1.22		1.18		1.56		1.09		1.76	**	1.68	**

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	0.34		0.41		-0.35		0.60		-0.74		-0.60	
hisatfat_entr_daysperwk_offer	0.73	**	0.74	*	0.62	*	0.77	*	0.55	**	0.58	**
fresh_fruit_daysperwk_offer	0.25		0.25		0.26		0.24		0.27		0.26	
avg_hotcereal_perday	-2.20		-2.01		-4.04		-1.51		-5.09		-4.69	
pastry_daysperwk_offer	-0.19		-0.19		-0.14		-0.21		-0.11		-0.13	
sweet_cereal_daysperwk_offer	-0.08		-0.11		0.21		-0.19		0.37		0.31	
R-squared	0.02		0.12		0.12		0.11		0.13		0.13	
N	630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.20 Meals Consumed Model – Breakfast for Elementary Students
Target Outcome: Fluid Milk Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	1.10	**	1.07	*	0.68		1.12	*	1.10	**	1.25	**
c_sbp	0.21		0.26		0.81		0.18		0.22	**	N/A	
female	-0.14	*	-0.14	*	-0.09		-0.15	*	-0.14	*	-0.16	*
black_i	-0.17		-0.17		-0.18		-0.17		-0.17		-0.17	
othrace_i	0.20		0.20		0.16		0.20		0.20		0.22	
white_i	0.15		0.15		0.16		0.15		0.15		0.15	
tue	-0.14		-0.14		-0.16		-0.14		-0.14		-0.13	
wed	-0.07		-0.07		-0.03		-0.07		-0.07		-0.08	
thu	-0.04		-0.04		-0.04		-0.04		-0.04		-0.03	
fri	0.11		0.11		0.12		0.11		0.11		0.11	
elig1_i	0.16		0.16		0.08		0.17		0.16		0.20	*
elig2_i	0.17		0.16		0.07		0.17		0.17		0.20	
schsize2_i	-0.03		-0.03		-0.05		-0.03		-0.03		-0.02	
schsize3_i	-0.11		-0.10		-0.08		-0.11		-0.11		-0.11	
pov2_i	-0.07		-0.07		-0.06		-0.07		-0.07		-0.07	
pov3_i	-0.17		-0.18		-0.19		-0.17		-0.17		-0.17	
reg_mt	-0.23		-0.21		-0.01		-0.24		-0.23		-0.31	
reg_mw	0.03		0.04		0.13		0.03		0.03		-0.01	
reg_ne	0.00		0.01		0.05		0.00		0.00		-0.02	
reg_se	-0.14		-0.13		-0.03		-0.14		-0.14		-0.18	
reg_sw	-0.09		-0.08		0.04		-0.10		-0.09		-0.14	
reg_we	-0.10		-0.08		0.14		-0.11		-0.10		-0.18	
urb0405_2	-0.23		-0.22		-0.13		-0.24		-0.23		-0.27	*
urb0405_3	-0.25	**	-0.25	**	-0.22	*	-0.26	**	-0.25	**	-0.27	**
dod_fresh_or_farm_i	-0.05		-0.05		-0.11		-0.05		-0.05		-0.03	
require5_vendorspecs_i	-0.02		-0.03		-0.16		-0.01		-0.02		0.03	
nutr_ed_i	0.02		0.02		0.09		0.01		0.02		-0.01	
nutr_content_avail_i	-0.06		-0.06		-0.08		-0.06		-0.06		-0.05	
no_vending_day_i	-0.17		-0.16		-0.07		-0.17		-0.17		-0.20	*
nossb_vending_i	-0.08		-0.07		0.01		-0.09		-0.08		-0.11	
noalc_lfmilk_i	-0.05		-0.05		-0.09		-0.04		-0.05		-0.03	
ac_hlthy	-0.03		-0.03		-0.05		-0.03		-0.03		-0.02	
alc_fruitveg	-0.03		-0.02		0.04		-0.03		-0.03		-0.05	
nofoodfund_i	-0.18	*	-0.18	*	-0.18	*	-0.18	*	-0.18	*	-0.18	*

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
onlyskim1per_offered	0.11		0.10		0.03		0.11		0.11		0.14	
whole_milk_not_offered	-0.26		-0.26		-0.19		-0.27		-0.26	*	-0.29	*
flavored_milk_offered	-0.13		-0.12		-0.06		-0.13		-0.13		-0.15	
cereal_offered_daily	-0.05		-0.06		-0.18		-0.04		-0.05		-0.01	
hisatfat_entr_daysperwk_offer	0.08	**	0.08	*	0.06		0.08	*	0.08	**	0.09	**
fresh_fruit_daysperwk_offer	-0.02		-0.02		-0.02		-0.02		-0.02		-0.02	
avg_hotcereal_perday	-0.18		-0.20		-0.52		-0.15		-0.18		-0.05	
pastry_daysperwk_offer	0.04		0.04		0.05		0.04		0.04		0.04	
sweet_cereal_daysperwk_offer	0.01		0.01		0.06		0.01		0.01		-0.01	
R-squared	0.12		0.12		0.02		0.12		0.12		0.11	
N	630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.21 Meals Consumed Model – Breakfast for Elementary Students
Target Outcome: Fruit Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.43	*	0.45	*	-0.22		0.51	*	0.24		0.23	
c_sbp	-0.29		-0.31		0.63		-0.41		-0.02		N/A	
female	-0.04		-0.05		0.04		-0.05		-0.02		-0.02	
black_i	-0.08		-0.08		-0.09		-0.08		-0.08		-0.08	
othrace_i	-0.13		-0.13		-0.19		-0.12		-0.14		-0.15	
white_i	-0.11		-0.11		-0.10		-0.11		-0.10		-0.10	
tue	0.02		0.02		-0.02		0.02		0.01		0.01	
wed	-0.04		-0.04		0.01		-0.05		-0.03		-0.02	
thu	0.04		0.04		0.04		0.04		0.04		0.04	
fri	0.01		0.01		0.02		0.00		0.01		0.01	
elig1_i	0.06		0.07		-0.07		0.08	*	0.02		0.02	
elig2_i	-0.04		-0.04		-0.18		-0.02		-0.08		-0.08	
schsize2_i	0.00		0.00		-0.04		0.00		-0.01		-0.02	
schsize3_i	-0.15	*	-0.16	*	-0.12		-0.16	*	-0.14	*	-0.14	*
pov2_i	-0.01		-0.01		0.01		-0.01		0.00		0.00	
pov3_i	-0.09		-0.09		-0.10		-0.08		-0.09		-0.09	
reg_mt	-0.03		-0.04		0.32		-0.07		0.07		0.08	
reg_mw	0.04		0.03		0.20		0.02		0.08		0.09	
reg_ne	-0.13		-0.13		-0.05		-0.14		-0.11		-0.11	
reg_se	-0.04		-0.04		0.13		-0.06		0.01		0.01	
reg_sw	0.03		0.02		0.23		0.00		0.09		0.09	
reg_we	-0.08		-0.09		0.28		-0.13		0.02		0.03	
urb0405_2	-0.28	**	-0.28	**	-0.13		-0.30	**	-0.24	**	-0.23	**
urb0405_3	-0.18	**	-0.19	**	-0.14		-0.19	**	-0.17	**	-0.17	**
dod_fresh_or_farm_i	0.02		0.02		-0.07		0.03		-0.01		-0.01	
require5_vendorspecs_i	0.01		0.02		-0.19		0.04		-0.04		-0.05	
nutr_ed_i	-0.06		-0.07		0.05		-0.08		-0.03		-0.03	
nutr_content_avail_i	-0.04		-0.04		-0.06		-0.04		-0.05		-0.05	
no_vending_day_i	0.06		0.05		0.20		0.04		0.10		0.10	
nossb_vending_i	0.03		0.03		0.17		0.02		0.07		0.08	
noalc_lfmilk_i	0.06		0.06		-0.01		0.07		0.04		0.04	
ac_hlthy	0.17	**	0.17	**	0.13		0.18	**	0.16	**	0.16	**
alc_fruitveg	0.10		0.09		0.20	*	0.08		0.13	**	0.13	**
nofoodfund_i	-0.03		-0.03		-0.02		-0.03		-0.03		-0.03	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
onlyskim1per_offered	0.06		0.06		-0.06		0.07		0.02		0.02	
whole_milk_not_offered	-0.03		-0.03		0.08		-0.04		0.00		0.01	
flavored_milk_offered	-0.04		-0.04		0.06		-0.05		-0.01		0.00	
cereal_offered_daily	-0.07		-0.07		-0.27		-0.05		-0.13	*	-0.14	*
hisatfat_entr_daysperwk_offer	0.03		0.03		-0.01		0.03		0.02		0.02	
fresh_fruit_daysperwk_offer	0.00		0.00		0.01		0.00		0.00		0.00	
avg_hotcereal_perday	0.09		0.10		-0.45		0.15		-0.07		-0.08	
pastry_daysperwk_offer	0.00		0.00		0.02		0.00		0.01		0.01	
sweet_cereal_daysperwk_offer	-0.02		-0.02		0.07		-0.03		0.01		0.01	
R-squared	0.05		0.04		0.08		0.10		0.11		0.11	
N	630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.22 Meals Consumed Model – Breakfast for Elementary Students
Target Outcome: Added Sugars Equivalents (Teaspoons)

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	3.55		3.36		-8.10		1.98		3.15		3.79	
c_sbp	0.34		0.61		16.82		-1.69		0.90		N/A	
female	-0.45		-0.42		1.03		-0.63		-0.40		-0.48	
black_i	0.33		0.32		0.08		0.36		0.32		0.33	
othrace_i	-0.49		-0.51		-1.57		-0.36		-0.53		-0.47	
white_i	-0.01		-0.01		0.19		-0.03		0.00		-0.01	
tue	0.49		0.48		-0.13		0.56		0.47		0.50	
wed	0.60		0.62		1.57		0.48		0.64		0.58	
thu	0.63		0.63		0.59		0.63		0.62		0.63	
fri	0.97		0.97		1.24		0.94		0.98		0.96	
elig1_i	0.86		0.82		-1.61		1.16		0.78		0.91	
elig2_i	0.98		0.93		-1.57		1.29		0.89		1.03	
schsize2_i	-0.14		-0.15		-0.78		-0.06		-0.16		-0.13	
schsize3_i	-2.15	**	-2.14	**	-1.47		-2.23	**	-2.13	**	-2.16	**
pov2_i	-0.94		-0.93		-0.65		-0.97		-0.93		-0.94	
pov3_i	-1.75	*	-1.75	*	-2.03		-1.71	*	-1.76	*	-1.74	*
reg_mt	-1.25		-1.15		4.94		-2.01		-1.04		-1.38	
reg_mw	0.28		0.33		3.11		-0.06		0.38		0.23	
reg_ne	0.00		0.02		1.44		-0.18		0.05		-0.03	
reg_se	-0.51		-0.46		2.46		-0.87		-0.41		-0.57	
reg_sw	-1.24		-1.18		2.43		-1.69		-1.12		-1.32	
reg_we	-0.22		-0.12		6.25		-1.02		0.00		-0.36	
urb0405_2	-0.85		-0.80		1.89		-1.18		-0.76		-0.90	
urb0405_3	-0.28		-0.26		0.57		-0.38		-0.25		-0.29	
dod_fresh_or_farm_i	-0.34		-0.37		-1.96		-0.14		-0.40		-0.31	
require5_vendorspecs_i	-0.44		-0.51		-4.14		0.01		-0.57		-0.37	
nutr_ed_i	1.48	*	1.51	*	3.63	*	1.22		1.55	**	1.44	**
nutr_content_avail_i	-0.49		-0.50		-0.93		-0.44		-0.51		-0.48	
no_vending_day_i	-0.12		-0.08		2.51		-0.44		-0.03		-0.17	
nossb_vending_i	-0.25		-0.21		2.19		-0.55		-0.17		-0.30	
noalc_lfmilk_i	0.44		0.42		-0.85		0.59		0.39		0.46	
ac_hlthy	-0.05		-0.06		-0.74		0.03		-0.07		-0.04	
alc_fruitveg	0.47		0.50		2.38		0.23		0.53		0.43	
nofoodfund_i	-0.14		-0.14		0.03		-0.16		-0.14		-0.15	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
onlyskim1per_offered	1.60	*	1.57	*	-0.58		1.87	**	1.53	**	1.65	**
whole_milk_not_offered	-1.38		-1.35		0.64		-1.63		-1.31	*	-1.42	*
flavored_milk_offered	0.58		0.61		2.37		0.36		0.64		0.54	
cereal_offered_daily	0.40		0.34		-3.20		0.84		0.28		0.47	
hisatfat_entr_daysperwk_offer	-0.15		-0.15		-0.73		-0.07		-0.17		-0.13	
fresh_fruit_daysperwk_offer	-0.27		-0.27		-0.22		-0.28		-0.27		-0.27	
avg_hotcereal_perday	1.39		1.23		-8.18		2.57		1.07		1.59	
pastry_daysperwk_offer	0.34		0.34		0.59		0.31		0.35		0.33	
sweet_cereal_daysperwk_offer	0.37		0.39		1.87		0.18		0.42	*	0.34	
R-squared	0.11		0.11		0.05		0.07		0.11		0.11	
N	630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.23 Meals Consumed Model – Breakfast for Secondary Students
Target Outcome: Percentage of Calories from Saturated Fat

