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Third Access, Participation, Eligibility, and Certification Study (APEC-III) Final Report

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Executive Summary

The Improper Payments Elimination and Recovery Act (IPERA) of 2012 (PL 111-204) requires that the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) identify and reduce improper payments in their programs, including both underpayments and overpayments. FNS relies upon the Access, Participation, Eligibility and Certification (APEC) Study series to provide "reliable, national estimates of improper payments made to school districts in which the National School Lunch Program (NSLP) and School Breakfast Program (SBP) operate."

FNS contracted with Westat to conduct the third study in the series, APEC-III, to provide accurate and precise estimates of the error rate and the dollar amount of the program error for the NSLP and SBP in School Year (SY) 2017-2018. The four objectives of the study were:

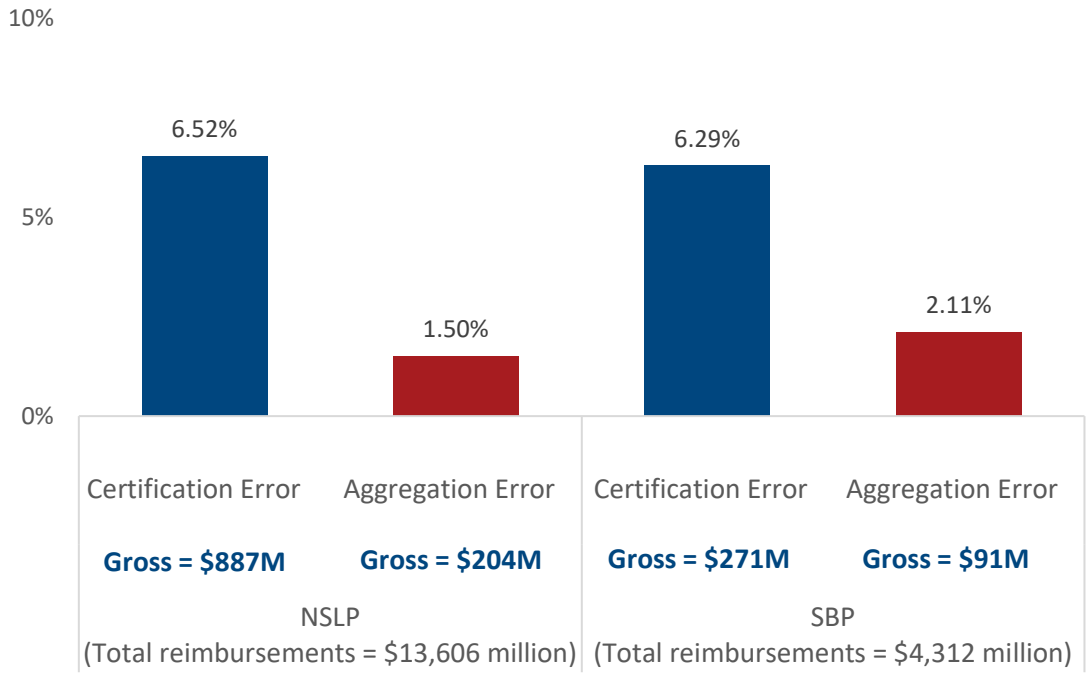
- **Objective 1:** Generate a national estimate of the annual amount of improper payments based on SY 2017-2018 by replicating previous APEC study methodology.
- **Objective 2:** Provide a robust examination of the relationship of student (household), school, and SFA characteristics to error rates.
- **Objective 3:** Conduct a substudy on the variation in error rates among School Food Authorities (SFAs) using different implementation strategies in their school meal programs.
- **Objective 4:** Present qualitative analyses examining the reasons for improper payments.

The findings from APEC-III can help FNS respond to Federal mandates, improve processes, and increase program integrity. APEC-III also provides FNS with an in-depth examination of the causes of errors to develop mitigation strategies to reduce errors in the future.

ES.1 Key Findings

Figure ES-1 provides a summary of the key IPERA reporting requirements. The program error rates are less than the 10 percent threshold specified in IPERA. The estimate of gross improper payments due to certification error is $887 million for the NSLP and $271 million for the SBP. This is for non-Community Eligibility Provision (CEP) and CEP schools combined. The estimate of gross improper payments due to aggregation error is $204 million for the NSLP and $91 million for the SBP. These estimates are based on the total reimbursements of $13.6 billion for NSLP and $4.3 billion for SBP.

Figure ES-1. Estimates of improper payment due to certification and aggregation error



In contrast, Figure ES-2 compares the gross and net estimates of improper payment due to certification error. The net improper payments subtracts the underpayments from the overpayments. This difference between gross and net improper payments reveals that overpayments are larger than underpayments. The gross improper payment rates due to certification error are 6.52% for the NSLP and 6.29% for the SBP for the 2017-2018 School Year. The APEC-II study estimated gross improper payment rates due to certification error of 9.81% for the NSLP and 10.97% for the SBP for the 2012-2013 School Year.

Figure ES-2. Estimates of gross improper payment rates and net improper payments due to certification error

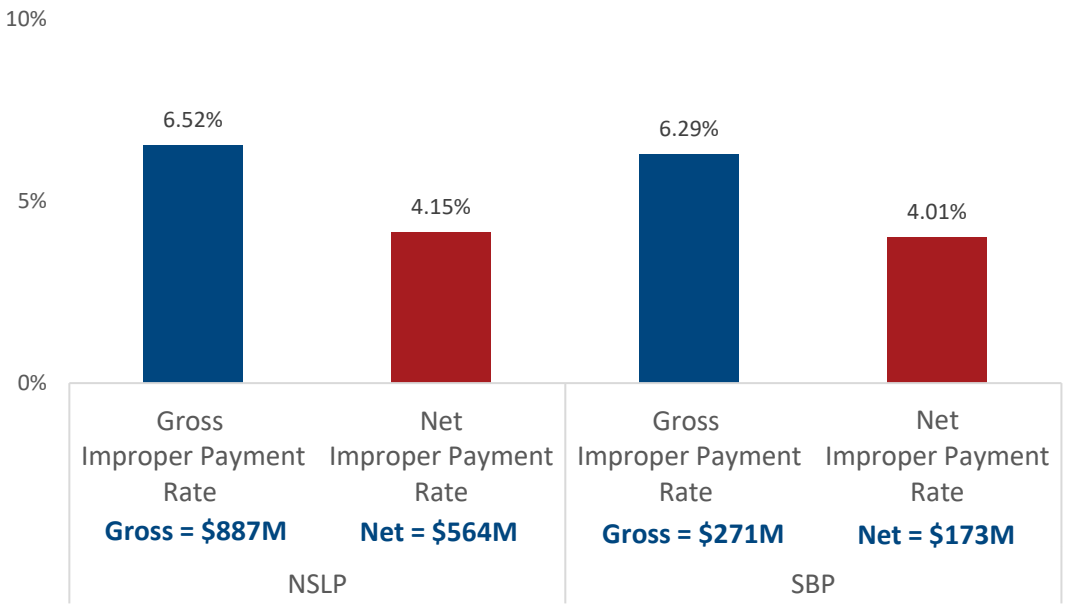
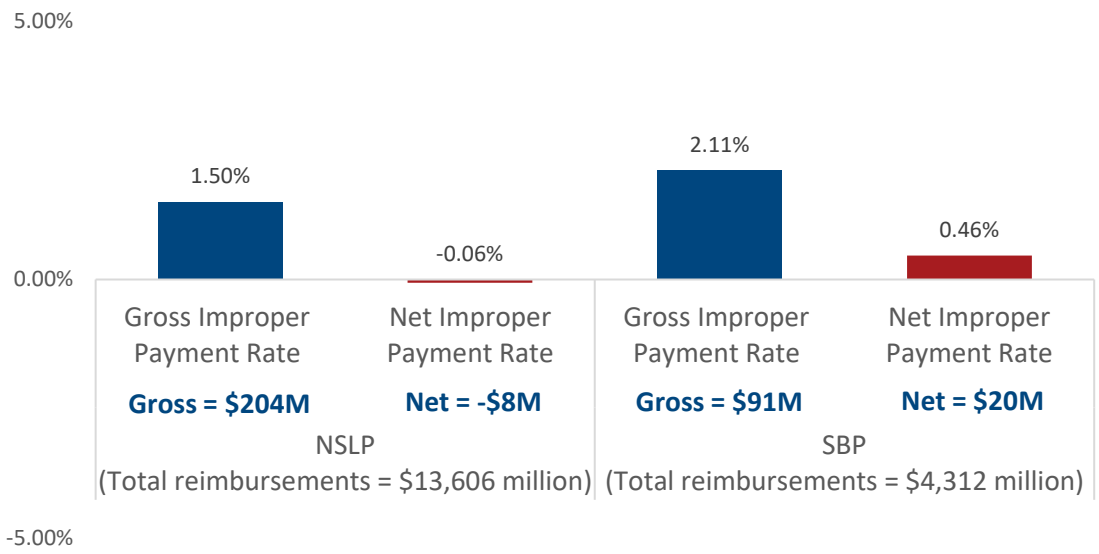


Figure ES-3 compares the gross and the net improper payment rates due to aggregation error. The net improper payments subtract the underpayments from the overpayments. Overpayments and underpayments due to aggregation error were similar in size for both the NSLP and the SBP. Therefore, the overpayments and underpayments largely cancel out, resulting in net improper payments due to aggregation error that are close to zero.

Figure ES-3. Estimates of gross improper payment rates and net improper payment rates due to aggregation error



ES.2 Background

The overarching goal of both the NSLP and SBP, known collectively as the school meal programs, is to ensure that students have access to nutritious meals and snacks during the school year. The National School Lunch Act (NSLA) requires the NSLP and SBP to serve meals that are consistent with the goals of the most recent *Dietary Guidelines for Americans (DGA)*. To ensure the nutritional quality of school meals, the USDA requires that SFAs, the entities responsible for the administration of the programs in their schools, comply with set meal patterns and nutrition standards for a meal to be eligible for Federal reimbursement. All public and private nonprofit schools and residential child care institutions are eligible to participate in the school meal programs.

The largest of the Child Nutrition Programs, the NSLP, provides nutritionally balanced meals and snacks to an average of 30 million children per day, 22 million of them free or at a reduced-price, in public and private non-profit schools and residential childcare institutions.[1] Operating similarly to the NSLP, the SBP provides breakfasts to about 14.7 million children per day, with 12.5 million

[1] https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLPFactSheet.pdf

receiving breakfasts free or at a reduced-price,[2] in schools and institutions. Together, the NSLP and SBP cost $18.2 billion in Fiscal Year 2018.[3]

FNS funds and administers the NSLP and SBP through agreements with State agencies, while the School Food Authorities (SFAs) implement and oversee the programs at the school level. SFAs receive cash reimbursement for each meal served that complies with the meal pattern requirements and other reimbursement rules. The process required to reimburse SFAs for meals served is complicated, with three levels of reimbursement (free, reduced-price, and paid), multiple ways for SFAs to certify students, and aggregation of meal counts at multiple levels. While there are many potential sources of error that may result in improper payments, APEC-III measures improper payments in two categories: certification (i.e., determining the eligibility of a student for a given level of reimbursement) and aggregation (i.e., adding up all the claims correctly).

In prior APEC studies, a third type of error, meal claiming error, was included in estimates of improper payments. Meal claiming errors occur when meals are misclassified as reimbursable when they do not comply with the meal pattern requirements. Although included in past studies, meal claiming errors are best understood as standard of service failures rather than errors that give rise to improper payments. Specifically, meal claiming errors do not result in a meal delivered to an ineligible recipient nor a payment for benefits that were not delivered. Meal claiming errors differ from certification and aggregation errors because the remedy is improvements in meeting meal pattern requirements, and does not give rise to a recoverable monetary loss. Therefore, in APEC-III and moving forward, meal claiming errors are excluded from improper payment estimates, and are examined separately.

ES.3 Overview of APEC-III

Key elements of the APEC-III approach are the definitions of errors and their implications for improper payments, the sampling design, and the data collection plan. Table ES-1 provides a

[2] https://fns-prod.azureedge.net/sites/default/files/resource-files/SBPfactsheet.pdf

[3] FNS July 2019 Key data report (May 2019 data), accessed at https://fns-prod.azureedge.net/sites/default/files/data-files/Keydata-May-2019.pdf

summary of the definition of errors, which are consistent with previous APEC studies. The main revision to the approach is that meal claiming errors are not associated with improper payments.

Following past APEC methodology, we used a multistage, clustered sample design, which included:

- A nationally representative sample of SFAs in the contiguous 48 States and the District of Columbia totaling 336 (144 CEP and 192 non-CEP);
- A stratified sample of schools within each SFA totaling 777 (278 CEP, 499 non-CEP); and
- A random sample of students (households) within each sampled school totaling 12,321 who applied for free and reduced-price meals, were categorically eligible for free meals, or were directly certified for free meals.

Table ES-1. Definition of errors

Type of error	Definition
Certification errors	Certification errors occur when applications are certified for levels of benefits for which they are not eligible. Specifically, the student is certified for the wrong meal eligibility category. Certification error (based on income application or direct certification) can result in an overpayment or underpayment. Certification error may result from administrative error on the part of the SFA during application review or it can result from a household reporting error. Certification errors contribute the largest share to the total improper payments.
Aggregation errors	Aggregation errors occur in the process of tallying the number of meals served each month (by reimbursement category), transferring meal counts from school to SFA, and from SFA to the State agency. These math or transcription errors result in the number of meals claimed not matching the number of meals served.
Meal claiming errors	Meal claiming errors occur in school cafeterias at the point-of-sale. These errors occur when meals that are served, and claimed for reimbursement, do not meet the meal pattern requirements. These errors do not result in an improper payment because they do not result in a meal delivered to an ineligible recipient or a miscount in meals. In schools operating with Offer versus Serve (OVS), including all high schools, the student may select fewer meal components/food items and still have a reimbursable meal (provided all components are offered to the student).

Note: The definition of meal claiming error is included for reference, though it is not included in estimates of improper payments.

APEC-III collected data via in-person visits to SFAs, schools, and households to measure certification, aggregation, and meal claiming errors. Data collection included: (a) abstraction from income eligibility applications and categorical eligibility records; (b) abstraction of meal count and claiming records from SFAs, schools, and FNS administrative data; (c) an SFA director survey; (d) household surveys; and (e) meal observations. Abstraction of income eligibility data and

household surveys took place three times during the study year to ensure coverage of applications submitted at different times during the year. APEC-III data collection also included qualitative data collection to understand the factors that contribute to errors, including an SFA director interview, a cafeteria manager interview, and in-depth interviews with select households. Finally, the study obtained administrative meal participation data (data on the number of meals served and claimed for sampled students).

ES.4 Analytic Approach

ES.4.1 Overview of Approach for Addressing Objective 1

Objective 1: Generate a national estimate of the annual amount of improper payments based on SY 2017-2018 by replicating previous APEC study methodology.

To measure certification error in non-CEP schools due to administrative errors, we independently determined certification status based on abstracted application data to assess errors in the SFA's determination of certification status. To measure certification error in non-CEP schools due to household reporting errors, we independently determined certification status based on household survey data. We then compared this independent determination to the SFA's assigned certification status based on the data reported on the application. For CEP schools, we verified the eligibility status of a sample of students used to support their meal claiming rate. To measure aggregation error, we abstracted meal count and claiming records from different sources (school, SFA, and State) for a target month, and identified if there were discrepancies in the data reported at each stage of the meal counting and claiming process.

We determined the associated improper payments for each type of error and program. We weighted the error rates and improper payments to produce national-level estimates. We calibrated the weights to the actual budget expenditures to ensure our national estimates of the dollar amount of the error were consistent with the actual aggregate NSLP and SBP expenditures for meals.

As a separate analysis, to measure the extent to which school meals met meal pattern requirements (i.e., meal claiming errors), we conducted observations of a sample of meals served to students to document instances in which meals claimed for reimbursement either: (a) did not meet the meal

pattern requirements; or (b) were served to an ineligible recipient. We report the meal claiming error rate separately as it has no impact on improper payments as defined by IPERA.

ES.4.2 Overview of Analytic Approach for Objective 2

Objective 2: Provide a robust examination of the relationship of student (household), school, and SFAs characteristics to error rates.

Westat collected information on the administrative and operational structure of SFAs and schools sampled for the study. After applying the appropriate weights, we tabulated data to provide descriptive summaries that are representative of SFAs and schools participating in the school meal programs nationally during SY 2017-2018. We examined the relationship between student, school, and SFA characteristics on each of the key types and sources of error. The characteristics we examined included, for example, student characteristics such as the child's grade level, household size, and household income; school characteristics such as region, school enrollment, and percentage of students certified as free or reduced-price eligible; and SFA characteristics such as district size, among other characteristics.

ES.4.3 Overview of Approach for Addressing Objective 3

Objective 3: Conduct a substudy on the differences in error rates among SFAs using different implementation strategies in their school meal programs.

We used bivariate and multivariate regression analysis at the SFA level to examine differences in household reporting and administrative error rates among SFAs. Bivariate analysis examined the effect of selected variables, revealing the impact of the variable and any other variables it may be correlated with. In contrast, multivariate analysis used regression to examine the effect a set of variables simultaneously had on the error rate, isolating the independent impact of each one and identifying their relative importance. Additionally, we used the findings from the qualitative analysis of the semi-structured interview data to assist in interpreting the implications of the findings. We weighted the data as appropriate given the sampling plan and nonresponse. The analyses used weighted regressions to explore relations between the SFA characteristics and error rates.

ES.4.4 Overview of Approach for Addressing Objective 4

Objective 4: Present qualitative analyses examining the reasons for improper payments.

APEC-III collected qualitative data from semi-structured interviews with forty-two (42) SFA directors, sixty (60) households, and sixty-four (64) cafeteria managers. We designed the interview guides to elicit responses that provide context, help understand how and why errors may occur, highlight facilitators and barriers, determine strategies implemented to minimize errors, and summarize improvements over time. The interviews were recorded, transcribed, and loaded into NVivo, a software package that facilitates coding and identifying themes from qualitative data.

ES.5 Key Findings on Certification Error

1. The estimate of national **administrative error** rate for all children is 10.01 percent.
2. The estimate of national **household reporting error** rate for all children is 12.00 percent.
3. The estimate of the national **total certification** error rate for all children in non-CEP schools is 20.04 percent.
4. For the NSLP overall (non-CEP and CEP schools), the gross improper payment rate is 6.52 percent. The net improper payment rate is 4.15 percent.
5. For the SBP overall (non-CEP and CEP schools), the gross improper payment rate is 6.29 percent. The net improper payment rate is 4.01 percent.
6. For non-CEP schools, the gross improper payment rate for the NSLP is 8.31 percent, resulting in $789 million in improper payments. The net improper payment rate is 7.79 percent, resulting in $465 million in improper payments.
7. For non-CEP schools, the gross improper payment rate for the SBP is 4.90 percent, resulting in $245 million in improper payments. The net improper payment rate is 4.67 percent, resulting in $147 million in improper payments.
8. Overcertification error is more common than undercertification error.
9. Household reporting certification error is statistically lower in APEC-III compared to APEC-II, likely due to the increase in direct certification.
10. Incorrect income[4] was the most common factor contributing to all types of certification error. Errors in reporting income accounted for more than half of all household reporting errors, affecting 6.43 percent of certified or denied students.

[4] This includes both incorrect reporting of income by households on the application (household reporting error) and incorrect assessment of income by the SFA (administrative error).

ES.6 Key Findings on Aggregation Error

1. For the NSLP, the net improper payment rate due to aggregation error is negative 0.06 percent, which results in an underpayment of $8.37 million.

2. For the SBP, the net improper payment rate due to aggregation error is 0.46 percent, which results in an underpayment of $19.96 million.

3. The net improper payment rates were less than 1 percent, and not statistically different from zero.

4. The majority of schools (87%) have no aggregation errors.

ES.7 Key Findings on Meal Claiming Error

1. For the NSLP, the gross meal claiming error rate is 7.62 percent. The net meal claiming error rate is 2.47 percent.

2. For the SBP, the gross meal claiming error is 12.36 percent. The net meal claiming error rate is 9.98 percent.

3. Nearly 50 percent of schools have no meal claiming error.

4. For NSLP lunches, the three primary sources of meal claiming error in OVS meals are: (1) tray does not have enough components, (2) tray does not contain a fruit or a vegetable, and (3) grain is not offered. The three primary sources of meal claiming error in non-OVS meals are: (1) tray is missing a milk, (2) tray is missing a vegetable, and (3) tray is missing a grain.

5. For SBP breakfasts, the three primary sources of meal claiming error in OVS meals are: (1) tray does not contain enough items total, (2) student did not take a fruit or a vegetable, and (3) milk is not offered. The three primary sources of meal claiming error for non-OVS meals are: (1) the tray does not contain milk, (2) the tray does not contain a fruit or a vegetable, and (3) the tray does not contain a grain.

ES.8 Implications of Study Findings

Certification error remains a non-trivial source of improper payments in the NSLP and the SBP. For all schools, the gross improper payment rate due to certification error is 6.52 percent for the NSLP, and 6.29 percent for the SBP. The increased reliance on direct certification and CEP to certify students reduced the prevalence of certain types of certification errors relative to prior school years. If continued, these procedural changes may result in even lower certification error rates in the future.

While aggregation error exists at each level of meal count aggregation, net estimates of improper payments are relatively low, and have remained consistent over the APEC studies. The net improper payment rates due to aggregation error were close to zero. This is because over counts and under counts were similar in proportion, largely cancelled out in the aggregate.

Findings from the analyses of meal claiming error rates reveal that net error is higher for SBP than NSLP meals. When compared to previous APEC studies, the analyses reveal no significant differences between the net error rates found from the APEC-III analysis and the estimates from the APEC-I and APEC-II studies. There was no change in the definition of errors due to meal claiming error or the procedures for identifying errors across the three APEC studies.

Although meal claiming error rates have not significantly increased, they also have not significantly decreased when compared to prior years. However, compared to prior years, APEC-III identified a higher percentage of trays that were reimbursable, but were not marked as reimbursable by the cashier (leading to underclaiming).

The findings from APEC-III suggest key focus areas to improve program integrity, including:

1. **Certification error:**
    - A. Continue to make improvements in the application process and application instructions.
    - B. Emphasize inclusion of all appropriate types of income for all household members on applications.
    - C. Increase the use of direct certification, CEP, and other methods that do not require applications.
    - D. Implement consistent procedures for verifying direct certification, and maintaining documentation.
2. **Aggregation error:**
    - A. Increase the use of electronic systems and tools for tracking meal counts, at all levels (school, SFA, and State).
    - B. Enhance automation of tracking and recording meals served outside of the cafeteria.
    - C. Increase technical assistance on the use of software systems.

3. **Meal claiming error:**

   A. Increase training and strategies to encourage students to take all of the required food components.

   B. Improve systems and tracking for meals served outside of the cafeteria.

1. Introduction

1.1 Overview

The Improper Payments Elimination and Recovery Act (IPERA) of 2012 (PL 111-204) requires that the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) identify and reduce improper payments in their programs, including both underpayments and overpayments. FNS relies upon the Access, Participation, Eligibility and Certification (APEC) Study series to provide "reliable, national estimates of improper payments made to school districts in which the National School Lunch Program (NSLP) and School Breakfast Program (SBP) operate."[5]

FNS contracted with Westat to conduct the third study in the series, APEC-III, to provide accurate and precise estimates of the error rate and the dollar amount of the program error for the NSLP and SBP in School Year (SY) 2017-2018. The four objectives of the study were:

- **Objective 1:** Generate a national estimate of the annual amount of improper payments based on SY 2017-2018 by replicating previous APEC study methodology.
- **Objective 2:** Provide a robust examination of the relationship of student (household), school, and School Food Authorities' (SFAs') characteristics to error rates.
- **Objective 3:** Conduct a substudy on the variation in error rates among SFAs using different implementation strategies in their school meal programs.
- **Objective 4:** Present qualitative analyses examining the reasons for improper payments.

The findings from APEC-III can help FNS respond to Federal mandates, improve processes, and increase program integrity. APEC-III also provides FNS with an in-depth examination of the causes of errors to develop mitigation strategies to reduce errors in the future.

1.2 Background

The overarching goal of both the NSLP and SBP, known collectively as the school meal programs, is to ensure that students have access to nutritious meals and snacks during the school year. The National School Lunch Act (NSLA) requires the NSLP and SBP to serve meals that are consistent

[5] The dollar estimate of program error from APEC-II was approximately $2.7 billion.

with the goals of the most recent *Dietary Guidelines for Americans (DGA)*. To ensure the nutritional quality of school meals, the USDA requires that SFAs, the entities responsible for the administration of the programs in their schools, comply with set meal patterns and nutrition standards, for a meal to be eligible for Federal reimbursement. All public and private nonprofit schools and residential child care institutions are eligible to participate in the school meal programs.

The largest of the Child Nutrition Programs, the NSLP, provides nutritionally balanced meals and snacks to an average of 30 million children per day, 22 million of them free or at a reduced-price, in public and private nonprofit schools and residential childcare institutions.[6] Operating similarly to the NSLP, the SBP provides breakfasts to about 14.7 million children per day, with 12.5 million receiving breakfasts free or at a reduced-price,[7] schools and institutions. Together, the NSLP and SBP cost $18.2 billion in Fiscal Year 2018.[8]

FNS funds and administers the NSLP and SBP through agreements with State agencies, while the School Food Authorities (SFAs) implement and oversee the programs at the school level. SFAs receive cash reimbursement for each meal served that complies with the meal pattern requirements and other reimbursement rules. The process required to reimburse SFAs for meals served is complicated, with three levels of reimbursement (free, reduced-price, and paid), multiple ways for SFAs to certify students, and aggregation of meal counts at multiple levels. While there are many potential sources of error that may result in improper payments, APEC-III measures improper payments in two categories: certification (i.e., determining the eligibility of a student for a given level of reimbursement) and aggregation (i.e., adding up all the claims correctly).

In prior APEC studies, a third type of error, meal claiming error, was included in estimates of improper payments. Meal claiming errors occur when meals are misclassified as reimbursable when they do not comply with the meal pattern requirements. Although included in past studies, meal claiming errors are best understood as standard of service failures rather than errors that give rise to improper payments. Specifically, meal claiming errors do not result in a meal delivered to an ineligible recipient nor a payment for benefits that were not delivered. Meal claiming errors differ

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[6] https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLPFactSheet.pdf

[7] https://fns-prod.azureedge.net/sites/default/files/resource-files/SBPfactsheet.pdf

[8] FNS July 2019 Key Data report (May 2019 data), accessed at https://fns-prod.azureedge.net/sites/default/files/data-files/Keydata-May-2019.pdf

from certification and aggregation errors because the remedy is improvements in meeting meal pattern requirements, and does not give rise to recoverably monetary loss. Therefore, in APEC-III and moving forward, meal claiming errors are excluded from improper payment estimates, and are examined separately.

Table 1-1 provides a summary of the gross error estimates ($ and %) of certification and aggregation error in NSLP and SBP in APEC-I (SY 2005-2006) and APEC-II (SY 2012-2013). In response to both APEC-I and APEC-II, FNS implemented a comprehensive legislative and administrative plan to reduce errors in the school meal programs. Actions included: (1) providing several approaches to certification that can reduce certification error; (2) implementing training programs and professional certifications; (3) funding investments in State technology improvement; and (4) creating the Office of Program Integrity for Child Nutrition Programs.[9] APEC-III provides insights into how these actions have impacted the error rates and ultimately, improper payments. Subsequent chapters of this report discuss the results from APEC-III.

Table 1-1. Estimates of gross improper payment amounts and rates for NSLP and SBP, APEC-I and APEC-II

Type of error	APEC-I SY 2005-2006	APEC-II SY 2012-2013
NSLP		
Certification error	$759 (9.42%)	$1,158 (9.81%)
Point-of-sale aggregation error	$26 (0.33%)	$3 (0.03%)
School-to-SFA aggregation error	$163 (2.02%)	$94 (0.80%)
SFA-to-State aggregation error	$87 (1.46%)	$<1 (<0.01%)
SBP		
Certification error	$177 (9.15%)	$366 (10.97%)
Point-of-sale aggregation error	$5 (0.24%)	$14 (0.42%)
School-to-SFA aggregation error	$77 (3.99%)	$9 (0.28%)
SFA-to-State aggregation error	$35 (1.78%)	$16 (0.49%)

Notes: Dollar amounts are in millions. Entries in parentheses are estimated improper payment rates. Specifically, the ratio of the improper payment amounts to total reimbursements.

[9] Food and Nutrition Service, "Measuring and Reducing Errors in the School Meal Programs (Summary)" May 2015, http://www.fns.usda.gov/sites/default/files/ops/APECII-Summary.pdf.