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	9.02	**	9.03	**	9.71	**	8.55	**	8.68	**	8.95	**
c_sbp	-0.67		-0.79		-7.29		3.81		2.53	**	N/A	
female	-1.05	**	-1.06	*	-1.60		-0.68		-0.78		-0.99	*
black_i	-1.95	*	-1.94	*	-1.28		-2.40	*	-2.27	**	-2.01	*
othrace_i	-2.12		-2.12		-1.91		-2.26		-2.22		-2.14	
white_i	-1.39	*	-1.39	*	-1.39	*	-1.40	*	-1.40	*	-1.39	*
tue	0.89		0.89		0.93		0.85		0.86		0.88	
wed	0.38		0.39		0.79		0.10		0.18		0.34	
thu	0.52		0.53		1.01		0.19		0.28		0.47	
fri	0.01		0.01		0.28		-0.18		-0.12		-0.02	
elig1_i	-0.86		-0.84		-0.05		-1.40	*	-1.25	**	-0.94	*
elig2_i	1.09		1.09		1.42		0.86		0.93		1.05	
schsize2_i	-1.06		-1.06		-1.04		-1.07		-1.06		-1.06	
schsize3_i	-1.73	*	-1.74	*	-1.94		-1.59	*	-1.63	*	-1.71	*
pov2_i	2.04	**	2.05	**	2.44	**	1.77	**	1.85	**	2.00	**
pov3_i	1.27	*	1.28	*	1.75		0.94		1.03		1.22	*
reg_mt	-0.27		-0.29		-1.17		0.33		0.16		-0.18	
reg_mw	-1.21		-1.22		-1.53		-1.00		-1.06		-1.18	
reg_ne	-0.54		-0.54		-0.62		-0.48		-0.49		-0.53	
reg_se	-0.58		-0.59		-0.90		-0.37		-0.43		-0.55	
reg_sw	-1.01		-1.01		-1.45		-0.71		-0.79		-0.96	
reg_we	-0.04		-0.05		-0.57		0.31		0.21		0.01	
urb0405_2	0.40		0.40		0.56		0.29		0.32		0.38	
urb0405_3	-0.90		-0.89		-0.47		-1.19		-1.11	*	-0.94	
high	0.19		0.18		-0.20		0.45		0.37		0.23	
dod_fresh_or_farm_i	-0.39		-0.39		-0.66		-0.21		-0.26		-0.36	
nutr_content_avail_i	0.75		0.74		0.65		0.81		0.79		0.75	
no_vending_meal_i	-0.51		-0.51		-0.55		-0.48		-0.49		-0.51	
no_vending_day_i	-0.37		-0.37		-0.40		-0.36		-0.36		-0.37	
vending_notinsfa	-0.35		-0.35		-0.18		-0.47		-0.44		-0.37	
nossb_vending_i	1.33		1.32		0.95		1.59		1.52		1.37	
onlyskim1per_offered	0.30		0.29		-0.02		0.51		0.45		0.33	
whole_milk_not_offered	-0.49		-0.48		0.05		-0.86		-0.75		-0.55	
flavored_milk_offered	0.80		0.79		0.34		1.11		1.02		0.84	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	0.02		0.02		-0.18		0.16		0.12		0.04	
hisatfat_entr_daysperwk_offer	-0.07		-0.07		0.04		-0.14		-0.12		-0.08	
fresh_fruit_daysperwk_offer	-0.15		-0.15		-0.12		-0.18		-0.17		-0.16	
avg_sweetcereal_perday	0.07		0.07		0.13		0.03		0.04		0.07	
unsw_cereal_daysperwk_offer	0.16		0.16		0.16		0.16		0.16		0.16	
R-squared	0.05		0.05		0.05		0.07		0.08		0.06	
N	1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.24 Meals Consumed Model – Breakfast for Secondary Students
Target Outcome: Fluid Milk Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.78	**	0.76	**	0.83	**	0.75	**	0.68	**	0.70	**
c_sbp	-0.81		-0.55		-1.24		-0.53		0.17	**	N/A	
female	-0.31	**	-0.28	**	-0.34	**	-0.28	**	-0.22	**	-0.24	**
black_i	-0.08		-0.10		-0.03		-0.10		-0.17	**	-0.16	**
othrace_i	-0.17		-0.18		-0.16		-0.18		-0.20	*	-0.19	*
white_i	-0.05		-0.05		-0.05		-0.05		-0.05		-0.05	
tue	-0.03		-0.03		-0.03		-0.03		-0.04		-0.04	
wed	0.11		0.09		0.13		0.09		0.05		0.06	
thu	0.12		0.10		0.15		0.10		0.05		0.06	
fri	0.16		0.14		0.17		0.14		0.11		0.12	
elig1_i	0.08		0.05		0.14		0.05		-0.04		-0.01	
elig2_i	0.11		0.10		0.13		0.10		0.06		0.07	
schsize2_i	-0.14		-0.14		-0.14		-0.14		-0.14	*	-0.14	*
schsize3_i	-0.14		-0.13		-0.15		-0.13		-0.11		-0.11	
pov2_i	0.17	*	0.15	*	0.19	*	0.15	*	0.11		0.12	
pov3_i	0.13		0.11		0.16		0.11		0.06		0.07	
reg_mt	0.07		0.10		0.01		0.10		0.20	*	0.18	
reg_mw	0.08		0.10		0.06		0.10		0.13		0.12	
reg_ne	0.28	*	0.28	**	0.27	*	0.28	**	0.29	**	0.29	**
reg_se	0.06		0.07		0.03		0.07		0.10		0.09	
reg_sw	-0.08		-0.06		-0.11		-0.06		-0.01		-0.02	
reg_we	-0.06		-0.04		-0.09		-0.04		0.02		0.01	
urb0405_2	0.08		0.07		0.09		0.07		0.05		0.06	
urb0405_3	0.05		0.03		0.08		0.03		-0.02		-0.01	
high	-0.11		-0.10		-0.13		-0.09		-0.05		-0.06	
dod_fresh_or_farm_i	-0.03		-0.02		-0.05		-0.02		0.01		0.00	
nutr_content_avail_i	0.06		0.06		0.05		0.06		0.07		0.07	
no_vending_meal_i	-0.02		-0.02		-0.03		-0.02		-0.02		-0.02	
no_vending_day_i	-0.02		-0.02		-0.02		-0.02		-0.01		-0.01	
vending_notinsfa	-0.01		-0.02		0.00		-0.02		-0.04		-0.03	
nossb_vending_i	-0.14		-0.13		-0.17		-0.12		-0.08		-0.09	
onlyskim1per_offered	0.04		0.05		0.02		0.05		0.09		0.08	
whole_milk_not_offered	0.02		0.00		0.05		0.00		-0.06		-0.05	
flavored_milk_offered	-0.12		-0.11		-0.15		-0.11		-0.06		-0.07	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	-0.11		-0.10		-0.12		-0.10		-0.08		-0.08	
hisatfat_entr_daysperwk_offer	0.02		0.01		0.02		0.01		0.00		0.00	
fresh_fruit_daysperwk_offer	0.01		0.00		0.01		0.00		0.00		0.00	
avg_sweetcereal_perday	0.02		0.01		0.02		0.01		0.01		0.01	
unsw_cereal_daysperwk_offer	0.01		0.01		0.01		0.01		0.01		0.01	
R-squared	0.06		0.07		0.05		0.07		0.08		0.08	
N	1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.25 Meals Consumed Model – Breakfast for Secondary Students
Target Outcome: Fruit Equivalents

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	0.01		0.01		0.00		0.01		0.02		0.02	
c_sbp	0.16		0.14		0.22		0.14		-0.02		N/A	
female	0.03		0.03		0.04		0.03		0.02		0.02	
black_i	-0.01		-0.01		-0.02		-0.01		0.00		0.00	
othrace_i	0.03		0.03		0.03		0.03		0.04		0.04	
white_i	0.01		0.01		0.01		0.01		0.01		0.01	
tue	0.00		0.00		0.00		0.00		0.00		0.00	
wed	0.00		0.00		-0.01		0.00		0.01		0.01	
thu	-0.02		-0.02		-0.03		-0.02		-0.01		-0.01	
fri	0.03		0.03		0.03		0.03		0.04		0.04	
elig1_i	-0.05		-0.05		-0.06		-0.05		-0.03		-0.03	
elig2_i	-0.02		-0.02		-0.03		-0.02		-0.01		-0.02	
schsize2_i	-0.02		-0.02		-0.02		-0.02		-0.02		-0.02	
schsize3_i	0.00		0.00		0.00		0.00		-0.01		-0.01	
pov2_i	-0.08	**	-0.07	**	-0.08	**	-0.07	*	-0.06	**	-0.07	**
pov3_i	-0.07	*	-0.07	*	-0.08	**	-0.07	*	-0.06	*	-0.06	*
reg_mt	-0.05		-0.05		-0.04		-0.05		-0.07		-0.07	
reg_mw	-0.05		-0.05		-0.05		-0.05		-0.06		-0.06	
reg_ne	0.09		0.08		0.09		0.08		0.08	*	0.08	*
reg_se	-0.02		-0.02		-0.01		-0.02		-0.03		-0.03	
reg_sw	0.02		0.02		0.02		0.02		0.01		0.01	
reg_we	0.06		0.06		0.06		0.06		0.04		0.05	
urb0405_2	-0.06	**	-0.06	**	-0.07	*	-0.06	**	-0.06	**	-0.06	**
urb0405_3	-0.02		-0.02		-0.02		-0.02		-0.01		-0.01	
high	0.02		0.02		0.03		0.02		0.01		0.01	
dod_fresh_or_farm_i	0.04		0.04		0.04		0.04		0.03		0.03	
nutr_content_avail_i	0.01		0.01		0.01		0.01		0.01		0.01	
no_vending_meal_i	0.01		0.01		0.01		0.01		0.01		0.01	
no_vending_day_i	0.04		0.04		0.04		0.04		0.04		0.04	
vending_notinsfa	-0.01		-0.01		-0.01		-0.01		0.00		0.00	
nossb_vending_i	-0.01		-0.01		0.00		-0.01		-0.02		-0.01	
onlyskim1per_offered	-0.04		-0.05		-0.04		-0.05		-0.05	*	-0.05	*
whole_milk_not_offered	0.06		0.06		0.05		0.06		0.07	*	0.07	*
flavored_milk_offered	0.04		0.04		0.04		0.04		0.02		0.03	

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	0.01		0.01		0.01		0.01		0.00		0.00	
hisatfat_entr_daysperwk_offer	0.00		0.00		0.00		0.00		0.01		0.01	
fresh_fruit_daysperwk_offer	0.00		0.00		0.00		0.00		0.00		0.00	
avg_sweetcereal_perday	0.00		0.00		0.00		0.00		0.00		0.00	
unsw_cereal_daysperwk_offer	0.00		0.00		0.00		0.00		0.00		0.00	
R-squared	0.03		0.03		0.06		0.03		0.06		0.06	
N	1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.26 Meals Consumed Model – Breakfast for Secondary Students
Target Outcome: Added Sugars Equivalents (Teaspoons)

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	3.93	**	3.93	**	4.41	**	3.59	**	3.78	**	3.77	**
c_sbp	-1.49		-1.52		-6.10		1.77		-0.08		N/A	
female	-1.12	*	-1.12	*	-1.50	*	-0.85		-1.00	**	-0.99	**
black_i	-0.14		-0.13		0.32		-0.46		-0.28		-0.29	
othrace_i	0.51		0.51		0.65		0.40		0.46		0.46	
white_i	0.10		0.10		0.10		0.10		0.10		0.10	
tue	-0.04		-0.04		-0.01		-0.06		-0.05		-0.05	
wed	0.07		0.07		0.35		-0.13		-0.02		-0.02	
thu	0.68		0.68		1.02		0.44		0.58		0.57	
fri	-0.82		-0.82		-0.63		-0.96		-0.88		-0.88	
elig1_i	-1.16		-1.16		-0.60		-1.56	*	-1.34	**	-1.35	**
elig2_i	-0.34		-0.34		-0.11		-0.51		-0.41		-0.42	
schsize2_i	-0.51		-0.51		-0.50		-0.52		-0.51		-0.51	
schsize3_i	-0.93		-0.93		-1.08		-0.83		-0.89		-0.89	
pov2_i	-0.48		-0.48		-0.20		-0.68		-0.57		-0.57	
pov3_i	-0.61		-0.61		-0.27		-0.85		-0.71		-0.72	
reg_mt	-0.56		-0.56		-1.18		-0.12		-0.37		-0.36	
reg_mw	-0.86		-0.86		-1.08		-0.71		-0.79		-0.79	
reg_ne	0.32		0.32		0.26		0.36		0.34		0.34	
reg_se	0.68		0.68		0.46		0.84		0.75		0.76	
reg_sw	0.88		0.88		0.57		1.10		0.98		0.98	
reg_we	-0.58		-0.58		-0.95		-0.32		-0.47		-0.46	
urb0405_2	-0.16		-0.16		-0.05		-0.24		-0.20		-0.20	
urb0405_3	-0.06		-0.05		0.24		-0.27		-0.15		-0.15	
high	0.46		0.46		0.19		0.65		0.54		0.54	
dod_fresh_or_farm_i	-0.73	*	-0.74	*	-0.92	*	-0.60		-0.68	*	-0.67	*
nutr_content_avail_i	0.25		0.25		0.18		0.30		0.27		0.27	
no_vending_meal_i	1.20		1.20		1.17		1.22		1.21		1.21	
no_vending_day_i	-1.19		-1.19		-1.20		-1.17		-1.18		-1.18	
vending_notinsfa	0.17		0.17		0.29		0.08		0.13		0.13	
nossb_vending_i	-0.07		-0.07		-0.34		0.12		0.01		0.01	
onlyskim1per_offered	-0.51		-0.51		-0.73		-0.36		-0.45		-0.44	
whole_milk_not_offered	1.50	*	1.50	*	1.87	*	1.23		1.38	**	1.37	**
flavored_milk_offered	1.49	**	1.49	**	1.17		1.71	**	1.59	**	1.59	**

	Original Model		S1: Drop OVS		S2: Drop Price		S3: Drop All IVs Except Price		S4: Use Actual Participation		S5: Reduced-Form	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	-0.85		-0.85		-0.99	*	-0.75		-0.81		-0.80	
hisatfat_entr_daysperwk_offer	0.04		0.04		0.11		-0.01		0.02		0.02	
fresh_fruit_daysperwk_offer	-0.07		-0.07		-0.04		-0.09		-0.08		-0.08	
avg_sweetcereal_perday	0.13		0.13		0.17		0.10		0.11		0.11	
unsw_cereal_daysperwk_offer	0.17		0.17		0.17		0.17		0.17		0.17	
R-squared	0.06		0.06		0.06		0.05		0.07		0.07	
N	1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Table B.27 Meals Consumed Collateral Outcomes – Lunch for Elementary Students