1.3 Certification and Eligibility Status

All children enrolled in schools participating in the school meal programs are eligible to receive program meals that receive reimbursement by the USDA. Children from families with incomes at or below 130 percent of the Federal poverty level are eligible for free meals. Those with incomes above 130 percent and are at or below 185 percent of the poverty level are eligible for reduced-price meals, for which students can be charged no more than 40 cents for lunch and 30 cents for breakfast. Within the requirements for paid lunch equity [(7 CFR 210.14 (e)], local education agencies (LEAs) typically coordinate with their SFAs[10] to establish the prices for meals served to children from families with incomes of more than 185 percent of poverty.[11] Nonetheless, these meals still receive some level of reimbursement. While FNS provides policy guidance and structure for operating the school meal programs, SFAs are responsible for certification. Furthermore, SFAs have some discretion in the procedures they elect to use to determine student's meal certification status (e.g., direct certification, use of provisions, etc.).

Students certified to receive free or reduced-price meals remain certified throughout the school year with some exceptions.[12] The SFA determines eligibility based on: (a) income eligibility as reported on a household application, (b) categorical eligibility based on households' participation in other Federal means-tested programs (e.g., the Supplemental Nutrition Assistance Program [SNAP], Temporary Assistance to Needy Families [TANF], and/or the Food Distribution Program on Indian Reservations [FDPIR], or (c) status as foster child, homeless, a runaway, or migrant).

Students from households that receive benefits from SNAP or other programs are categorically eligible for free meals, and can be directly certified. Direct certification is an administrative process

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[10] School Food Authority is defined as the governing body that is responsible for the administration of one or more schools and has the legal authority to operate a nonprofit school food service therein or otherwise approved by FNS. Please see https://www.govinfo.gov/content/pkg/CFR-2018-title7-vol4/xml/CFR-2018-title7-vol4-sec210-2.xml

[11] Before passage of the Healthy, Hunger-Free Kids Act of 2010 (HHFKA), Federal regulations did not include restrictions on what SFAs could charge for paid lunches and breakfasts. HHFKA amended the Richard B. Russell National School Lunch Act to now require SFAs participating in the NSLP to ensure sufficient funds are provided to the nonprofit school food service account for lunches served to students not certified for free or reduced-price meals. SFAs can meet this requirement by: (1) gradually raising the prices charged for paid lunches, (2) providing an equivalent amount of funds from non-Federal sources to the nonprofit school food service account, or (3) by implementing both options. SFAs are not required to raise the prices of paid lunches more than $0.10 per year, but they do have the option to do so.

[12] Benefits may change as part of the verification process or if the household reapplies and is certified as eligible for a higher level of benefits.

that documents eligibility through processes by which State agencies and school districts share eligibility information. The Healthy, Hunger-Free Kids Act of 2010 also authorized a demonstration to use Medicaid data to directly certify students for school meal benefits in selected SFAs and States.

All States are required to directly certify students based on SNAP participation; however, States also directly certify students based on information related to TANF, FDPIR, foster care, and other programs that confer categorical eligibility. These students are not required to submit an application to establish eligibility for free school meals. Students who are foster children, homeless, runaways, or children of migrants under the programs specified in the Richard B. Russell NSLA may be certified outside the traditional application process based on procedures in which the SFA documents students' eligibility with the appropriate agencies.[13] Based on the eligibility determination, most SFAs assign students to free, reduced-price, or paid meal status categories and count and claim meals for reimbursement on that basis. In some SFAs, or in schools within an SFA, all students can receive free meals without applying or being directly certified in a current school year using alternative provisions.

1.3.1 Alternative Provisions

Some SFAs, typically those that serve a high proportion of students from low-income households, may opt for the alternative methods for determining eligibility and receiving reimbursement allowed under Provision 2, Provision 3, or the Community Eligibility Provision (CEP).[14] In an effort to reduce paperwork at the local level, Section 11(a)(1) of the NSLA includes three alternative provisions to the normal requirements for annual determinations of eligibility for free and reduced-price school meals. Additionally, the Healthy, Hunger-Free Kids Act of 2010 more recently added CEP to section 11(a)(1)(F) of the NSLA, providing another alternative. All of these alternative provisions are methods for reducing paperwork and other administrative burdens at the local level by simplifying the traditional operating procedures for determining eligibility and meal counting and claiming. Table 1-2 provides a summary of Provision 2, 3, and CEP. In many cases, CEP is a more attractive option for schools than the provisions.

[13] For a history of the NSLA, please see https://fns-prod.azureedge.net/sites/default/files/resource-files/NSLP-Program%20History.pdf

[14] There is also Provision 1; however it is no longer in use.

Beginning in SY 2014-2015, high-poverty schools and school districts in all States were eligible to participate in CEP. CEP allows school districts, individual schools, or groups of schools to offer breakfasts and lunches at no charge to all students if at least 40 percent of their students are "Identified Students"—that is, approved for free meals without an application based on data from other Federal means-tested programs, like SNAP that serve low-income children. In SY 2015-2016, more than 18,500 schools elected the CEP.[15]

Table 1-2. Summary of Provision 2, Provision 3, and CEP

Provision 2
Allows schools to establish claiming percentages and serve all meals at no charge. Schools must serve meals to all participating children at no charge for a period of 4 years. (Note: SFAs may opt to use Provision 2 for breakfast and regular counting and claiming for lunch.) During the first year, or base year, the school makes eligibility determinations and takes meal counts by type. During the next 3 years, the school counts only the total number of reimbursable meals served each day. Reimbursement during these years is determined by applying the percentages of free, reduced-price, and paid meals served during the corresponding month of the base year to the total meal count for the claiming month. Schools electing this alternative must pay the difference between Federal reimbursement and the cost of providing all meals at no charge. The money to pay for this difference must be from sources other than Federal funds. At the end of each period, the State agency may approve 4-year extensions if the income level of the school's population remains stable. Provision 2 became an option in 1980.
Provision 3
Allows schools to receive the same level of Federal cash and commodity assistance each year, with some adjustments, for a 4-year period. Schools must serve meals to all participating children at no charge for a period of 4 years. These schools do not make additional eligibility determinations after the base year. For each of the 4 years, the level of Federal cash and commodity support is adjusted to reflect changes in enrollment and inflation. The base year is not included as part of the 4 years. At the end of each 4-year period, the State agency may approve 4-year extensions if the income level of the school's population remains stable. Schools electing this alternative must pay the difference between Federal reimbursement and the cost to provide all meals at no charge. The money to pay for this difference must be from sources other than Federal funds. Provision 3 has been an option for schools since 1995.
CEP
For schools using CEP, reimbursements are based on the CEP groups' Identified Student Percentage (ISP), which reflects the percentage of students directly certified for free meals. The group can be an individual school, group of schools, or the entire school district. The ISP is the proportion of "identified students" out of the total enrolled students who are directly certified for free school meals through means other than a household application, and who are not subject to verification (e.g., SNAP, TANF, etc.). The denominator, enrolled students, is the number of students enrolled at all schools included in the CEP group.

1.4 Meal Claims for Reimbursement

Each month, schools submit claims for reimbursable meals served in the prior month to their SFA. These monthly claims identify the meals served on each day to each student (by reimbursement rate). The SFAs review and combine the claims of the individual school and submit a monthly claim

[15] CEP Planning & Implementation Guidance. Please see https://fns-prod.azureedge.net/sites/default/files/cn/SP61-2016-CEP_Guidance.pdf

form to the appropriate State agency.[16] The State agency aggregates all of the SFAs' claims and files a single claim for reimbursement to FNS. FNS reviews these claims and approves reimbursements for each State agency. Upon approval, the State agency forwards the appropriate reimbursement to each SFA for use in the nonprofit school food service account. The USDA reimbursement rate for NSLP and SBP programs varies by meal type and eligibility status. Table 1-3 provides the meal reimbursement rates for July 1, 2017, through June 30, 2018, the school year of APEC-III data collection.

Table 1-3. Reimbursement rates per meal in the contiguous United States, SY 2017-2018

Reimbursement rate type	Meal category		
	Free	Reduced-price (RP)	Paid
NSLP			
Base rate	$3.23	$2.83	$0.31
Base rate plus 6-cents	$3.29	$2.89	$0.37
60% or more Free or RP	$3.25	$2.85	$0.33
60% or more Free or RP plus 6-cents	$3.31	$2.91	$0.39
SBP			
Base rate (non-Severe Need)	$1.75	$1.45	$0.30
Severe Need rate	$2.09	$1.79	$0.30

Source: Federal Register Vol. 82 No. 144, page 35177.

1.5 Summary of Study Approach

The APEC-III study objectives, along with the intention to maintain consistency with past APEC studies as appropriate, guided the development of the study approach. Key elements of the approach are the definitions of errors and their implications for improper payments, the sampling design, and the data collection plan. Table 1-4 provides a summary of the definition of errors, which are consistent with previous APEC studies. The main revision to the approach is that meal claiming errors are not associated with improper payments.

[16] The Stage agency is typically a division within the State Department of Education, however, it can vary from State to State.

Following past APEC methodology, we used a multistage, clustered sample design, which included:

- A nationally representative sample of SFAs in the contiguous 48 States and the District of Columbia totaling 336 (144 CEP and 192 non-CEP);
- A stratified sample of schools within each SFA totaling 777 (278 CEP, 499 non-CEP); and
- A random sample of students (households) within each sampled school, totaling 12,321 who applied for free and reduced-price meals, were categorically eligible for free meals or directly certified for free meals.

Appendix A provides a summary of sampling and the sampling design.

Table 1-4. Definition of errors

Type of error	Definition
Certification errors	Certification errors occur when applications are certified for levels of benefits for which they are not eligible. Specifically, the student is certified for the wrong meal eligibility category. Certification error (based on income application or direct certification) can result in an overpayment or underpayment. Certification error may result from administrative error on the part of the SFA during application review, or it can result from a household reporting error. Certification errors contribute the largest share to the total improper payments.
Aggregation errors	Aggregation errors occur in the process of tallying the number of meals served each month (by reimbursement category), transferring meal counts from school to SFA, and from SFA to the State agency. These math or transcription errors result in the number of meals claimed not matching the number of meals served.
Meal claiming errors	Meal claiming errors occur in school cafeterias at the point-of-sale. These errors occur when meals that are served, and claimed for reimbursement, do not meet the meal pattern requirements. These errors do not result in an improper payment because they do not result in a meal delivered to an ineligible recipient or a miscount in meals. In schools operating with Offer versus Serve (OVS), including all high schools, the student may select fewer meal components/food items and still have a reimbursable meal (provided all components are offered to the student).

Note: The definition of meal claiming error is included for reference, though it is not included in estimates of improper payments.

APEC-III collected data via in-person visits to SFAs, schools, and households to measure certification, aggregation, and meal claiming errors. Data collection included: (a) abstraction from income eligibility applications and categorical eligibility records; (b) abstraction of meal count and claiming records from SFAs, schools, and FNS administrative data; (c) an SFA director survey; (d) household surveys; and (e) meal observations. Abstraction of income eligibility data and household surveys took place three times during the study year to ensure coverage of applications submitted at different times during the year. APEC-III data collection also included qualitative data

collection to understand the factors that contribute to errors, including an SFA director interview, a cafeteria manager interview, and in-depth interviews with select households. Finally, the study obtained administrative meal participation data (data on the number of meals served and claimed for sampled students).

1.5.1 Overview of Approach for Addressing Objective 1

Objective 1: Generate a national estimate of the annual amount of improper payments based on SY 2017-2018 by replicating previous APEC study methodology.

Following the APEC-II methodology, we first estimated the certification and aggregation error rates and improper payments for NSLP and SBP separately. We then combined them for a single estimate of improper payments due to certification and aggregation errors for the NSLP and SBP.

To measure certification error in non-CEP schools due to administrative errors, we independently determined certification status based on abstracted application data to assess errors in the SFA's determination of certification status. To measure certification error in non-CEP schools due to household reporting errors, we independently determined certification status based on household survey data. We then compared this independent determination to the SFA's assigned certification status based on the data reported on the application. For CEP schools, we verified the eligibility status of a sample of students used to support their meal claiming rate. To measure aggregation error, we abstracted meal count and claiming records from different sources (school, SFA, and State) for a target month, and identified if there were discrepancies in the data reported at each stage of the meal counting and claiming process.

We determined the associated improper payments for each type of error and program. We weighted the error rates and improper payments to produce national level estimates. We calibrated the weights to the actual budget expenditures to ensure our national estimates of the dollar amount of the error were consistent with the actual aggregate NSLP and SBP expenditures for meals.

For each program, we also calculated the combined certification and aggregation error rates. For this calculation, we estimated a net error rate that factored in the potential interaction between certification and aggregation errors. Again, we determined the associated dollar amount of payments

that were in error, calibrated the weights to the actual budget expenditures, and applied the weights to obtain the **national estimate of improper payments** for the NSLP and SBP.

Lastly, we compared key findings of this study to those found in the previous two APEC studies along with tests of significance. These key findings include certification and non-certification (meal claiming and aggregation) error rates as well as improper payment rates for certification and aggregation errors (i.e., under and overpayment) and source of error (e.g., point-of-sale, SFA meal counts), and for NSLP and SBP separately.

As a separate analysis, to measure the extent to which school meals met meal pattern requirements (i.e., meal claiming errors), we conducted observations of a sample of meals served to students to document instances in which meals claimed for reimbursement either: (a) did not meet the meal pattern requirements, or (b) were served to an ineligible recipient. We report the meal claiming error rate separately as it has no impact on improper payments as defined by IPERA.

1.5.2 Overview of Analytic Approach for Objective 2

Objective 2: Provide a robust examination of the relationship of student (household), school, and SFA's characteristics to error rates.

To meet Study Objective 2, we increased the number of SFAs and schools in the sample relative to past APEC studies, which improved our ability to discern which policies and SFA, school, and student population characteristics were correlated with the various types of error. We explored the relationships between SFA, schools, and student characteristics with errors using bivariate analyses. Increasing the number of SFAs allowed us to conduct more robust analyses of the relationship between SFA characteristics and errors. It is through the SFAs that FNS could affect policies that show promise in lowering errors.

Westat collected information on the administrative and operational structure of SFAs and schools sampled for the study. After applying the appropriate weights, we tabulated data to provide descriptive summaries that are representative of SFAs and schools participating in the school meal programs nationally during SY 2017-2018. We examined the relationship between student, school, and SFA characteristics on each of the key types and sources of error. Data collectors systematically collected information on any unusual activity that may have affected the error rates. Such unusual

activities include a substitute cashier, an unusually crowded cafeteria, and others (e.g., parent boycott demanding whole milk instead of low fat milk). We examined the distribution of error data at all levels before starting the analyses. We flagged observations associated with unusual contextual factors that contributed to the errors observed on the data collection day(s). The unusual activities did have an impact on the results. While we report the data including the cases associated with unusual activities, we also include the analyses showing the results without the unusual case outliers, and include a brief discussion.

1.5.3 Overview of Approach for Addressing Objective 3

Objective 3: Conduct a substudy on the differences in error rates among SFAs using different implementation strategies in their school meals programs.

The expanded SFA sample also allowed us to conduct a substudy to examine differences in error rates for SFAs using different implementation strategies in their school meal programs. We used bivariate and multivariate regression analysis at the SFA level to answer this research question. Bivariate analysis examined the effect of selected variables, revealing the impact of the variable and any other variables it may be correlated with. In contrast, multivariate analysis used regression to examine the effect a set of variables simultaneously had on the error rate, isolating the independent impact of each one and identifying their relative importance. Additionally, we used the findings from the qualitative analysis of the semi-structured interview data to assist in interpreting the implications of the findings.

We weighted the data as appropriate given the sampling plan and nonresponse. We used Chi-square tests to test if differences in SFA characteristics and policies affected the error rates. An analogue of the Wilcoxon test was used to test for differences between groups for continuous data. Specifically, data was ranked in the combined study groups. Then, weighted t-tests (computed in SURVEYREG) were used to test for differences between ranks in groups of SFAs. To provide a better understanding of the drivers of the SFA error rates, the analyses used regression to explore relations among potential predictor variables. These analyses included logistic regressions with binary dependent variables, such as SFAs with higher than median error rates and SFAs with lower than median error rates.

1.5.4 Overview of Approach for Addressing Objective 4

Objective 4: Present qualitative analyses examining the reasons for improper payments.

APEC-III expands on its predecessors by incorporating qualitative research into the study design. Addressing Objective 4, we conducted and analyzed in-depth interviews with SFA directors, households, and cafeteria managers to shed light on factors that may contribute to program error and strategies to minimize errors. By examining the procedures and perspectives of staff and households, qualitative data help illuminate quantitative findings regarding underpayment and overpayment across the certification, aggregation, and meal claiming processes.

APEC-III collected qualitative data from semi-structured interviews with forty-two (42) SFA directors, sixty (60) households, and sixty-four (64) cafeteria managers. We designed the interview guides to elicit responses that provide context, help understand how and why errors may occur, highlight facilitators and barriers, determine strategies implemented to minimize errors, and summarize improvements over time. The interviews were recorded and then transcribed and loaded into NVivo, a software package that facilitates coding and identifying themes from qualitative data.

1.6 Report Organization

The APEC-III Final Report includes an Executive Summary and four volumes. Volume 1 (the main report) provides a summary of the APEC-III study including the design, sampling, instruments, data collection, analytic methods, weighting, nonresponse bias analyses, variance estimation, study results, and conclusions for Study Objectives 1, 2, and 3. Volume 2 presents the qualitative analysis examining reasons for program error (Study Objective 4). Volume 3 provides the estimation modeling for State and National Estimates. Volume 4 contains the report appendices.

The remaining chapters of the main report (Volume 1) include the following additional chapters:

- Chapter 2: Summary of methodology and data collection, supplemented by the following appendices in Volume 4:
  - Appendix A: Sampling Procedures
  - Appendix B: Student, School, and SFA Characteristics
  - Appendix C: Data Collection Procedures

  - Appendix D: Study Instruments
  - Appendix E: Nonresponse Bias Analyses
  - Appendix F: Constructing Analytic Weights
  - Appendix G: Variance Estimation

- Chapters 3 and 4 provide study results, key findings, and special considerations for understanding and interpreting the findings for certification and aggregation errors, respectively, supplemented by the following appendices in Volume 4:
  - Appendix H: Methods for Calculating Certification Error Estimates (non-CEP)
  - Appendix: I: Methods for Calculating Certification Error Estimates (CEP)
  - Appendix J: Methods for Calculating Aggregation Error Estimates
- Chapter 5 provides an estimation of net combined error rate and improper payments for certification and aggregation. The estimates are based on the possible combinations of certification and aggregation errors as they may augment or offset each other. Chapter 5 is supplemented by Appendix K: Methods for Calculating Net Error Estimates, found in Volume 4.
- Chapter 6 examines the extent to which schools are meeting the meal pattern requirements for school meals (i.e., meal claiming error), supplemented by Appendix L: Methods for Calculating Meal Claiming Error Estimates, found in Volume 4.
- Chapter 7 provides a summary of the relationship between student/households, school and SFA characteristics, and error rates (Objective 2), supplemented by Appendix M with additional tables, found in Volume 4.
- Chapter 8 presents a substudy among SFAs using different implementation strategies (Objective 3).
- Chapter 9 provides a synthesis and implications based on current findings, implications of study findings, and considerations.

2. Methodology and Data Collection

This chapter provides a summary of the APEC-III study design including the sampling plan, data collection procedures, and analytic weighting. While this chapter provides a high-level summary, the supplemental appendices in Volume 4 provide more detail on each component as follows:

- Appendix A: Sampling Procedures;
- Appendix B: Student, School, and SFA Characteristics;
- Appendix C: Data Collection Procedures;
- Appendix D: Study Instruments;
- Appendix E: Nonresponse Bias Analysis;
- Appendix F: Constructing Analytic Weights; and
- Appendix G: Variance Estimation.

2.1 Overview of Study Design

Certification and aggregation errors can result in overpayments or underpayments. Figure 2-1 provides a high-level overview of the analyses involved in estimating the certification and aggregation error rates,[17] and their effect on payments. This summary provides a conceptual synopsis of our approach, while chapters 3 and 4, and their supplemental appendices, detail the analyses conducted. The first step in the process was to estimate the number of certification and aggregation errors associated with each school using sample data. While the number of meals affected by aggregation errors is relatively transparent, estimating the number of meals affected by certification errors requires determining eligibility, the frequency of occurrence, and the payment implications using application, survey, and student meal participation data.[18] Once we knew the number of meals affected by the error, we calculated the dollar amounts associated with the errors.

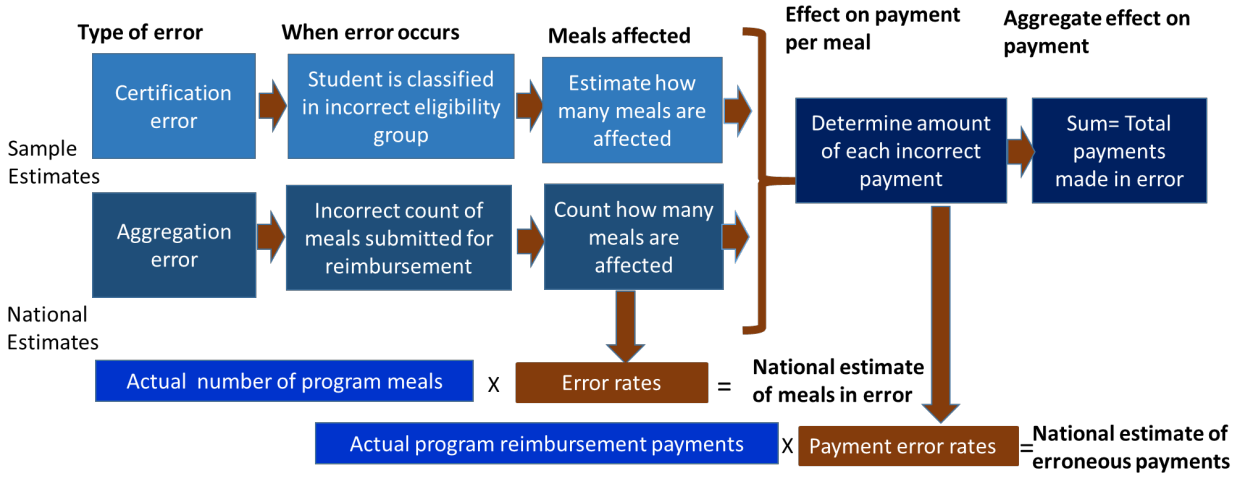
[17] Though meal claiming error was included in these analyses for APEC-II, they are not included in APEC-III, as they do not result in an improper payment according to the Improper Payments Elimination and Recovery Act (IPERA) of 2012 definition.

[18] See Appendix H for details on this estimation using a student meal participation data, and imputations for missing data.

From these estimates, we calculated school-level error and improper payment rates (the percentage of dollars paid in error). Summing up all of the individual, school-level payment errors yielded an estimate of the total payments made in error based on the sample.

To obtain national meal error estimates, we weighted the school-level error and improper payment estimates. Prior to applying the weights, we adjusted the school-level weights so that a weighted estimate of total reimbursements equaled the total reimbursements paid based on Food and Nutrition Service (FNS) administrative data. By calibrating the weights to the actual total reimbursement amount paid, we ensure that the estimated payments are in line with the actual payments.

Figure 2-1. Conceptual overview of the steps used to estimate meals and payments in errors



2.2 Sample Selection

To obtain the data necessary for estimating the dollar amount of program error, the APEC-III study used a multistage stratified probability sampling design. The sampling plan was similar to the multi-stage sampling approach used in APEC-I and -II, but with an increased sampling of Community Eligibility Provision (CEP) schools. Because the certification process differs between CEP and non-CEP schools, we sampled schools that elected to participate in CEP separately from non-CEP schools. We divided School Food Authorities (SFAs) into those with no CEP schools and those with at least one CEP school. Among SFAs with at least one CEP school, we sampled both CEP schools and non-CEP schools to ensure that the sample was nationally representative.

The sampling process occurred in three primary stages. The first-stage sampling units were comprised of a nationally representative sample of SFAs. The second-stage sampling units were comprised of stratified samples of schools within SFAs. Last, the third-stage sampling units were comprised of samples of students (households) within schools. Table 2-1 provides a summary of the sampling results.

Table 2-1. APEC-III sampling results

Respondent type	Sample frame	Number sampled	Number of respondents[a]
SFAs	17,854	336	302
Schools	16,156	777	747
CEP	6,624	278	254
Non-CEP	9,532	499	456
Household application (non-CEP schools)	Average of 11 students per school	12,321	11,353
Household survey (non-CEP schools)	Average of 11 students per school	12,321	3,792[b]
Identified students (CEP schools)	Average of 24 students per school	3,291	3,291

[a] For SFAs and schools, the number of respondents reflects the number who agreed to participate in the study, however, the number who completed different components of the study may vary. For household applications, the number of respondents reflects the number of completed application abstractions. For household surveys, the number of respondents is the number of completed surveys. For identified students, this reflects the number of students selected for verification and who were reviewed.

[b] The sample size of 3,792 includes the total number of completed household surveys. The final analytic sample size of 3,541 includes the subgroup for which we also have household application abstraction data.

We used two data files maintained by the FNS to construct for the SFA sample frame. These included (1) FY15 FNS-742 SFA File (version dated 2-22-2016), which provides information on all SFAs; and (2) CEP SY15-16 National Elections Data-September 2015 (version dated 3-25-2016), which provides information on which SFAs have schools participating in the CEP. We categorized SFAs into those that had at least one CEP school and those that had no CEP schools.

For the first stage of sampling, the final SFA sample frame included 17,854 SFAs (including both non-CEP and CEP SFAs). Of this, 2,973 SFAs had at least one CEP school. Although the CEP SFAs accounted for only about 17 percent of all SFAs in the frame, they accounted for a much greater share of total enrollment (32%) and students certified for free/reduced-price lunch (43%).

A total of 323 of the 336 sampled SFAs were confirmed for participation in the study (96% response rate). The number of responding SFAs was much greater than our response rate target of

80 percent; therefore, a random sample of 302 of the 323 SFAs (93% of responding SFAs, 90% of sampled SFAs) were selected for subsequent school sampling.

For the second stage of sampling, we collected school data from the responding SFAs. We conducted quality-control checks on the data reported by SFAs by having them verify and update the information. SFAs provided updates and corrections as needed directly in the secure web portal. The updated school list (i.e., school sampling frame) contained a total of 16,156 schools, of which 9,532 were non-CEP and 6,624 were CEP. We sampled a total of 782 schools of which 548 were non-CEP schools and 234 were CEP schools.

The third stage included sampling students/households using data files provided by SFAs, which included student application date and meal eligibility status. Sampling occurred three times during the school year to ensure that the sample represented all of the applications for the school year and eliminated any potential seasonal biases.

In the third stage, we sampled an average of 11 households from non-CEP schools and 24 households from CEP schools. These households were sampled from 777 (499 CEP and 278 non-CEP) selected schools, resulting in 12,321 sampled households for application abstraction and the household survey. Of the 12,321 sampled students, 92 were found to be ineligible for APEC-III, leaving a total of 12,229 eligible sample students.

Appendix A provides more details on the sampling procedures. Appendix B provides a summary of characteristics of the SFA, school, household, and student samples.

2.3 Summary of Data Collection Procedures

APEC-III collected data via in-person visits to SFAs, schools, and households to estimate certification, aggregation, and meal claiming errors. Our approach required data collection from multiple sources at multiple times during the school year between November 2017 and June 2018. Table 2-2 summarizes the data collection from each source, including the instruments, mode of data collection, and the key data elements. Appendix C presents a detailed discussion of the data collection procedures. Appendix D includes the study instruments.

Table 2-2. Summary of APEC-III data collection

Source	Instrument	Mode of data collection	Key data elements
SFA	Pre-visit checklist	• Phone/Email	• SFA and school information (to prepare for data collection visit)
	Household sampling protocol	• Electronic data request	• Student information • Student certification status
	Application abstraction form	• In-person record abstraction • Data entry via web/MiFi • Hardcopy backup	• Household size and income • Participation in the Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance to Needy Families (TANF), etc. • Basis for eligibility • Eligibility determination
	CEP records review form	• Electronic Data Request	• Source documentation for determining Identified Student Percentage (ISP)
	SFA meal claim abstraction form	• In-person record abstraction • Data entry via web/MiFi • Hardcopy backup	• Meal claims submitted to State
	SFA director survey	• Web-based survey	• SFA characteristics and processes
	SFA director interview guide	• Phone Interview • Recorded and later transcribed	• Questions on process for eligibility determination and potential sources of error
	Administrative data abstraction	• Electronic data request • Web portal for uploading data files	• Meal participation data • Updated certification status
School	Meal observation form	• Observation • Hardcopy booklet • Later, web-based data entry	• Meal components • Meal recipient • Meal reimbursement status
	Cafeteria manager interview guide	• In-person interview • Recorded and later transcribed	• Meal claiming protocol • Staff training
	School meal count abstraction form	• In-person record abstraction • Data entry via web/MiFi • Hardcopy backup, later data entry	• Meal counts cashier level • Meal counts at school level • Meal counts submitted to SFA
Parents / Guardians	Household survey	• In-person interview • Computer-assisted personal interview (CAPI)	• Household size and income • Participation in SNAP, TANF, etc. • Application process
	Household in-depth interview guide	• Phone interview • Recorded and later transcribed	• Targeted questions to further understand reasons for errors
State	State meal claims abstraction form	• Electronic data request • Web portal for uploading data	• Meal claims submitted to USDA

APEC-III includes qualitative data collection and analysis as part of the study design to understand more fully the factors that contribute to errors and how to minimize error (Objective 4, Volume 2 of Final Report). The study team conducted in-depth interviews with a random sample of 42 SFA directors, 60 cafeteria managers, and 60 households. We conducted the in-depth SFA director and household interviews via telephone over the course of data collection. We conducted the cafeteria manager interviews in-person during our visits to the schools. Appendix N provides a summary of the in-depth interview procedures. Volume 2 of the final reports provides a summary of the findings.

Table 2-3 provides a summary of response rates for each data collection. Because students are nested within schools and schools are nested within SFAs, we collected data at multiple levels with varying response rates. For example, for certification data, 75.17 percent of SFAs provided data for one or more of their schools, with some SFAs not providing data for at least one of their schools. At the school level, 82.57 percent of non-CEP schools provided data for one or more of their students. At the student level, we received application abstraction data for 92.87 percent of the students from participating schools. In contrast, the response rate for the household survey, at 31.02 percent, was much lower than previous APEC studies cited.

There were some differences in how APEC-III determined SFA and student eligibility compared to APEC-II. This affected the household survey response rates by decreasing the ineligible cases and increasing the non-respondent cases. Further, we could not replicate the calculation of the APEC-II response rate for the household survey from the APEC-II data. As a result, it was not feasible make a direct comparison to clarify the areas of divergence across the two studies. Finally, the unusually high response rate from APEC-II is an outlier among similar surveys from the same time period.

Although, we believe that some of the response rate differences is due to how the studies count ineligibles and report response rates, we also recognize that the current household survey response rate is lower than expected. A major factor affecting the household survey was the general declining trend in survey response rates over the past decade. In addition to the national trend, the household survey response rate was affected by increasing concerns about use of public assistance and other benefits, particularly among immigrant households. Moreover, the increase in "scams" in which

individuals are asked to provide personal information over the phone, created heightened apprehension among respondents.[19]

Table 2-3. APEC-III response rates by respondent type and activity

Respondent type/activity	Number released	Number eligible	Number participated	Number ineligible	Number unknown	Response rate (percentage)
SFAs						
SFA director survey	302	302	234	0	0	77.48%
SFA certification data	302	302	227	0	0	75.17%
SFA aggregation data	302	302	271	0	0	89.74%
SFA meal observation	302	302	291	0	0	96.36%
Schools						
School certification data	777	777	542	0	0	69.76%
CEP	278	278	130	0	0	46.76%
Non-CEP	499	499	412	0	0	82.57%
School aggregation data	777	777	639	0	0	82.24%
School meal observation	777	777	659	0	0	84.81%
Students						
Application record abstraction	12,321	11,624	11,353	92	605	92.87%
Free/reduced-price certified	11,482	10,860	10,618	87	535	93.22%
Paid	839	764	735	5	70	88.18%
Household survey	12,321	11,624	3,792	92	605	31.02%
Free/reduced-price certified	11,482	10,860	3,560	87	535	31.25%
Paid	839	764	232	5	70	27.83%
Meal participation records	12,321	11,624	6,987	92	605	57.16%
Free/reduced-price certified	11,482	10,860	6,519	87	535	57.23%
Paid	839	764	468	5	70	56.15%

Source: APEC-III study, unweighted data.

Notes: To calculate response rates, analysts assumed that the proportion of ineligible respondents among the number with unknown eligibility was the same as the proportion of ineligible respondents among those with known eligibility. Response Rate = C / { B + E * (B / (A-E)) }, where A = number released, B = number eligible, C = number participated, D = number ineligible, E = number unknown. When calculating nonresponse-adjusted weights for error rate analyses, non-respondents with unknown eligibility status are treated as eligible non-respondents.

The SFA certification data response rate is for both CEP and non-CEP SFAs combined.

The SFA Meal Observation Response Rate refers to the number of SFAs where we observed meals for at least one school in the SFA. It's here as a separate row because it serves as a component of the meal observation analysis weights, which are calculated at the school level (i.e., the level where the meal observation took place).

The School certification data for CEP response rate is reported at the school level because the CEP analyses (and weights) are computed at the school level, even though we collected CEP data from the SFAs.

Students certification status are as reported on the SFA's master benefit list.

Because the household survey response rates are below 70 percent, we cannot rule out the potential that there may be bias. To address this possibility, we conducted a nonresponse bias analyses, comparing respondents to non-respondents, which we used to inform the construction of the

[19] During data collection, many parents reported that their local school advised them not to complete the survey because it was likely fraudulent. This occurred after they contacted the schools to verify the validity of the study.

weights. A comparison of the nonresponse-adjusted weighted distribution with the corresponding base-weighted distribution showed, in general, very little difference between the base-weighted and the nonresponse-adjusted weighted distributions. This suggests that the nonresponse weight adjustments made to account for nonresponse mitigates potential nonresponse bias, confirming the results provide valid estimates. Appendix E provides more details about the nonresponse bias analyses, and the nonresponse bias assessment applied for both missing household data and application data.

Table 2-4 provides a summary of the sample sizes for each type of analysis. The analytic sample size for calculating certification error in non-CEP schools was 3,541 students. For CEP schools, all 130 participating schools provided data for the analysis of certification error. Similarly, nearly all of the schools, SFAs, and States provided aggregation data resulting in analytical samples close to the full sample. For meal claiming, the analytical sample included 659 schools and 30,284 trays.

Table 2-4. Data sources and sample size by analysis

Analysis	Data sources	Analytic sample size[a]
Certification error in non-CEP schools	Household survey, application record abstraction, meal participation records[b]	3,541 students
Certification error rates and improper payments in CEP schools	SFA and school CEP records	130 schools
Aggregation error rates and improper payments	School, SFA, and State aggregation data	**NSLP counts:** Point-of-sale error: 558 schools School to SFA error: 525 schools SFA to State error: 469 schools **SBP counts:** Point-of-sale error: 567 schools School to SFA error: 538 schools SFA to State error: 478 schools
Meal claiming error rates	School meal observation	30,284 trays; 659 schools

[a] Analytic sample size includes only students/schools/SFAs with nonmissing data from each of the data sources listed. The analytic sample for aggregation and meal claiming error include both non-CEP and CEP schools.

[b] Missing student meal participation records were imputed using information from the household survey.

2.4 Weighting and Estimation

The analyses in this report use weighted data to produce nationally representative estimates. We weighted the data to reflect the probabilities of selection at the three stages of sampling—SFAs, schools, and students/households; and compensate for differential rates of nonresponse at the various stages of sampling. In addition, we post-stratified all weights used to estimate the dollar

amounts of the error and calibrated them to sum to total reimbursement amounts obtained from administrative data.

Our first step in developing the weights was to conduct a nonresponse bias analysis to assess the effect of survey nonresponse on the estimates and inform the development of the weights to address any potential nonresponse biases. Appendix E provides a summary of the nonresponse bias analyses and results. We conducted three types of nonresponse bias assessments: (1) nonresponse to the SFA director survey, (2) missing school data required for analysis of specified types of school-level errors (i.e., missing meal observations or missing aggregation data), and (3) missing household data and application data for estimation of specified types of certification errors.

We calculated *nine* component weights and *five* analytic weights as illustrated in Table 2-5. Table 2-6 provides a summary of the SFA, school, and student-level *component* weights. The analytic weights include one SFA-level weight, three school-level weights, and one student-level weight. Appendix F provides a complete summary of the sample weighting, both component and analytical weights, as well as an explanation of how we computed the weights.

Table 2-5. Summary of APEC-III component and analytic weights

	Analytic weights				
	(1) SFA director survey	(2) Certification error – CEP	(3) Aggregation error	(4) Meal observation error	(5) Certification error – non-CEP
Unit of analysis	SFA	School	School	School	Student
SFA component weights					
SFA director survey	✓				
SFA certification error		✓			✓
SFA aggregation error			✓		
SFA meal observation				✓	
School component weights					
School certification error		✓			✓
School aggregation error			✓		
School meal observation				✓	
Student component weights					
Household survey					✓
Application abstraction					✓

Notes: ✓ indicates that the component weight is incorporated into the analytic weight. Analyses at the SFA level use only SFA-level weights. Analyses at the school level incorporates both SFA- and school-level weights. Analyses at the student level incorporates SFA-, school-, and student-level weights.

Table 2-6. Summary of SFA-, school-, and household-level component weights

Weight	Description	Purpose
SFA-level component weights		
SFA Director Survey	Adjusts for nonresponse to the SFA Director Survey	Weight for analyses of SFA characteristics
SFA Certification Error	Adjusts for certification error nonresponse (sampled SFAs that did not provide student lists to support the certification error analysis)	Input for certification error analysis weights
SFA Aggregation Error	Adjusts for aggregation error nonresponse at the SFA level (sampled SFAs that did not provide meal count data to support the school-to-SFA and the SFA-to-State aggregation error analysis)	Input for aggregation error analysis weights
SFA Meal Observation	Adjusts for meal observation nonresponse (SFAs that did not participate in meal observations)	Input for meal claiming error analysis weights
School-level component weights		
School certification error	Accounts for school nonresponse to certification data collection	Combined with SFA certification error weight, serves as weight for certification error, CEP. Also serves as input for student-level certification error analysis weight
School aggregation error	Accounts for school nonresponse to point-of-sale aggregation data collection	Combined with SFA aggregation error weight, serves as weight for aggregation error analysis
School meal observation	Accounts for school nonresponse to meal observation	Combined with SFA meal observation weight, serves as weight for meal-claiming error analysis
Student-level component weights		
Household survey	Accounts for nonresponse to the household survey	Combined with SFA and school certification error weights, serves as the weight for non-CEP total certification error and reporting certification error analyses
Application abstraction	Accounts for applications not received or not requested	Combined with SFA and school certification error weights, serves as the weight for the non-CEP administrative certification error analysis

In addition to the full-sample weights, we created a series of replicate weights for purposes of variance estimation. We used the replicate weights in conjunction with the full-sample weights to generate standard errors and confidence limits and to conduct statistical tests. The procedures used to derive the replicate weights are also described in Appendix F.

2.5 Study Strengths and Limitations

2.5.1 Strengths

A major strength of the error estimates is that they are derived from nationally representative probability samples of SFAs, schools, and applications/households (after weighting). Using this sample, we collected data that allowed us to independently determine and estimate program errors.

Following the methodology from prior APEC studies, we determined certification errors based on the in-person household survey data, collecting detailed income and household composition data. Further, 89.3 percent of the survey respondents provided income documentation (such as a pay stub). The survey collected more information on income, household size, and government benefits than the income eligibility applications, thus making the survey a better instrument for determining true eligibility status of students.

In addition, the majority of the household surveys were conducted between 6 to 12 weeks of certification date. The month in which the application was submitted was included in the survey to ensure that the income reported reflected the household's income at the time in which they submitted the application. This helped to ensure that differences between survey and the application data were due to certification errors, and not changes in household income.

For estimates of meal claiming error, we used observations of actual meals served to determine if the meal was reimbursable. Observing actual meals served from randomly sampled locations, meal periods, and trays at schools provided an unbiased estimate.

2.5.2 Potential Limitations

The household survey response rate of 31.02 percent is also a potential limitation. A low response rate *may* result in lower-than-expected precision and increased bias in the analysis. Precision refers to the size of the standard errors and confidence intervals associated with each estimate; the level of precision is estimated as part of each analysis. Bias refers to the potential for systematic differences between the sample and the population, which may result in estimates that may be higher or lower than the true values. The potential for bias is mitigated by having the nonresponse bias analyses inform the construction of sampling weights.

Another potential study limitation is that the behavior and responses of study participants may be affected by being in the study. Knowing they are part of the APEC-III data collection, SFAs and schools might make additional efforts to reduce administrative certification errors and aggregation errors. If they apply new focus to error reduction, they potentially could lower these error rates. In contrast, our approach for measuring certification error that uses the household survey data to independently verify certification error minimizes the influence that SFAs or schools could have on these estimations. Second, households may not answer truthfully with regard to income as they may not want to contradict the information on their application for free and reduced-price meals. We mitigate this possibility by asking for income verification documentation. With 89.3 percent of respondents providing income verification information suggests that those who responded to the survey did so accurately.

3. National Estimates of Improper Payments Due to Certification Error

Certification error occurs when a student is certified for a level of benefits for which they are not eligible. This can result in an "overcertification" or "undercertification." For non-Community Eligibility Provision (non-CEP) schools, program eligibility and the associated reimbursement rate is determined separately for each student. In CEP schools, the CEP group's eligibility is determined jointly resulting in one reimbursement rate (using a claiming percentage) for all of the schools in the group. As such, the effect of misclassifying a student's eligibility has on payments is different between non-CEP and CEP schools.

This chapter describes the methodology and findings for estimates of error rates and improper payments due to certification error. First, we define and present estimates of error rates and improper payments for certification errors in non-CEP schools, as well as the findings on the sources of these certification errors. The certification error rate for non-CEP schools is 20.04 percent. Next, we address certification errors in CEP schools. The certification error rate for CEP schools is 2.65 percent.

The final section of this chapter combines the error rate and improper payment estimates in non-CEP and CEP schools to provide a national estimate of improper payments due to certification error in all schools. For the National School Lunch Program (NSLP), the gross improper payment rate is 6.52 percent ($887 million); for the School Breakfast Program (SBP), the improper payment rate is 6.29 percent ($271 million). Appendices H and I (found in Volume 4) provide more details on the procedures for calculating certification errors in non-CEP and CEP schools, respectively.

3.1 Certification Error Rates in Non-CEP Schools

3.1.1 Definitions and Measurement Approach

For non-CEP schools, an error occurs if the student is certified for the wrong meal eligibility category (such as being certified for free meals when they are only eligible for reduced-price meals). Because each meal eligibility category is reimbursed at different rates, a mistake in certification

results in an incorrect level of benefit being paid. For non-CEP schools, certification error can be due to administrative error, reporting error, or a combination of administrative and reporting error. The definitions of these error types are:

- **Administrative error** occurs when the School Food Authority (SFA) staff made an error in determining certification status based on the household application information. If the student was directly certified, administrative error occurs when the certification status is not supported by direct certification documentation, or by the household survey if direct certification documentation is not available. Finally, administrative error can occur in the transmission of certification status to the master benefit list.[20]

- **Reporting error** occurs when the eligibility status based on the household survey differs from the eligibility status based on the household information submitted in the application. This type of error occurs during the parent/guardian's completion of the application for free or reduced-price meals.

- **Certification error** captures the differences between the student's eligibility status based on direct certification documentation or our independent assessment based on the household survey and the certification status on the district's master benefit list. Certification error may be due to administrative error, reporting error, or a combination of both. Administrative and reporting errors may also cancel each other out and not contribute to the certification error.

For the purposes of estimating certification error, we independently determine a student's eligibility status by reviewing (a) direct certification documentation provided by the SFA or school, or (b) responses to the household survey. The source used (i.e., direct certification documentation or survey) depends on whether or not the student is listed as directly certified on the district's master benefit list.[21] Figure 3-1 summarizes the methodology used to identify certification errors, which replicates the approach used in APEC-II.

We examined if there was appropriate supporting documentation for all sampled students listed as directly certified on the district's master lists. We determined if the SFA or school provided evidence from one of several sources, including school/State/district direct certification matching lists; school or district summary reports; and direct certification eligibility notifications (hard copies or

[20] The "district master benefit list" is the certification status maintained by the SFA and collected by Westat as part of the sample frame for the household survey. It indicates the student's certification status at the time of sampling.

[21] The sample of students for calculating certification error include those who applied for meal benefits, or were directly certified for free meals. In other words, it includes students who are certified as free, reduced-price, or paid, and excludes students who did not submit an application for meal benefits (i.e., paid, with no application).

screenshots). If a student was listed as direct certified on the district' master benefit list and there was supporting documentation, there was no certification error. There was, however, a possibility of administrative certification error if there was documentation of direct certification but the student was not listed as directly certified and the student's certification status did not match their eligibility status based on the household survey.[22] For directly certified students, reporting errors was not possible because the household did not submit an application.

For cases where the SFA/school used applications to determine the certification status, we assessed the information provided on the application as compared to the household survey.[23] Household reporting error occurs when a student is certified by application and the information provided on the household survey does not support the eligibility status based on the information on the application. For students certified based on household applications, both administrative and reporting errors are possible. Figure 3-1 shows these possible combinations in the bottom-right section of the figure. The scenarios in the bottom-right box are not mutually exclusive; it is possible that administrative and reporting errors overlap, either reinforcing one another or cancelling one another out. If the administrative and reporting errors cancel out, there is no certification error resulting in improper payments.

Table 3-1 shows the possible outcomes that can occur when comparing the students' eligibility status, based on Westat's independent review of the direct certification documentation or household survey, to the certification status on the district's master benefit list. The cases along the diagonal, in the white cells with plain text, represent the situations where students are certified correctly for free, reduced-price, or paid meal benefits and there is no error. The remaining cells indicate instances when there is a mismatch between eligibility determination and the certification status assigned by the district. These mismatches reflect certification errors. The orange cells with bold text (D, G, H) are cases in which the student is overcertified and getting a benefit for which they are not eligible. In contrast, the blue cells with italic text (B, C, F) reflect circumstances in which the student is undercertified and therefore not receiving the level of benefit for which they are eligible.

[22] This allows for the "benefit of the doubt" when the documentation is not available. In this case, we used the household survey eligibility status as an additional means for confirmation.

[23] In some cases a household submitted an application even though they were directly certified for free meals. The direct certification status always superseded.

Figure 3-1. Measuring certification error, administrative error, and household reporting error (Replica of Figure IV.1 from APEC-II Final Report)

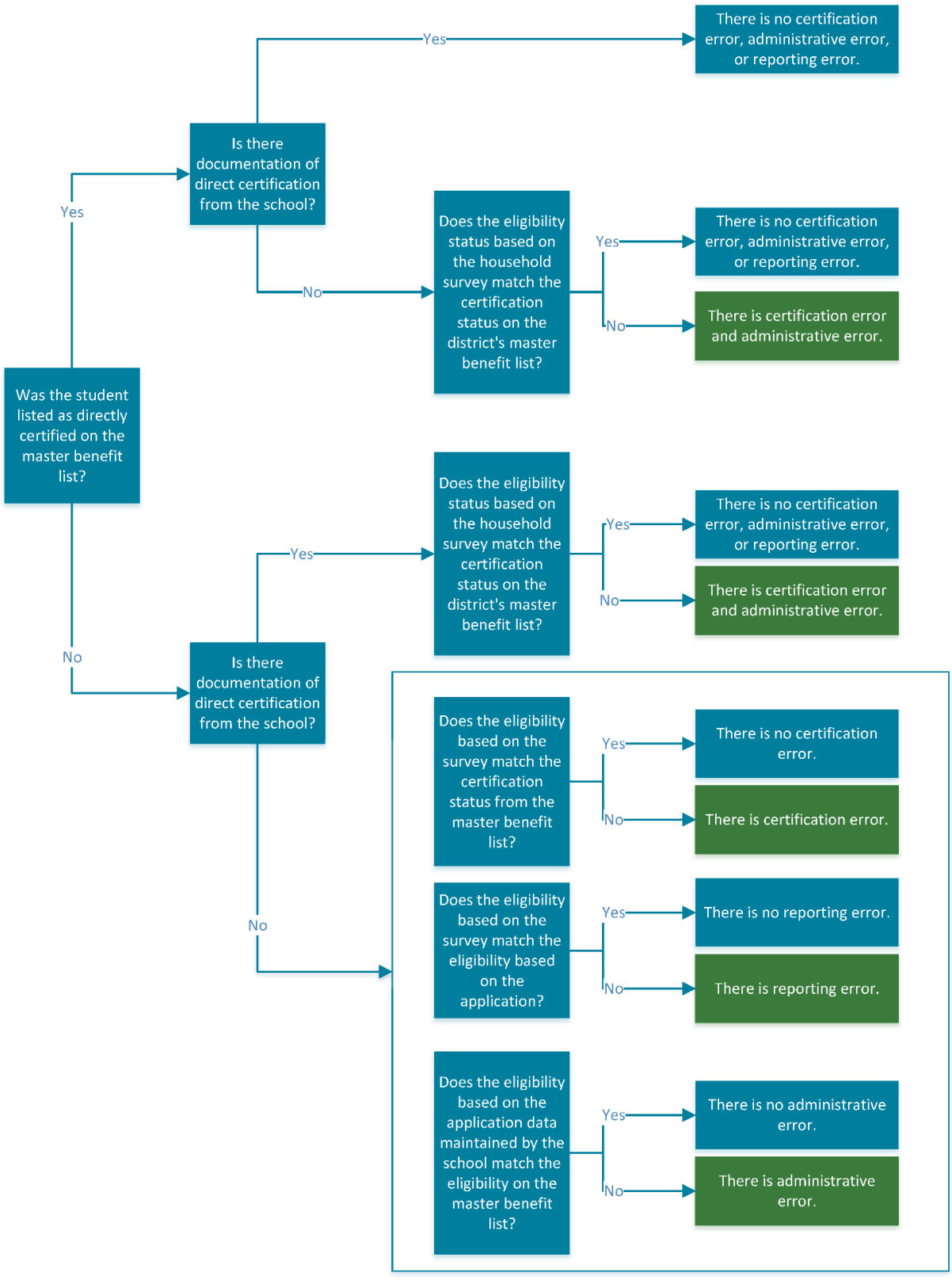


Table 3-1. Combinations of certification error

Eligibility status based on household survey	Certification status on SFA master benefit list		
	Free	Reduced-price	Paid
Free[a]	A) No error	*B) R/P (but free)*	*C) Paid (but free)*
Reduced-price[b]	**D) Free (but R/P)**	E) No error	*F) Paid (but R/P)*
Paid	**G) Free (but paid)**	**H) R/P (but paid)**	I) No error

Notes: Cells are color-coded and text coded to indicate correct certification (white, plain text), overcertification (orange, bold text), or undercertification (blue, italic text).

[a] Students eligible for free meals include those eligible based on survey data, or documented direct certification, regardless of the eligibility status as determined on the household survey.

[b] Students eligible for reduced-price meals include those eligible based on survey data, or documented direct certification (i.e., Medicaid Reduced Price), regardless of the eligibility status as determined on the household survey.

For the groups defined in Table 3-1, Table 3-2 shows how we calculate the overcertified and undercertified error rates as well as the gross certification error and broad certification error. We also computed the "broad certification error rate" to allow for comparison to APEC-II. The broad certification error rate represents the percentage of students who are either certified for benefits when they are not eligible or who are not certified when they are eligible for at least reduced-price benefits. The key difference between the broad and the gross certification error rates is the former does not include as errors those who are certified, but at the wrong level (i.e., certified as free but are eligible for reduced-price meals, and certified as reduced-price but are eligible for free meals).

Table 3-2. Certification error rate calculations

Type of error	Basic rate calculation
Overcertified as free should be R/P	Group (D)/all certified and denied applicants
Overcertified as free should be paid	Group (G)/all certified and denied applicants
Overcertified as R/P should be paid	Group (H)/all certified and denied applicants
Undercertified as R/P should be free	Group (B)/all certified and denied applicants
Undercertified as paid should be R/P	Group (F)/all certified and denied applicants
Undercertified as paid should be free	Group (C)/all certified and denied applicants
Overcertification error rate	Overcertified applicants (D+G+H)/all certified and denied applicants
Undercertification error rate	Undercertified applicants (B+C+F)/all certified and denied applicants
Gross certification error rate	Over + under certified applicants (B+C+D+F+G+H)/all certified and denied applicants
Administrative error rate	Over + under certified applicants due to administrative error/all certified and denied applicants
Household reporting error rate	Over + under certified applicants due to household reporting error/all certified and denied applicants
Broad certification error rate	(C+F+G+H)/all certified and denied applicants

Note: Broad certification error rate is the percentage of all certified students and paid applicants who are either certified at some level for benefits when they are not eligible for either free or reduced-price benefits, or who are not certified for free or reduced-price benefits when they are eligible for at least reduced-price benefits.

3.1.2 Certification Error Estimates in Non-CEP Schools

Table 3-3 shows the possible combinations of eligibility status based on the household survey and direct certification documentation as compared to the eligibility status recorded on the district's master benefits list (i.e., certification status). The white cells in plain text show the percentage of students who are correctly certified in each eligibility category while the blue cells with italic text and orange cells with bold text show the percentage of students under- and overcertified, respectively. The percentages in Table 3-3 sum down the columns; the percentages in the "Free" column, for example, represent the percentages of free-certified students who fell into each eligibility category (based on direct certification documentation or the household survey). The majority of those certified as free eligible on the master benefit list were correctly certified (85.96%), as were the majority of those who were classified as paid (66.13%). The highest error rates occurred among those certified as reduced-price eligible on the master benefit list. Less than half (47.24%) of those certified as reduced-price were certified correctly. The higher error rate among reduced-price certified students occurs in part because reduced-price students are primarily certified based on income, and their income must fall within a narrow range to qualify for reduced-price status. Furthermore, reduced-price certified students may be either overcertified (should have been certified as paid) or undercertified (should have been certified as free). Whereas, students certified as free can only be overcertified if miscertified, and students certified as paid can only be undercertified if miscertified.

Following the definitions listed in Table 3-2, we estimated the over- and undercertified error rates and the gross and broad certification error rates, by comparing the certification status as determined by the household survey or review of the direct certification documentation to the certification status reported on the master benefit list. Table 3-4 provides the national estimates of these certification error rates (weighted) by the certification status recorded on the district's master benefit list. Certification error rates were largest among those certified as reduced-price according to the district's master benefit list (52.76%). The gross certification error rate across students in all certification statuses is 20.04 percent.

Table 3-3. Comparison of eligibility status between SFA master benefit list and household survey, School Year (SY) 2017-2018

Eligibility status based on household survey or documentation of direct certification[a]	Certification status on SFA master benefit list (n=3,541)			
	Free	Reduced-price	Paid	All
Free[b]	85.96% (0.82%)	*28.45% (2.65%)*	*20.42% (3.47%)*	74.84% (1.06%)
Reduced-price[c]	**8.13% (0.66%)**	47.24% (3.10%)	*13.45% (2.90%)*	13.29% (0.70%)
Paid	**5.91% (0.59%)**	**24.32% (2.76%)**	66.13% (4.95%)	11.86% (0.82%)
Sample size (complete household surveys)	2,906	432	203	3,541

Source: APEC-III study, weighted data.

Notes: Cells are color-coded and text coded to indicate correct certification (white, plain text), overcertification (orange, bold text), or undercertification (blue, italic text).

Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Totals may not add to 100 percent due to rounding.

[a] Eligibility status as determined by the APEC-III household survey or documentation of direct certification. Household survey data was not used if there was documentation of direct certification.

[b] Students eligible for free meals include those eligible based on survey data, or documented direct certification regardless of the eligibility status as determined on the household survey.

[c] Students eligible for reduced-price meals include those eligible based on survey data, or documented direct certification (i.e., Medicaid Reduced-Price), regardless of the eligibility status as determined on the household survey.

Table 3-4. Certification error rates by certification status on the master benefit list, SY 2017-2018

Type of error	Certification status on SFA master benefit list			All[d]
	Free[a]	Reduced-price[b]	Paid[c]	
Overcertification rate	14.04% (0.82%)	24.32% (2.76%)	0% (0.00%)	14.46% (0.76%)
Undercertification rate	0% (0.00%)	28.45% (2.65%)	33.87% (4.95%)	5.58% (0.57%)
Gross certification error rate	14.04% (0.82%)	52.76% (3.10%)	33.87% (4.95%)	20.04% (0.85%)
Broad certification error rate	5.91% (0.59%)	24.32% (2.76%)	33.87% (4.95%)	9.89% (0.75%)
Sample size (students)	2,906	432	203	3,541

Source: APEC-III study, weighted data.

Notes: Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Error rates are the differences between the eligibility status based on the household survey or documentation of direct certification and the certification status on the district's master benefit list.

[a] The error rates in the Free column are calculated as the free-certified students with each associated certification error (Overcertification, Undercertification, Gross, or Broad) divided by the total number of free-certified students.

[b] The error rates in the Reduced-price column are calculated as the reduced-price certified students with each associated certification error (Overcertification, Undercertification, Gross, or Broad) divided by the total number of reduced-price certified students.

[c] The error rates in the Paid column are calculated as the denied students with each associated certification error (Overcertification, Undercertification, Gross, or Broad) divided by the total number of denied students.

[d] The error rates in the All column are calculated using the formulas in Table 3-2; the denominator for these calculations is the total number of certified and denied students.

Gross certification error rate is the sum of overcertification errors and undercertification errors.