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	553.83	**	4.73	*	31.30	**	209.56		−118.31	*	224.16		60.13	**
c_nslp	246.52	*	4.10	*	0.04		479.56		76.04		548.90	**	48.18	*
female	−52.36		−0.70		−0.30		−60.33		−7.82		−74.43	*	−8.97	*
black_i	42.42		1.13		2.83		160.49		44.83	**	55.49		−0.86	
othrace_i	155.40		1.93		0.69		146.58		36.00		161.10		15.10	
white_i	132.25	**	2.36	**	3.98	**	234.38	**	8.08		126.79	*	16.53	*
tue	−30.38		−0.27		−0.29		−57.03		−13.59		−42.37		−2.65	
wed	−1.92		0.52		−0.29		44.97		37.84		12.79		0.32	
thu	−72.41		0.31		0.44		−8.06		−25.67		−77.11		−13.33	
fri	−78.68	*	−1.42	*	−1.33		−83.25		6.68		−66.26		−13.01	
elig1_i	−28.72		−0.38		1.28		−79.03		6.09		18.10		1.45	
elig2_i	−54.51		−0.26		1.38		−83.37		9.19		−58.16		−5.48	
schsize2_i	−3.19		−0.15		−0.73		−96.62		−3.25		86.85		4.19	
schsize3_i	−26.50		−0.22		−3.03		55.39		74.73	*	204.67		13.22	
pov2_i	−90.44	*	0.75		1.58		−213.58	**	20.59		−118.66		−13.48	
pov3_i	−97.45	*	0.20		−1.00		−261.31	**	−8.22		−64.09		−8.80	
reg_mt	−60.50		−1.59		1.26		127.51		70.44		−28.91		−15.88	
reg_mw	−100.33		−2.39	*	2.13		59.13		−18.66		−100.10		−21.74	
reg_ne	18.76		−0.39		2.64		102.60		−50.83		−32.71		−3.44	
reg_se	−91.32		−3.89	**	−0.43		−75.23		−24.22		−156.49		−19.63	
reg_sw	−93.21		−3.07	**	1.17		73.67		−8.81		−108.55		−13.77	
reg_we	0.39		−0.66		6.73		152.49		−6.90		−88.65		−1.52	
schl_sbp	−22.16		−0.24		−0.76		91.18		48.86		18.23		−9.92	
urb0405_2	−101.29	**	−0.52		−0.31		−143.75		6.69		−91.12		−19.68	**
urb0405_3	−53.12		1.29	*	−0.31		93.17		51.62	*	53.97		0.36	
dist_nutreq_vendorspecs_i	−25.63		−1.51	**	−1.43		−69.54		−17.81		−65.81		−1.52	
nochainfd_i	−38.43		−1.35	**	−2.58	*	−138.81	*	−41.62	*	−53.82		−4.51	
recess_b4lunch_i	−19.82		−0.90		−3.83	*	52.20		18.42		86.69	*	2.59	
nopour_i	27.21		0.76		−0.23		−25.85		23.91		40.63		4.47	
noalc_lfmilk_i	35.80		0.17		−0.38		−90.31		56.41		260.19	*	12.77	
ac_hlthy	35.08		0.46		2.23		17.83		23.33		79.76		4.99	
alc_nounhlthy	−96.21	*	−1.55	*	−5.05	**	−193.22		−33.41		−90.18		−4.50	
alc_noffentree	−17.20		−0.88		−1.37		15.72		45.98	*	176.61	*	5.85	
alc_nossb	66.41		0.50		−0.31		114.41		11.98		97.93		5.59	

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
days_store_open_i	-0.02		-0.22		0.23		15.29		6.30		-19.89		-1.26	
onlyskim1per_offered	-29.28		-1.34	**	-2.31		-143.35	*	-53.45	**	-11.47		-4.85	
whole_milk_not_offered	-2.49		0.23		-0.38		16.69		56.26	*	17.41		14.95	*
pct_entrees_highsatfat	0.59		0.01		0.05		4.34	*	0.57		1.04		-0.02	
juice_not_offered	-12.81		0.12		2.91	*	10.19		-9.49		-58.86		-11.10	*
fresh_fruit_daysperwk_offer	1.61		0.33	*	-0.42		33.50		4.46		27.91		3.25	*
side_salad_bar_offered	-116.23	*	-2.11	*	-5.34		-258.05	*	-32.51		71.27		3.55	
avg_veg_perday	57.43	**	0.30		0.75		87.99		-12.17		-46.68		0.98	
raw_veggies_offered	-5.21		1.80		-2.36		195.16		46.99		48.39		6.67	
darkveg_daysperwk_offer	-21.12		-0.12		-0.04		-62.69		6.75		24.19		-1.04	
frenchfries_not_offered	8.33		0.98		3.09	*	59.40		46.50	*	-93.94		-3.57	
self_serve_dress_not_off	-16.91		-0.68		-1.12		-4.11		29.18		-12.30		-6.90	
high_satfat_condt_not_off	-20.73		-1.23	*	-3.32	*	89.16		-25.73		-119.16	**	-10.84	*
high_satfat_dress_not_off	-25.60		-0.36		-0.91		-36.65		13.57		-66.03		-7.38	
R-squared	0.12		0.04		0.12		0.08		0.29		0.12		0.12	
N	732		732		732		732		732		732		732	
N (weighted)	22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613		22,212,613	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.28 Meals Consumed Collateral Outcomes – Lunch for Secondary Students

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	600.96	**	7.40	**	24.24	**	664.52	*	135.37	**	810.48	**	78.65	**
c_nslp	130.38		1.98		4.60		15.79		101.23	*	370.24	**	33.29	*
female	−154.07	**	−2.07	**	0.91		−283.45	**	−27.81	**	−206.32	**	−14.30	**
black_i	12.55		−0.59		0.17		8.87		−14.50		11.44		2.23	
othrace_i	2.66		0.12		2.73		−86.10		−4.91		−14.41		9.13	
white_i	−15.77		−0.51		1.32		25.35		−1.77		−17.38		3.56	
tue	−40.34		−1.24	*	−1.29		−47.50		−10.57		−87.34	**	−5.22	
wed	1.77		0.16		0.31		79.55		1.01		25.13		5.87	
thu	−8.15		−0.50		−1.26		−76.40		−8.76		−22.00		−3.16	
fri	49.85		0.03		0.78		−19.40		15.74		32.38		10.87	
elig1_i	−14.60		0.21		−0.07		35.76		8.70		15.45		−4.23	
elig2_i	12.71		0.23		−1.16		115.55		27.40		27.23		−1.28	
schsize2_i	−31.00		0.09		−0.54		46.52		7.35		−94.83	*	−8.19	
schsize3_i	−37.88		−0.31		−1.30		−100.81		−19.60		−118.13	*	−6.85	
pov2_i	−55.32		−0.50		−1.91		39.22		−17.75		−72.30		−12.48	**
pov3_i	−47.31		−0.26		−0.81		106.13		−15.62		−49.41		−10.27	*
reg_mt	111.05	*	2.69	*	2.92		192.68		11.02		42.28		3.29	
reg_mw	44.09		1.35		3.92		63.34		24.76		5.77		5.34	
reg_ne	83.58		2.21	*	2.11		298.90	**	39.60		53.33		9.64	
reg_se	85.62	*	0.82		4.39	*	109.88		−9.67		40.64		12.19	*
reg_sw	104.06	*	2.59	**	9.17	**	141.81		6.88		70.03		16.28	**
reg_we	−21.71		−0.20		2.89		8.13		7.14		−66.15		6.50	
schl_sbp	−34.26		−0.65		−1.43		−159.28	*	−10.05		−13.26		−1.26	
urb0405_2	51.13		1.00	*	1.74		84.63		−1.72		103.56	**	4.98	
urb0405_3	1.69		0.40		0.04		45.69		4.19		26.42		−2.08	
high	116.41	**	1.87	**	3.24	**	295.60	**	28.19	*	174.11	**	14.32	**
dist_nutreq_vendorspecs_i	−59.22		−0.68		1.13		−273.17	**	−14.08		−94.91		−4.48	
lim_fat_vendorspecs_i	−19.55		−0.68		−1.23		162.53	*	−9.91		−40.02		−5.41	
prep_onsite_i	−19.51		−0.24		−0.37		−80.40		−14.88		−41.67		−2.04	
nochainfd_i	−2.35		0.54		1.20		11.42		−14.15		−43.67		−5.78	
no_open_campus_i	−49.60		−0.04		1.58		−39.31		−1.99		−57.79		0.09	
no_vending_meal_i	−47.11		−0.58		−0.40		−29.99		−18.05		−33.92		−3.70	
no_vending_day_i	33.64		0.13		0.20		8.12		19.84		47.70		6.68	
low_vending	16.16		0.50		1.36		97.38		17.12		63.35	*	4.24	

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
alc_noffentree	-63.76		-0.73		-0.18		-1.73		6.52		-14.71		-2.15	
alc_nossb	10.77		0.58		0.14		20.13		9.13		-35.50		-3.15	
nobarstore_i	-17.90		-0.11		0.42		-9.58		2.26		-16.12		1.05	
onlyskim1per_offered	-11.77		0.00		0.52		10.84		-13.92		-1.88		0.39	
whole_milk_not_offered	-20.68		-0.74		1.04		-26.25		-1.71		11.65		0.44	
yogurt_offered	26.00		0.30		2.29		43.17		-9.07		-28.52		0.55	
pct_entrees_highsatfat	0.82		0.00		-0.02		3.45		-0.17		-1.12		-0.23	
juice_not_offered	18.73		-0.30		-2.14	*	0.90		10.85		31.48		4.18	
fresh_fruit_daysperwk_offer	0.83		0.21		0.30		12.26		-0.11		1.38		0.58	
side_salad_bar_offered	51.55		-0.32		0.57		94.88		1.06		70.96		6.90	
avg_veg_perday	-28.19	**	-0.52	*	-0.98	*	4.52		-1.63		-49.92	**	-4.79	**
raw_veggies_offered	55.47		0.72		-0.06		34.27		11.61		101.81	**	6.75	
darkveg_daysperwk_offer	25.91	**	0.40	*	0.67		28.72		2.51		31.18	**	3.49	**
frenchfries_daysperwk_offer	5.31		-0.07		0.37		-4.07		-2.40		16.26	*	1.11	
self_serve_dress_not_off	28.06		0.79		-0.05		-4.32		-2.18		26.59		0.51	
high_satfat_condt_not_off	31.15		0.35		0.92		-42.95		5.86		-43.74		5.54	
high_satfat_dress_not_off	16.97		-0.06		1.01		168.58	**	-3.91		-3.82		-2.32	
R-squared	0.13		0.11		0.08		0.10		0.22		0.23		0.11	
N	1578		1578		1578		1578		1578		1578		1578	
N (weighted)	21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088		21,741,088	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.29 Meals Consumed Collateral Outcomes – Breakfast for Elementary Students

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	625.32	**	9.16	*	41.11	**	614.66	*	111.93		1144.06	**	118.40	**
c_sbp	106.89		-0.18		-17.44		555.99		196.75		17.50		-1.20	
female	-12.29		-0.66		-2.30		-0.34		0.11		1.33		0.17	
black_i	29.93		-0.05		3.85		-5.84		6.13		9.05		3.21	
othrace_i	-21.99		0.58		4.21		106.80		37.88		15.23		9.26	
white_i	18.50		-0.13		0.39		51.88		62.50		43.64		8.48	
tue	-45.29		-1.21	*	-4.01		-20.82		-34.09		-125.03		-7.25	
wed	-23.97		-0.47		-1.21		24.61		24.07		-60.36		-3.27	
thu	5.81		-0.62		-1.29		-8.73		33.87		50.59		-0.79	
fri	27.32		0.93		-1.75		45.67		0.74		-5.63		2.26	
elig1_i	25.13		0.80		0.86		-91.82		-0.85		92.22		4.40	
elig2_i	15.18		0.45		2.67		-51.04		-1.52		51.86		7.47	
schsize2_i	15.39		0.12		1.58		11.30		-58.58	*	12.84		4.25	
schsize3_i	-102.03	*	-1.43		0.82		-88.57		-21.32		-97.73		-10.75	
pov2_i	-135.52	**	-1.29		-1.59		-198.92	**	-26.57		-142.04	*	-19.93	**
pov3_i	-173.96	*	-2.41		-4.06		-164.22	*	-28.70		-203.98	*	-23.73	*
reg_mt	-96.40		-2.98	*	-12.20	*	-55.37		155.40	*	-194.76		-15.48	
reg_mw	-118.27	*	-2.78	*	-10.42	*	-140.51		165.06	**	-158.97		-12.01	
reg_ne	-146.15	*	-3.04	**	-9.02	*	-24.20		109.72		-152.97		-12.10	
reg_se	-155.61	*	-2.25	*	-6.81	*	-120.07		31.17		-272.86	**	-19.55	
reg_sw	-155.02	*	-2.24		-11.17	**	-170.14		76.52		-210.63	*	-14.06	
reg_we	-95.59		-2.46		-12.95	*	-5.00		157.87	*	-238.74	*	-13.28	
urb0405_2	-117.45	*	-2.72	*	-3.91		-3.71		-36.37		-222.98	**	-26.31	**
urb0405_3	-77.64		-1.70		-2.21		-28.79		-33.22		-138.10	*	-17.54	*
dod_fresh_or_farm_i	-7.51		-0.19		0.95		-2.90		-17.33		-4.93		-3.29	
require5_vendorspecs_i	-72.28		-0.36		2.65		-153.23		-48.02		-30.11		-9.63	
nutr_ed_i	129.86	**	2.01	**	0.98		191.85	**	26.86		53.44		8.53	
nutr_content_avail_i	-34.20		0.36		1.27		-51.72		-13.90		-60.73		-9.75	*
no_vending_day_i	34.35		-0.82		-2.51		35.18		70.66		73.47		7.89	
nossb_vending_i	20.17		1.23		-1.77		45.18		7.33		-40.92		-5.44	
noalc_lfmilk_i	-20.97		0.21		-0.17		-98.56		-80.50	**	-124.78		-9.97	
ac_hlthy	-10.80		0.13		-3.53		-38.37		-11.05		-61.24		-3.87	
alc_fruitveg	15.20		-0.80		-6.08	**	21.72		47.51		-3.85		4.97	
nofoodfund_i	-32.47		-0.64		-1.14		-17.26		-55.70	*	-93.82	*	-8.39	

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
onlyskim1per_offered	49.59		0.17		4.16		32.24		26.84		105.37		6.08	
whole_milk_not_offered	-91.14		-2.01	*	-4.05		-151.76		-65.99		-171.06	*	-19.44	
flavored_milk_offered	-5.92		-0.46		0.53		36.62		30.51		-35.12		-16.70	**
cereal_offered_daily	-18.57		0.55		2.64		-138.59		-66.94		-22.25		2.95	
hisatfat_entr_daysperwk_offer	2.87		0.31		2.20	**	-6.90		10.86		33.72		3.71	
fresh_fruit_daysperwk_offer	-29.84	**	-0.26		0.14		-38.42		1.33		-31.09		-3.08	
avg_hotcereal_perday	-168.59		-4.19		-1.60		-440.49		-69.27		-2.17		-25.72	
pastry_daysperwk_offer	-2.56		0.10		-0.37		-12.49		1.70		-12.64		-0.39	
sweet_cereal_daysperwk_offer	27.04		0.14		-1.42		63.75		15.60		-7.24		-0.19	
R-squared	0.13		0.09		0.11		0.07		0.01		0.13		0.09	
N	630		630		630		630		630		630		630	
N (weighted)	18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957		18,042,957	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