Broad certification error rate is the percentage of all certified students and paid applicants who are either certified at some level for benefits when they are not eligible for either free or reduced-price benefits, or who are not certified for free or reduced-price benefits when they are eligible for at least reduced-price benefits.

Table 3-5 provides the error rates among free-certified students separately from those certified as free based on direct certification versus an application. Students certified as free based on direct certification tend to have a lower error rate than those certified based on applications. However, error can still occur among directly certified students if there is no supporting direct certification documentation available and responses to the household survey do not support the eligibility status recorded on the district's master benefit list. The error rates among those certified as free by direct certification (8.66%) are much lower than those certified free by application (25.86%).

Table 3-5. Certification error among students certified for free meals on SFA master benefits list, SY 2017-2018

Eligibility status and error rates	Free certification status recorded on SFA master benefit list (n=2,906)	
	Free by direct certification	Free based on application
Eligibility status based on household survey or documentation of direct certification[a]		
Free	91.34% (0.87%)	74.14% (1.97%)
Reduced-price	4.56% (0.65%)	15.99% (1.51%)
Paid	4.10% (0.68%)	9.88% (1.21%)
Certification error rates		
Gross[b]	8.66% (0.87%)	25.86% (1.97%)
Broad[c]	4.10% (0.68%)	9.88% (1.21%)
Sample size (Total n=2,906)	1,991	915

Source: APEC-III study, weighted data.

Notes: Totals may not add to 100 percent due to rounding.

Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools.

This table is a replication of Tables III.4 and III.5 from the APEC-II final report. It illustrates that error rates are much lower among those who are certified for free meals by direct certification versus by income application.

This table provides a summary of the match between free certification status (based on direct certification or application, as recorded on the district's master benefit list), and the eligibility status as determined by the household survey data. It does not include students directly certified for reduced-price meals based on Medicaid.

If there was documentation of direct certification, there was no error regardless of the household survey result. This includes Medicaid direct certification.

[a] Eligibility status as determined by the APEC-III household survey or documentation of direct certification. Household survey data was not used if there was documentation of direct certification.

[b] The error rate in this table only applies to free-certified students; therefore, no undercertification errors are possible. Because the analysis only includes free-certified students, the errors summarized in the table do not include errors due to failure to copy a valid, direct certification documentation to the SFA master benefit list (these types of errors result in undercertification).

[c] Broad certification error rate is the percentage of all certified students and paid applicants who are either certified at some level for benefits when they are not eligible for either free or reduced-price benefits, or who are not certified for free or reduced-price benefits when they are eligible for at least reduced-price benefits.

3.1.3 Sources of Certification Error

In contrast to the overall certification error, the following sections examine sources of certification error in non-CEP schools and provide separate estimates of error rates due to household reporting error and administrative mistakes.

Reporting Error

As discussed previously, household reporting error occurs when a student is certified by application but the information provided on the household survey does not support the certification status based on the data reported on the application. Table 3-6 summarizes the differences in eligibility status based on the household survey and the certification status based on the information on the application that are due to reporting errors. The error rates in Table 3-6 include students directly certified who did not submit an application, for whom the reporting error rate was 0 percent. Generally, more errors occur among students eligible for reduced-price meals based on application data;[24] only half (53.78%) of these students did not have a reporting error. In contrast, 92.47 percent of students eligible for free meals based on application data had no reporting errors, and 84.88 percent of students who were not eligible (paid) had no reporting errors.

Table 3-7 provides a summary of the reporting error rates and the reasons for household reporting error separately for those certified as free, reduced-price, or paid (denied/not certified), and all students combined (All). The error rates in Table 3-7 include students directly certified who did not submit an application, for whom the reporting error rate was 0 percent. The gross reporting error rates were larger for students certified as reduced-price or paid (46.22% and 15.12%, respectively) compared to those certified as free eligible (7.53%). The gross reporting error rate for all students was 12.00 percent. Reporting error resulted in an overcertification (8.35% overall) more often than an undercertification (3.66% overall). There are several reasons in which a reporting error may occur. If a household is certified based on income, a discrepancy in the household size, household earnings, or both, as well as participation in means-tested program benefit receipt (e.g., Supplemental Nutrition Assistance Program [SNAP], Temporary Assistance to Needy Families [TANF]), can result in a household reporting error.

[24] This may be different from the certification status on the master benefit list.

Table 3-6. Household reporting error: Eligibility based on survey versus certification status based on application data, SY 2017-2018 (non-CEP schools)

Eligibility status based on household survey or documentation of direct certification[b]	Eligibility status based on the information on the application or direct certification[a]			
	Free	Reduced-price	Paid	All
Free[c]	92.47% (0.77%)	*25.42% (2.94%)*	*8.39% (2.32%)*	79.67% (1.20%)
Reduced-price[d]	**4.83% (0.56%)**	53.78% (3.39%)	*6.73% (1.93%)*	9.94% (0.68%)
Paid	**2.70% (0.41%)**	**20.81% (2.67%)**	84.88% (3.08%)	10.39% (0.97%)
Sample size (students)	2,925	351	265	3,541

Source: APEC-III study, weighted data.

Notes: Cells are color-coded and text coded to indicate correct certification (white, plain text), overcertification (orange, bold text), or undercertification (blue, italic text).

Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Totals may not add to 100 percent due to rounding.

[a] Eligibility status based on the information on the application or direct certification status recorded by the school.

[b] Eligibility status as determined by the APEC-III household survey or documentation of direct certification. Household survey data was not used if there was documentation of direct certification.

[c] Students eligible for free meals include those eligible based on documented direct certification, regardless of the eligibility status determined using information on the household survey.

[d] Students eligible for reduced-price meals include those eligible based on documented direct certification, regardless of the eligibility status determined using information on the household survey.

Table 3-7. Reasons for household reporting error, SY 2017-2018 (non-CEP schools)

Error type and reason	Eligibility status based on the information on the application or direct certification[a]			All
	Free	Reduced-price	Paid	
Household reporting error rate				
Household reporting error rate[b]	7.53% (0.77%)	46.22% (3.39%)	15.12% (3.08%)	12.00% (0.87%)
Overcertification rate	7.53% (0.77%)	20.81% (2.67%)	0% (0.00%)	8.35% (0.70%)
Undercertification rate	0% (0.00%)	25.42% (2.94%)	15.12% (3.08%)	3.66% (0.39%)
Reasons for household reporting error				
Differences in income only	3.62% (0.49%)	26.9% (3.22%)	9.87% (2.58%)	6.43% (0.57%)
One data source indicates zero income	0% (0.00%)	3.32% (2.17%)	0.18% (0.19%)	0.35% (0.22%)
Number of household members with income[c]	0% (0.00%)	0% (0.00%)	1.17% (1.11%)	0.08% (0.08%)
Number of types of income[c]	0.31% (0.13%)	1.38% (0.88%)	0.14% (0.15%)	0.40% (0.14%)
Number of household members with income and number of types of income[d]	3.31% (0.46%)	22.2% (2.80%)	8.37% (2.37%)	5.59% (0.55%)
Individual income amounts[e]	0% (0.00%)	0% (0.00%)	0% (0.00%)	0% (0.00%)

Table 3-7. Reasons for household reporting error, SY 2017-2018 (non-CEP schools) (continued)

Error type and reason	Eligibility status based on the information on the application or direct certification[a]			All
	Free	Reduced-price	Paid	
Reasons for household reporting error (continued)				
Total household size only	0% (0.00%)	0% (0.00%)	0% (0.00%)	0% (0.00%)
Both household size and income	1.99% (0.34%)	16.0% (2.71%)	3.59% (1.12%)	3.52% (0.46%)
Application incomplete	0% (0.00%)	0% (0.00%)	0% (0.00%)	0% (0.00%)
Differences in categorical eligibility	1.93% (0.35%)	3.39% (1.24%)	1.66% (0.98%)	2.06% (0.33%)
Unknown/other reporting error[f]	0% (0.00%)	0% (0.00%)	0% (0.00%)	0% (0.00%)
Sample size (students)	2,925	351	265	3,541

Source: APEC-III study, weighted data.

Notes: Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Totals may not add to 100 percent due to rounding.

[a] Eligibility status based on the information on the application or direct certification status recorded by the school.

[b] Gross error rate (includes both over- and underpayments).

[c] Due to differences in the survey and the application, it was not always clear if the application and the survey refer to the same household member. Therefore, the differences in household members and number of types of income are based on aggregate measures for the household (i.e., a comparison of the total number of household members with income and a comparison of the total number of income types reported by the household).

[d] APEC-III collected a more detailed accounting of income types from households than previous studies in the APEC series by providing respondents with an income worksheet ahead of the interview. It is possible that the more detailed approach to collecting income information identified more types of income that respondents did not report on the application.

[e] This only occurs if there are no other errors due to differences in income.

[f] This excludes students with missing applications, which are not considered as a reporting error. As a result, this eliminated "unknown" reporting errors.

Differences in income reported on the application and the income determined by the household survey accounted for more than half of all household reporting errors (affecting 6.43% of students overall, and 53.58% of household reporting errors [6.43%/12.00%]). These types of errors occur when the household size reported on the application matches the household size determined by the survey, but the differences in the total household income reported based on these two sources result in different eligibility statuses.

Among those with reporting errors due to differences in income, the majority of the income discrepancies were due to divergences in both the number of household members with income and the types of income reported (affecting 5.59% of students overall, and accounting for 46.58% of all reporting errors [5.59% /12.00%]). Much smaller percentages of students have reporting errors due

only to differences in the number of household members with income (0.08% of students overall; 0.67% of reporting errors [0.08%/12.00%]) or due only to differences in types of income (0.40% of students overall; 3.33% of reporting errors [0.40%/12.00%]).

It is important to note that the APEC-III household survey instrument collected detailed information on each potential income type, including earnings from work, earnings from multiple means-tested programs, alimony, Social Security, and other sources. In contrast to previous studies in the APEC series, APEC-III collected a more detailed accounting of income types from households by providing respondents with an income worksheet ahead of the interview. It is possible that the more detailed approach to collecting income information identified more types of income that respondents did not report on the application.

The next most common reason for household reporting error was differences in both the household size and income. These types of errors may have occurred because applicants failed to list a household member and therefore, did not correctly report the household's income. These types of errors are most prevalent among those certified as reduced-price (16.00%), and are applied to 3.52 percent of students overall.

Differences in categorical eligibility also account for a portion of household reporting errors (2.06% overall). These types of errors can result in overcertification or undercertification. They can occur because from the survey, the applicant was found to be categorically eligible, but categorical eligibility was not recorded on the application (resulting in undercertification). Alternatively, from the survey an applicant can be deemed ineligible, but the application indicated that they were categorically eligible (resulting in overcertification).

Administrative Error

Administrative errors occur in the processing of applications and direct certification documents, the determination of eligibility, and the transmission of the certification status determination to the district's master benefit list. Table 3-8 compares eligibility status, based on the application abstraction data, to the certification status on the SFA master benefit list (i.e., administrative error).

Table 3-9 provides the administrative error rates separately by each certification status on the district's master benefit list along with estimates of the reasons for administrative error. Following

the same pattern as reporting errors, the gross administrative error rates were larger for students certified as reduced-price or paid (20.54% and 21.85%, respectively) compared to those certified as free eligible (7.53%). The gross administrative error rate for all students combined was 10.00 percent.

Table 3-8. Administrative error: Eligibility status based on application data or direct certification compared to certification status on SFA master benefit list, SY 2017-2018 (non-CEP schools)

Eligibility status[a]	Certification status on SFA master benefit list			
	Free	Reduced-price	Paid	All
Free	92.47% (0.64%)	*13.37% (1.99%)*	*13.85% (2.97%)*	77.89% (0.98%)
Reduced-price	**3.94% (0.50%)**	79.46% (2.75%)	*7.99% (2.71%)*	13.52% (0.79%)
Paid	**3.59% (0.52%)**	**7.17% (2.05%)**	78.15% (4.53%)	8.59% (0.77%)
Sample size (students)	2,906	432	203	3,541

Source: APEC-III study, weighted data.

Notes: Cells are color-coded and text coded to indicate correct certification (white, plain text), overcertification (orange, bold text), or undercertification (blue, italic text).

Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Totals may not add to 100 percent due to rounding.

[a] Eligibility status based on the information on the application or direct certification.

Table 3-9. Reasons for administrative error, SY 2017-2018 (non-CEP schools)

Error type and reason	Certification status on SFA master benefit list			All
	Free	Reduced-price	Paid	
Administrative error rate (percentages out of 100)				
Administrative error rate	7.53 (0.64)	20.54 (2.75)	21.85 (4.53)	10.01 (0.73)
Overcertification rate	7.53 (0.64)	7.17 (2.05)	0 (0.00)	7.02 (0.60)
Undercertification rate	0 (0.00)	13.37 (1.99)	21.85 (4.53)	2.99 (0.45)
Reasons for administrative error rate (percentages out of 100)				
Application status transmittal error	0.16 (0.08)	2.96 (0.78)	2.96 (1.43)	0.68 (0.16)
Application completeness error	0.05 (0.03)	0 (0.00)	0 (0.00)	0.04 (0.03)
Application assessment error[a]	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Application lookup error	0.32 (0.11)	0.86 (0.43)	3.46 (2.26)	0.58 (0.17)
Direct certification status transmittal error	0 (0.00)	4.62 (1.55)	0.20 (0.20)	0.58 (0.20)
Missing application[b]	0.38 (0.15)	2.40 (1.15)	4.95 (2.11)	0.91 (0.31)

Table 3-9. Reasons for administrative error, SY 2017-2018 (non-CEP schools) (continued)

Error type and reason	Certification status on SFA master benefit list			All
	Free	Reduced-price	Paid	
Reasons for administrative error rate (percentages out of 100) (continued)				
Missing direct certification documentation	4.89 (0.64)	0 (0.00)	0 (0.00)	3.98 (0.53)
Multiple errors	0.64 (0.19)	5.77 (1.50)	7.28 (2.60)	1.68 (0.31)
Other, unknown error	1.09 (0.26)	3.94 (1.15)	3.00 (2.16)	1.56 (0.31)
Sample size (students)	2,906	432	203	3,541

Source: APEC-III study, weighted data.

Notes: Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. Totals may not add to 100 percent due to rounding.

[a] Categories are mutually exclusive. There were no instances of errors that were due to only application assessment errors alone; those application assessment errors that were present were combined with other error types and included under "multiple errors."

[b] Some of the "missing applications" are certified as "paid" on the master benefit list because the SFA could not find the application. However, the survey found some of these to be eligible for free or reduced-price meals.

There are several potential sources of administrative error, and administrative error may result from one or multiple sources. To maintain comparability, the analyses presented in Table 3-9 uses the same definitions for the sources of administrative error as those presented in the APEC-II study. When interpreting the reasons for administrative error, it is important to keep in mind that the categories are mutually exclusive and that there is a separate category for multiple errors. In other words, administrative errors that fall in the "Multiple errors" category do not appear in the other categories.

- **Application status transmittal error** occurs when a different [incorrect] certification status is reported on the master benefit list from what is recorded on the application. Less than 1 percent of all students were incorrectly certified due to an application status transmittal error alone.

- **Application completeness error** occurs when there is an error in judging the completeness of an application. This may result in a student being certified for benefits despite submitting an incomplete application, which means that the SFA/school should not have certified the student. The percentage of administrative errors that resulted in errors due to application completeness errors alone was relatively low (0.05%) and occurred only for students certified for free meals based on an application on the district's master benefit list.

- **Application assessment error** occurs when there is an incorrect assessment of the household information such as household size, income, or categorical eligibility. Although there were instances of application assessment error, they were always

combined with other types of error, meaning that they were categorized as "multiple errors" in the table.

- **Application lookup error** occurs when staff made a mistake applying the Food and Nutrition Service (FNS) guidelines using the data available from the application. This type of error occurred for 0.58 percent of the overall students.

- **Direct certification status transmittal error** occurs when there is a discrepancy between the direct certification documentation and the certification status on the district's master benefit list. This typically results in an undercertification, because the direct certification documentation on file with the school/SFA indicates that the student should have been certified for free (or reduced-price if Medicaid direct certified for reduced-price) meals, but the master benefit list does not indicate that the student was direct certified. This occurred most often among students who were certified as reduced-price on the district's master benefit list (4.62%).

- **Missing application** error occurs when the district does not have an application on file for a student. This could result in overcertification if the student was certified but no application is on file to support the level of certification. Conversely, a missing application may result in an undercertification if the district did not certify a student who should have been free or reduced-price certified because the district lost or cannot locate the application for the student. Compared to APEC-II, the APEC-III study found more instances in which districts marked students as paid (not certified) who were free or reduced-price eligible (0.38% and 2.40% respectively), and they could not locate the application that the student submitted. Missing application error applied to 4.95 percent of paid (not certified) students, and to 0.91 percent of students overall.

- **Missing direct certification documentation** occurs when a student who is recorded as directly certified on the district's master benefit list does not have direct certification documentation on file and is not eligible for the level they were certified for based on their household survey data. This type of error occurred among 4.89 percent of students who were free certified, and among 3.98 percent of students overall.

- **Multiple errors** are administrative errors that were due to more than one of the categories (1.68% overall). This type of error typically occurs due to a combination of errors relating to the data on file from the application and the determination of the eligibility status made by staff, such as incomplete applications that were also assessed incorrectly by staff. Because multiple errors typically occur in the process of assessing applications that were required to provide income and household size information, they were more prevalent among students who were certified as reduced-price (5.77%) or paid (7.28%) compared to free-certified (less than 1%) students (many of whom were directly certified without an application).

- **Other/unknown.** A number of administrative errors (affecting 1.56% of students overall) did not meet the criteria for the categories listed above. These occurred because the eligibility status based on the survey or direct certification documentation did not match the status on the district's master benefit list (resulting in certification error), but

the sources that staff used to determine eligibility were not clearly identified. Some applications, for example, did not use sources that matched the categories used by data collectors but instead listed sources such as "software" or "verbal report from staff." These sources were not clear evidence of direct certification documentation; they also did not indicate that the source was an application. It is possible that some of these errors may have been due to reporting errors, but without an application from the school/SFA, it is not possible to determine whether a reporting error occurred. Therefore, these errors were classified as "other, unknown" administrative errors.

3.1.4 Overlap in Administrative and Reporting Errors, and the Implications for Payments

Certification errors that result in improper payments can be due to administrative error alone, reporting error alone, or a combination of administrative and reporting error. Table 3-10 shows the possible combinations of administrative and reporting error by the district's certification status for the student. Some administrative and reporting errors are offsetting. These errors need to be excluded when summing to the certification error. Excluding the offsetting errors, the certification error rate is 20.04 percent and is the sum of the first three rows of the last column in Table 3-10.

Table 3-10. Overlapping and offsetting reporting and administrative errors, SY 2017-2018

Type of error	Certification status on SFA master benefit list			All
	Free	Reduced-price	Paid	
Administrative error only	7.15% (0.64%)	16.19% (2.65%)	16.45% (4.54%)	8.83% (0.73%)
Household reporting error only	6.82% (0.75%)	35.17% (3.14%)	15.00% (3.02%)	10.83% (0.79%)
Reinforcing administrative and reporting errors[a]	0.07% (0.05%)	1.40% (0.56%)	2.42% (1.38%)	0.38% (0.12%)
Offsetting administrative and reporting errors[b]	0.31% (0.14%)	2.95% (0.73%)	2.98% (1.16%)	0.80% (0.17%)
Sample size (students)	2,906	432	203	3,541

Source: APEC-III study, weighted data.

Notes: Cell entries are percentages out of 100. Standard errors are in parentheses. Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools.

[a] Reinforcing errors occurs when there is both a household error and an administrative error resulting in a net improper payment (i.e., the eligibility status as determined by the household survey does not match the certification status on the district's master benefit list. Compared to APEC-II, there are fewer overlapping errors because more students were directly certified, resulting in less opportunity for reporting error.

[b] Offsetting errors occurs when there is both a household reporting error and an administrative error but there is no improper payment. This occurs when, despite the presence of both a household reporting and an administrative error, the eligibility status as determined by either documentation of direct certification or the APEC-III household survey matches the certification status on the district's master benefit list.

3.1.5 Comparisons of Error Rates to APEC-I and APEC-II

Compared to previous studies in the APEC series, the certification error rate is lower but not statistically different. The certification error rate was 22.5 percent in APEC-I and 20.15 percent in APEC-II. Table 3-11 provides a comparison of error rates by certification error, reporting error, and administrative error. The error estimates are highly similar over time. Only the reporting error rate (12.00%) differs statistically from the APEC-I and the APEC-II estimates (23.23% and 16.46%).

Table 3-11 Change in error rate estimates from APEC-I, APEC-II, and APEC-II, by type (non-CEP schools)

Type of error	APEC-I SY 2005-2006	APEC-II SY 2012-2013	APEC-III SY 2017-2018	Difference (APEC-I vs. III)	Difference (APEC-II vs. III)
Certification error rates (percentages out of 100)					
Certification error rate	22.50 (1.29)	20.15 (1.21)	20.04 (0.85)	-2.46 (1.54)	-0.11 (1.48)
Overcertification	14.95 (1.1)	12.50 (1.12)	14.46 (0.76)	-0.49 (1.34)	1.96 (1.35)
Undercertification	7.55 (0.67)	7.65 (.59)	5.58 (0.57)	-1.97 (0.88)	-2.07 (0.82)
Administrative error rate	8.26 (0.91)	8.94 (1.02)	10.01 (0.73)	1.75 (1.17)	1.07 (1.25)
Overcertification	6.21 (0.84)	6.03 (0.94)	7.02 (0.6)	0.81 (1.03)	0.99 (1.12)
Undercertification	2.06 (0.41)	2.91 (0.43)	2.99 (0.45)	0.93 (0.61)	0.08 (0.62)
Reporting error	23.23 (1.36)	16.46 (0.99)	12.00 (0.87)	-11.23*** (1.61)	-4.46*** (1.32)
Overcertification	13.57 (0.93)	9.11 (0.76)	8.35 (0.7)	-5.22*** (1.16)	-0.76 (1.03)
Undercertification	9.66 (0.96)	7.35 (0.55)	3.66 (0.39)	-6*** (1.04)	-3.69*** (0.67)

Source: APEC-I, APEC-II, and APEC-III studies, weighted data.

Note: Standard errors in parentheses; tests of mean differences are corrected for multiple testing using the Bonferonni correction (see Simes, R.J. 1986. An improved Bonferroni procedure for multiple tests of significance. Biometrika 73: 751-754): *** p<0.01.

One reason APEC-III may have found lower household reporting error rates compared to previous APEC studies is that a larger percentage of students were directly certified. Directly certified students do not submit applications and therefore do not have a reporting error. A larger percentage of directly certified students, however, also means that more students' certification statuses rely on documentation of direct certification, which presents more of an opportunity for administrative error due to missing documentation. However, although the APEC-III administrative error rates are higher than estimates from the prior studies, the differences are not statistically significant.

3.2 Certification Error in CEP Schools

The potential for errors is substantially different in CEP versus non-CEP schools. In CEP schools, a certification error may occur if there is an error in the process of determining the Identified Student Percentage (ISP). For schools using CEP, reimbursements are based on the CEP groups'[25] ISP, which reflects the percentage of students directly certified for free meals. The ISP is the proportion of "identified students" out of the total enrolled students who are directly certified for free school meals through means other than a household application, and who are not subject to verification (e.g., SNAP, TANF, etc.). The denominator, enrolled students, is the number of students enrolled at all schools included in the CEP group.

To be eligible for CEP, the group of schools must have an ISP of at least 40 percent. The ISP determines the claiming percentages for free and paid meals for the CEP group. The percentage of meals that can be claimed at the free rate equals the ISP multiplied by 1.6, and can range from 64 percent to 100 percent. The remaining percentage of meals is reimbursed at the Federal paid reimbursement rate (100-[ISP*1.6]). Once a CEP group has justified an ISP of 62.5 percent they have reached the maximum, and 100 percent of their claimed meals will be at the free rate. As such, for CEP groups with ISPs greater than 62.5, only errors that would cause them to fall below this threshold will result in improper payments.

A certification error occurs if the CEP group cannot justify the ISP they used. It is not considered an error if the ISP they used is below the "true" level. Specifically, we will define a certification error for CEP schools as cases of misclassified students that cause:

- The CEP group's ISP to be incorrect, and
- The ISP is higher than their records can justify, and
- The corrected ISP is below 62.5 percent.

Under these criteria, only cases in which students are incorrectly classified [as identified students] are counted as errors. These are the circumstances that lead to an overpayment of benefits.

[25] The group can be an individual school, group of schools, or the entire school district. For discussion purposes, it will be referred to as the CEP group as this is the most common approach.

Schools must use information from means-tested programs, such as SNAP and TANF, to verify students are eligible for free meals. There are 10 programs/sources that can be used to verify a student's eligibility. However, schools have latitude regarding how many of these sources they choose to use to identify students eligible for free meals.[26]

In assessing the accuracy of the ISP, we only considered the sources the CEP group used in calculating this measure. The use of fewer than the 10 potential sources allowed was not counted as an error even if using additional sources would have resulted in a higher ISP. We collected data on which sources were used, why these sources were used, and why others were not used, to provide information on the school's selection process. Appendix I provides more details on the process for calculating certification error for CEP schools.

Following the procedures above, we used the data from each CEP school to independently estimate the ISP and free claiming percentage (FCP), based on a review of the documentation. These calculated values, referred to as the "adjusted" ISP and claiming percentages, were then compared to the observed ISP and FCP that the CEP group reported. Table 3-12 presents the comparison between the observed and the adjusted ISP, FCP, and paid claiming percentage for CEP schools. The adjusted ISP is 2.12 percentage points lower than the observed ISP, and the adjusted FCP is 2.65 percentage points lower than the observed FCP. This indicates an overcertification rate of 2.65 percentage points.[27]

[26] The approach does not include the offsetting due to misclassification of non-identified students. FNS approved this approach outlined in the memorandum (dated January 6, 2016) on the CEP analytic approach. Further, the CEP data provided by the SFAs and/or State does not consistently allow for offsetting. The summary section of this chapter provides a discussion on this issue.

[27] The calculation of the adjusted ISP for each school in the sample was based on a verification sample that is itself subject to uncertainty. The overall difference in the observed and adjusted ISP was not statistically significant ($p<0.1$). However, we feel confident about assessing some amount of overclaiming error using the methods described in this report, as there was some degree of overclaiming in the verification sample in over 20 percent of schools in the unweighted CEP sample. However, a reliance on small samples subject to varying degrees of uncertainty at each stage of the analysis coupled with the fact that, in the aggregate, the differences between actual and observed ISP estimates were not statistically significant suggests that the magnitude of error estimated here should be considered with less confidence than other such estimates in the present report.

Table 3-12. Observed versus adjusted identified student percentages and claiming percentages in CEP schools

Type of percentage	Observed	Adjusted	Difference
Identified student percentage (ISP)	62.71 (1.05)	60.59 (1.32)	2.12** (0.90)
Free claiming percentage (FCP)	95.76 (0.92)	93.11 (1.44)	2.65*** (0.98)
Paid claiming percentage	4.24 (0.92)	6.89 (1.44)	-2.65*** (0.98)

Source: APEC-III study, weighted data.

Notes: Cell entries are percentages out of 100. Standard errors are in parentheses. T-test of mean differences. *** p<0.01, ** p<0.05. Differences in observed and adjusted FCP are larger than the differences in observed and adjusted ISP because the FCP is 1.6*ISP. However, the mean FCP reported in the table does not equal 1.6*ISP because the FCP cannot exceed 100 percent, and therefore, any ISP above 62.5 percent results in an FCP of 100 percent. This conversion process means that the statistical significance of the difference between the observed and the adjusted FCP is different from that of the difference between the observed and the adjusted ISP.

3.2.1 Current Methodology for Measuring Error CEP Schools as Compared to APEC-II

The CEP option was relatively new and was just being adopted during the APEC-II study time period. As such, the APEC-II study assessed the certification error rate among CEP schools during the initial program roll out. At the time, CEP was an option in just a few States. The program is now national and State agencies and SFAs have several years of experience calculating the ISP.

The methodology used to determine errors has also evolved between APEC-II and III. The APEC-II methodology estimated offsetting errors and underpayments by flagging students who were not identified by the CEP group based on sources not used by the CEP group. APEC-III did not consider additional sources beyond those used by each CEP group because SFAs are not required to use all allowable sources in their determination of the ISP. This change in methodology means that the CEP certification error rate appears higher in APEC-III compared to APEC-II. We do not make a statistical comparison between these estimates because the change in methodology makes them incomparable. Table 3-13 provides the CEP certification error rates from APEC-II and APEC-III for reference only; readers should not interpret this as evidence of a trend in CEP certification error rates in either direction.

Table 3-13. Comparison of free claiming percentages and net error rates due to certification error in CEP schools, APEC-II and APEC-III

Claiming percentage type and error rate	APEC-II SY 2012-2013	APEC-III SY 2017-2018	Difference
Free claiming percentage (out of 100)			
Observed	94.11 (2.16)	95.76 (0.92)	1.65 (2.35)
Actual	96.29 (1.93)	93.11 (1.44)	-3.18 (2.41)
Net error rate	-2.19 (1.00)	2.65 (0.98)	4.84 (1.4)

Source: APEC-III data and APEC-II data, weighted.

Note: Standard errors in parentheses.

3.3 Estimating Improper Payment Amounts

As the approach for estimating improper payments differs for CEP and non-CEP schools, as a first step, we estimated reimbursements divided between CEP and non-CEP schools. Although the total reimbursement amounts paid by USDA for SY 2017-2018 are available from the FNS National Data Bank (NDB), the data does not distinguish between payments made to CEP schools versus non-CEP schools. Therefore, analysts developed an estimate of the proportion of total reimbursements made to CEP schools using multiple FNS administrative data sources.[28]

The FNS 742 Verification Collection Report provides total student counts by SFA of students attending CEP and non-CEP schools. By summing the total number of students reported nationally on the FNS 742, we estimated that 22.93 percent of students attended a CEP school in SY 2017-2018. One approach to estimating the percentage of reimbursements paid to CEP schools only is simply to multiply the percentage of CEP students nationally by the total national reimbursements paid. However, this approach is likely to underestimate the true proportion of reimbursements paid to CEP schools because there is a higher proportion of meals reimbursed at the free rate in CEP schools compared to non-CEP schools. Therefore, we took in to account the estimated number of free, reduced-price, and paid meals served in CEP and non-CEP schools when estimating the total reimbursements paid to CEP and non-CEP schools separately. The result is that the estimated

[28] The methodology to estimate the proportion of payments to CEP schools vs. non-CEP schools is new to APEC-III. APEC-II did not need to estimate the percentage of payments made to non-CEP schools because CEP was a pilot program at the time and the total amount of payments to CEP schools was a known amount; therefore, no estimation was necessary.

percentage of reimbursement paid to CEP schools is slightly higher than the percentage of students in CEP schools. This reflects the higher rate of free meals in CEP schools versus non-CEP schools.

The steps to generate the national estimate of NSLP and SBP reimbursements made separately to CEP and non-CEP schools were:

1. Calculate the sum of students attending CEP schools using the FNS 742 Verification Collection Report (item 2-3b) and the sum of students attending all (CEP and non-CEP) schools (item 1-1b) by State. Divide the total number of CEP students by the total number of students in the State to obtain the percentage of CEP students in the State.

2. Multiply the estimated percentage of CEP students by State calculated (in #1 above) with the numbers of NSLP and SBP meals served in each State from the FNS 10 Report of School Operations data to obtain the estimated total number of NSLP/SBP meals served separately to CEP and non-CEP students in the State.

3. Estimate the percentages of meals served nationally at the free, reduced-price, and paid rate in non-CEP schools using weighted APEC-III meal count data.

4. Apply the percentages of non-CEP free/reduced-price/paid meals obtained in step 3 to the number of meals served from step 2 to obtain the estimated numbers of meals served as the free, reduced-price, and paid rate in non-CEP schools.

5. Estimate the percentages of meals reimbursed at the free rate and the paid rate in CEP schools using the national average FCP calculated using the weighted APEC-III data.

6. Apply the percentages from step 5 to the estimated number of NSLP/SBP meals served in CEP schools obtained in step 2 to obtain the estimated number of meals served at the free and paid rates in CEP schools (no meals are served at the reduced-price rate in CEP schools).

7. Multiply the separate estimates of free/reduced-price/paid meals served in CEP and non-CEP schools by the reimbursement rates for each certification type to obtain the estimated reimbursement amounts to CEP and non-CEP schools and the proportion of reimbursements paid to CEP versus non-CEP schools.

8. Budget calibrate the estimates: Multiply the proportion of reimbursements paid to CEP versus non-CEP schools by the known total reimbursement amounts for NSLP/SBP in SY 2017-2018. (This "budget calibration" step is necessary because the actual per meal reimbursement rates used for each meal in CEP vs. non-CEP schools are not available from the data at the SFA or State level. These rates may vary depending on whether the school is receiving additional subsidies, such as those used for SBP Severe Needs schools).

Following these procedures, the estimated percentage of NSLP reimbursements paid to CEP schools in SY 2017-2018 was 30.25 percent and the estimated percentage of SBP reimbursements

paid to CEP schools was 27.10 percent. As expected, these reimbursement percentages are higher than the national percentage of students attending CEP schools calculated from the FNS 742 Verification Collection Report (22.93%), due to the higher proportion of meals reimbursed at the free rate in CEP schools. Also, a lower percentage of lunches than breakfasts were served at the free rate in non-CEP schools, resulting in a comparatively lower percentage of lunch reimbursements going to non-CEP schools compared to non-CEP breakfast reimbursements (of which a comparatively high percentage were served at the free rate).

3.3.1 Method for Estimating Improper Payment Amounts in Non-CEP Schools

Estimating improper payments in non-CEP schools is a more complicated process than it is for CEP schools. As such, we first discuss the approach used for non-CEP schools and associated findings in detail. In contrast, for CEP schools, we show only the aggregate findings when we combine both measures to estimate the certification error for all schools together.

Analysts estimated the improper payments for non-CEP by comparing the estimates of the actual payments made to each student in the sample to the payments that would have been made if the student had been certified correctly. Analysts estimated the improper payments made to each student by following these steps:

1. Drawing from the meal participation and mid-year change-in-status information, sum the number of meals each student received at each certification status (free, reduced-price, or paid).

    A. Some students changed certification status mid-year; this approach accounts for mid-year changes by summing the estimated numbers of meals received at each certification status for the entire year.

    B. We received meal participation records for approximately 56 percent of the 3,541 students included in the certification error analyses (consistent with the 55% in APEC-II).

    C. We imputed missing meal participation data using information on the student's meal school breakfast and school lunch meal participation collected from the household survey and student demographics (see Appendix H for details of the imputation approach).

2. Multiply the number of meals served to the student at each certification status by the appropriate per-meal reimbursement rate (accounting for differences in reimbursement

rates for the school the student attended, such as SBP Severe-Needs rates and additional NSLP subsidies).

3. Sum the total reimbursements to obtain the estimate of the actual total reimbursements made to the student during the school year.

4. Calculate the estimated correct reimbursement amount by summing the total meals received by the student during the year by the correct reimbursement rate based on the certification status as determined by the household survey.

5. Compare the correct reimbursement amount to the actual reimbursement amount. Correct reimbursement amounts that are larger than the actual reimbursement amounts result in underpayments; correct reimbursement amounts that are smaller than actual reimbursement amounts count as overpayments.

Budget calibration in non-CEP requires an additional adjustment due to the sampling design because the household survey sample only includes students certified at the free or reduced-price rate (certified students) and paid applicants. The sample does not include non-applicants (i.e., students who did not apply, and were not certified as free, reduced-price, nor paid). Non-applicants correctly receive meals at the paid rate; therefore, no improper payments were made to non-applicants. To adjust for payments made to non-applicants, we used records of meal counts collected from sampled SFAs to estimate the proportion of meals served at the paid rate in a given month (including paid applicants and non-applicants). We then compared the proportion of meals served at the paid rate to the proportion of meals served to paid applicants only based on the household survey and meal participation records. This comparison allows us to adjust the budget calibration to include non-applicants in the denominator when calculating improper payment rates. The non-applicants have zero error rate. Appendix H provides a description of this adjustment procedure.[29]

SFAs submitted information for the students in our sample who changed eligibility status during the school year, including the old and new eligibility status and the date of the change. We incorporated this information in to the estimates of improper payments by adjusting the total payments made to students during the school year based on any mid-year changes in eligibility. Following the methodology used by the APEC-II study, we assumed that the certification status as determined by the household survey and verification of direct certification documentation was the "correct"

[29] This adjustment procedure follows the same approach as APEC-II.

certification status for the student for the entire school year.[30] In some cases, students who were incorrectly certified at the beginning of the school year changed to a correct certification status during the year. This type of change reduced the estimated improper payments made to that student because only a portion of the meals served to that student were in error. However, in other cases, students who were correctly certified at the beginning of the school year may have changed to a different eligibility status during the school year, resulting in some improper payments made to that student if we assume that the certification status as determined by the study is correct.

We acknowledge that it is possible that some mid-year changes were the result of correct changes in eligibility (e.g., a new application submitted based on changes in household income). However, because this study only verified application and direct certification data at one time during the school year, the data collected for the APEC-III study do not allow us to verify the accuracy of these changes. This limitation is because APEC III data collection only conducted one visit to the SFA during the school year. The APEC-II study acknowledged the same limitation to this approach, and as a sensitivity test, estimated the improper payment amounts assuming that all mid-year changes in eligibility are "correct." Both the APEC-II and the APEC-III studies found that mid-year changes in eligibility account for very small improper payment amounts relative to total reimbursements. For APEC-III, mid-year changes in eligibility were so rare that they account for a negligible amount of estimated improper payments (accounting for estimated improper payments of less than 0.01% of total reimbursements for the NSLP or the SBP). Therefore, assuming that all mid-year changes were made correctly has a negligible impact on estimated improper payment rates and amounts.

3.3.2 Improper Payment Estimates in Non-CEP Schools

Tables 3-14 through 3-19 summarize estimates of total improper payments due to certification error in non-CEP schools by certification status, the combinations of misclassifications, the specific type of certification error, and the source of error. We examine improper payments from these alternative perspectives to gain insights regarding the underlying factors that contribute the most to payment mistakes. We used improper payment rates, meal participation data, reimbursement rates, and total

[30] U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, Program Error in the National School Lunch Program and School Breakfast Program: Findings from the Second Access, Participation, Eligibility and Certification Study (APEC II) Volume 1: Findings by Quinn Moore, Judith Cannon, Dallas Dotter, Esa Eslami, John Hall, Joanne Lee, Alicia Leonard, Nora Paxton, Michael Ponza, Emily Weaver, Eric Zeidman, Mustafa Karakus, Roline Milfort. Project Officer Joseph F. Robare. Alexandria, VA: May 2015, pp. 68-69.

payments to non-CEP schools to generate the estimated improper payments for NSLP and SBP in SY 2017-2018 shown in Tables 3-14 to 3-19.

Tables 3-14 and 3-15 provide national estimates of improper payments (weighted) in non-CEP schools for the NSLP and SBP by certification status and type. This type of analysis is useful because it accounts for the fact that meals for students with different certification statuses are reimbursed at different rates. Table 3-14 shows, for example, that the rates of overpayment among certified students are lowest among students who were certified as free by direct certification (3.59%) and free by categorical eligibility (5.62%), and highest among those certified as free by application based on income (11.59%) or certified as reduced-price (21.19%). Among those listed on the district's master benefit list as paid (i.e., not certified), the underpayment amount was large (20.56%). This finding shows that certification based on participation in other means-tested programs leads to fewer improper payments compared to certification methods relying on income and household size as reported on the application. Furthermore, errors in assessing income and/or eligibility based on participation in means-tested programs lead to a significant underpayment rate among those not certified.

Table 3-14. National estimates of improper payments in non-CEP schools due to certification in the NSLP by certification type and status, SY 2017-2018

Improper payment amount and rate	Certification status					All students
	Free by direct certification	Free by application based on categorical eligibility	Free by application based on income	Reduced-price certified[b]	Not certified[c]	
Total reimbursements (millions of dollars)	5,585	831	1,532	951	591	9,490
Improper payment amounts (millions of dollars)						
Overpayments[a]	200 (29)	47 (12)	178 (29)	201 (31)	1 (1)	627 (58)
Underpayments[a]	<1 (.08)	0 (0)	<1 (<.01)	40 (6)	122 (27)	162 (29)
Gross improper payments	201 (29)	47 (12)	178 (29)	241 (32)	123 (27)	789 (68)
Net improper payments	200 (29)	47 (12)	178 (29)	161 (31)	-121 (28)	465 (61)
Improper payment rates (percentages out of 100)						
Overpayments	3.59 (0.51)	5.62 (1.504)	11.59 (1.88)	21.19 (3.27)	0.17 (0.16)	6.61 (0.61)
Underpayments	<.01 (<.01)	<.01 (<.01)	<.01 (<.01)	4.21 (0.63)	20.56 (4.65)	1.70 (0.3)
Gross improper payments	3.59 (0.51)	5.62 (1.504)	11.59 (1.88)	25.40 (3.37)	20.73 (4.64)	8.31 (0.72)
Net improper payments	3.59 (0.51)	5.62 (1.5)	11.58 (1.88)	16.99 (3.3)	-20.40 (4.66)	4.90 (0.61)

Source: APEC-III study, weighted data.

Notes: Analysis weights are calibrated based on total national reimbursements reported in the FNS national data file. Standard errors are in parentheses.

[a] The certification statuses listed represent students' certification at the beginning of the school year. Underpayments for free-certified students and overpayments for not-certified students can occur because certification statuses can change mid-year.

[b] Includes students certified as reduced-price based on Medicaid direct certification.

[c] For students who were not certified, total underpayments can exceed total reimbursements due to the high percentage of undercertified students in this category.

Table 3-15. National estimates of improper payments in non-CEP schools due to certification in the SBP by certification type and status, SY 2017-2018

Improper payment amount and rate	Certification status					All students
	Free by direct certification	Free by application based on categorical eligibility	Free by application based on income	Reduced-price certified[b]	Not certified[c]	
Total reimbursements (millions of dollars)	1,951	286	532	259	116	3,144
Improper payment amounts (millions of dollars)						
Overpayments[a]	66 (11)	14 (4)	55 (13)	61 (10)	<1 (<1)	196 (22)
Underpayments[a]	<1 (<1)	0 (0)	0 (0)	14 (2)	35 (9)	49 (10)
Gross improper payments	66 (11)	14 (4)	55 (13)	75 (10)	35 (9)	245 (25)
Net improper payments	66 (11)	14 (4)	55 (13)	47 (10)	-35 (9)	147 (22)
Improper payment rates (percentages out of 100)						
Overpayments	3.37 (0.54)	4.89 (1.47)	10.33 (2.42)	23.55 (3.88)	<.01 (<.01)	6.23 (0.69)
Underpayments	<.01 (<.01)	0.00 (0.0)	0.00 (0.0)	5.49 (0.79)	29.97 (7.93)	1.56 (0.3)
Gross improper payments	3.38 (0.54)	4.89 (1.47)	10.33 (2.42)	29.04 (4.03)	30.02 (7.92)	7.79 (0.8)
Net improper payments	3.37 (0.54)	4.89 (1.47)	10.33 (2.42)	18.06 (3.88)	-29.92 (7.93)	4.67 (0.71)

Source: APEC-III study, weighted data.

Notes: Analysis weights are calibrated based on total national reimbursements reported in the FNS national data file. Standard errors are in parentheses.

[a] The certification statuses listed represent students' certification at the beginning of the school year. Underpayments for free-certified students and overpayments for not-certified students can occur because certification statuses can change mid-year.

[b] Includes students certified as reduced-price based on Medicaid direct certification.

[c] For students who were not certified, total underpayments can exceed total reimbursements due to the high percentage of undercertified students in this category.

A similar pattern occurs with SBP reimbursements (Table 3-15); overpayment rates among free by direct certification (3.37%) and free by categorical eligibility (4.89%) were much lower than those certified as free by application based on income (10.33%) and reduced-price (23.55%). Under-certification rates were higher among non-certified students who participated in the SBP than non-certified students participating in the NSLP. This is because the group of non-certified students who participated in SBP differed from those who participated in NSLP, and those who participated in the SBP were more likely to be undercertified than those who participated in NSLP.

We also examined improper payments due to certification error in non-CEP schools by the combinations of misclassifications that can occur. Table 3-16 displays improper payment estimates (in millions) for the NSLP in the top section with improper payment rates in the bottom section. This analysis reveals that improper payments vary by the type of misclassification that underlies the certification error. For example, students who were certified as free (but should have certified as paid) resulted in larger improper payments than other errors because the difference between the payment rates based on their eligibility status versus the rate based on their certification status was large. Nearly half of improper payments for NSLP ($353 million out of $789 million) were due to students who were certified as free but should have been certified as paid.

Table 3-16. National estimates of improper payments in non-CEP schools due to certification error in the NSLP, SY 2017-2018

Eligibility status[b]	Certification status[a]			
	Free	Reduced-price	Paid	All
Improper payments (millions of dollars)[c]				
Free[d]	<1[e]	*40*	*68*	108
Reduced-price	**72**	0	*54*	126
Paid	**353**	**201**	1[e]	555
Total	425	241	123	789
Percentage of improper payments[c]				
Free[d]	<0.01[e]	*16.56*	*55.30*	13.66
Reduced-price	**16.90**	0	*43.90*	15.92
Paid	**83.10**	**83.44**	0.80[e]	70.42

Source: APEC-III study, weighted data.

Notes: Cells are color-coded and text coded to indicate correct payments (white, plain text), overpayments (orange, bold text), or underpayments (blue, italic text).

Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. The totals based on the dollar amounts rounded to the millions may not add to the total displayed in the table because the totals are based on the sum of the actual (unrounded) dollar amounts.

[a] Certification status recorded on the district's master benefit list.

[b] Eligibility status as determined by the APEC-III household survey if no evidence of direct certification documentation. If the school provided evidence of direct certification, the eligibility status was free regardless of the survey responses.

[c] The certification and eligibility statuses listed represent students' certification at the beginning of the school year. Underpayments for free-certified students and overpayments for not-certified students can occur because certification statuses can change mid-year.

[d] Students eligible for free meals include those eligible based on documented direct certification, regardless of the eligibility status determined using information on the household survey.

[e] Because we are comparing eligibility status and certification status at the beginning of the year, improper payments can occur in the white cells in plain text because of mid-year changes in eligibility even if students were initially correctly certified.

Similar patterns emerge among the SBP reimbursements and improper payments presented in Table 3-17. Nearly half of SBP reimbursements in error ($109 million out of $245 million total improper payments) were due to students certified as free who should have been certified as paid. The next largest category were payments made in error due to students who were certified as reduced-price but should have been certified as paid ($61 million in estimated improper payments).

Table 3-17. National estimates of improper payments due to certification error in the SBP, SY 2017-2018

Eligibility status[b]	Certification status[a]			
	Free	Reduced-price	Paid	All
Improper payments (millions of dollars)[c]				
Free[d]	0	*14*	*17*	31
Reduced-price	**26**	0	*18*	44
Paid	**109**	**61**	<1[e]	170
Total	135	75	35	245
Percentage of improper payments				
Free[d]	0	*18.90*	*47.98*	12.64
Reduced-price	**18.93**	0	*52.02*	17.82
Paid	**81.07**	**81.10**	<0.01[e]	69.54

Source: APEC-III study, weighted data.

Notes: Cells are color-coded and text coded to indicate correct payments (white, plain text), overpayments (orange, bold text), or underpayments (blue, italic text).

Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools. The totals based on the dollar amounts rounded to the millions may not add to the total displayed in the table because the totals are based on the sum of the actual (unrounded) dollar amounts.

[a] Certification status recorded on the district's master benefit list.

[b] Eligibility status as determined by the APEC-III household survey if no evidence of direct certification documentation. If the school provided evidence of direct certification, the eligibility status is free regardless of the survey responses.

[c] The certification and eligibility statuses listed represent students' certification at the beginning of the school year. Underpayments for free-certified students and overpayments for not-certified students can occur because certification statuses can change mid-year.

[d] Students eligible for free meals include those eligible based on documented direct certification, regardless of the eligibility status determined using information on the household survey.

[e] Because we are comparing eligibility status and certification status at the beginning of the year, improper payments can occur in the white cells in plain text because of mid-year changes in eligibility even if students were initially correctly certified.

The next table shows improper payments due to certification error in non-CEP schools among administrative error, reporting error, and a combination of reinforcing administrative and reporting errors. Table 3-18 shows the estimated improper payment amounts attributed to administrative and reporting errors for the NSLP and the SBP. As the table reveals, improper payments due to certification errors divide nearly equally between administrative and reporting errors.

In contrast to previous studies in the APEC series, which found that improper payments due to reporting errors were substantially larger than those due to administrative error, APEC-III finds that the improper payment amounts due to administrative and reporting errors were similar.

Table 3-18. National estimates of improper payments in non-CEP schools due to certification in the NSLP and SBP by type of certification error, SY 2017-2018

Type of overpayment	NSLP		SBP	
	Dollars (millions)	Percentage of improper payments	Dollars (millions)	Percentage of improper payments
Overpayments				
Administrative error only	304	48.53	97	49.72
Reporting error only	311	49.58	96	49.24
Both administrative and reporting error	11	1.73	2	1.01
Other[a]	1	0.16	0	0.03
Total overpayments	627	100.00	196	100.00
Underpayments				
Administrative error only	78	48.06	26	52.21
Reporting error only	73	45.17	19	39.54
Both administrative and reporting error	11	6.76	4	8.25
Other[a]	0	0.01	0	0.00
Total underpayments	162	100.00	49	100.00
Total improper payments				
Administrative error only	382	48.44	123	50.22
Reporting error only	384	48.67	116	47.29
Both administrative and reporting error	22	2.76	6	2.46
Other[a]	1	0.13	0	0.03
Total improper payments	789	100.00	245	100.00

Source: APEC-III study, weighted data. The totals based on the dollar amounts rounded to the millions may not add to the total displayed in the table because the totals are based on the sum of the actual (unrounded) dollar amounts.

Notes: Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools.

[a] Includes students with no initial error who had changes in eligibility or certification during the year. In some cases, the eligibility status changed later in the school year to an incorrect status.

This finding occurs, in part, because more students in the APEC-III sample were directly certified without an application compared to the students in the APEC-I or APEC-II studies. Reporting error, therefore, was not possible for this large group of students who did not submit an application. This also means that there is a greater possibility for administrative error alone resulting in improper payments than in previous studies because more students were certified through direct certification, which is an administrative process. For NSLP reimbursements, the total estimated improper payments due to administrative error alone were $382 million, and for reporting error alone were $384 million; for the SBP, administrative error alone accounted for $123 million in improper payments compared to $116 million due to reporting error alone.

Table 3-19 examines how improper payments vary by the reasons for the error. This analysis provides insights into the types of errors that contribute the most to improper payments. The table shows the estimates of the improper payments for non-CEP schools that are due to administrative and household reporting error by the reasons for error. For administrative error, the largest type of error contributing to improper payments was "Missing direct certification documentation" (19.64% of improper payments for NSLP; 18.40% for SBP). These types of errors accounted for a large portion of improper payments because those missing direct certification documentation were certified as free but should have been reduced-price or paid (based on household survey data), resulting in a large difference between the correct reimbursement rate and the actual reimbursement rate used. For household reporting errors, the type of errors that lead to the largest share of improper payments were those resulting from differences in household income, specifically, differences in the number of household members with income and the number of types of income. Errors resulting from both administrative and reporting errors accounted for a small share of total improper payments (2.76% for NSLP; 2.46% for SBP).

Table 3-19. National estimates of improper payments in non-CEP schools due to certification error in the NSLP and SBP by certification error source, SY 2017-2018

Source of certification error	NSLP		SBP	
	Dollars (millions)	Percentage of improper payments	Dollars (millions)	Percentage of improper payments
Total improper payments	789	100.00	245	100.00
Administrative error only	**382**	**48.44**	**123**	**50.22**
Application status transmittal error	7	0.86	2	0.83
Application completeness error	3	0.39	1	0.22
Application lookup error	26	3.27	12	4.87
Direct certification status transmittal error	32	4.10	8	3.44
Missing application	51	6.52	13	5.11
Missing direct certification documentation	155	19.64	45	18.40
Multiple administrative errors	34	4.26	15	6.14
Other administrative error	74	9.40	28	11.22
Reporting error only	**384**	**48.67**	**116**	**47.29**
Total household income only	224	28.39	65	26.45
One data source indicates zero income	6	0.73	1	0.57
Number of types of income	3	0.41	0	0.06
Number of household members with income	14	1.78	4	1.79
Number of household members with income and number of types of income	201	25.47	59	24.03
Individual income amounts	0	0.00	0	0.00
Both household size and income	113	14.32	37	15.10
Categorical eligibility	47	5.97	14	5.74
Other reporting error	0	0.00	0	0.00
Both administrative and reporting error	**22**	**2.76**	**6**	**2.46**
Other[a]	**1**	**0.13**	**0**	**0.03**

Source: APEC-III study, weighted data. The totals based on the dollar amounts rounded to the millions may not add to the total displayed in the table because the totals are based on the sum of the actual (unrounded) dollar amounts.

Notes: Estimates include improper certification statuses at all schools participating in the NSLP and/or SBP, excluding those using CEP and Provision 2/3 non-base year schools.

[a] Includes students with no initial error who had changes in eligibility or certification during the year.

3.3.3 Method for Estimating Improper Payments in CEP Schools

Both the data sources and method for estimating improper payments in non-CEP schools differs from the approach used for non-CEP schools. We estimated CEP errors and meal counts for the entire group, rather than for individual students. For CEP schools, we used the following procedures to estimate total reimbursements, improper payment rates, and improper payments:

1. Used the meal counts provided by the schools and SFAs for a target month to estimate the numbers of meals served during the school year for each CEP school.

2. Applied the school's reported FCP to the estimated number of meals served to generate an estimate of total reimbursements.

3. Calculated the adjusted reimbursement amount by applying the adjusted FCP to the meal counts.

4. If there was a certification error that applies to the school, then the difference between the total reimbursements and the corrected reimbursement amount was the improper payment amount. If there was no certification error, then the improper payment amount was $0.

As the calculation for improper payments in CEP schools is straightforward, we present these findings as part of the total improper payment calculations in the next section.

3.4 Total Improper Payments Due to Certification Error in All Schools

This section presents the estimates of total improper payments due to certification error in CEP and non-CEP schools separately and then combined. The combined improper payments provide the total improper payment rates and amounts due to certification errors in all schools. These improper payment estimates take in to account the estimated shares of payments made to CEP and non-CEP schools. APEC-II was the first study in the APEC series to estimate certification error in CEP schools, examining errors for the SY 2012-2013. CEP was a new option during the SY 2012-2013, and only a small portion of the total payments were made to CEP schools in that year (representing approximately 2.5% of NSLP payments and 3.5% of SBP payments). In contrast, in SY 2017-2018, roughly 25 percent of NSLP and SBP payments were made to CEP schools.

Table 3-20 presents the estimates of improper payment due to certification error in non-CEP and CEP schools combined.

Table 3-20. Improper payments due to certification errors in CEP and non-CEP schools, SY 2017-2018

Improper payment amount and rate	NSLP			SBP		
	CEP schools	Non-CEP schools	All schools	CEP schools	Non-CEP schools	All schools
Total reimbursements (millions of dollars)[a]	4,115	9,490	13,606	1,169	3,144	4,312
Improper payment amounts (millions of dollars)						
Overpayments	99 (34)	627 (58)	726 (67)	26 (10)	196 (22)	222 (24)
Underpayments (not assessed for CEP)	–	162 (29)	162 (29)	–	49 (10)	49 (10)
Gross improper payments	99 (34)	789 (68)	887 (76)	26 (10)	245 (25)	271 (27)
Net improper payments	99 (34)	465 (61)	564 (70)	26 (10)	147 (22)	173 (24)
Improper payment rates (percentages out of 100)						
Overpayments	2.40 (0.82)	6.61 (0.61)	5.33 (0.49)	2.24 (0.85)	6.23 (0.69)	5.15 (0.56)
Underpayments (not assessed for CEP)	–	1.70 (0.3)	1.19 (0.3)	–	1.56 (0.3)	1.14 (0.28)
Gross improper payments	2.40 (0.82)	8.31 (0.72)	6.52 (0.56)	2.24 (0.85)	7.79 (0.8)	6.29 (0.63)
Net improper payments	2.40 (0.82)	4.90 (0.61)	4.15 (0.51)	2.24 (0.85)	4.67 (0.71)	4.01 (0.57)

Source: APEC-III study, weighted data.

Notes: Analysis weights are calibrated based on total national reimbursements reported in the FNS national data file. Standard errors are in parentheses.

[a] The data in this table reflect actual amounts from APEC-III using budget calibrated weights. However, the amounts for CEP, and thus all schools, are estimates because it was necessary to estimate the proportion of the reimbursements that went to CEP schools using the meal participation data (FNS 10 and verification data FNS 742).

While the Improper Payments Elimination and Recovery Act (IPERA) of 2012 definition of improper payments focuses the sum of overpayments and underpayments (gross improper payments), the net improper payment includes an adjustment for underpayments to the overpayments, resulting in the net impact on payments. The net improper payments are presented for reference. Combined, all schools (non-CEP and CEP) had estimated gross improper payments of $887 million due to certification error, which reflects 6.52 percent of NSLP reimbursements. Similarly, gross improper payments were $271 million for the SBP, which is 6.29 percent of reimbursements. Net improper payments were $564 and $173 million for the NSLP and SBP and the associated net improper payment rates were 4.15 and 4.01 percent, respectively.[31] The improper

[31] The comparable gross improper payment rates due to certification error in all schools from the APEC-II study were 9.81 percent for NSLP and 10.97 percent for SBP. The net improper payment rates due to certification error in all schools from the APEC-II study were 4.16 percent for NSLP and 4.42 percent for SBP.

payment rates due to certification error were lower for CEP schools than non-CEP schools; the gross improper payment rate was 2.40 percent for CEP NSLP payments compared to 8.31 percent for non-CEP NSLP payments. Net improper payments were 2.40 percent for CEP NSLP schools, compared to 4.90 percent for non-CEP NSLP. A similar pattern held for the SBP.