Table B.30 Meals Consumed Collateral Outcomes – Breakfast for Secondary Students

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Intercept	388.24	**	5.41	**	16.31	**	500.05	**	273.48	**	482.46	**	38.18	**
c_sbp	200.57		2.04		12.45		566.54		−160.34		132.48		−13.53	
female	−96.43	**	−1.48	**	−0.95		−137.10	**	−81.26	**	−142.60	**	−17.05	**
black_i	−64.93		−1.28	*	−3.85		−166.88	*	−23.03		−82.01		−5.97	
othrace_i	−21.85		−1.25		−2.80		−70.26		−23.91		−53.77		2.64	
white_i	1.03		−0.71		−0.53		−31.92		4.38		14.71		7.68	
tue	−19.41		−0.29		2.32	*	−41.11		−20.57		−20.75		−0.93	
wed	−4.91		−0.23		−0.03		−44.17		9.01		33.95		6.52	
thu	−8.70		−0.25		1.87		−21.64		7.61		9.82		1.24	
fri	−51.64		−1.03		−1.43		−123.31	*	−16.61		−0.88		2.88	
elig1_i	−81.65	**	−0.71		−2.83		−105.20	*	−9.47		−67.64		−2.80	
elig2_i	−8.68		0.55		1.87		50.71		28.54		−7.75		0.60	
schsize2_i	−67.13	**	−0.96	*	−2.85	*	−114.55	**	−62.05	*	−80.10	*	−4.54	
schsize3_i	−38.06		−0.39		−3.06		−36.01		−64.65	*	−50.27		−3.02	
pov2_i	8.84		0.91	*	4.05	**	47.53		27.28		56.28		7.18	
pov3_i	−26.92		0.20		2.33		−48.77		21.90		14.22		2.83	
reg_mt	−11.50		0.46		0.30		−21.39		2.37		−76.52		−5.85	
reg_mw	−37.74		−1.20		−3.80		−135.70		49.85		−13.88		0.08	
reg_ne	42.77		−0.39		−1.20		−10.97		64.76	*	148.64	**	24.42	**
reg_se	13.57		−0.22		−0.10		29.39		45.02		−36.15		0.07	
reg_sw	−5.50		−0.34		−1.29		−51.26		2.32		−69.51		−4.58	
reg_we	−56.26		−1.06		0.30		−101.11		−20.85		−40.42		−0.27	
urb0405_2	−5.37		0.27		−1.16		−11.78		56.43	*	7.68		4.66	
urb0405_3	−44.47		−0.28		−2.41		−86.54	*	−8.74		−72.62	*	−5.63	
high	33.76		0.26		0.37		41.50		1.33		26.34		3.97	
dod_fresh_or_farm_i	−4.79		−0.04		−0.46		16.00		−11.41		10.40		−0.62	
nutr_content_avail_i	8.67		0.15		1.29		2.99		15.69		18.32		1.97	
no_vending_meal_i	38.69		0.00		0.16		19.62		13.80		15.62		0.48	
no_vending_day_i	−32.18		−0.22		−1.26		−21.64		10.60		−10.74		2.87	
vending_notinsfa	−9.40		−0.40		−0.86		−11.65		5.39		1.00		0.58	
nossb_vending_i	−38.32		−0.12		3.39		−39.62		−44.59		−85.52		−12.13	
onlyskim1per_offered	6.98		0.14		0.49		21.12		18.54		1.17		0.67	
whole_milk_not_offered	45.50		0.15		−0.58		58.67		14.72		60.08		7.30	
flavored_milk_offered	44.80		0.17		3.58	*	112.10		−17.64		27.51		4.15	

	Calories		Grams of Saturated Fat		Percentage of Calories from Total Fat		Sodium (mg)		Vitamin A (mcg RAE)		Potassium (mg)		Magnesium (mg)	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
cereal_offered_daily	-28.06		-0.35		0.36		-32.53		-40.59	*	-36.52		-6.55	
hisatfat_entr_daysperwk_offer	12.00		0.11		0.10		8.53		-6.11		15.33		1.99	
fresh_fruit_daysperwk_offer	-8.65		-0.08		-0.49		-13.40		2.08		-4.01		-0.42	
avg_sweetcereal_perday	-1.55		-0.02		0.10		4.86		4.66		-7.85		-1.01	
unsw_cereal_daysperwk_offer	3.38		0.11		0.33		8.50		2.90		3.64		0.17	
R-squared	0.11		0.09		0.09		0.10		0.01		0.11		0.07	
N	1375		1375		1375		1375		1375		1375		1375	
N (weighted)	18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956		18,609,956	

Source: SNDA-III Public Use File.

Note: Imputation flags were included in the models except when they were collinear with other variables.

*Significantly different from zero at the .05 level, two-tailed test.

**Significantly different from zero at the .01 level, two-tailed test.

APPENDIX C

SIMULATION RESULTS

Table C.1
Meals Served Outcomes Under Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Average Nutrients and Number of Servings

	Elementary			Secondary			All Schools		
Outcome	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Percentage of calories from saturated fat	10.79	10.52	-2.50	11.04	10.11	-8.42	10.88	10.37	-4.69
Fluid milk servings	0.91	0.92	1.10	0.82	0.75	-8.54	0.88	0.85	-3.41
Number of discrete fruit servings[a]	0.63	0.63	0.00	0.49	0.55	12.24	0.58	0.60	3.45
Number of discrete vegetable servings[b]	0.73	0.71	-2.74	0.69	0.74	7.25	0.72	0.72	0.00
Number of discrete dark green and orange vegetable servings	0.13	0.14	7.69	0.09	0.09	0.00	0.12	0.12	0.00
Sample size (weighted)	58614			34262			92876		
Sample size (unweighted)	144			253			397		
Breakfast									
Percentage of calories from saturated fat	8.91	7.66	-14.03	9.60	8.56	-10.83	9.17	8.00	-12.76
Fluid milk servings	0.89	0.87	-2.25	0.83	0.79	-4.82	0.87	0.84	-3.45
Number of discrete fruit servings[a]	0.17	0.21	23.53	0.11	0.10	-9.09	0.15	0.17	13.33
Sample size (weighted)	46853			28614			75467		
Sample size (unweighted)	117			208			325		

Source: SNDA-III Public Use File.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table C.2
Meals Served Outcomes Under Reform 2: Offer Fresh Fruit Daily
Average Nutrients and Number of Servings

	Elementary			Secondary			All Schools		
Outcome	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Percentage of calories from saturated fat	10.79	10.94	1.39	11.04	11.33	2.63	10.88	11.08	1.84
Fluid milk servings	0.91	0.88	-3.30	0.82	0.82	0.00	0.88	0.86	-2.27
Number of discrete fruit servings[a]	0.63	0.67	6.35	0.49	0.43	-12.24	0.58	0.58	0.00
Number of discrete vegetable servings[b]	0.73	0.61	-16.44	0.69	0.54	-21.74	0.72	0.58	-19.44
Number of discrete dark green and orange vegetable servings	0.13	0.12	-7.69	0.09	0.08	-11.11	0.12	0.10	-16.67
Sample size (weighted)	58614			34262			92876		
Sample size (unweighted)	144			253			397		
Breakfast									
Percentage of calories from saturated fat	8.91	8.41	-5.61	9.60	9.87	2.81	9.17	8.96	-2.29
Fluid milk servings	0.89	0.95	6.74	0.83	0.80	-3.61	0.87	0.90	3.45
Number of discrete fruit servings[a]	0.17	0.57	235.29	0.11	0.29	163.64	0.15	0.47	213.33
Sample size (weighted)	46853			28614			75467		
Sample size (unweighted)	117			208			325		

Source: SNDA-III Public Use File.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table C.3
Meals Served Outcomes Under Reform 3: Comprehensive Reform
Average Nutrients and Number of Servings

Outcome	Elementary			Secondary			All Schools		
	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Percentage of calories from saturated fat	10.79	10.52	-2.50	11.04	10.52	-4.71	10.88	10.52	-3.31
Fluid milk servings	0.91	0.92	1.10	0.82	0.81	-1.22	0.88	0.88	0.00
Number of discrete fruit servings[a]	0.63	0.75	19.05	0.49	0.57	16.33	0.58	0.69	18.97
Number of discrete vegetable servings[b]	0.73	0.75	2.74	0.69	0.82	18.84	0.72	0.77	6.94
Number of discrete dark green and orange vegetable servings	0.13	0.20	53.85	0.09	0.19	111.11	0.12	0.19	58.33
Sample size (weighted)	58614			34262			92876		
Sample size (unweighted)	144			253			397		

Source: SNDA-III Public Use File.

Note: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table C.4
Participation Outcomes Under Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Number of Participants and Participation Rate: Overall and by Meal-Price Category

	Elementary			Secondary			All Students		
Outcome	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Number of Participants									
Overall	16,133,187	15,647,120	-3.01	11,009,190	10,905,380	-0.94	27,142,377	26,552,500	-2.17
Free	5,870,175	5,662,320	-3.54	3,738,636	3,647,153	-2.45	9,608,810	9,309,473	-3.12
Reduced Price	2,388,617	2,388,617	0.00	1,681,337	1,747,559	3.94	4,069,954	4,136,176	1.63
Full Price	7,874,395	7,596,183	-3.53	5,589,218	5,510,668	-1.41	13,463,613	13,106,851	-2.65
Participation Rate									
Overall	72.6%	70.4%	-3.01	50.6%	50.2%	-0.94	61.8%	60.4%	-2.17
Free	86.2%	83.2%	-3.54	61.2%	59.7%	-2.45	74.4%	72.1%	-3.12
Reduced Price	86.5%	86.5%	0.00	63.6%	66.1%	3.94	75.3%	76.5%	1.63
Full Price	62.3%	60.1%	-3.53	43.0%	42.4%	-1.41	52.5%	51.1%	-2.65
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)									
Overall	732			1,578			2,310		
Free	244			497			741		
Reduced Price	95			207			302		
Full Price	393			874			1,267		
Breakfast									
Number of Participants									
Overall	5,134,650	5,757,381	12.13	2,663,126	2,177,867	-18.22	7,797,775	7,935,247	1.76
Free	2,527,885	2,712,838	7.32	1,339,156	1,101,400	-17.75	3,867,041	3,814,238	-1.37
Reduced Price	1,000,092	1,096,793	9.67	350,690	308,089	-12.15	1,350,781	1,404,882	4.01
Full Price	1,606,673	1,947,750	21.23	973,280	768,378	-21.05	2,579,953	2,716,128	5.28
Participation Rate									
Overall	28.5%	31.9%	12.13	14.3%	11.7%	-18.22	21.3%	21.6%	1.76
Free	39.3%	42.2%	7.32	22.9%	18.9%	-17.75	31.5%	31.1%	-1.37
Reduced Price	40.4%	44.3%	9.67	15.9%	14.0%	-12.15	28.9%	30.0%	4.01
Full Price	17.6%	21.3%	21.23	9.2%	7.3%	-21.05	13.1%	13.8%	5.28
Sample size (weighted)	18,042,957			18,609,956			36,652,914		
Sample size (unweighted)									
Overall	630			1,375			2,005		
Free	236			480			716		
Reduced Price	88			179			267		
Full Price	306			716			1,022		

Source: SNDA-III Public Use File.

Note: Meal-price status is not interacted with the reform (i.e., the reform does not differ by meal-price category).

Table C.5
Participation Outcomes Under Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Changes in Participation: Overall and by Meal-Price Category

Outcome	Elementary		Secondary		All Students	
	Number of students	Percentage of total students	Number of students	Percentage of total students	Number of students	Percentage of total students
Lunch						
Overall						
Participants - unchanged	15,618,138	70.3%	10,548,082	48.5%	26,166,220	59.5%
Nonparticipants - unchanged	6,050,444	27.2%	10,374,599	47.7%	16,425,043	37.4%
Participant to Nonparticipant	515,049	2.3%	461,109	2.1%	976,158	2.2%
Nonparticipant to Participant	28,982	0.1%	357,298	1.6%	386,281	0.9%
Free						
Participants - unchanged	5,662,320	25.5%	3,587,052	16.5%	9,249,372	21.0%
Nonparticipants - unchanged	936,334	4.2%	2,308,383	10.6%	3,244,716	7.4%
Participant to Nonparticipant	207,854	0.9%	151,584	0.7%	359,438	0.8%
Nonparticipant to Participant	0	0.0%	60,101	0.3%	60,101	0.1%
Reduced Price						
Participants - unchanged	2,388,617	10.8%	1,651,557	7.6%	4,040,174	9.2%
Nonparticipants - unchanged	374,068	1.7%	865,325	4.0%	1,239,392	2.8%
Participant to Nonparticipant	0	0.0%	29,780	0.1%	29,780	0.1%
Nonparticipant to Participant	0	0.0%	96,002	0.4%	96,002	0.2%
Full Price						
Participants - unchanged	7,567,200	34.1%	5,309,473	24.4%	12,876,674	29.3%
Nonparticipants - unchanged	4,740,043	21.3%	7,200,891	33.1%	11,940,934	27.2%
Participant to Nonparticipant	307,195	1.4%	279,745	1.3%	586,939	1.3%
Nonparticipant to Participant	28,982	0.1%	201,195	0.9%	230,177	0.5%
Total sample size (weighted)	22,212,613		21,741,088		43,953,701	
Total sample size (unweighted)	732		1,578		2,310	
Breakfast						
Overall						
Participants - unchanged	5,134,650	28.5%	2,177,867	11.7%	7,312,516	20.0%
Nonparticipants - unchanged	12,285,577	68.1%	15,946,831	85.7%	28,232,407	77.0%
Participant to Nonparticipant	0	0.0%	485,259	2.6%	485,259	1.3%
Nonparticipant to Participant	622,731	3.5%	0	0.0%	622,731	1.7%
Free						
Participants - unchanged	2,527,885	14.0%	1,101,400	5.9%	3,629,284	9.9%
Nonparticipants - unchanged	3,720,465	20.6%	4,497,116	24.2%	8,217,581	22.4%
Participant to Nonparticipant	0	0.0%	237,757	1.3%	237,757	0.6%
Nonparticipant to Participant	184,953	1.0%	0	0.0%	184,953	0.5%
Reduced Price						
Participants - unchanged	1,000,092	5.5%	308,089	1.7%	1,308,181	3.6%
Nonparticipants - unchanged	1,376,641	7.6%	1,852,426	10.0%	3,229,066	8.8%
Participant to Nonparticipant	0	0.0%	42,601	0.2%	42,601	0.1%
Nonparticipant to Participant	96,701	0.5%	0	0.0%	96,701	0.3%
Full Price						
Participants - unchanged	1,606,673	8.9%	768,378	4.1%	2,375,051	6.5%
Nonparticipants - unchanged	7,188,472	39.8%	9,597,289	51.6%	16,785,760	45.8%
Participant to Nonparticipant	0	0.0%	204,902	1.1%	204,902	0.6%
Nonparticipant to Participant	341,077	1.9%	0	0.0%	341,077	0.9%
Total sample size (weighted)	18,042,957		18,609,956		36,652,914	
Total sample size (unweighted)	630		1,375		2,005	

Source: SNDA-III Public Use File.

Notes: Participation status is calculated by summing each student's predicted propensity to participate (from the probit model) and their residual (or error term). If this sum is >0, they are coded as a participant. If this sum is <0, they are coded as a non-participant. If a student's participation status does not switch from >0 to <0 or from <0 to >0 in reponse to the reform, they are coded as "unchanged."