3.5 Comparisons to APEC-II and APEC-I

The overall certification error rate estimated in APEC-III was not statistically significantly different from previous studies in the APEC series. However, in comparison to APEC-I and APEC-II, this study finds that certain sources and types of errors, such as certification errors due to household reporting error and errors among directly certified students, differ from the previous APEC study estimates.

Changes to the policies and procedures that SFAs and schools use to assess eligibility may explain many of the differences in certification errors relative to previous years. We outline two key procedural changes below and describe their potential impacts on the rates and sources of certification error.

Increased use of direct certification. The first significant difference to note is the increased reliance on direct certification to certify students in non-CEP schools. In SY 2012-2013, APEC-II examined approximately 39 percent of certified students and denied applicants were certified as free by direct certification. In comparison, 57 percent of certified students and denied applicants in the SY 2017-2018 that APEC-III examined were certified as free by direct certification. This change likely contributed to the finding that reporting error rates for SY 2017-2018 were lower compared to SY 2012-2013, because a larger portion of students were certified without an application and therefore had no opportunity to make a household reporting error.

The increased use of direct certification to certify students may have also contributed to higher error rates among directly certified students due to miscertification and missing direct certification documentation. Schools increasingly rely on the administrative data sources used for direct certification to confer eligibility. While in many ways direct certification is less complex and less error-prone than the process of collecting and assessing applications, it does require increased reliance on administrative matching and documentation. Furthermore, staff may strive to ensure that

all students who are eligible for direct certification are certified to minimize household and staff burden. This increased reliance on direct certification and increased volume may result in increased possibility of misidentification relative to previous years. Volume 2 presents evidence from discussions with staff, which provide more detail relevant to this discussion.

Increased use of CEP. In contrast to previous school years studied as part of the APEC series, a substantial portion of schools are now CEP schools. Certification error rates are lower in CEP schools compared to non-CEP schools, meaning that the increased utilization of CEP likely leads to reduced overall error rates due to certification error in all schools relative to prior years.

3.6 Summary

Certification error remains a non-trivial source of improper payments in the NSLP and the SBP. For all schools, the gross improper payment rate due to certification error is 6.52 percent for the NSLP, and 6.29 percent for the SBP. Despite the continued significance of certification error, the increased reliance on direct certification and CEP to certify students reduced the prevalence of certain types of certification errors relative to prior school years. If continued, these procedural changes may result in even lower certification error rates in the future.

The types of students and households that are most likely to have a certification error are similar to those identified by prior APEC studies. Households that are most prone to certification error are those certified by application, particularly those certified as reduced-price. Households more often make mistakes in reporting the sources of income, earners, and overall amounts of income. These findings suggest that reducing the reliance on applications and/or improving the application process may result in lower error rates.

This study also finds that the direct certification process in non-CEP schools may lead to errors if staff do not follow consistent procedures for verifying and maintaining direct certification documentation. The increased reliance on direct certification to determine eligibility reduces error rates relative to relying on applications, but the process is not error free.

Furthermore, CEP schools have a lower certification error rate. The increased reliance on CEP among schools reduced certification error overall. CEP utilization is a positive trend that, in future years, may lead to significantly lower certification error rates overall.

In CEP, 10 programs/sources can be used to verify a student's eligibility. SFAs have latitude regarding how many sources they choose to use to identify students as eligible. For time and cost efficiency, some SFAs may opt to use fewer than the ten sources. Moreover, they may opt to limit the extent of their matching. As a result, they may not identify all students who may be eligible. This potential under identification is not an error in CEP. Therefore, it is important to note that, by design, for CEP schools, APEC III did not attempt to offset improperly identified students with students who were not identified but should have been. Thus, the percentage of students missed by the direct certification process in CEP schools is unknown. In theory, the claiming percentage is not erroneous despite the unidentified students. The "direct certification status transmittal" error rate for reduced-priced students (4.62%) provides a benchmark estimate of the percentage who might be "unidentified" based on failure to record the correct status on the district's master benefit list. However, estimating the undercertification rate due to missing direct certification that is representative of the entire student population is outside the scope of the current study and would require additional data collection from non-applicants. The additional data needed is extensive and would involve obtaining full benefit lists for all available programs that are part of direct certification, including SNAP, TANF, Medicaid, and Food Distribution Program on Indian Reservations (FDPIR) benefit lists from the State and matching those lists to the district's master benefit list.

4. National Estimates of Error Rates and Improper Payments Due to Aggregation Error

Aggregation errors are summation errors that occur in the process of submitting total meal counts for reimbursement. Aggregation errors occur when there are discrepancies between (1) the school's sum of the daily meal count and the School Food Authorities' (SFAs') record of the school meal count (point-of-sale error), (2) the SFA's record of the school's meal count and the meal count the SFA sent to the State agency (school-to-SFA error), and (3) the meal count the SFA sent to the State agency and the State agency's record of the meal count submitted to Food and Nutrition Service (FNS) (SFA-to-State error). At each stage, there can be a discrepancy between the records and what is submitted to the next level.

Aggregation errors result in improper payments when the final (i.e., net) counts submitted by the State to FNS for reimbursement differ from the correct counts. Therefore, the net improper payment rate (calculated by subtracting estimated underpayments from overpayments) represents the improper payment amount due to aggregation error. The analysis reveals that the majority of SFAs had no aggregation errors, and a minority submitted either overcounts or undercounts. The overcounts and undercounts largely cancelled out in the aggregate, resulting in estimated net improper payment rates of -0.06 percent for the National School Lunch Program (NSLP) and 0.46 percent for the School Breakfast Program (SBP).[32] These rates translate to a net underpayment of $8.37 million for the NSLP and a net overpayment of $19.96 million for the SBP for School Year (SY) 2017-2018. These estimated net improper payment rates and amounts, however, were not statistically different from zero. Therefore, aggregation errors were not a significant source of improper payments for either the NSLP or the SBP in SY 2017-2018.

This chapter provides a summary of the measurement procedures, error definitions, estimates of aggregation error at each level, and estimates of improper payments due to true aggregation error. Appendix J provides details on the procedures to calculate the errors.

[32] A negative net improper payment rate indicates a net underpayment.

4.1 Measurement Procedures and Error Definitions

Aggregation errors can occur at three stages. The first stage in which aggregation error can occur is the summation of point-of-sale meal counts by the school; the second stage is from the school to the SFA; and the final is from the SFA to the State agency. To measure aggregation errors, we requested meal counts for a target month for each of the sampled schools. We asked for the target month's meal count data for each sampled school from three sources: the sampled schools, the associated SFAs, and the State agencies. If the school was a non-Community Eligibility Provision (CEP) school or Provision school in a base year, data collectors requested the numbers of free, reduced-price, and paid meals claimed in the target month, separately for NSLP and SBP. If the school was a CEP school or a Provision school in a non-base year, data collectors requested the total numbers of meals claimed and the claiming percentage. The target month, which varied by school, was the most recent calendar month in which claims were submitted to the SFA.

APEC-III followed the methodology of prior APEC studies to generate estimates of aggregation error at each level of aggregation. Analysts compared the meal counts submitted by schools, SFAs, and State agencies to generate gross and net estimates of point-of-sale error, school-to-SFA error, and SFA-to-State error for a target month. Gross and net estimates were calculated at each level. Gross estimates of the error rates and payment amounts include all meals in error (overcounts and undercounts). Net estimates adjust for the amount of overcounts by the amount of the undercounts resulting in a net improper payment.

Although discrepancies in meal counts may exist at many levels, payment is made only when counts are submitted by the State agency to FNS. Therefore, aggregation errors at the different levels (i.e., point-of-sale, school to SFA, SFA to State) may cancel out and never result in an improper payment.[33] To generate an estimate of the overall impact of aggregation error on improper payments, analysts drew comparisons between the counts recorded by the State agency for reimbursement and the "most accurate" meal counts recorded, the SFA's counts. Although it may seem that the most accurate meal count may be the school's sum of the daily meal count, there is qualitative evidence (see Volume 2 Qualitative Analyses Report) and evidence from previous APEC studies suggesting otherwise. SFAs often make corrections to errors identified in the point-of-sale

[33] Note that this is different from the net estimates as this refers to calculation of error across the multiple levels of aggregation error.

meal counts submitted by schools to the SFAs prior to recording the submitted school counts.[34] Therefore, we use the SFA's record of the school counts (i.e., School-to-SFA counts) as the "most accurate" meal counts. We then defined the "true" aggregation error, as the comparison between the "most accurate" meal counts and the counts submitted by the State agency to FNS for reimbursement. Table 4-1 provides a summary and definition of aggregation error comparisons.

Table 4-1. Summary and definition of aggregation error comparisons

Type of error	Comparison	
	Base count	Aggregated count
Point-of-sale error	School's sum of daily meal count	School meal count total recorded by SFA
School-to-SFA error	School meal count total recorded by SFA	SFA meal count sent to State
SFA-to-State error	SFA meal count sent to State	State agency's record of meal count
True error[a]	School meal count total recorded by SFA	State agency's record of meal count

[a] The SFA record of the school meal count is considered to be the "most accurate" meal count for the purposes of estimating overall true improper payments due to aggregation error.

Net meals in error equals aggregated count minus base count; positive values indicate an overcount; negative values indicate an undercount.

Similar to previous studies, APEC-III finds that aggregation error is not a significant source of improper payments in the NSLP or the SBP. We report findings on both gross and net aggregation error. While overcounts and undercounts were found at each level, these accounting errors largely cancel out when estimating net improper payment rates and dollar amounts, which is consistent with the error being purely random.

We begin with a discussion of true aggregation error, followed by a discussion of the error rates at the intermediate levels. We do not calculate improper payment estimates at the intermediate levels because only the true aggregation error affects payments. While we also report both gross and net error rates for true aggregation error, for improper payments we only report the net improper payment. This is consistent with the fact that for aggregation error, improper payments only occur when the net of meal counts submitted to FNS by the State result in an overcount.

[34] The APEC-II Final Report notes a similar finding (page 110, Table VIII.5), stating "the SFA record may correct an obvious error in the meal totals initially reported by the school."

4.2 Estimates of National Program Error Rates and Improper Payments Due to True Aggregation Errors

To generate estimates of improper payments due to aggregation error, we compared the SFA record of the school meal counts (considered the most accurate count) to the meal counts on record with the State agency. The net improper payment rate best represents the improper payments made due to true aggregation errors. This is because overcounts and undercounts may cancel out in the aggregation process, resulting in no net impact on improper payments. This resulted in very small net improper payment rates and amounts.

Table 4-2 provides a summary of the improper payment, improper payment rates, and error rates for true aggregation error. The net improper payments due to "true" aggregation error are less than 1 percent for both NSLP and SBP. The net true aggregation error results in an underpayment for NSLP of $8.37 million. In contrast, the estimated net true error results in an overpayment for SBPs of $19.96 million. **However, due to the distribution of aggregation errors and the relatively small net errors due to aggregation error, these net improper payment rates and amounts were not statistically different from zero.**

Although overcounts and undercounts may cancel out, resulting in no improper payment, for informational purposes, we also measured the overcounts, undercounts, and gross error rates due to true aggregation error. As Table 4-2 shows, we find the associated **gross** improper payment rates, which reflect all meals that were miscounted, were 1.50 percent for the NSLP and 2.11 percent for the SBP (resulting in $203.87 million and $91.02 million in gross improper payments for the NSLP and the SBP, respectively). The net improper payment rate is equal to the net error rate, which subtracts the undercounts from the overcounts. For both NSLP and SBP, the undercounts are nearly equal in magnitude, resulting in net improper payment rates of less than 1 percent for both NSLP (-0.06%) and SBP (0.46%).

Table 4-2. Estimates of improper payments due to true aggregation error, SY 2017-2018

Improper payment type	NSLP	SBP
Total reimbursements (millions)	13,606	4,312
Improper payments (millions of dollars)		
Net improper payments[a]	-8.37 (40.44)	19.96 (21.66)
Underpayments	106.12 (26.65)	35.53 (9.75)
Overpayments	97.75 (30.36)	55.49 (19.42)
Gross improper payments	203.87 (40.35)	91.02 (21.80)
Improper payment rates (percentages out of 100)		
Net improper payments[a]	-0.06 (0.30)	0.46 (0.50)
Underpayments	0.78 (0.20)	0.82 (0.23)
Overpayments	0.72 (0.22)	1.29 (0.45)
Gross improper payments	1.50 (0.29)	2.11 (0.50)
Sample size (schools; whole numbers)	509	518

Source: APEC-III data, weighted.

Notes: Analyses include only schools/SFAs that provided both the "accurate" count and the "aggregated" count used in the comparison (see Table 4-1). The improper payment rates shown are based on the "true" aggregation error, which is a comparison of the school meal count total recorded by the SFA to the school meal counts submitted to the State agency.

[a] A negative amount for the net improper payments indicates a net underpayment; positive values indicate a net overpayment.

4.3 Error Rates at Intermediate Levels of Aggregation

Errors can occur in the meal counts at each level of aggregation, but they do not result in improper payments. An analysis of the differences due to over- and undercounts at the intermediate levels of aggregation, however, can reveal whether more errors occur at certain stages in the aggregation process compared to others. This type of analysis may suggest areas of focus to reduce aggregation error rates overall.

Table 4-3 provides a summary of error rates at each level of aggregation due to over- and undercounts. It is important to keep in mind that the estimates in Table 4-3 at each aggregation level are based on different samples. Data for the aggregation analyses comes from three different sources: schools, SFA's, and State agencies. The schools included in each analysis must have meal counts from both points of comparison, and therefore must have complete meal count data from multiple sources. As in previous APEC studies, we removed schools that did not have valid meal

count data from one or both points of comparison from the analyses. As such, the samples at each level vary in size as not all schools are in all samples. The sample size of schools for each level is presented in the table.

Table 4-3. Estimates of error rates due to aggregation error at the intermediate levels, SY 2017-2018

Type of error	NSLP	SBP
Point-of-sale error estimates		
Overcounts	0.94% (0.33%)	0.74% (0.27%)
Undercounts	0.93% (0.49%)	1.12% (0.88%)
Gross	1.88% (0.59%)	1.86% (0.92%)
Net[a]	0.01% (0.60%)	-0.37% (0.92%)
Sample size (schools)	558	567
School-to-SFA error estimates		
Overcounts	0.12% (0.07%)	0.84% (0.41%)
Undercounts	0.24% (0.12%)	0.06% (0.05%)
Gross	0.36% (0.14%)	0.90% (0.41%)
Net[a]	-0.11% (0.14%)	0.78% (0.41%)
Sample size (schools)	525	538
SFA-to-State error estimates		
Overcounts	0.79% (0.25%)	1.22% (0.48%)
Undercounts	0.72% (0.18%)	1.58% (0.46%)
Gross	1.50% (0.31%)	2.80% (0.66%)
Net[a]	0.07% (0.31%)	-0.35% (0.66%)
Sample size (schools)	469	478

Source: APEC-III data, weighted.

Notes: Cell entries are percentages out of 100; standard errors are in parentheses. Analyses include only schools/SFAs that provided both the "accurate" count and the "aggregated" count used in the comparison (see Table 4-1); sample sizes for individual analyses vary due to missing data for one or both counts used in the comparison.

[a] A negative amount for the net error indicates a net undercount; positive values indicate a net overcount.

Point-of-sale Error. The national estimate of the **gross** error rate due to point-of-sale error is 1.88 percent for the NSLP, and 1.86 percent for the SBP. For the NSLP, this gross error rate is comprised of almost equal parts overcounts and undercounts, which mostly cancel each other out. As a result, the **net** national error rate due to point-of-sale aggregation error is 0.01 percent, which is

not statistically different from zero. For the SBP, the net error rate due to point-of-sale aggregation error is negative (-0.37%), indicating a small net error rate.

School-to-SFA Error. The national estimates of the **gross** error rates due to school-to-SFA aggregation error for both the NSLP and SBP were under 1 percent (0.36% and 0.90% for the NSLP and the SBP, respectively). These included both overcounts and undercounts, resulting in net national error rates of -0.11 percent and 0.78 percent, respectively.

SFA-to-State Error. The national estimates of the gross error rates due to SFA-to-State aggregation error were higher than for School-to-SFA or point-of-sale error. The **gross** error rates due to SFA-to-State aggregation error were 1.50 percent and 2.80 percent for the NSLP and the SBP, respectively. However, overcount and undercount errors largely cancelled out, resulting in a low **net** error rate for the NSLP (0.07%) and a negative net error rate for the SBP (-0.35%).

4.4 Comparisons to APEC-I and APEC-II

Although the estimated error rates due to aggregation error differ across the APEC studies, the APEC-III estimates were not statistically different from those estimated by APEC-I nor APEC-II. The comparison presented in Table 4-4 indicates that, similar to the previous APEC studies, national aggregation error rates are relatively low and do not represent a significant source of error in the NSLP or the SBP. The findings suggest that there is not an upward nor a downward trend in the error rates relative to prior years. It is important to note that the APEC-I and APEC-II analyses only estimated aggregation errors at intermediate levels; these studies did not estimate a true aggregation error rate. Therefore, the comparisons to previous studies only include error rates at the intermediate levels of aggregation.

As shown in Table 4-4, the gross point-of-sale error rates for both NSLP and SBP remained below 2 percent across the three APEC studies. The gross school-to-SFA error rates were less than 4 percent across the APEC studies. The gross SFA-to-State error rates were less than 3 percent across APEC-I, II, and III. Again, due to the combination of undercounts and overcounts, the net aggregation error rates were much lower, with all net estimates, at each level, less than 1.12 percent—with the one exception of SBP for APEC-I at 2.48 percent.

The fact that the estimated error rates from prior studies do not differ significantly from those estimated by APEC-III may be due, in part, to the large standard errors and confidence intervals that are associated with these estimates. The estimated error rates due to aggregation error from all three studies have large standard errors relative to the size of the estimated rate. The distribution of aggregation error data is a key reason for the larger standard errors. Specifically, at each level, the majority of schools have no aggregation error, but a minority of outliers have large aggregation errors, meaning that the point-of-sale estimates are influenced by a small number of schools. This type of distribution can lead to wider confidence intervals when estimating population averages with weighted data. At each aggregation level, the percentage of schools with no error ranges from 80 percent to 90 percent. Appendix J provides further details of the distribution of errors across schools at each level of aggregation.

Table 4-4. Comparison of aggregation error rates from APEC-I, II, and III

	NSLP			SBP		
Type of error	APEC-I 2005-2006	APEC-II 2012-2013	APEC-III 2017-2018	APEC-I 2005-2006	APEC-II 2012-2013	APEC-III 2017-2018
Point-of-sale error						
Gross	0.33% (0.16%)	0.03% (0.01%)	1.88% (0.59%)	0.24% (0.14%)	0.42% (0.26%)	1.86% (0.92%)
Net	-0.12% (0.13%)	<0.01% (0.01%)	0.01% (0.6%)	0.16% (0.14%)	-0.28% (0.26%)	-0.37% (0.92%)
Sample size (schools)	181	385	558	171	375	567
School-to-SFA error						
Gross	2.02% (0.78%)	0.8% (0.4%)	0.36% (0.14%)	3.99% (1.8%)	0.28% (0.14%)	0.9% (0.41%)
Net	1.12% (0.78%)	-0.02% (0.4%)	-0.11% (0.14%)	2.48% (1.84%)	0.17% (0.14%)	0.78% (0.41%)
Sample size (schools)	208	411	525	206	400	538
SFA-to-State error						
Gross	1.46% (0.69%)	<0.01% (0.0%)	1.5% (0.31%)	1.78% (1.01%)	0.49% (0.45%)	2.8% (0.66%)
Net	1.08% (0.69%)	<0.01% (0.0%)	0.07% (0.31%)	1.12% (0.98%)	-0.48% (0.45%)	-0.35% (0.66%)
Sample size (schools)	135	384	469	129	378	478

Source: APEC-I, APEC-II, and APEC-III data, weighted.

Notes: Analysts tested the differences between the gross and net improper payments for each type of error by comparing rates in APEC-I to APEC-III and in APEC-II to APEC-III. No significant differences were found. The true aggregation error rates were not compared because the APEC-I and APEC-II studies did not estimate a true aggregation error rate.

4.5 Summary

While aggregation error exists at each level of meal count aggregation, net estimates of improper payments are relatively low, and have remained consistent over the APEC studies. As shown in Table 4-2, the net improper payment rates due to aggregation error were close to zero. This is because overcounts and undercounts were similar in proportion, largely cancelled out in the aggregate.

Furthermore, it is important to note that the high standard errors and point estimates close to zero indicate that in most cases the net improper payment rates and amounts were not statistically distinguishable from zero, and did not differ significantly across the studies in the APEC series. This finding stems in large part from the distribution of the meal count data. The majority of schools in the sample had no aggregation errors, and a relatively small number of schools made larger meal counting errors. Similar to APEC-I and APEC-II, APEC-III found that the aggregation errors that did exist were concentrated in a minority of the schools in the sample (see Appendix J).

5. Net Errors and Net Dollar Estimates of Program Error Due to Certification and Aggregation Error Combined

APEC-III measured two types of errors that contribute to improper payments: certification errors and aggregation errors. These errors do not occur in isolation. For each meal, different types of errors can overlap, cancelling out or reinforcing one another. Furthermore, different combinations of errors can result in different improper payment amounts. Some types of errors result in an improper payment of the entire claimed reimbursement amount while for others the improper payment is the difference between the claimed rate and the correct rate.

This chapter discusses **estimates** of net errors when combining the aggregation errors and certification errors and applying them to the National School Lunch Program (NSLP) and School Breakfast Program (SBP) meals served during School Year (SY) 2017-2018. The data collected for certification and aggregation errors used different samples and units of analyses, and are not linked to specific students or specific meals. Therefore, the net improper payments presented in this chapter are estimates, not net error calculations. Appendix N describes the methodology used to provide these estimates, the possible combinations of errors, and the estimated numbers of meals served with each combination of errors.

The prior APEC-II study examined the overlap of three types of error: certification, meal claiming, and aggregation errors. In a departure from the APEC-II study approach, this study no longer considers meal claiming error as a source of improper payment because meal claiming errors do not result in a meal delivered to an ineligible recipient nor a miscounted meal. Therefore, APEC-III only considers the overlap in net improper payments due to certification and aggregation errors.

Although we report combined certification and aggregation net improper payments in terms of dollars, these estimates are for informational purposes only and do not represent actual improper payments suitable for the Improper Payments Elimination and Recovery Act (IPERA) of 2012 reporting. The samples we use to estimate each type of error overlap, and because we cannot directly link meals in the sample used to estimate certification error to meals in the sample used to estimate aggregation error, the degree of overlap is unknown. Therefore, it is not possible to calculate a

standard error and confidence interval for these estimates, and we cannot make statistical comparisons between the combined net error estimates and those estimated by prior studies in the APEC series.

5.1 Combined Net Error

It is theoretically possible for aggregation and certification error rates to overlap in ways that affect improper payments. However, in practice this overlap occurs only in rare circumstances. The only circumstance in which these types of errors may overlap in a way that affects improper payments is when an aggregation undercount occurs at the same time as a certification error. This is because an undercounted meal should have received a reimbursement at the "correct" rate based on the student's correct eligibility status, rather than a reimbursement at the claimed (i.e., incorrect certification status) rate. For example, if the State agency submits a meal count for reimbursement that undercounts a free meal served by the school, the undercounted meal may have been served to a miscertified student. If that meal also has an associated certification error (for example, the student is misclassified as free when they should have been certified as paid), it should have been reimbursed at the paid rate. The improper payment is the cost of a meal at the paid rate (i.e., the "correct" rate based on the student's correct eligibility status).[35]

Appendix N includes a chart (Figure N-1) to illustrate the potential combinations of error that can occur. Only 0.04 percent of NSLP meals and 0.07 percent of SBP meals are estimated to have overlapping aggregation and certification errors that affect improper payments. Because overlapping errors are rare, simply adding the net certification error rates and net aggregation rates error (calculated separately in Chapters 3 and 4) yields a similar percentage error to the estimates accounting for potential overlap. Accounting for potential overlap between improper payments due to aggregation error and certification error results in an estimated net improper payment rate of 4.90 percent for the NSLP and 4.87 percent for the SBP.

[35] This is the cost of the paid meal because the meal was never claimed at all. The erroneous payment is the total reimbursement that should have been paid for a paid meal.

5.2 Summary

Accounting for potential overlap, the estimated net improper payment rates due to the combination certification and aggregation errors for SY 2017-2018 was 4.90 percent ($667 million) for the NSLP and 4.87 percent ($210 million) for the SBP. For both the NSLP and the SBP, the largest source of improper payments were certification errors, and the largest category of meals with an error were those resulting in overpayments due to certification error.

These findings suggest that efforts to reduce net combined improper payments should focus on reducing certification errors, and in particular, certification errors that result in overpayments. The bulk of these types of improper payments, as shown in Chapter 3, are due to students erroneously certified as free when they were in fact eligible for reduced-price meals or not eligible for free or reduced-price meals. As mentioned previously, efforts to reduce these types of errors may include increased reliance on direct certification and Community Eligibility Provision (CEP), as the error rates are much lower for these certification methods as compared to applications.

The previous APEC-I and APEC-II studies also estimated net combined improper payment amounts and rates due to certification and noncertification errors. APEC-II was the first study in the series to calculate estimates of net combined improper payments due to certification and noncertification error. However, as we mention above, a key difference between this study and the APEC-II study is that the APEC-II study included over- and underpayments due to meal claiming error in the net combined improper payment estimates, whereas this study does not. The fact that the studies use different definitions of the sources of improper payments greatly limits the conclusions that one can draw from comparing the estimates. Furthermore, due to the estimation methodology, it is not possible to calculate the statistical significance of any differences in improper payment rates due to net errors across studies.[36]

[36] The estimation procedures for calculating net combinations of error combine estimates from different samples of schools and students. These are not statistically independent samples, and the degree to which these samples overlap is not known. Therefore, it is not possible to estimate a standard error for the estimates of net combinations of error, which would be needed to make statistical comparisons across studies.

6. National Estimates of Meal Claiming Error

Meal claiming error occurs when a meal is claimed for reimbursement that did not meet the USDA meal pattern requirements (or vice versa); or the meal was served to an ineligible recipient. There are two types of meal claiming errors. The first occurs when a meal is recorded as reimbursable by the cafeteria staff but is not in fact reimbursable according to the applicable National School Lunch Program (NSLP)/School Breakfast Program (SBP) meal pattern requirements. The second type of meal claiming error occurs when a meal is not recorded as reimbursable by cafeteria staff but is reimbursable based on the NSLP/SBP meal pattern rules. Meal claiming errors are best understood as standard of service errors rather than errors that give rise to improper payments. Thus, they are not included in APEC-III's improper payment estimates.

6.1 Measurement Procedures and Error Definitions

Westat field data collectors observed breakfast and lunch trays at schools participating in the APEC-III data collection and recorded key information about the meals served. For both SBP and NSLP meals, schools have two options for how meals are served. The first option is to serve meals with all the required components. The second option is Offer versus Serve (OVS), which is a provision that allows students to choose from among the required components, following specific OVS guidelines to ensure meals are reimbursable.[37]

At the tray level, data collectors recorded: (1) names of the food items available, (2) names of the food items on the sampled trays, (3) the recipient of the meal (i.e., student or adult), (4) tray level exceptions,[38] and (5) if the cashier recorded the meal as reimbursable. At the meal level, data collectors recorded: (1) the location of the meal (i.e., cafeteria, classroom, etc.), (2) the delivery of the meal (i.e., tray, boxed meal, salad bar, etc.), (3) whether or not the cafeteria was using OVS for the meal, and (4) meal level exceptions.[39] For OVS meals, the data collector also recorded the number

[37] https://www.fns.usda.gov/cn/updated-offer-vs-serve-guidance-nslp-and-sbp-beginning-sy2015-16

[38] Tray level exceptions such as certain food items not available to the student, unable to see all items on tray, etc.

[39] Meal level exceptions such as substitute cashier, certain food items ran out, unusual circumstances, etc.

and types of food items offered, taking special note of the number of fruits and vegetables. Appendix K provides details on the procedures and coding of meal observation data.[40]

Westat analysts then made independent determinations of the reimbursable status of the tray by applying the NSLP and SBP rules to the data collected from the tray observations. They compared this determination to the cafeteria staff's determination of whether the tray was reimbursable. The steps to make independent determinations of whether meals were reimbursable were as follows:

1. Using the names of the food items on the tray, we coded the food components offered to the students and the food components on the tray (milk, grains, meat/meat alternatives, fruits, and vegetables).