Table C.6
Participation Outcomes Under Reform 2: Offer Fresh Fruit Daily
Number of Participants and Participation Rate: Overall and by Meal-Price Category

	Elementary			Secondary			All Students		
Outcome	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Number of Participants									
Overall	16,133,187	14,056,000	-12.88	11,009,190	10,789,530	-2.00	27,142,377	24,845,530	-8.46
Free	5,870,175	5,435,686	-7.40	3,738,636	3,672,961	-1.76	9,608,810	9,108,647	-5.21
Reduced Price	2,388,617	2,188,925	-8.36	1,681,337	1,681,337	0.00	4,069,954	3,870,261	-4.91
Full Price	7,874,395	6,431,389	-18.33	5,589,218	5,435,232	-2.76	13,463,613	11,866,621	-11.86
Participation Rate									
Overall	72.6%	63.3%	-12.88	50.6%	49.6%	-2.00	61.8%	56.5%	-8.46
Free	86.2%	79.9%	-7.40	61.2%	60.1%	-1.76	74.4%	70.5%	-5.21
Reduced Price	86.5%	79.2%	-8.36	63.6%	63.6%	0.00	75.3%	71.6%	-4.91
Full Price	62.3%	50.9%	-18.33	43.0%	41.8%	-2.76	52.5%	46.3%	-11.86
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)									
Overall	732			1,578			2,310		
Free	244			497			741		
Reduced Price	95			207			302		
Full Price	393			874			1,267		
Breakfast									
Number of Participants									
Overall	5,134,650	4,371,449	-14.86	2,663,126	2,634,420	-1.08	7,797,775	7,005,869	-10.16
Free	2,527,885	2,241,282	-11.34	1,339,156	1,310,451	-2.14	3,867,041	3,551,733	-8.15
Reduced Price	1,000,092	927,702	-7.24	350,690	350,690	0.00	1,350,781	1,278,392	-5.36
Full Price	1,606,673	1,202,465	-25.16	973,280	973,280	0.00	2,579,953	2,175,745	-15.67
Participation Rate									
Overall	28.5%	24.2%	-14.86	14.3%	14.2%	-1.08	21.3%	19.1%	-10.16
Free	39.3%	34.8%	-11.34	22.9%	22.5%	-2.14	31.5%	28.9%	-8.15
Reduced Price	40.4%	37.5%	-7.24	15.9%	15.9%	0.00	28.9%	27.3%	-5.36
Full Price	17.6%	13.2%	-25.16	9.2%	9.2%	0.00	13.1%	11.0%	-15.67
Sample size (weighted)	18,042,957			18,609,956			36,652,914		
Sample size (unweighted)									
Overall	630			1,375			2,005		
Free	236			480			716		
Reduced Price	88			179			267		
Full Price	306			716			1,022		

Source: SNDA-III Public Use File.

Note: Meal-price status is not interacted with the reform (i.e., the reform does not differ by meal-price category).

Table C.7
Participation Outcomes Under Reform 2: Offer Fresh Fruit Daily
Changes in Participation: Overall and by Meal-Price Category

Outcome	Elementary		Secondary		All Students	
	Number of students	Percentage of total students	Number of students	Percentage of total students	Number of students	Percentage of total students
Lunch						
Overall						
Participants - unchanged	14,056,000	63.3%	10,789,530	49.6%	24,845,530	56.5%
Nonparticipants - unchanged	6,079,426	27.4%	10,731,897	49.4%	16,811,323	38.2%
Participant to Nonparticipant	2,077,187	9.4%	219,661	1.0%	2,296,847	5.2%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Free						
Participants - unchanged	5,435,686	24.5%	3,672,961	16.9%	9,108,647	20.7%
Nonparticipants - unchanged	936,334	4.2%	2,368,484	10.9%	3,304,818	7.5%
Participant to Nonparticipant	434,488	2.0%	65,675	0.3%	500,163	1.1%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Reduced Price						
Participants - unchanged	2,188,925	9.9%	1,681,337	7.7%	3,870,261	8.8%
Nonparticipants - unchanged	374,068	1.7%	961,327	4.4%	1,335,395	3.0%
Participant to Nonparticipant	199,692	0.9%	0	0.0%	199,692	0.5%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Full Price						
Participants - unchanged	6,431,389	29.0%	5,435,232	25.0%	11,866,621	27.0%
Nonparticipants - unchanged	4,769,025	21.5%	7,402,086	34.0%	12,171,111	27.7%
Participant to Nonparticipant	1,443,006	6.5%	153,986	0.7%	1,596,992	3.6%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Total sample size (weighted)	22,212,613		21,741,088		43,953,701	
Total sample size (unweighted)	732		1,578		2,310	
Breakfast						
Overall						
Participants - unchanged	4,371,449	24.2%	2,634,420	14.2%	7,005,869	19.1%
Nonparticipants - unchanged	12,908,308	71.5%	15,946,831	85.7%	28,855,139	78.7%
Participant to Nonparticipant	763,201	4.2%	28,706	0.2%	791,906	2.2%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Free						
Participants - unchanged	2,241,282	12.4%	1,310,451	7.0%	3,551,733	9.7%
Nonparticipants - unchanged	3,905,418	21.6%	4,497,116	24.2%	8,402,534	22.9%
Participant to Nonparticipant	286,603	1.6%	28,706	0.2%	315,308	0.9%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Reduced Price						
Participants - unchanged	927,702	5.1%	350,690	1.9%	1,278,392	3.5%
Nonparticipants - unchanged	1,473,342	8.2%	1,852,426	10.0%	3,325,767	9.1%
Participant to Nonparticipant	72,390	0.4%	0	0.0%	72,390	0.2%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Full Price						
Participants - unchanged	1,202,465	6.7%	973,280	5.2%	2,175,745	5.9%
Nonparticipants - unchanged	7,529,548	41.7%	9,597,289	51.6%	17,126,837	46.7%
Participant to Nonparticipant	404,208	2.2%	0	0.0%	404,208	1.1%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Total sample size (weighted)	18,042,957		18,609,956		36,652,914	
Total sample size (unweighted)	630		1,375		2,005	

Source: SNDA-III Public Use File.

Notes: Participation status is calculated by summing each student's predicted propensity to participate (from the probit model) and their residual (or error term). If this sum is >0, they are coded as a participant. If this sum is <0, they are coded as a non-participant. If a student's participation status does not switch from >0 to <0 or from <0 to >0 in reponse to the reform, they are coded as “unchanged.”

Table C.8
Participation Outcomes Under Reform 3: Comprehensive Reform
Number of Participants and Participation Rate: Overall and by Meal-Price Category

	Elementary			Secondary			All Students		
Outcome	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Number of Participants									
Overall	16,133,187	15,325,927	-5.00	11,009,190	9,651,182	-12.34	27,142,377	24,977,109	-7.98
Free	5,870,175	5,546,441	-5.51	3,738,636	3,349,437	-10.41	9,608,810	8,895,878	-7.42
Reduced Price	2,388,617	2,347,867	-1.71	1,681,337	1,563,648	-7.00	4,069,954	3,911,515	-3.89
Full Price	7,874,395	7,431,619	-5.62	5,589,218	4,738,097	-15.23	13,463,613	12,169,716	-9.61
Participation Rate									
Overall	72.6%	69.0%	-5.00	50.6%	44.4%	-12.34	61.8%	56.8%	-7.98
Free	86.2%	81.5%	-5.51	61.2%	54.8%	-10.41	74.4%	68.9%	-7.42
Reduced Price	86.5%	85.0%	-1.71	63.6%	59.2%	-7.00	75.3%	72.4%	-3.89
Full Price	62.3%	58.8%	-5.62	43.0%	36.5%	-15.23	52.5%	47.5%	-9.61
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)									
Overall	732			1,578			2,310		
Free	244			497			741		
Reduced Price	95			207			302		
Full Price	393			874			1,267		

Source: SNDA-III Public Use File.

Note: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week. Meal-price status is not interacted with the reform (i.e., the reform does not differ by meal-price category).

Table C.9
Participation Outcomes Under Reform 3: Comprehensive Reform
Changes in Participation: Overall and by Meal-Price Category

Outcome	Elementary		Secondary		All Students	
	Number of students	Percentage of total students	Number of students	Percentage of total students	Number of students	Percentage of total students
Lunch						
Overall						
Participants - unchanged	15,195,550	68.4%	9,620,535	44.3%	24,816,084	56.5%
Nonparticipants - unchanged	5,949,049	26.8%	10,701,249	49.2%	16,650,298	37.9%
Participant to Nonparticipant	937,637	4.2%	1,388,656	6.4%	2,326,293	5.3%
Nonparticipant to Participant	130,377	0.6%	30,648	0.1%	161,025	0.4%
Free						
Participants - unchanged	5,546,441	25.0%	3,349,437	15.4%	8,895,878	20.2%
Nonparticipants - unchanged	936,334	4.2%	2,368,484	10.9%	3,304,818	7.5%
Participant to Nonparticipant	323,733	1.5%	389,199	1.8%	712,932	1.6%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Reduced Price						
Participants - unchanged	2,347,867	10.6%	1,563,648	7.2%	3,911,515	8.9%
Nonparticipants - unchanged	374,068	1.7%	961,327	4.4%	1,335,395	3.0%
Participant to Nonparticipant	40,750	0.2%	117,688	0.5%	158,439	0.4%
Nonparticipant to Participant	0	0.0%	0	0.0%	0	0.0%
Full Price						
Participants - unchanged	7,301,242	32.9%	4,707,449	21.7%	12,008,691	27.3%
Nonparticipants - unchanged	4,638,647	20.9%	7,371,438	33.9%	12,010,086	27.3%
Participant to Nonparticipant	573,153	2.6%	881,769	4.1%	1,454,922	3.3%
Nonparticipant to Participant	130,377	0.6%	30,648	0.1%	161,025	0.4%
Total sample size (weighted)	22,212,613		21,741,088		43,953,701	
Total sample size (unweighted)	732		1,578		2,310	

Source: SNDA-III Public Use File.

Notes: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week. Participation status is calculated by summing each student's predicted propensity to participate (from the probit model) and their residual (or error term). If this sum is >0, they are coded as a participant. If this sum is <0, they are coded as a non-participant. If a student's participation status does not switch from >0 to <0 or from <0 to >0 in reponse to the reform, they are coded as "unchanged."

Table C.10
Meals Consumed Outcomes Under Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary			Secondary			All Students		
Outcomes	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Target Outcomes									
Percentage of calories from saturated fat	10.70	9.93	-7.20	10.75	11.04	2.70	10.72	10.48	-2.24
MPEs of fluid milk	0.61	0.57	-6.56	0.37	0.35	-5.41	0.49	0.46	-6.12
MPEs of fruit	0.27	0.27	0.00	0.15	0.16	6.67	0.21	0.22	4.76
MPEs of vegetables[a]	0.28	0.32	14.29	0.30	0.31	3.33	0.29	0.32	10.34
MPEs of dark green and orange vegetables	0.03	0.03	0.00	0.02	0.02	0.00	0.02	0.02	0.00
Collateral Outcomes									
Calories	601.90	580.27	-3.59	626.34	612.64	-2.19	613.99	596.28	-2.88
Grams of saturated fat	7.40	6.66	-10.00	8.10	7.89	-2.59	7.74	7.26	-6.20
Percentage of calories from total fat	31.55	30.23	-4.18	32.79	33.42	1.92	32.16	31.81	-1.09
Sodium (mg)	1037.79	955.18	-7.96	1080.21	1079.26	-0.09	1058.78	1016.55	-3.99
Vitamin A (mcg RAE)	172.93	157.52	-8.91	134.32	126.10	-6.12	153.83	141.98	-7.70
Potassium (mg)	802.27	788.37	-1.73	721.82	722.52	0.10	762.48	755.79	-0.88
Magnesium (mg)	79.26	79.25	-0.01	71.73	71.97	0.33	75.54	75.64	0.13
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)	732			1,578			2,310		
Breakfast									
Target Outcomes									
Percentage of calories from saturated fat	8.48	8.63	1.77	7.11	7.18	0.98	7.79	7.90	1.41
MPEs of fluid milk	0.61	0.63	3.28	0.48	0.53	10.42	0.55	0.58	5.45
MPEs of fruit	0.12	0.14	16.67	0.08	0.08	0.00	0.10	0.11	10.00
MPEs (teaspoons) of added sugars	4.47	5.00	11.86	4.13	4.38	6.05	4.30	4.68	8.84
Collateral Outcomes									
Calories	405.64	414.87	2.28	345.42	359.54	4.09	375.06	386.78	3.12
Grams of saturated fat	4.23	3.93	-7.09	3.65	3.74	2.47	3.94	3.84	-2.54
Percentage of calories from total fat	21.99	22.74	3.41	18.56	18.38	-0.97	20.25	20.53	1.38
Sodium (mg)	530.64	535.01	0.82	454.78	474.70	4.38	492.12	504.39	2.49
Vitamin A (mcg RAE)	206.75	213.91	3.46	178.56	199.59	11.78	192.43	206.64	7.38
Potassium (mg)	527.06	544.47	3.30	437.57	454.29	3.82	481.62	498.69	3.54
Magnesium (mg)	51.73	50.68	-2.03	44.87	48.02	7.02	48.24	49.33	2.26
Sample size (weighted)	18,042,957			18,609,956			36,652,914		
Sample size (unweighted)	630			1,375			2,005		

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

Table C.11
Meals Consumed Outcomes Under Reform 2: Offer Fresh Fruit Daily
Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary			Secondary			All Students		
Outcomes	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Target Outcomes									
Percentage of calories from saturated fat	10.70	11.67	9.07	10.75	11.02	2.51	10.72	11.35	5.88
MPEs of fluid milk	0.61	0.57	-6.56	0.37	0.38	2.70	0.49	0.48	-2.04
MPEs of fruit	0.27	0.38	40.74	0.15	0.15	0.00	0.21	0.27	28.57
MPEs of vegetables[a]	0.28	0.41	46.43	0.30	0.31	3.33	0.29	0.36	24.14
MPEs of dark green and orange vegetables	0.03	0.03	0.00	0.02	0.02	0.00	0.02	0.02	0.00
Collateral Outcomes									
Calories	601.90	583.36	-3.08	626.34	626.41	0.01	613.99	604.65	-1.52
Grams of saturated fat	7.40	7.92	7.03	8.10	8.42	3.95	7.74	8.17	5.56
Percentage of calories from total fat	31.55	30.40	-3.65	32.79	33.24	1.37	32.16	31.80	-1.12
Sodium (mg)	1037.79	1086.36	4.68	1080.21	1100.44	1.87	1058.78	1093.33	3.26
Vitamin A (mcg RAE)	172.93	178.48	3.21	134.32	133.36	-0.71	153.83	156.16	1.51
Potassium (mg)	802.27	828.92	3.32	721.82	720.44	-0.19	762.48	775.26	1.68
Magnesium (mg)	79.26	83.82	5.75	71.73	72.37	0.89	75.54	78.16	3.47
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)	732			1,578			2,310		
Breakfast									
Target Outcomes									
Percentage of calories from saturated fat	8.48	9.72	14.62	7.11	6.75	-5.06	7.79	8.21	5.39
MPEs of fluid milk	0.61	0.56	-8.20	0.48	0.50	4.17	0.55	0.53	-3.64
MPEs of fruit	0.12	0.14	16.67	0.08	0.08	0.00	0.10	0.11	10.00
MPEs (teaspoons) of added sugars	4.47	3.55	-20.58	4.13	3.99	-3.39	4.30	3.78	-12.09
Collateral Outcomes									
Calories	405.64	287.78	-29.06	345.42	323.92	-6.22	375.06	306.13	-18.38
Grams of saturated fat	4.23	3.31	-21.75	3.65	3.46	-5.21	3.94	3.39	-13.96
Percentage of calories from total fat	21.99	23.30	5.96	18.56	17.44	-6.03	20.25	20.32	0.35
Sodium (mg)	530.64	375.49	-29.24	454.78	422.99	-6.99	492.12	399.61	-18.80
Vitamin A (mcg RAE)	206.75	207.22	0.23	178.56	185.17	3.70	192.43	196.02	1.87
Potassium (mg)	527.06	410.27	-22.16	437.57	427.66	-2.26	481.62	419.10	-12.98
Magnesium (mg)	51.73	40.14	-22.40	44.87	43.84	-2.30	48.24	42.02	-12.89
Sample size (weighted)	18,042,957			18,609,956			36,652,914		
Sample size (unweighted)	630			1,375			2,005		