    A. Combination foods were identified and credited for each of the components they contained.

    B. For cases in which the names of food items matched those of food items already coded for the APEC-II analysis, analysts used the APEC-II codes for the food component categorization (i.e., fruit, vegetable, grain, etc.). This approach was applied to single food items (e.g., apple, broccoli, banana, carrots, etc.), and does not apply to combination foods or foods with unique recipes.[41]

    C. If the meal was served to a student, analysts used the food components offered to the student and food components served to the student and applied the appropriate meal pattern requirements to determine if the tray was reimbursable.

    D. If the tray was served to a teacher or other adult, the analyst marked the tray as nonreimbursable.

The definitions of meal claiming errors in APEC-III were the same as APEC-I and APEC-II. The most recent changes to NSLP requirements were included in the coding in APEC-II. The changes to the SBP requirements took effect in 2013 and were related to the formulations (not amounts) for grains (i.e., whole grain-rich foods) and milk (fat free or low-fat).[42]

Different rules apply to NSLP OVS, NSLP non-OVS, SBP OVS, and SBP non-OVS trays. OVS is a provision in the NSLP and SBP that attempts to reduce food waste by allowing students to decline

[40] For all meal observations, data collectors recorded the food items and description, but did not record the serving size nor volume.

[41] In addition, the team reviewed all matched food items to confirm that they fit the current requirements. Adjustments were applied as needed.

[42] We provided the benefit of the doubt in coding of grains and milk. If the grain content was not specified, we assumed it was whole grain-rich. If the fat content for the milk was not specified, we assumed it was fat free or low-fat. In general, the notations on the menus supported this assumption.

foods they will not eat. The OVS approach allows for choice by the student as long as the reimbursable meal requirements are met. Students are offered a number of selections, and must select three (for breakfast) and four (for lunch). OVS for lunch is mandatory at the high school level and optional at the elementary and junior high levels. Table 6-1 provides a summary of OVS requirements for both lunch and breakfast.[43]

Table 6-1. Summary of Offer vs. Serve (OVS)

Feature	School lunch	School breakfast
Which schools may offer OVS?	• Mandatory at the high school level • Optional at elementary and junior high level	• Optional at all grade levels
Number of food components offered/food items offered	• Offer five food components (see Table 6-2) • Number of food items varies	• Offer four food items from three components (see Table 6-2)
Required number of food components for a reimbursable meal	• Students must select at least three components, one of which must add up to a ½ cup of fruit or vegetable	• Students must select three components, one of which must be a ½ cup of fruit[44]
Quantities of food components	• Must select at minimum a ½ cup of fruit and/or vegetables	• Must select at minimum ½ cup of fruit
When is a meal not reimbursable?	• A meal is not reimbursable if it does not contain at least three components, including a fruit or vegetable, or is not served in the correct quantity	• A meal is not reimbursable if it does not contain three components, including a fruit, or is not served in the correct quantity
Extra foods offered	Schools may offer extra foods such as a dessert. However, if it is not one of the food components, it does not count toward making a meal reimbursable.	

Non-OVS meals must include all of the required meal components for a reimbursable meal as summarized in Table 6-2. Table 6-3 summarizes the meal pattern requirements for NSLP OVS, NSLP non-OVS, SBP OVS, and SBP non-OVS meals.

[43] Source: Meal Reimbursement Resource Docs: OVS Guidance 2015-2016 from FNS. (https://fns-prod.azureedge.net/sites/default/files/cn/SP41-2015av2.pdf)

[44] Vegetables may be offered to meet all or part of the fruit requirement.

Table 6-2. Components of a reimbursable meal

School Breakfast Program or SBP (3 components)	National School Lunch Program or NSLP (5 components)
• Fruit • Grain • Liquid milk (1% fat or fat-free)	• Fruit • Vegetable • Meat or meat alternative • Grain • Liquid milk (1% fat or fat-free)

Table 6-3. Meal pattern requirements for NSLP and SBP

Meal program	OVS status	Cafeteria must offer	Tray must include
NSLP	OVS	1. Fruit 2. Grain 3. Milk 4. Vegetable 5. Meat / meat alternative	1. At least 3 of the 5 components 2. At least one fruit or vegetable
	Not OVS	1. Fruit 2. Grain 3. Milk 4. Meat / meat alternative 5. Vegetable	1. Fruit 2. Grain 3. Milk 4. Meat / meat alternative 5. Vegetable
SBP	OVS	1. At least 4 food items available 2. Items from 3 food components (at least one fruit or vegetable, milk, and grain)	1. At least one fruit or vegetable 2. At least 3 food items on tray
	Not OVS	1. Fruit or vegetable 2. Milk 3. Grain	1. Fruit or vegetable 2. Milk 3. Grain

Source: U.S. Department of Agriculture, "Offer versus Serve: Guidance for the National School Lunch Program and School Breakfast Program," https://www.fns.usda.gov/updated-offer-vs-serve-guidance-nslp-and-sbp-beginning-sy2015-16.

After determining which trays were reimbursable based on the NSLP/SBP meal pattern requirements, analysts compared the independently determined reimbursable status to the reimbursable status recorded by the cashier. Overclaiming errors were identified as trays that were not reimbursable based on the independent assessment, but were recorded as reimbursable by the cashier. Underclaiming errors resulted when reimbursable trays were instead marked as nonreimbursable by the cashier. Analysts estimated the error rate due to meal claiming error for each school by dividing the number of trays in error for each error type (overclaim or underclaim) by the total number of trays observed at the school. The total of overclaiming and underclaiming errors are the gross meal claiming error rates. The net meal claiming error rates accounts for the offsetting of over- and underclaiming errors.

6.2 Sources of Error

NSLP Trays in Error

Table 6-4 provides an unweighted summary of the reasons that NSLP trays resulted in errors (Figures 6-1 and 6-2 provide weighted summaries). To qualify as reimbursable, NSLP OVS trays must include at least three of the five components offered, and must have at least one fruit or vegetable. For NSLP OVS, most trays resulting in an error were not reimbursable because the student did not take the correct components, despite having been offered the correct components (affecting 3.32% of all NSLP OVS trays). A small number of NSLP OVS trays that resulted in overclaiming were served to adults or non-students and marked as reimbursable (0.08% of all NSLP OVS trays). For NSLP non-OVS trays, the most common reason that the tray did not meet the requirements was that the tray did not contain milk (affecting 10.08% of NSLP non-OVS trays). A small percentage of non-OVS trays had "multiple errors," meaning they were missing more than one required component (3.10% of NSLP non-OVS trays). It is important to note that while we coded for all possible types of errors, if there was no instance of an error type, it was not included in Table 6-4. For example, there was no observed instance in which neither a meat nor a vegetable were offered for NSLP OVS trays.

Trays resulting in underclaiming were only found among NSLP OVS meals. These accounted for 2.26 percent of all trays observed. The data collected do not provide further details about the reasons that the cashier marked a reimbursable tray as nonreimbursable, but it is possible that cashiers found the NSLP OVS rules to be more complex and were cautious about marking trays that were potentially nonreimbursable as reimbursable trays.

Reasons for Error Among NSLP Trays Resulting in Overclaiming Error

Figures 6-1 and 6-2 provide weighted estimates of the percentage of NSLP trays resulting in overclaiming errors by the reason for error. Figure 6-1 summarizes the reasons for error among only the NSLP trays, resulting in overclaiming in schools using OVS for lunch (the percentages are

among NSLP trays with overclaiming error).[45] The most common reason for an overclaiming error among NSLP OVS trays was that the student was offered the correct components but the tray did not contain enough (28.58% of trays with an overclaiming error are a result of missing components). The second most common reason for an error was although the tray contained enough components, it was missing a fruit or vegetable (accounting for 25.05% of the trays with an overclaiming error).

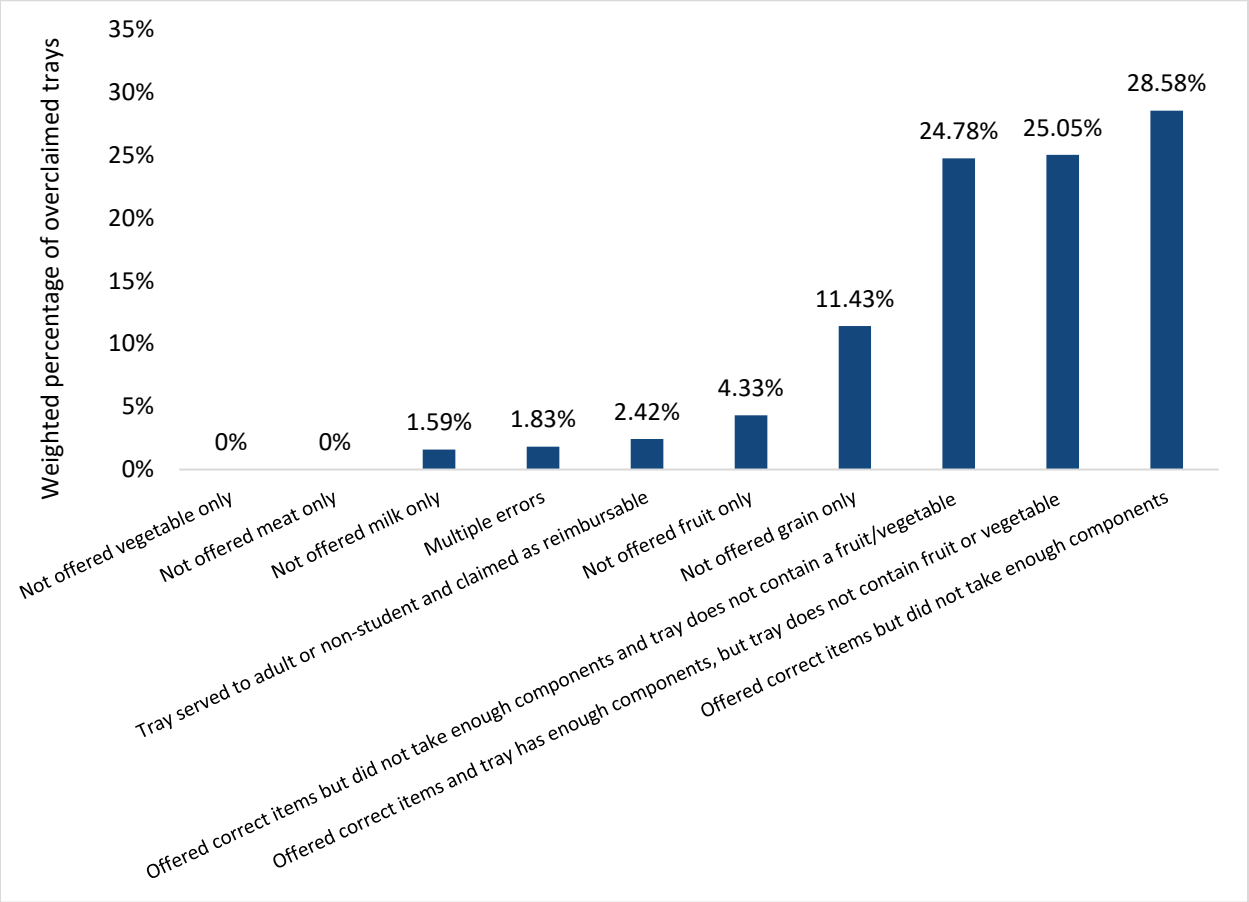
Table 6-4. Reasons for meal claiming error, NSLP OVS and non-OVS trays

Type of error	# of trays	% of all trays	% of trays in error
NSLP OVS trays			
No error	16,243	93.48	n/a
Trays resulting in underclaiming	393	2.26	34.69
Trays resulting in overclaiming	740	4.26	65.31
Not offered fruit only	16	0.09	1.41
Not offered grain only	89	0.51	7.86
Not offered milk only	28	0.16	2.47
Multiple components not offered	16	0.09	1.41
Offered correct items but did not take enough components	179	1.03	15.80
Offered correct items and tray has enough components, but tray does not contain fruit or vegetable	193	1.11	17.03
Offered correct items but did not take enough components and tray does not contain a fruit/vegetable	205	1.18	18.09
Tray served to adult or non-student and claimed as reimbursable	14	0.08	1.24
Total (trays observed)	17,376	100.00	n/a
Total schools=629			
NSLP non-OVS trays			
No error	568	73.39	n/a
Trays resulting in underclaiming	0	0.00	0.00
Trays resulting in overclaiming	206	26.61	100.00
No fruit only	11	1.42	5.34
No grain only	30	3.88	14.56
No milk only	78	10.08	37.86
No vegetable only	63	8.14	30.58
Multiple errors	24	3.10	11.65
Total (trays observed)	774	100.00	n/a
Total schools=26			
Total NSLP trays	**18,150**		

Source: APEC-III meal observation data, unweighted.

[45] Figure 6-1 percentages use a different denominator than the percentages in Table 6-4. In Figure 6-1, the percentages are among NSLP trays resulting in overclaiming. Whereas in Table 6-4, the percentages are out of all NSLP trays and out of all NSLP trays in error (over- and underclaiming).

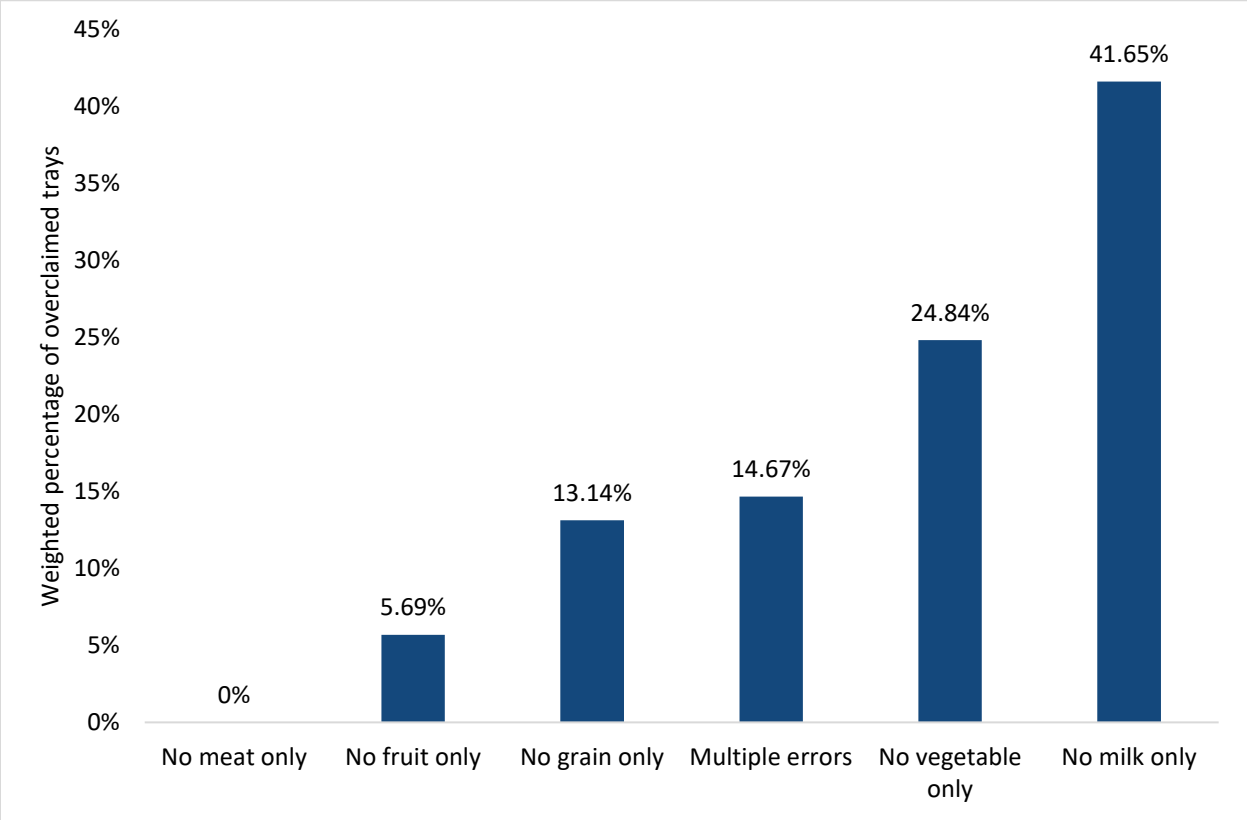
Figure 6-1. Reasons for error, among NSLP OVS trays with an overclaiming error



Source: APEC-III meal observation data, weighted.

Figure 6-2 summarizes the reasons for error among NSLP non-OVS trays. For NSLP non-OVS trays, the most common reason that the tray did not meet the meal pattern requirements was that it did not contain milk (accounting for 41.65% of NSLP non-OVS trays with an overclaiming error). The second most common reason for an error was the tray did not contain a vegetable (accounting for 24.84% of NSLP non-OVS trays with an overclaiming error).

Figure 6-2. Reasons for error, among NSLP Non-OVS trays with an overclaiming error



Source: APEC-III meal observation data, weighted.

SBP Trays in Error

Table 6-5 provides an unweighted summary of the error rates associated with observed SBP trays and the reasons for errors that resulted in overclaiming (Figures 6-3 and 6-4 provide weighted summaries). Most errors among breakfast OVS meals were due to students not taking/being served the items required for a reimbursable tray. Among breakfast OVS meals served, the most common reason that the tray did not meet the requirements was that the student did not take enough total food items (affecting 5.86% of observed SBP OVS trays). The second most common reason was that the student did not take a fruit or vegetable despite having enough total food items on the tray (2.93% of all observed SBP OVS trays). The third most common reason that an SBP OVS tray was not reimbursable was that the tray did not contain enough items total and did not contain a fruit or vegetable (2.23% of all observed SBP OVS trays). Among non-OVS breakfast trays, the most common reason the tray did not meet the requirements was that it did not contain milk (21.41% of all observed SBP non-OVS trays). Trays resulting in underclaiming were more common among SBP

OVS meals than SBP non-OVS (1.32% for all OVS trays, and 0.93% for all non-OVS trays). It is important to note that while we coded for all possible types of errors, if there was no instance of an error type, it was not included in Table 6-5. For example, there was no observed instance in which no fruit was offered or fewer than four total items were offered.

Table 6-5. Reasons for meal claiming error, SBP OVS and non-OVS trays

Type of error	# of trays	% of all trays	% of trays in error
SBP OVS trays			
No error	9,919	87.09	n/a
Trays resulting in underclaiming	150	1.32	10.19
Trays resulting in overclaiming	1,322	11.61	89.81
Not offered grain only	8	0.07	0.54
Not offered milk only	27	0.24	1.83
Multiple components not offered	24	0.21	1.63
Offered correct items but student did not take fruit or vegetable	334	2.93	22.69
Offered correct items and took fruit or vegetable, but student did not take enough items total	667	5.86	45.31
Offered correct items, did not take fruit or vegetable and did not have enough items total	254	2.23	17.26
Tray served to adult or non-student and claimed as reimbursable	8	0.07	0.54
Total (trays observed)	11,390	100.00	n/a
Total schools=597			
SBP non-OVS trays			
No error	559	74.34	n/a
Trays resulting in underclaiming	7	0.93	3.63
Trays resulting in overclaiming	186	24.73	96.37
No fruit or vegetable only	15	1.99	7.77
No milk only	161	21.41	83.42
No grain only	4	0.53	2.07
Multiple errors	6	0.80	3.11
Total (trays observed)	752	100.00	
Total schools=48			
Total SBP Trays	**12,142**		

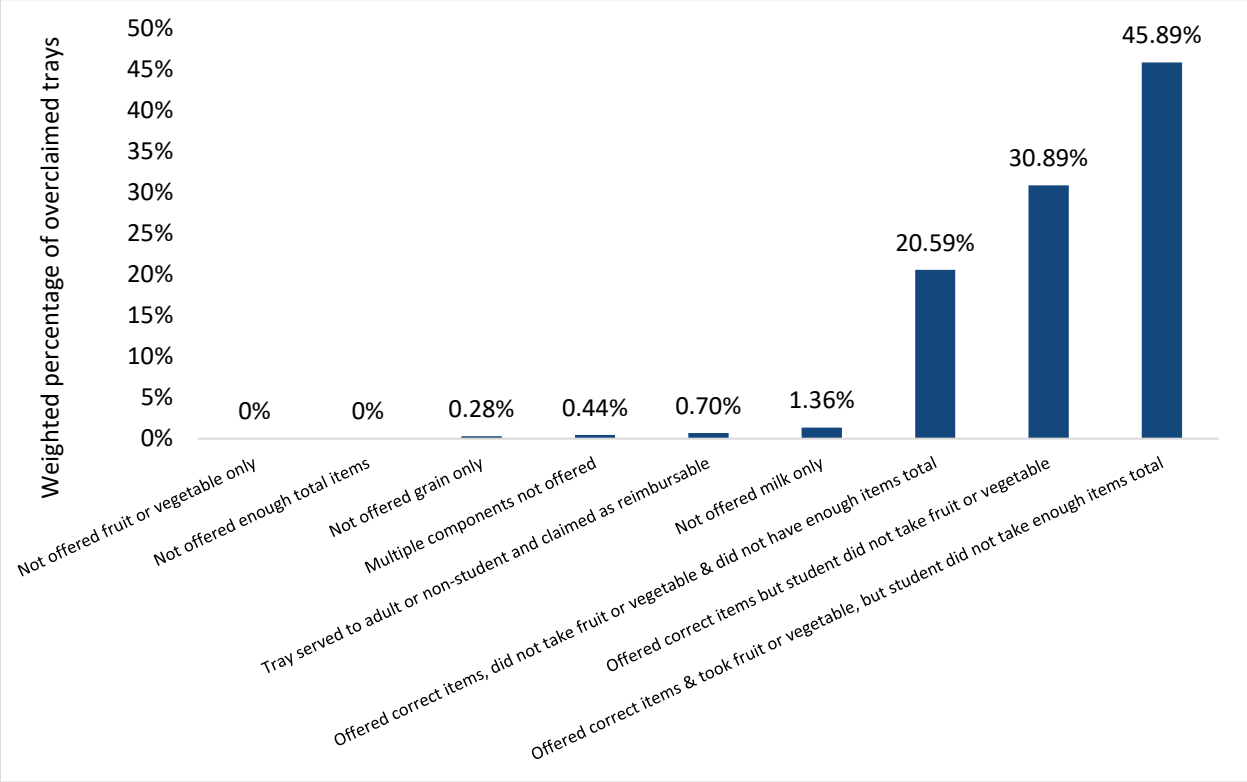
Source: APEC-III meal observation data, unweighted.

Reasons for Error Among SBP Trays Resulting in Overclaiming Error

Figures 6-3 and 6-4 provide weighted estimates of the percentage of SBP trays resulting in overclaiming errors by the reason for error. Figure 6-3 provides a summary of the reasons for error among SBP trays that resulted in overclaiming (the percentages in Figure 6-3 are among SBP trays

with overclaiming error).[46] For SBP OVS trays, students must take at least three food items total. The most common reason that SBP OVS trays were not reimbursable and resulted in overclaiming is that the student did not take enough items on the tray (50.49% of the trays with an overclaiming error). The next most common reason for errors resulting in overclaiming among SBP OVS trays was that the student did not take a fruit or vegetable (25.28% of the trays with an overclaiming error).

Figure 6-3. Reasons for error, among SBP OVS trays with an overclaiming error

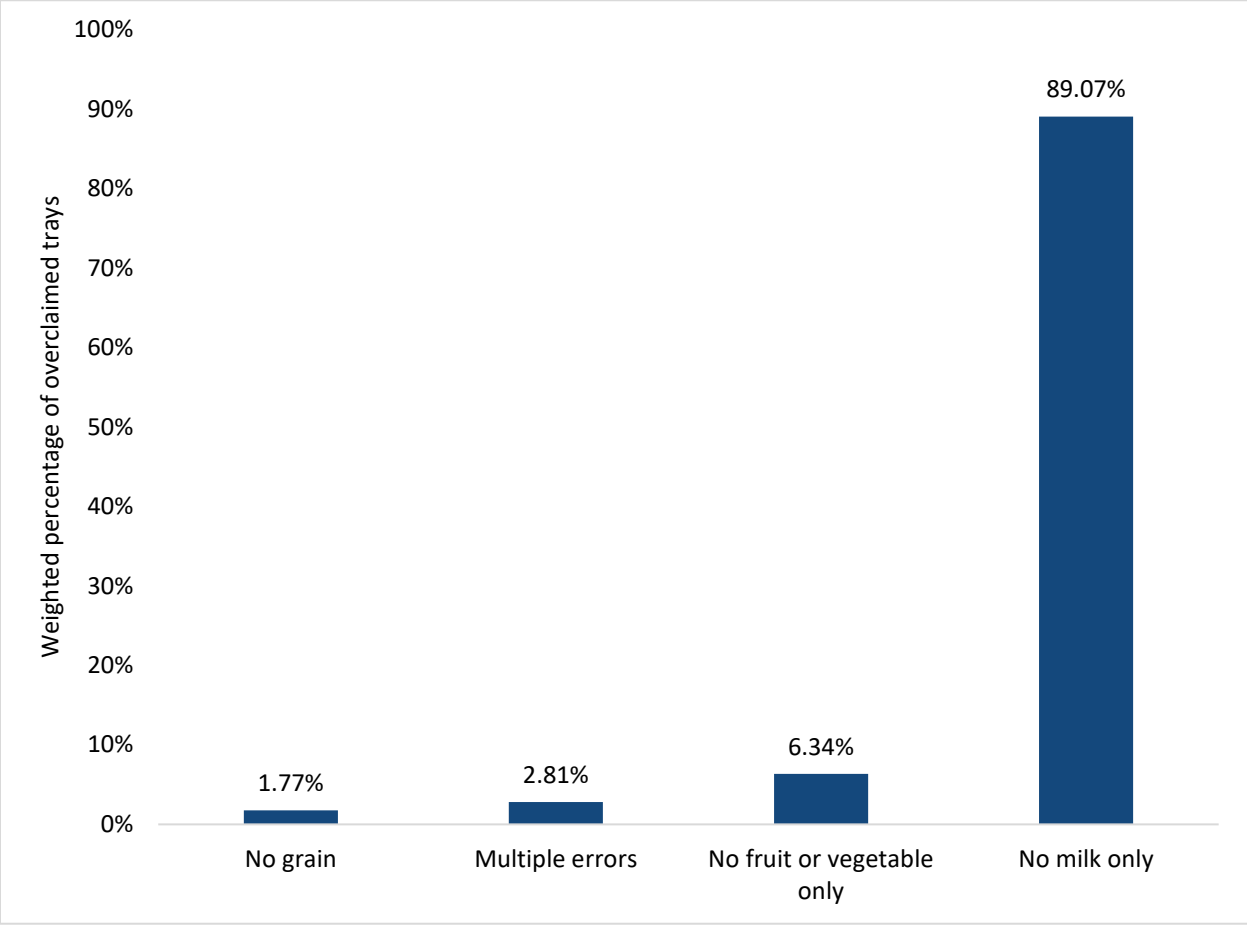


Source: APEC-III meal observation data, weighted.

Figure 6-4 summarizes the reasons for error for SBP non-OVS trays. For SBP non-OVS trays, by far the most common reason for error resulting in overclaiming was that the tray did not contain milk (86.56% of the trays with an overclaiming error).

[46] Figure 6-2 percentages use a different denominator than the percentages in Table 6-5. In Figure 6-2, the percentages are among SBP trays resulting in overclaiming. Whereas in Table 6-5, the percentages are out of all SBP trays and out of all SBP trays in error (over- and underclaiming).

Figure 6-4. Reasons for error, among SBP non-OVS trays with an overclaiming error



Source: APEC-III meal observation data, weighted.

6.3 Estimates of National Program Error Rates Due to Meal Claiming Error

Table 6-6 displays the gross and net error rates for NSLP and SBP. Similar to previous APEC studies, APEC-III finds that meal claiming error rates were higher for meals served as part of the SBP compared to meals served as part of the NSLP.

Table 6-6. Meal claiming error rates in the NSLP and SBP, School Year (SY) 2017-2018

Type of error	NSLP	SBP
Error rates (percentages out of 100)		
Overclaiming rate for all meals	5.04 (0.53)	11.17 (0.88)
Underclaiming rate for all meals	2.57 (0.49)	1.19 (0.43)
Gross error rate	7.62 (0.70)	12.36 (0.96)
Net error rate	2.47 (0.74)	9.98 (1.00)
Sample size (trays; whole numbers)	18,150	12,142
Sample size (schools; whole numbers)	655	645

Source: APEC-III meal observation data, weighted.