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

Table C.12
Meals Consumed Outcomes Under Reform 3: Comprehensive Reform
Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary			Secondary			All Students		
Outcomes	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change	Baseline	Reform	Percent Change
Lunch									
Target Outcomes									
Percentage of calories from saturated fat	10.70	11.39	6.45	10.75	11.51	7.07	10.72	11.45	6.81
MPEs of fluid milk	0.61	0.55	-9.84	0.37	0.34	-8.11	0.49	0.45	-8.16
MPEs of fruit	0.27	0.38	40.74	0.15	0.16	6.67	0.21	0.28	33.33
MPEs of vegetables[a]	0.28	0.44	57.14	0.30	0.32	6.67	0.29	0.38	31.03
MPEs of dark green and orange vegetables	0.03	0.03	0.00	0.02	0.02	0.00	0.02	0.02	0.00
Collateral Outcomes									
Calories	601.90	568.31	-5.58	626.34	616.47	-1.58	613.99	592.13	-3.56
Grams of saturated fat	7.40	7.49	1.22	8.10	8.49	4.81	7.74	7.98	3.10
Percentage of calories from total fat	31.55	30.49	-3.36	32.79	33.51	2.20	32.16	31.98	-0.56
Sodium (mg)	1037.79	1012.44	-2.44	1080.21	1131.51	4.75	1058.78	1071.34	1.19
Vitamin A (mcg RAE)	172.93	167.34	-3.23	134.32	125.96	-6.22	153.83	146.87	-4.52
Potassium (mg)	802.27	841.81	4.93	721.82	698.75	-3.20	762.48	771.05	1.12
Magnesium (mg)	79.26	81.85	3.27	71.73	71.63	-0.14	75.54	76.79	1.65
Sample size (weighted)	22,212,613			21,741,088			43,953,701		
Sample size (unweighted)	732			1,578			2,310		

Source: SNDA-III Public Use File, Day 1 recall data only.

Note: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week.

[a]Other than French fries and similar potato products.

APPENDIX D

SENSITIVITY ANALYSES: SIMULATION RESULTS

Table D.1
Sensitivity Analysis
Meals Served Outcomes Under Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Average Nutrients and Number of Servings

	Elementary		Secondary		All Schools	
Outcome	Baseline	Reform 1	Baseline	Reform 1	Baseline	Reform 1
Lunch						
Percentage of calories from saturated fat	10.79	10.46	11.04	10.08	10.88	10.32
Fluid milk servings	0.91	0.91	0.82	0.75	0.88	0.85
Number of discrete fruit servings[a]	0.63	0.63	0.49	0.55	0.58	0.60
Number of discrete vegetable servings[b]	0.73	0.69	0.69	0.73	0.72	0.71
Number of discrete dark green and orange vegetable servings	0.13	0.13	0.09	0.09	0.12	0.12
Sample size (weighted)	58614		34262		92876	
Sample size (unweighted)	144		253		397	
Breakfast						
Percentage of calories from saturated fat	8.91	7.66	9.60	8.54	9.17	7.99
Fluid milk servings	0.89	0.86	0.83	0.79	0.87	0.83
Number of discrete fruit servings[a]	0.17	0.20	0.11	0.10	0.15	0.16
Sample size (weighted)	46853		28614		75467	
Sample size (unweighted)	117		208		325	

Source: SNDA-III Public Use File.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table D.2
Sensitivity Analysis
Meals Served Outcomes Under Reform 2: Offer Fresh Fruit Daily
Average Nutrients and Number of Servings

Outcome	Elementary		Secondary		All Schools	
	Baseline	Reform 2	Baseline	Reform 2	Baseline	Reform 2
Lunch						
Percentage of calories from saturated fat	10.79	11.09	11.04	11.36	10.88	11.19
Fluid milk servings	0.91	0.88	0.82	0.82	0.88	0.86
Number of discrete fruit servings[a]	0.63	0.69	0.49	0.44	0.58	0.60
Number of discrete vegetable servings[b]	0.73	0.65	0.69	0.56	0.72	0.62
Number of discrete dark green and orange vegetable servings	0.13	0.12	0.09	0.09	0.12	0.11
Sample size (weighted)	58614		34262		92876	
Sample size (unweighted)	144		253		397	
Breakfast						
Percentage of calories from saturated fat	8.91	8.43	9.60	9.87	9.17	8.97
Fluid milk servings	0.89	0.96	0.83	0.81	0.87	0.90
Number of discrete fruit servings[a]	0.17	0.56	0.11	0.29	0.15	0.46
Sample size (weighted)	46853		28614		75467	
Sample size (unweighted)	117		208		325	

Source: SNDA-III Public Use File.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table D.3
Sensitivity Analysis
Meals Served Outcomes Under Reform 3: Comprehensive Reform
Average Nutrients and Number of Servings

Outcome	Elementary		Secondary		All Schools	
	Baseline	Reform 3	Baseline	Reform 3	Baseline	Reform 3
Lunch						
Percentage of calories from saturated fat	10.79	10.65	11.04	10.48	10.88	10.59
Fluid milk servings	0.91	0.92	0.82	0.81	0.88	0.88
Number of discrete fruit servings[a]	0.63	0.77	0.49	0.57	0.58	0.70
Number of discrete vegetable servings[b]	0.73	0.77	0.69	0.82	0.72	0.79
Number of discrete dark green and orange vegetable servings	0.13	0.20	0.09	0.18	0.12	0.19
Sample size (weighted)	58614		34262		92876	
Sample size (unweighted)	144		253		397	

Source: SNDA-III Public Use File.

Note: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week.

[a]Not including juice.

[b]Other than French fries and similar potato products.

Table D.4
Sensitivity Analyses for Participation Simulation – LUNCH
Outcomes: Number of Participants and Participation Rate

Outcome	Elementary		Secondary		All Students	
	Baseline	Reform	Baseline	Reform	Baseline	Reform
Reform 1: Discontinue Offering Reduced-Fat and Whole Milk						
Original model:						
Number of Participants	16,133,187	15,647,120	11,009,190	10,905,380	27,142,377	26,552,500
Participation Rate	72.6%	70.4%	50.6%	50.2%	61.8%	60.4%
S1: Add Demographics						
Number of Participants	16,133,187	15,578,188	11,009,190	10,830,196	27,142,377	26,408,384
Participation Rate	72.6%	70.1%	50.6%	49.8%	61.8%	60.1%
S2: Drop Competitive Foods						
Number of Participants	16,133,187	15,905,454	11,009,190	10,899,222	27,142,377	26,804,676
Participation Rate	72.6%	71.6%	50.6%	50.1%	61.8%	61.0%
S3: Drop OVS						
Number of Participants	16,133,187	15,876,704	11,009,190	10,593,508	27,142,377	26,470,212
Participation Rate	72.6%	71.5%	50.6%	48.7%	61.8%	60.2%
S4: Drop Price						
Number of Participants	16,133,187	15,801,817	11,009,190	10,894,015	27,142,377	26,695,833
Participation Rate	72.6%	71.1%	50.6%	50.1%	61.8%	60.7%
S5: Drop All IVs Except Price						
Number of Participants	16,133,187	15,404,352	11,009,190	11,172,435	27,142,377	26,576,787
Participation Rate	72.6%	69.3%	50.6%	51.4%	61.8%	60.5%
Reform 2: Offer Fresh Fruit Daily						
Original model:						
Number of Participants	16,133,187	14,056,000	11,009,190	10,789,530	27,142,377	24,845,530
Participation Rate	72.6%	63.3%	50.6%	49.6%	61.8%	56.5%
S1: Add Demographics						
Number of Participants	16,133,187	15,176,345	11,009,190	10,796,457	27,142,377	25,972,802
Participation Rate	72.6%	68.3%	50.6%	49.7%	61.8%	59.1%
S2: Drop Competitive Foods						
Number of Participants	16,133,187	14,460,151	11,009,190	10,416,055	27,142,377	24,876,206
Participation Rate	72.6%	65.1%	50.6%	47.9%	61.8%	56.6%
S3: Drop OVS						
Number of Participants	16,133,187	13,961,214	11,009,190	10,688,315	27,142,377	24,649,529
Participation Rate	72.6%	62.9%	50.6%	49.2%	61.8%	56.1%
S4: Drop Price						
Number of Participants	16,133,187	14,283,734	11,009,190	10,568,735	27,142,377	24,852,469
Participation Rate	72.6%	64.3%	50.6%	48.6%	61.8%	56.5%
S5: Drop All IVs Except Price						
Number of Participants	16,133,187	13,175,348	11,009,190	10,722,782	27,142,377	23,898,130
Participation Rate	72.6%	59.3%	50.6%	49.3%	61.8%	54.4%
Reform 3: Comprehensive Reform						
Original model:						
Number of Participants	16,133,187	15,325,927	11,009,190	9,651,182	27,142,377	24,977,109
Participation Rate	72.6%	69.0%	50.6%	44.4%	61.8%	56.8%
S1: Add Demographics						
Number of Participants	16,133,187	15,951,892	11,009,190	9,789,948	27,142,377	25,741,839
Participation Rate	72.6%	71.8%	50.6%	45.0%	61.8%	58.6%
S2: Drop Competitive Foods						

Outcome	Elementary		Secondary		All Students	
	Baseline	Reform	Baseline	Reform	Baseline	Reform
Number of Participants	16,133,187	16,053,575	11,009,190	9,517,600	27,142,377	25,571,176
Participation Rate	72.6%	72.3%	50.6%	43.8%	61.8%	58.2%
S3: Drop OVS						
Number of Participants	16,133,187	15,510,073	11,009,190	9,445,809	27,142,377	24,955,882
Participation Rate	72.6%	69.8%	50.6%	43.4%	61.8%	56.8%
S4: Drop Price						
Number of Participants	16,133,187	15,650,918	11,009,190	9,754,814	27,142,377	25,405,732
Participation Rate	72.6%	70.5%	50.6%	44.9%	61.8%	57.8%
S5: Drop All IVs Except Price						
Number of Participants	16,133,187	14,654,308	11,009,190	10,046,128	27,142,377	24,700,436
Participation Rate	72.6%	66.0%	50.6%	46.2%	61.8%	56.2%
Sample size (weighted)	22,212,613		21,741,088		43,953,701	
Sample size (unweighted)	732		1,578		2,310	

Source: SNDA-III Public Use File.

Note: Meal-price status is not interacted with the reform (i.e., the reform does not differ by meal-price category). Reform 3: Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week.

Table D.5
Sensitivity Analyses for Participation Simulation – BREAKFAST
Outcomes: Number of Participants and Participation Rate

Outcome	Elementary		Secondary		All Students	
	Baseline	Reform	Baseline	Reform	Baseline	Reform
Reform 1: Discontinue Offering Reduced-Fat and Whole Milk						
Original model:						
Number of Participants	5,134,650	5,757,381	2,663,126	2,177,867	7,797,775	7,935,247
Participation Rate	28.5%	31.9%	14.3%	11.7%	21.3%	21.6%
S1: Add Demographics						
Number of Participants	5,134,650	5,991,021	2,663,126	2,217,520	7,797,775	8,208,542
Participation Rate	28.5%	33.2%	14.3%	11.9%	21.3%	22.4%
S2: Drop Competitive Foods						
Number of Participants	5,134,650	5,833,025	2,663,126	2,129,551	7,797,775	7,962,576
Participation Rate	28.5%	32.3%	14.3%	11.4%	21.3%	21.7%
S3: Drop OVS						
Number of Participants	5,134,650	5,970,378	2,663,126	2,199,344	7,797,775	8,169,722
Participation Rate	28.5%	33.1%	14.3%	11.8%	21.3%	22.3%
S4: Drop Price						
Number of Participants	5,134,650	5,526,876	2,663,126	2,302,347	7,797,775	7,829,223
Participation Rate	28.5%	30.6%	14.3%	12.4%	21.3%	21.4%
S5: Drop All IVs Except Price						
Number of Participants	5,134,650	6,198,906	2,663,126	2,532,027	7,797,775	8,730,933
Participation Rate	28.5%	34.4%	14.3%	13.6%	21.3%	23.8%
Reform 2: Offer Fresh Fruit Daily						
Original model:						
Number of Participants	5,134,650	4,371,449	2,663,126	2,634,420	7,797,775	7,005,869
Participation Rate	28.5%	24.2%	14.3%	14.2%	21.3%	19.1%
S1: Add Demographics						
Number of Participants	5,134,650	3,949,248	2,663,126	2,634,787	7,797,775	6,584,035
Participation Rate	28.5%	21.9%	14.3%	14.2%	21.3%	18.0%
S2: Drop Competitive Foods						
Number of Participants	5,134,650	3,136,884	2,663,126	2,556,991	7,797,775	5,693,875
Participation Rate	28.5%	17.4%	14.3%	13.7%	21.3%	15.5%
S3: Drop OVS						
Number of Participants	5,134,650	4,719,044	2,663,126	2,619,437	7,797,775	7,338,482
Participation Rate	28.5%	26.2%	14.3%	14.1%	21.3%	20.0%
S4: Drop Price						
Number of Participants	5,134,650	3,547,148	2,663,126	2,790,299	7,797,775	6,337,447
Participation Rate	28.5%	19.7%	14.3%	15.0%	21.3%	17.3%
S5: Drop All IVs Except Price						
Number of Participants	5,134,650	5,021,912	2,663,126	2,715,262	7,797,775	7,737,174
Participation Rate	28.5%	27.8%	14.3%	14.6%	21.3%	21.1%
Sample size (weighted)	18,042,957		18,609,956		36,652,914	
Sample size (unweighted)	630		1,375		2,005	

Source: SNDA-III Public Use File.

Note: Meal-price status is not interacted with the reform (i.e., the reform does not differ by meal-price category).

Table D.6
Sensitivity Analyses for Meals Consumed - LUNCH
Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Outcomes: Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 1	Baseline	Reform 1	Baseline	Reform 1
Original Model:						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.93	10.75	11.04	10.72	10.48
MPEs of fluid milk	0.61	0.57	0.37	0.35	0.49	0.46
MPEs of fruit	0.27	0.27	0.15	0.16	0.21	0.22
MPEs of vegetables[a]	0.28	0.32	0.30	0.31	0.29	0.32
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	580.27	626.34	612.64	613.99	596.28
Grams of saturated fat	7.40	6.66	8.10	7.89	7.74	7.26
Percentage of calories from total fat	31.55	30.23	32.79	33.42	32.16	31.81
Sodium (mg)	1037.79	955.18	1080.21	1079.26	1058.78	1016.55
Vitamin A (mcg RAE)	172.93	157.52	134.32	126.10	153.83	141.98
Potassium (mg)	802.27	788.37	721.82	722.52	762.48	755.79
Magnesium (mg)	79.26	79.25	71.73	71.97	75.54	75.64
S1: Drop OVS						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.93	10.75	11.00	10.72	10.46
MPEs of fluid milk	0.61	0.58	0.37	0.35	0.49	0.46
MPEs of fruit	0.27	0.28	0.15	0.16	0.21	0.22
MPEs of vegetables[a]	0.28	0.33	0.30	0.31	0.29	0.32
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	583.45	626.34	610.86	613.99	597.01
Grams of saturated fat	7.40	6.71	8.10	7.86	7.74	7.28
Percentage of calories from total fat	31.55	30.22	32.79	33.35	32.16	31.77
Sodium (mg)	1037.79	961.36	1080.21	1079.08	1058.78	1019.59
Vitamin A (mcg RAE)	172.93	158.32	134.32	125.31	153.83	141.99
Potassium (mg)	802.27	795.32	721.82	717.88	762.48	757.01
Magnesium (mg)	79.26	79.81	71.73	71.53	75.54	75.71
S2: Drop Price						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.92	10.75	11.05	10.72	10.48
MPEs of fluid milk	0.61	0.58	0.37	0.35	0.49	0.47
MPEs of fruit	0.27	0.27	0.15	0.16	0.21	0.22
MPEs of vegetables[a]	0.28	0.32	0.30	0.31	0.29	0.32
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	584.10	626.34	610.68	613.99	597.25
Grams of saturated fat	7.40	6.71	8.10	7.87	7.74	7.28
Percentage of calories from total fat	31.55	30.27	32.79	33.35	32.16	31.80
Sodium (mg)	1037.79	960.09	1080.21	1075.49	1058.78	1017.17
Vitamin A (mcg RAE)	172.93	158.49	134.32	126.27	153.83	142.55
Potassium (mg)	802.27	791.32	721.82	722.47	762.48	757.26
Magnesium (mg)	79.26	79.86	71.73	71.85	75.54	75.90
S3: Drop All IVs Except Price						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.93	10.75	11.08	10.72	10.50

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 1	Baseline	Reform 1	Baseline	Reform 1
MPEs of fluid milk	0.61	0.57	0.37	0.37	0.49	0.47
MPEs of fruit	0.27	0.28	0.15	0.16	0.21	0.22
MPEs of vegetables[a]	0.28	0.33	0.30	0.32	0.29	0.32
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	578.45	626.34	614.57	613.99	596.32
Grams of saturated fat	7.40	6.62	8.10	7.91	7.74	7.26
Percentage of calories from total fat	31.55	30.25	32.79	33.48	32.16	31.85
Sodium (mg)	1037.79	951.37	1080.21	1082.87	1058.78	1016.42
Vitamin A (mcg RAE)	172.93	156.99	134.32	127.67	153.83	142.49
Potassium (mg)	802.27	783.67	721.82	727.05	762.48	755.67
Magnesium (mg)	79.26	78.81	71.73	72.37	75.54	75.63
S4: Use Actual Participation						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.96	10.75	11.06	10.72	10.50
MPEs of fluid milk	0.61	0.58	0.37	0.35	0.49	0.47
MPEs of fruit	0.27	0.26	0.15	0.16	0.21	0.21
MPEs of vegetables[a]	0.28	0.31	0.30	0.31	0.29	0.31
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	577.28	626.34	613.11	613.99	595.00
Grams of saturated fat	7.40	6.62	8.10	7.89	7.74	7.25
Percentage of calories from total fat	31.55	30.25	32.79	33.43	32.16	31.82
Sodium (mg)	1037.79	952.36	1080.21	1077.27	1058.78	1014.14
Vitamin A (mcg RAE)	172.93	159.01	134.32	126.98	153.83	143.17
Potassium (mg)	802.27	787.17	721.82	724.35	762.48	756.09
Magnesium (mg)	79.26	78.84	71.73	72.19	75.54	75.55
S5: Reduced-Form						
Target Outcomes						
Percentage of calories from saturated fat	10.70	9.93	10.75	11.08	10.72	10.50
MPEs of fluid milk	0.61	0.57	0.37	0.35	0.49	0.46
MPEs of fruit	0.27	0.26	0.15	0.16	0.21	0.21
MPEs of vegetables[a]	0.28	0.31	0.30	0.32	0.29	0.31
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	578.41	626.34	614.20	613.99	596.11
Grams of saturated fat	7.40	6.62	8.10	7.91	7.74	7.26
Percentage of calories from total fat	31.55	30.23	32.79	33.47	32.16	31.83
Sodium (mg)	1037.79	951.51	1080.21	1079.44	1058.78	1014.79
Vitamin A (mcg RAE)	172.93	156.94	134.32	126.99	153.83	142.13
Potassium (mg)	802.27	784.15	721.82	727.36	762.48	756.06
Magnesium (mg)	79.26	78.85	71.73	72.38	75.54	75.65
Sample size (weighted)	22,212,613		21,741,088		43,953,701	
Sample size (unweighted)	732		1,578		2,310	

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

Table D.7
Sensitivity Analyses for Meals Consumed – LUNCH
Reform 2: Offer Fresh Fruit Daily
Outcomes: Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 2	Baseline	Reform 2	Baseline	Reform 2
Original Model:						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.67	10.75	11.02	10.72	11.35
MPEs of fluid milk	0.61	0.57	0.37	0.38	0.49	0.48
MPEs of fruit	0.27	0.38	0.15	0.15	0.21	0.27
MPEs of vegetables[a]	0.28	0.41	0.30	0.31	0.29	0.36
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	583.36	626.34	626.41	613.99	604.65
Grams of saturated fat	7.40	7.92	8.10	8.42	7.74	8.17
Percentage of calories from total fat	31.55	30.40	32.79	33.24	32.16	31.80
Sodium (mg)	1037.79	1086.36	1080.21	1100.44	1058.78	1093.33
Vitamin A (mcg RAE)	172.93	178.48	134.32	133.36	153.83	156.16
Potassium (mg)	802.27	828.92	721.82	720.44	762.48	775.26
Magnesium (mg)	79.26	83.82	71.73	72.37	75.54	78.16
S1: Drop OVS						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.67	10.75	11.01	10.72	11.34
MPEs of fluid milk	0.61	0.57	0.37	0.38	0.49	0.47
MPEs of fruit	0.27	0.37	0.15	0.15	0.21	0.26
MPEs of vegetables[a]	0.28	0.42	0.30	0.31	0.29	0.37
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	582.85	626.34	625.81	613.99	604.10
Grams of saturated fat	7.40	7.91	8.10	8.42	7.74	8.16
Percentage of calories from total fat	31.55	30.40	32.79	33.22	32.16	31.79
Sodium (mg)	1037.79	1085.03	1080.21	1100.37	1058.78	1092.62
Vitamin A (mcg RAE)	172.93	177.92	134.32	132.80	153.83	155.60
Potassium (mg)	802.27	827.51	721.82	718.94	762.48	773.81
Magnesium (mg)	79.26	83.67	71.73	72.23	75.54	78.01
S2: Drop Price						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.63	10.75	11.00	10.72	11.32
MPEs of fluid milk	0.61	0.57	0.37	0.38	0.49	0.47
MPEs of fruit	0.27	0.37	0.15	0.15	0.21	0.26
MPEs of vegetables[a]	0.28	0.40	0.30	0.31	0.29	0.35
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	591.83	626.34	623.65	613.99	607.57
Grams of saturated fat	7.40	8.03	8.10	8.39	7.74	8.21
Percentage of calories from total fat	31.55	30.52	32.79	33.15	32.16	31.82
Sodium (mg)	1037.79	1096.24	1080.21	1097.26	1058.78	1096.74
Vitamin A (mcg RAE)	172.93	180.68	134.32	132.43	153.83	156.82
Potassium (mg)	802.27	832.01	721.82	716.85	762.48	775.05
Magnesium (mg)	79.26	84.97	71.73	71.97	75.54	78.54

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 2	Baseline	Reform 2	Baseline	Reform 2
S3: Drop All IVs Except Price						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.65	10.75	11.01	10.72	11.33
MPEs of fluid milk	0.61	0.56	0.37	0.39	0.49	0.48
MPEs of fruit	0.27	0.40	0.15	0.15	0.21	0.28
MPEs of vegetables[a]	0.28	0.42	0.30	0.31	0.29	0.37
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.03
Collateral Outcomes						
Calories	601.90	577.58	626.34	626.68	613.99	601.87
Grams of saturated fat	7.40	7.79	8.10	8.43	7.74	8.10
Percentage of calories from total fat	31.55	30.49	32.79	33.24	32.16	31.85
Sodium (mg)	1037.79	1073.10	1080.21	1101.79	1058.78	1087.29
Vitamin A (mcg RAE)	172.93	176.50	134.32	133.33	153.83	155.15
Potassium (mg)	802.27	808.25	721.82	719.63	762.48	764.41
Magnesium (mg)	79.26	82.38	71.73	72.30	75.54	77.40
S4: Use Actual Participation						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.73	10.75	11.03	10.72	11.38
MPEs of fluid milk	0.61	0.58	0.37	0.38	0.49	0.48
MPEs of fruit	0.27	0.34	0.15	0.15	0.21	0.25
MPEs of vegetables[a]	0.28	0.39	0.30	0.31	0.29	0.35
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	575.03	626.34	626.83	613.99	600.65
Grams of saturated fat	7.40	7.81	8.10	8.43	7.74	8.12
Percentage of calories from total fat	31.55	30.46	32.79	33.26	32.16	31.84
Sodium (mg)	1037.79	1076.03	1080.21	1101.82	1058.78	1088.79
Vitamin A (mcg RAE)	172.93	181.97	134.32	133.44	153.83	157.97
Potassium (mg)	802.27	821.36	721.82	721.34	762.48	771.89
Magnesium (mg)	79.26	82.58	71.73	72.41	75.54	77.55
S5: Reduced-Form						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.67	10.75	11.02	10.72	11.34
MPEs of fluid milk	0.61	0.57	0.37	0.38	0.49	0.47
MPEs of fruit	0.27	0.34	0.15	0.15	0.21	0.25
MPEs of vegetables[a]	0.28	0.38	0.30	0.31	0.29	0.35
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	577.40	626.34	626.24	613.99	601.56
Grams of saturated fat	7.40	7.82	8.10	8.42	7.74	8.12
Percentage of calories from total fat	31.55	30.40	32.79	33.23	32.16	31.80
Sodium (mg)	1037.79	1074.14	1080.21	1100.42	1058.78	1087.14
Vitamin A (mcg RAE)	172.93	176.33	134.32	133.09	153.83	154.94
Potassium (mg)	802.27	814.86	721.82	719.98	762.48	767.93
Magnesium (mg)	79.26	82.60	71.73	72.32	75.54	77.52
Sample size (weighted)	22,212,613		21,741,088		43,953,701	
Sample size (unweighted)	732		1,578		2,310	

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

Table D.8
Sensitivity Analyses for Meals Consumed – LUNCH
Reform 3: Comprehensive Reform
Outcomes: Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary		Secondary		All Students	
Outcomes	Baseline	Reform 3	Baseline	Reform 3	Baseline	Reform 3
Original Model:						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.39	10.75	11.51	10.72	11.45
MPEs of fluid milk	0.61	0.55	0.37	0.34	0.49	0.45
MPEs of fruit	0.27	0.38	0.15	0.16	0.21	0.28
MPEs of vegetables[a]	0.28	0.44	0.30	0.32	0.29	0.38
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	568.31	626.34	616.47	613.99	592.13
Grams of saturated fat	7.40	7.49	8.10	8.49	7.74	7.98
Percentage of calories from total fat	31.55	30.49	32.79	33.51	32.16	31.98
Sodium (mg)	1037.79	1012.44	1080.21	1131.51	1058.78	1071.34
Vitamin A (mcg RAE)	172.93	167.34	134.32	125.96	153.83	146.87
Potassium (mg)	802.27	841.81	721.82	698.75	762.48	771.05
Magnesium (mg)	79.26	81.85	71.73	71.63	75.54	76.79
S1: Drop OVS						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.39	10.75	11.48	10.72	11.43
MPEs of fluid milk	0.61	0.55	0.37	0.35	0.49	0.45
MPEs of fruit	0.27	0.39	0.15	0.17	0.21	0.28
MPEs of vegetables[a]	0.28	0.45	0.30	0.32	0.29	0.39
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	571.17	626.34	615.28	613.99	592.99
Grams of saturated fat	7.40	7.53	8.10	8.47	7.74	7.99
Percentage of calories from total fat	31.55	30.48	32.79	33.47	32.16	31.96
Sodium (mg)	1037.79	1017.32	1080.21	1131.37	1058.78	1073.73
Vitamin A (mcg RAE)	172.93	167.59	134.32	125.66	153.83	146.85
Potassium (mg)	802.27	847.31	721.82	696.04	762.48	772.49
Magnesium (mg)	79.26	82.30	71.73	71.35	75.54	76.88
S2: Drop Price						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.34	10.75	11.52	10.72	11.43
MPEs of fluid milk	0.61	0.55	0.37	0.35	0.49	0.45
MPEs of fruit	0.27	0.38	0.15	0.17	0.21	0.27
MPEs of vegetables[a]	0.28	0.43	0.30	0.33	0.29	0.38
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	578.81	626.34	617.84	613.99	598.11
Grams of saturated fat	7.40	7.62	8.10	8.50	7.74	8.06
Percentage of calories from total fat	31.55	30.65	32.79	33.55	32.16	32.08
Sodium (mg)	1037.79	1025.06	1080.21	1133.26	1058.78	1078.58
Vitamin A (mcg RAE)	172.93	169.97	134.32	126.05	153.83	148.25
Potassium (mg)	802.27	846.26	721.82	700.87	762.48	774.34
Magnesium (mg)	79.26	83.32	71.73	71.86	75.54	77.65
S3: Drop All IVs Except Price						
Target Outcomes						

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 3	Baseline	Reform 3	Baseline	Reform 3
Percentage of calories from saturated fat	10.70	11.39	10.75	11.55	10.72	11.47
MPEs of fluid milk	0.61	0.54	0.37	0.39	0.49	0.47
MPEs of fruit	0.27	0.40	0.15	0.16	0.21	0.29
MPEs of vegetables[a]	0.28	0.45	0.30	0.32	0.29	0.38
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	560.36	626.34	613.90	613.99	586.85
Grams of saturated fat	7.40	7.36	8.10	8.44	7.74	7.90
Percentage of calories from total fat	31.55	30.48	32.79	33.44	32.16	31.94
Sodium (mg)	1037.79	996.88	1080.21	1119.52	1058.78	1057.54
Vitamin A (mcg RAE)	172.93	164.78	134.32	129.44	153.83	147.30
Potassium (mg)	802.27	829.30	721.82	706.05	762.48	768.34
Magnesium (mg)	79.26	80.29	71.73	71.90	75.54	76.14
S4: Use Actual Participation						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.48	10.75	11.17	10.72	11.33
MPEs of fluid milk	0.61	0.57	0.37	0.37	0.49	0.47
MPEs of fruit	0.27	0.36	0.15	0.18	0.21	0.27
MPEs of vegetables[a]	0.28	0.42	0.30	0.34	0.29	0.38
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	556.70	626.34	625.94	613.99	590.95
Grams of saturated fat	7.40	7.34	8.10	8.37	7.74	7.85
Percentage of calories from total fat	31.55	30.57	32.79	32.60	32.16	31.57
Sodium (mg)	1037.79	999.52	1080.21	1131.87	1058.78	1064.99
Vitamin A (mcg RAE)	172.93	171.40	134.32	131.49	153.83	151.66
Potassium (mg)	802.27	833.71	721.82	716.03	762.48	775.50
Magnesium (mg)	79.26	80.23	71.73	73.80	75.54	77.05
S5: Reduced-Form						
Target Outcomes						
Percentage of calories from saturated fat	10.70	11.38	10.75	11.18	10.72	11.28
MPEs of fluid milk	0.61	0.54	0.37	0.37	0.49	0.46
MPEs of fruit	0.27	0.36	0.15	0.18	0.21	0.27
MPEs of vegetables[a]	0.28	0.41	0.30	0.34	0.29	0.38
MPEs of dark green and orange vegetables	0.03	0.03	0.02	0.02	0.02	0.02
Collateral Outcomes						
Calories	601.90	560.38	626.34	626.19	613.99	592.94
Grams of saturated fat	7.40	7.36	8.10	8.37	7.74	7.86
Percentage of calories from total fat	31.55	30.49	32.79	32.61	32.16	31.54
Sodium (mg)	1037.79	996.67	1080.21	1132.06	1058.78	1063.64
Vitamin A (mcg RAE)	172.93	164.76	134.32	130.94	153.83	148.03
Potassium (mg)	802.27	823.83	721.82	716.85	762.48	770.91
Magnesium (mg)	79.26	80.26	71.73	73.85	75.54	77.09
Sample size (weighted)	22,212,613		21,741,088		43,953,701	
Sample size (unweighted)	732		1,578		2,310	

Source: SNDA-III Public Use File, Day 1 recall data only.

Note: Reform 3 (Lunch only): Discontinue offering reduced-fat and whole milk, offer French fries and similar potato products no more than 1 day per week, offer fresh fruit daily, no longer allow juice to be served at lunch, and offer dark green or orange vegetables at least 2 days per week.

[a]Other than French fries and similar potato products.

Table D.9
Sensitivity Analyses for Meals Consumed - BREAKFAST
Reform 1: Discontinue Offering Reduced-Fat and Whole Milk
Outcomes: Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary		Secondary		All Students	
Outcomes	Baseline	Reform 1	Baseline	Reform 1	Baseline	Reform 1
Original Model:						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.63	7.11	7.18	7.79	7.90
MPEs of fluid milk	0.61	0.63	0.48	0.53	0.55	0.58
MPEs of fruit	0.12	0.14	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	5.00	4.13	4.38	4.30	4.68
Collateral Outcomes						
Calories	405.64	414.87	345.42	359.54	375.06	386.78
Grams of saturated fat	4.23	3.93	3.65	3.74	3.94	3.84
Percentage of calories from total fat	21.99	22.74	18.56	18.38	20.25	20.53
Sodium (mg)	530.64	535.01	454.78	474.70	492.12	504.39
Vitamin A (mcg RAE)	206.75	213.91	178.56	199.59	192.43	206.64
Potassium (mg)	527.06	544.47	437.57	454.29	481.62	498.69
Magnesium (mg)	51.73	50.68	44.87	48.02	48.24	49.33
S1: Drop OVS						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.59	7.11	7.19	7.79	7.88
MPEs of fluid milk	0.61	0.63	0.48	0.53	0.55	0.58
MPEs of fruit	0.12	0.14	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	5.01	4.13	4.37	4.30	4.68
Collateral Outcomes						
Calories	405.64	416.17	345.42	358.76	375.06	387.02
Grams of saturated fat	4.23	3.93	3.65	3.74	3.94	3.84
Percentage of calories from total fat	21.99	22.54	18.56	18.40	20.25	20.44
Sodium (mg)	530.64	541.57	454.78	474.90	492.12	507.72
Vitamin A (mcg RAE)	206.75	216.25	178.56	196.66	192.43	206.30
Potassium (mg)	527.06	544.75	437.57	452.04	481.62	497.67
Magnesium (mg)	51.73	50.67	44.87	48.03	48.24	49.33
S2: Drop Price						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.60	7.11	7.26	7.79	7.92
MPEs of fluid milk	0.61	0.62	0.48	0.53	0.55	0.58
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.10
MPEs (teaspoons) of added sugars	4.47	4.72	4.13	4.46	4.30	4.59
Collateral Outcomes						
Calories	405.64	404.26	345.42	367.46	375.06	385.58
Grams of saturated fat	4.23	3.86	3.65	3.82	3.94	3.84
Percentage of calories from total fat	21.99	22.77	18.56	18.62	20.25	20.66
Sodium (mg)	530.64	511.45	454.78	487.37	492.12	499.22
Vitamin A (mcg RAE)	206.75	206.44	178.56	201.64	192.43	204.00
Potassium (mg)	527.06	529.10	437.57	463.13	481.62	495.60
Magnesium (mg)	51.73	49.36	44.87	48.76	48.24	49.06

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 1	Baseline	Reform 1	Baseline	Reform 1
S3: Drop All IVs Except Price						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.55	7.11	7.18	7.79	7.86
MPEs of fluid milk	0.61	0.64	0.48	0.52	0.55	0.58
MPEs of fruit	0.12	0.14	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	4.97	4.13	4.34	4.30	4.65
Collateral Outcomes						
Calories	405.64	416.05	345.42	365.23	375.06	390.25
Grams of saturated fat	4.23	3.93	3.65	3.80	3.94	3.87
Percentage of calories from total fat	21.99	22.40	18.56	18.69	20.25	20.52
Sodium (mg)	530.64	545.98	454.78	492.55	492.12	518.85
Vitamin A (mcg RAE)	206.75	217.26	178.56	196.10	192.43	206.52
Potassium (mg)	527.06	543.42	437.57	456.75	481.62	499.41
Magnesium (mg)	51.73	50.56	44.87	47.69	48.24	49.11
S4: Use Actual Participation						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.58	7.11	7.12	7.79	7.84
MPEs of fluid milk	0.61	0.63	0.48	0.51	0.55	0.57
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	5.01	4.13	4.34	4.30	4.67
Collateral Outcomes						
Calories	405.64	416.11	345.42	360.48	375.06	387.87
Grams of saturated fat	4.23	3.93	3.65	3.76	3.94	3.84
Percentage of calories from total fat	21.99	22.54	18.56	18.42	20.25	20.45
Sodium (mg)	530.64	538.96	454.78	479.16	492.12	508.60
Vitamin A (mcg RAE)	206.75	215.07	178.56	195.67	192.43	205.22
Potassium (mg)	527.06	545.59	437.57	452.61	481.62	498.38
Magnesium (mg)	51.73	50.73	44.87	47.43	48.24	49.05
S5: Reduced-Form						
Target Outcomes						
Percentage of calories from saturated fat	8.48	8.58	7.11	7.17	7.79	7.86
MPEs of fluid milk	0.61	0.63	0.48	0.52	0.55	0.57
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	5.00	4.13	4.34	4.30	4.66
Collateral Outcomes						
Calories	405.64	415.52	345.42	363.88	375.06	389.30
Grams of saturated fat	4.23	3.93	3.65	3.78	3.94	3.86
Percentage of calories from total fat	21.99	22.51	18.56	18.64	20.25	20.54
Sodium (mg)	530.64	538.28	454.78	485.22	492.12	511.34
Vitamin A (mcg RAE)	206.75	215.02	178.56	196.16	192.43	205.45
Potassium (mg)	527.06	544.58	437.57	457.44	481.62	500.34
Magnesium (mg)	51.73	50.68	44.87	47.73	48.24	49.18
Sample size (weighted)	18,042,957		18,609,956		36,652,914	
Sample size (unweighted)	630		1,375		2,005	

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

Table D.10
Sensitivity Analyses for Meals Consumed - BREAKFAST
Reform 2: Offer Fresh Fruit Daily
Outcomes: Average Nutrients and MyPyramid Equivalents (MPEs) Consumed

	Elementary		Secondary		All Students	
Outcomes	Baseline	Reform 2	Baseline	Reform 2	Baseline	Reform 2
Original Model:						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.72	7.11	6.75	7.79	8.21
MPEs of fluid milk	0.61	0.56	0.48	0.50	0.55	0.53
MPEs of fruit	0.12	0.14	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	3.55	4.13	3.99	4.30	3.78
Collateral Outcomes						
Calories	405.64	287.78	345.42	323.92	375.06	306.13
Grams of saturated fat	4.23	3.31	3.65	3.46	3.94	3.39
Percentage of calories from total fat	21.99	23.30	18.56	17.44	20.25	20.32
Sodium (mg)	530.64	375.49	454.78	422.99	492.12	399.61
Vitamin A (mcg RAE)	206.75	207.22	178.56	185.17	192.43	196.02
Potassium (mg)	527.06	410.27	437.57	427.66	481.62	419.10
Magnesium (mg)	51.73	40.14	44.87	43.84	48.24	42.02
S1: Drop OVS						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.64	7.11	6.76	7.79	8.17
MPEs of fluid milk	0.61	0.56	0.48	0.49	0.55	0.53
MPEs of fruit	0.12	0.14	0.08	0.08	0.10	0.10
MPEs (teaspoons) of added sugars	4.47	3.56	4.13	3.99	4.30	3.78
Collateral Outcomes						
Calories	405.64	289.70	345.42	322.66	375.06	306.44
Grams of saturated fat	4.23	3.31	3.65	3.45	3.94	3.39
Percentage of calories from total fat	21.99	22.97	18.56	17.41	20.25	20.15
Sodium (mg)	530.64	380.77	454.78	420.05	492.12	400.71
Vitamin A (mcg RAE)	206.75	208.09	178.56	182.57	192.43	195.13
Potassium (mg)	527.06	410.40	437.57	425.58	481.62	418.11
Magnesium (mg)	51.73	40.12	44.87	43.87	48.24	42.02
S2: Drop Price						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.68	7.11	6.81	7.79	8.22
MPEs of fluid milk	0.61	0.52	0.48	0.50	0.55	0.51
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.11
MPEs (teaspoons) of added sugars	4.47	3.39	4.13	4.02	4.30	3.71
Collateral Outcomes						
Calories	405.64	272.00	345.42	328.92	375.06	300.90
Grams of saturated fat	4.23	3.13	3.65	3.51	3.94	3.32
Percentage of calories from total fat	21.99	23.75	18.56	17.61	20.25	20.63
Sodium (mg)	530.64	365.43	454.78	432.18	492.12	399.32
Vitamin A (mcg RAE)	206.75	201.03	178.56	187.19	192.43	194.00
Potassium (mg)	527.06	381.97	437.57	432.75	481.62	407.75
Magnesium (mg)	51.73	37.66	44.87	44.32	48.24	41.04

Outcomes	Elementary		Secondary		All Students	
	Baseline	Reform 2	Baseline	Reform 2	Baseline	Reform 2
S3: Drop All IVs Except Price						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.55	7.11	6.70	7.79	8.11
MPEs of fluid milk	0.61	0.56	0.48	0.49	0.55	0.53
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.10
MPEs (teaspoons) of added sugars	4.47	3.56	4.13	3.96	4.30	3.76
Collateral Outcomes						
Calories	405.64	291.08	345.42	321.51	375.06	306.53
Grams of saturated fat	4.23	3.30	3.65	3.44	3.94	3.37
Percentage of calories from total fat	21.99	22.66	18.56	17.41	20.25	19.99
Sodium (mg)	530.64	385.65	454.78	420.34	492.12	403.27
Vitamin A (mcg RAE)	206.75	210.63	178.56	181.69	192.43	195.93
Potassium (mg)	527.06	410.32	437.57	424.23	481.62	417.38
Magnesium (mg)	51.73	40.04	44.87	43.32	48.24	41.71
S4: Use Actual Participation						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.57	7.11	6.70	7.79	8.12
MPEs of fluid milk	0.61	0.56	0.48	0.48	0.55	0.52
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.10
MPEs (teaspoons) of added sugars	4.47	3.53	4.13	3.97	4.30	3.76
Collateral Outcomes						
Calories	405.64	288.00	345.42	324.67	375.06	306.62
Grams of saturated fat	4.23	3.29	3.65	3.47	3.94	3.38
Percentage of calories from total fat	21.99	22.69	18.56	17.47	20.25	20.04
Sodium (mg)	530.64	380.09	454.78	426.75	492.12	403.78
Vitamin A (mcg RAE)	206.75	209.24	178.56	181.66	192.43	195.24
Potassium (mg)	527.06	406.67	437.57	426.57	481.62	416.77
Magnesium (mg)	51.73	39.80	44.87	43.41	48.24	41.63
S5: Reduced-Form						
Target Outcomes						
Percentage of calories from saturated fat	8.48	9.60	7.11	6.74	7.79	8.15
MPEs of fluid milk	0.61	0.56	0.48	0.48	0.55	0.52
MPEs of fruit	0.12	0.13	0.08	0.08	0.10	0.10
MPEs (teaspoons) of added sugars	4.47	3.56	4.13	3.97	4.30	3.77
Collateral Outcomes						
Calories	405.64	290.89	345.42	327.04	375.06	309.25
Grams of saturated fat	4.23	3.31	3.65	3.49	3.94	3.40
Percentage of calories from total fat	21.99	22.81	18.56	17.62	20.25	20.17
Sodium (mg)	530.64	383.04	454.78	431.20	492.12	407.49
Vitamin A (mcg RAE)	206.75	209.60	178.56	182.08	192.43	195.63
Potassium (mg)	527.06	410.74	437.57	429.71	481.62	420.37
Magnesium (mg)	51.73	40.10	44.87	43.62	48.24	41.89
Sample size (weighted)	18,042,957		18,609,956		36,652,914	
Sample size (unweighted)	630		1,375		2,005	

Source: SNDA-III Public Use File, Day 1 recall data only.

[a]Other than French fries and similar potato products.

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