Table 6-7 shows the distribution of meal claiming errors by school. For NSLP meals, about half of schools had no errors (49.60%), and more than half had no errors resulting in overclaiming (59.73%). More than 8 in 10 had no meal claiming errors resulting in underclaiming (82.07%). A very small number of schools (less than 0.5%) had an error rate of 100 percent. This occurred when all of the meals observed were missing the same required component, resulting in all meals being in error. For these schools, all meals served were found to be in error, and they are included in the more than 5-percent error subgroup. The errors in these schools were as follows: (a) one school using OVS failed to offer a grain component to students, (b) one school using OVS failed to offer a milk component to students, and (c) one non-OVS school failed to include a vegetable on any of the observed trays.

For SBP meals, the error rates were higher; although about half of schools had no errors (47.69%), nearly half of the schools had an error rate of more than 5 percent (46.17%). A small percentage (less than 1%) of schools had an error rate of 100 percent. Again, for these schools, all meals served were found to be in error, and they are included in the more than 5-percent error subgroup. For NSLP and SBP, 13.19 percent and 5.92 percent of schools had more than 5 percent underclaiming, respectively. APEC-III does not calculate an improper payment estimate due to meal claiming error because they do not result in a meal delivered to an ineligible recipient or a miscount in meals.

Table 6-7. Percentage of schools with different gross error rate levels, SY 2017-2018

Type and level of error	NSLP	SBP
Gross error rate	7.62	12.33
Percentage of schools with different overall error rates		
No error	49.60	47.69
At most 5 percent error	17.00	5.90
More than 5 percent error	33.40	46.42
Percentage of schools with different overclaiming rates		
No error	59.73	50.48
At most 5 percent error	17.72	6.17
More than 5 percent error	22.55	43.34
Percentage of schools with different underclaiming rates		
No error	82.07	92.68
At most 5 percent error	4.74	1.40
More than 5 percent error	13.19	5.92
Sample size (schools; whole number)	655	645

Source: APEC-III meal observation data, weighted.

6.4 Comparisons With Findings From APEC-I and APEC-II

The gross and net error rates estimated by APEC-III did not differ significantly from those found in APEC-II, and only the gross error rates differed significantly when comparing APEC-I and APEC-III.[47] Table 6-8 presents a comparison between the gross and net error rates found using the same methodology as APEC-I and APEC-II. Analysts made pairwise comparisons between these rates to identify any significant differences. For gross meal claiming error rate, the only significant difference was between the rates estimated by APEC-I and APEC-III. Compared to APEC-I, the gross error rates estimated by APEC-III were 4.55 percentage points higher for the NSLP and 2.58 percentage points higher for the SBP.

The net error rates were not statistically different when comparing APEC-III to APEC-I or APEC-II, both for NSLP and SBP. Although APEC-III found a higher gross error rate than APEC-I, the APEC-III estimates indicate a higher rate of both overclaiming and underclaiming. The larger estimated underclaiming cancelled out some of the additional overclaiming, resulting in net error rates that do not differ across the studies.

[47] The gross error rate in APEC-III was compared to the erroneous payment rates in APEC-II and APEC-I. These percentages represent the percentage of meals in error. In APEC-II the error rate used the erroneous payment rate to estimate improper payments due to meal claiming error. However, improper payments due to meal claiming error is not applicable in APEC-III.

Table 6-8. Comparison of meal claiming error rates estimated by APEC-I, APEC-II, and APEC-III

Type of error	NSLP			SBP		
	APEC-I 2005-2006	APEC-II 2012-2013	APEC-III 2017-2018	APEC-I 2005-2006	APEC-II 2012-2013	APEC-III 2017-2018
Meal claiming error rates (percentages out of 100)						
Gross	3.07[a] (0.5)	5.14 (0.6)	7.62[a] (0.7)	9.78[b] (2.45)	10.94 (1.13)	12.36[b] (0.96)
Net	1.55 (0.42)	3.76 (0.63)	2.47 (0.74)	9.34 (2.46)	10.49 (1.14)	9.98 (1.00)
Sample size (schools; whole numbers)	245	436	655	218	421	645

Source: APEC-I, APEC-II, and APEC-III data, weighted.

Notes: Analysts tested the mean differences between each error rate by comparing each of the means for APEC-I to APEC-III, and the means for APEC-II to APEC-III. The only significant difference at the p<0.1 level or greater is the difference in gross error rates in NSLP and SBP between APEC-I and APEC-III for both NSLP and SBP. All other comparisons revealed no significant differences.

[a] The difference in NSLP gross error rates between APEC-I and APEC-III are statistically different at p<0.1 level.

[b] The difference in SBP gross error rates between APEC-I and APEC-III are statistically different at p<0.1 level.

6.5 Summary

Findings from the analyses of meal claiming error rates reveal that net error rates are higher for SBP than NSLP meals (the estimated gross and net error rates are 12.36% and 9.98% for SBP meals and 7.62% and 2.47% for NSLP meals). When compared to previous APEC studies, the analyses reveal no significant differences between the net error rates found from the APEC-III analysis and the estimates from the APEC-I and APEC-II studies. There was no change in the definition of errors due to meal claiming error or the procedures for identifying errors across the three APEC studies.

Although meal claiming error rates have not significantly increased, they also have not significantly decreased when compared to prior years. However, compared to prior years, APEC-III identified a higher percentage of trays that were reimbursable, but were not marked as reimbursable by the cashier (leading to underclaiming). It is possible that in these cases, cashiers misinterpreted the rules and were hesitant to mark trays as reimbursable, erring on the side of caution if they were not sure of the correct reimbursable status.

A key strength of meal claiming error estimates is the use of a random sample of meal periods and actual tray observations in real time. On the other hand, a potential limitation is that the observations do not include the serving sizes of each food component on the tray, which are a part of the meal pattern requirements for the NSLP and SBP. Instead, the data simply indicate whether a food component was offered to a student and whether the student took the food component.

7. Subgroup Analyses of Program Error Rates by Student, Household, School, and SFA Characteristics

The process of certifying students, assessing trays, and aggregating meal counts for the National School Lunch Program (NSLP) and School Breakfast Program (SBP) involves households and schools and School Food Authority (SFA) staff. Errors can occur at multiple points in the process. This chapter addresses Objective 2 of the third iteration of the Access, Participation, Eligibility, and Certification Study (APEC-III Study), examining the relationships between characteristics of students, households, schools, and SFAs to identify factors potentially associated with higher or lower error rates. These findings may suggest possible strategies that Food and Nutrition Service (FNS) could take to reduce errors in future years. For example, if specific characteristics are associated with errors, targeted guidance and training may reduce these types of errors. We first discuss the methodology, strengths, and limitations of the analyses, followed by a discussion of the bivariate and multivariate results for each type of error.

7.1 Methodology

This study collected a variety of information from households, schools, and SFAs that we used to examine potential characteristics associated with different errors. To examine characteristics associated with error rates, we first defined the error rates of interest, which serve as the outcomes for bivariate subgroup comparisons and multivariate models. Next, we identified characteristics that may relate, in theory, to each error rate. Finally, we compared the weighted mean error rates of the groups with the characteristic of interest to the group without the characteristic. We tested if the differences in the groups' error rates were statistically significant using weighted t-tests. We also used multivariate regressions to test the effect of each characteristic on the error rate simultaneously, controlling for other characteristics of interest.

Table 7-1 provides a summary of the error rates and characteristics analyzed. The error rates of interest for the test were:

1. **Certification error due to household reporting error (REPERR):** The error rate of interest is the gross certification error due to reporting error (measured as any error due

to reporting error, resulting in either an overcertification or an undercertification). Because reporting errors are made by households during the application process, the characteristics potentially associated with reporting error are primarily student and household characteristics. These include characteristics such as the child's grade level, the parents' education level, participation in means-tested programs, and household size and income level.

2. **Certification error due to administrative error (ADMERR):** Certification error due to administrative error occurs due to mistakes by staff at the SFA or school. As described in Chapter 3, these errors may occur due to mistakes made in assessing information on the application, maintaining documentation of applications and direct certification, and transmitting certification statuses to the district. With this in mind, the characteristics that may relate to administrative error include characteristics of the household that may cause the staff to have more difficulty assessing applications (such as the household size, income level, and participation in means-tested programs). In addition, characteristics of the school and SFA such as staff training may relate to administrative error.

3. **CEP certification error (CEP):** Characteristics of schools and districts may relate to CEP error rates because of their process in determining the Identified Student Percentage (ISP) and maintaining documentation. The analyses examine characteristics of schools and SFAs such as the region, urban/rural location, and level of CEP participation as they relate to CEP error rates.

4. **Meal claiming error (MLCLM):** Meal claiming errors occur due to errors made by cashiers in assessing the reimbursable status of a tray, based on the foods offered, the components on the tray, and the person receiving the meal (i.e., a student, adult, or other non-student). Due to the nature of these errors, characteristics of the school and the cafeteria staff that may relate to meal claiming errors include the level of staff training and the use of OVS. The size of the school (school enrollment) may also relate to meal claiming error. Larger schools tend to have shorter lunch periods to accommodate the larger number of students. Schools serving different grade levels (elementary, middle, or secondary) may also have different meal claiming error rates because the meal pattern requirements are different for students of different ages.

5. **Aggregation error (AGG):** Aggregation errors are math errors made in the process of aggregating meal counts and reporting these counts from the school to the SFA, and from the SFA to the State agency. Some characteristics of schools and SFAs may relate to aggregation error, such as the aggregation procedures (e.g., manual or automated), size of the SFA (single- versus multiple-district), and the school size based on student enrollment.

Table 7-1. Characteristics tested to determine association with error rates in Objective 2 analyses

Variable	Source	Error rate analysis				
		REPERR	ADMERR	CEP	MLCLM	AGG
Student level						
Child's grade	HHS	X				
Parent's education	HHS	X				
Means tested program participation	HHS	X				
Number of children in the household<18 years	HHS	X	X			
Age of youngest child	HHS	X				
Household size	HHS	X	X			
Income relative to poverty (percentage)	HHS	X	X			
English as a second language	HHS	X				
Participates in SBP	HHS	X				
Number of reimbursable meals taken	MLP	X				
Perceived difficulty of application	HHS	X				
Used an electronic / online application	HHS	X				
Urbanicity	FRAME	X	X			
Gender[a]	–					
Race/ethnicity[a]	–					
School level						
Region	FRAME			X		
School grade level	FRAME			X	X	
School enrollment	FRAME			X	X	
Percentage of students certified for free or reduced-price meals	FRAME				X	
Number of cashier lines	MLOBS				X	
English as a Second Language (ESL)%[a]	-					
NSLP/SBP						
Meal programs offered	SFADS					X
Provision 2 or 3 status	SFADS					X
Use of offer versus serve	MLOBS				X	
Percentage of NSLP lunches by type	MLC					X
Percentages of SBP breakfast by type	MLC					X
Receives NSLP 60 percent subsidy (additional 2 cents)	SFADS				X	X
Receives severe needs SBP subsidy	SFADS				X	X
Receives performance-based cash reimbursement (additional 6 cents)[b]	SFADS					
SFA						
SFAs with more than five schools compared to those with less than five schools	SFADS					X
Single- vs. multiple-district SFAs	SFADS					X
District size (total number of schools)	SFADS					X
Percentage of schools by type of school	SFADS					X
Student enrollment	SFADS					X
Aggregation procedures (manual, automated)	SFADS					X
Level of CEP Participation	SFADS			X		X
Staff Training	SFADS		X		X	

Table 7-1. Characteristics tested to determine association with error rates in Objective 2 analyses (continued)

Variable	Source	Error rate analysis				
		REPERR	ADMERR	CEP	MLCLM	AGG
SFA meal program						
Use of food service mgmt. company	SFADS				X	
District tracks and maintains data on student participation in NSLP and/or SBP at individual level	SFADS					X
Use of direct certification[c]	-					
Number of years using direct certification[d]	-					
Percentage of students certified for free meals by certification method[e]	-					
Percentage of approved application by type of approval[e]	-					

Notes: X indicates that the variable is included in the analyses of the error rate.

[a] These variables were originally proposed as part of the Reporting and Administrative error analyses but were excluded from the final analyses due to concerns over the theoretical link between these demographics and the error rates.

[b] Performance-based cash reimbursements were not included in the analysis due to the small number of schools that do not receive performance-based cash reimbursements.

[c] Excluded from analyses due to lack of variation (n=1 SFA did not use direct certification).

[d] Excluded due to large percentages of missing values (many SFA directors did not know the answer and left this question blank).

[e] These SFA-level variables were originally proposed for the Objective 2 analyses but were excluded because they were not expected to directly affect errors at the student level. Objective 3 examines the relationship between Reporting and Administrative error rates at the SFA level using details about each SFA's certification methods.

REPERR=Certification error due to reporting error in non-CEP schools

ADMERR=Certification error due to administrative error in non-CEP schools

CEP=Certification error in CEP schools

MLCLM=Meal claiming error

AGG=Aggregation error

HHS=Household survey

MLOBS=Meal observation data

FRAME=Sample frame data

SFADS=SFA director survey

MLP=Meal participation data (student-level meal counts provided by SFAs)

MLC=School-level meal counts (provided by SFA)

We considered a number of variables that we ultimately excluded from these analyses. We found no theoretical basis for gender, race, ethnicity, and percentage of ESL affecting errors and therefore did not consider these variables. We excluded other variables because there was no variability across schools or SFAs. Specifically, only a small number of schools do not receive performance-based cash reimbursements, and only one SFA did not use direct certification. The number of years using direct certification was excluded because of the high number of missing values for this question. Finally, the percentage of students certified for free meals by certification method and the percentage of approved applications by type of approval were excluded from these student-level analyses. Instead, they are included in the Objective 3 analyses, which examines error rates at the SFA level using details about each SFA's certification methods.

7.2 Strengths and Limitations

The analyses on the factors that are associated with errors are exploratory and limited by the characteristics available from the data. To keep burden within reasonable levels, we limited the amount of background information collection. It is possible that characteristics that are not available from the data relate to error rates, and that these unobserved characteristics correlate with or interact with the observed characteristics in unanticipated ways. For example, the household survey did not collect certain data, such as household size and income, for households that were categorically eligible or directly certified (and therefore did not need to report income).

The bivariate and multivariate analyses used multiple data sources (e.g., surveys, administrative data abstraction, etc.). Item nonresponse occurred; although item nonresponse was small in most cases, it was more prevalent for some items and from some data sources than from others. The analyses used case-wise deletion, excluding cases with missing data (i.e., we did not attempt to impute any data for these analyses). The tables note the sample size for each comparison; smaller sample sizes indicate missing data due to either a skip pattern or item nonresponse.

Despite the limitations of the available data, there are many strengths. The variety of the data sources available allow for analyses of many different characteristics of students, households, schools, and SFAs. The data provide detailed information from households that is not available from any other source that may relate to errors, including the perception of the difficulty of the

application process. Finally, the survey data are from a nationally representative probability sample of SFAs, schools, and households (after weighting).

7.3 Certification Error Due to Household Reporting Error

This section discusses household reporting errors, which are the mistakes made by households in the reporting process that lead to certification errors. Table 7-2 provides a summary of the bivariate analyses of characteristics that may relate to household reporting error. Table 7-2 displays, in each row, the comparisons between groups with each characteristic to the remaining set of students without the characteristic. The primary variables that relate to reporting error are household characteristics associated with eligibility, namely, whether the household participates in a means-tested program, and the household's income. Households participating in means-tested programs that confer eligibility due to either direct certification or categorical eligibility had significantly lower reporting error rates. This comes as little surprise because participation in one of these programs significantly simplifies the certification process, and, in the case of direct certification, reporting error is not a possibility because no household application is required.

Among households who reported income on an application, the household income relative to the Federal Poverty Level (FPL) is also a significant predictor of household reporting error. Households with higher income are significantly more likely to have a reporting error than those with lower incomes. This makes intuitive sense because households with very low income are unlikely to misreport their income in a way that would result in a certification error. On the other hand, households with income levels close to the thresholds needed for certification as free or reduced-price, for example, are prone to errors because even small mistakes in reporting income can result in differences between the certification status and the actual eligibility status. Parent education being less than high school diploma and household size between four to six people were also found to be significant predictors, though to a lesser extent. The remaining characteristics were not found to be significant predictors.

Table 7-2. Bivariate analysis of characteristics associated with reporting error

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (students)	% error rate[a] (SE) [lower CI, upper CI]	Sample size (students)	% error rate[a] (SE) [lower CI, upper CI]		
Grade						
Child in preschool or kindergarten	364	9.08 (2.13) [4.88, 13.29]	3,177	12.34 (0.91) [10.55, 14.14]	0.14	3,541
Child in grades 1 to 3	832	13.03 (1.81) [9.46, 16.61]	2,709	11.70 (0.96) [9.80, 13.59]	0.51	3,541
Child in grades 4 to 5	634	11.75 (1.50) [8.79, 14.70]	2,907	12.06 (0.96) [10.17, 13.95]	0.85	3,541
Child in grades 6 to 8	744	11.89 (1.61) [8.71, 15.07]	2,797	12.03 (1.01) [10.05, 14.02]	0.94	3,541
Child in grades 9 to 12	965	12.51 (1.71) [9.15, 15.88]	2,576	11.81 (0.92) [10.00, 13.62]	0.70	3,541
Urbanicity						
Household in a rural area	685	11.62 (1.99) [7.70, 15.55]	2,856	12.09 (0.98) [10.15, 14.03]	0.84	3,541
Household in a city	879	10.94 (1.50) [7.97, 13.91]	2,662	12.35 (1.09) [10.20, 14.50]	0.47	3,541
Household in a suburban area	1,559	11.82 (1.52) [8.82, 14.83]	1,982	12.15 (1.09) [9.99, 14.30]	0.87	3,541
Household in a town	418	15.12 (2.45) [10.28, 19.95]	3,123	11.53 (0.92) [9.72, 13.35]	0.16	3,541
Language						
English as a second language (language other than English spoken at home)	853	12.08 (1.44) [9.25, 14.91]	2,685	12.00 (1.01) [10.01, 13.98]	0.96	3,538
Means-tested program participation[c]						
Temporary Assistance to Needy Families (TANF) received by someone in household	243	0.00 (0.00) [0.00, 0.00]	3,238	13.08 (0.95) [11.21, 14.95]	<0.01***	3,481
Supplemental Nutrition Assistance Program (SNAP) received by someone in household	1,368	1.09 (0.35) [0.40, 1.77]	1,872	21.72 (1.47) [18.82, 24.63]	<0.01***	3,240
Medicaid received by someone in household	1,022	19.80 (2.07) [15.71, 23.88]	837	24.25 (1.85) [20.61, 27.89]	0.09*	1,859

Table 7-2. Bivariate analysis of reporting error (continued)

Characteristics	Presence of characteristic: Yes – Sample size (students)	Yes – % error rate[a] (SE) [lower CI, upper CI]	No – Sample size (students)	No – % error rate[a] (SE) [lower CI, upper CI]	t-test P-value	Total sample size[b]
Means-tested program participation[c] (continued)						
Participates in any means-tested program (TANF, SNAP, Food Distribution Program on Indian Reservations [FDPIR], or Medicaid)	2,636	8.20 (0.92) [6.38, 10.01]	905	22.71 (1.74) [19.29, 26.14]	<0.01***	3,541
Parent's education						
Parent's education: less than high school	707	9.53 (1.39) [6.78, 12.28]	2,809	12.67 (0.97) [10.74, 14.59]	0.04**	3,516
Parent's education: high school diploma or GED	1,636	11.61 (1.14) [9.35, 13.86]	1,880	12.39 (1.07) [10.29, 14.50]	0.56	3,516
Parent's education: some college or technical	697	14.19 (1.78) [10.68,17.69]	2,819	11.53 (0.87) [9.81, 13.25]	0.12	3,516
Parent's education: college graduate	476	14.11 (2.33) [9.50, 18.72]	3,040	11.68 (0.96) [9.78, 13.58]	0.35	3,516
SBP participation						
Participates in SBP	2,595	11.40 (1.04) [9.35, 13.45]	910	14.09 (1.51) [11.10, 17.07]	0.14	3,505
Perceived difficulty of the application						
Perceived difficulty of application – Very Difficult or Difficult	196	14.68 (2.95) [8.85, 20.50]	3,140	12.55 (0.89) [10.79, 14.31]	0.46	3,336
Perceived difficulty of application – Very Easy or Easy	2,888	12.96 (0.95) [11.09, 14.83]	448	10.91 (1.81) [7.33, 14.49]	0.28	3,336
Application type						
Completed an online application	1,225	14.5 (1.62) [11.3, 17.7]	2,089	11.7 (1.03) [9.68, 13.7]	0.15	3,314
Household size and income questions – asked only of households not eligible for direct certification and/or categorical eligibility						
Youngest child in household						
Youngest child in household less than 5 years old	473	19.42 (2.54) [14.41, 24.43]	1,383	22.57 (1.63) [19.36, 25.79]	0.26	1,856
Youngest child in household 5 to 8 years old	570	23.17 (2.22) [18.79, 27.54]	1,286	21.12 (1.65) [17.87, 24.37]	0.40	1,856

Table 7-2. Bivariate analysis of reporting error (continued)

Characteristics	Presence of characteristic: Yes – Sample size (students)	Yes – % error rate[a] (SE) [lower CI, upper CI]	No – Sample size (students)	No – % error rate[a] (SE) [lower CI, upper CI]	t-test P-value	Total sample size[b]
Youngest child in household (continued)						
Youngest child in household 9 to 13 years old	555	22.37 (2.30) [17.83, 26.91]	1,301	21.48 (1.68) [18.18, 24.79]	0.73	1,856
Youngest child in household 14 to 18 years old	258	21.64 (3.31) [15.10, 28.17]	1,598	21.77 (1.53) [18.75, 24.78]	0.97	1,856
Household size						
1 to 3 people in the household	445	19.36 (2.53) [14.36, 24.36]	1,431	22.39 (1.62) [19.19, 25.58]	0.27	1,876
4 to 6 people in the household	1,204	23.03 (1.60) [19.88, 26.18]	672	19.13 (2.18) [14.83, 23.43]	0.08*	1,876
7 to 9 people in the household	191	19.47 (3.64) [12.30, 26.64]	1,685	21.93 (1.44) [19.09, 24.77]	0.46	1,876
10 or more people in the household	36	13.56 (6.27) [1.20, 25.93]	1,840	21.82 (1.48) [18.91, 24.73]	0.19	1,876
Income						
Income relative to poverty – 0 to 130 percent	911	10.99 (1.35) [8.32, 13.66]	963	31.22 (2.40) [26.48, 35.95]	<0.01***	1,874
Income relative to poverty – 131 to 185 percent	504	30.38 (3.04) [24.38, 36.38]	1,370	18.40 (1.41) [15.62, 21.19]	<0.01***	1,874
Income relative to poverty – more than 185 percent	459	32.13 (3.31) [25.60, 38.65]	1,415	18.16 (1.52) [15.16, 21.16]	<0.01***	1,874

Notes: A6P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: *** p<0.01, ** p<0.05, * p<0.1.

[a] The Error Rate is the weighted percentage of students (out of 100) with household reporting errors. Standard errors in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[b] Sample sizes differ due to skip patterns and item nonresponse.

[c] Sample sizes differ for means-tested programs due to skip patterns. For example, a household that receives TANF skips subsequent questions about mean-tested program participation. Comparisons are not shown separately for students in households receiving benefits from the FDPIR due to small cell sizes.

Summary: This table provides a summary of the results of bivariate tests for differences in household reporting error rate based on certain household characteristics. Yes= with characteristic. N = without characteristic.

Expanding on the bivariate analyses, we examined the effect of the selected characteristics on the incidence of reporting error using a logistic regression model, controlling for multiple characteristics simultaneously. We used logistic regression because the outcome variable is dichotomous (1=reporting error, 0=no reporting error), and logistic regression is an appropriate estimation method for dichotomous outcomes and it accounts for the fact that predicted outcomes must be between 0 percent and 100 percent. The multivariate analyses of reporting error, presented in Table 7-3, echo the findings from the bivariate analyses. The table displays the marginal effects of each characteristic on the likelihood of a student having a reporting error; the cell entries are percentage point increases or decreases (out of 100) due to the characteristic. Appendix M provides the corresponding coefficients from the logistic regressions, expressed as log-odds ratios. Relative to households with incomes less than or equal to 130 percent FPL, students living in households with incomes of 131 percent to 185 percent FPL and those in households with income over 185 percent FPL were 22.63 percentage points and 25.12 percentage points more likely, respectively, to have a reporting error. Consistent with the bivariate analyses, other characteristics such as perceived difficulty with application and application method (online vs. hard copy) were not significant predicators. However, in the multivariate analyses, parent's education less than high school diploma was no longer a significant predictor.

Table 7-3. The effect of selected characteristics on the likelihood of reporting error

Characteristic	All	Among those completing income portion of household survey
Grade (base=pre-k or kindergarten)		
Child in grades 1 to 3	4.63% (3.33%)	8.01% (5.69%)
Child in grades 4 to 5	2.84% (2.94%)	0.88% (4.99%)
Child in grades 6 to 8	1.87% (3.35%)	0.10% (5.90%)
Child in grades 9 to 12	1.56% (2.97%)	0.81% (4.73%)
Parent's education (base=less than high school)		
Parent's education: high school diploma or GED	1.90% (1.95%)	0.72% (3.24%)
Parent's education: some college or technical	3.68% (2.29%)	0.77% (4.39%)
Parent's education: college graduate	0.91% (2.91%)	-5.39% (5.64%)
Participation in means-tested programs		
Participates in a means-tested program[a]	-11.77%*** (1.35%)	-1.56% (2.71%)

Table 7-3. The effect of selected characteristics on the likelihood of reporting error (continued)

Characteristic	All	Among those completing income portion of household survey
Language		
English as a second language	1.44% (1.70%)	-1.72% (3.74%)
School meal participation		
Participates in SBP	1.76% (1.86%)	5.38%* (3.87%)
Total number of NSLP meals received	<0.01% (0.02%)	0.03% (0.03%)
Total number of SBP meals received	-0.06%*** (0.02%)	-0.07%*** (0.03%)
Age of youngest child in household (base=less than 5 years old)		
Youngest child in household 5 to 8 years old	–	3.13% (3.22%)
Youngest child in household 9 to 13 years old	–	5.82% (3.80%)
Youngest child in household 14 to 18 years old	–	4.73% (5.35%)
Household size (base=1 to 3 people in the household)		
4 to 6 people in the household	–	5.15% (3.19%)
7 to 9 people in the household	–	5.37% (4.77%)
10 or more people in the household	–	6.42% (10.38%)
Income relative to poverty (base=less than or equal to 130 percent)		
Income relative to poverty: 131 to 185 percent	–	22.63%*** (2.96%)
Income relative to poverty: greater than 185 percent	–	25.12%*** (3.74%)
Difficulty of application (base=neither easy nor difficult)		
Perceived difficulty of application – Very Easy or Easy	–	8.85%* (5.34%)
Perceived difficulty of application – Very Difficult or Difficult	–	11.21% (7.04%)
Application method (base=did not apply online)		
Applied online	–	0.20% (3.11%)
Sample size (students)	3,479	1,709

Source: APEC-III household survey and application record abstraction data, weighted.

Notes: The dependent variable is certification error due to reporting error (1=reporting error, 0=no reporting error). Cell entries are marginal effects generated from weighted logistic regressions with standard errors in parentheses. The marginal effects represent the estimated percentage point change in the likelihood of a reporting error due to the corresponding variable, holding all else constant. Estimates were generated using Stata's logistic regression for survey data command (svy: logit) and margins procedures.

[a] Households skipped the income portion of the survey if they received TANF, SNAP, or FDPIR benefits. Households receiving Medicaid benefits completed the income portion of the survey despite participating in a means-tested program.

*** p<0.01, * p<0.1

Summary: This table provides the results of multivariate analyses of reporting error. There are two analyses presented - the first includes all students, and the second includes only students from households who provided income information. Additional variables are included for students with an income application because they were not categorically eligible or directly certified.

7.4 Certification Error Due to Administrative Error

Administrative errors differ from household reporting errors in that they occur due to mistakes by SFA and/or school staff members rather than mistakes on the part of the applicants. Nonetheless, the types of households most likely to have a certification error due to administrative error are similar to those likely to have a household reporting error. Specifically, households that do not participate in a means-tested program that would confer eligibility due to direct certification and/or categorical eligibility are significantly more likely to be certified incorrectly due to an administrative error. Also, households that indicated a higher household income amount on the survey were more likely to have a certification error due to administrative error.

Table 7-4 displays the bivariate comparisons of administrative error rates by selected subgroups of interest. For example, 0.31 percent of students in households that participate in TANF (according to the household survey) were incorrectly certified due to an administrative reporting error, compared to 10.87 percent of households that did not participate in TANF. Among households participating in SNAP, only 0.73 percent had an administrative error, compared to 18.07 percent of households not participating in SNAP. This difference occurs because determination eligibility for TANF or SNAP participants is straightforward in comparison to a determination of eligibility based on an assessment of household size and income.

Table 7-4. Bivariate analyses of characteristics associated with administrative error

Characteristics	Presence of characteristic: Yes — Sample size	Yes — % error rate[a] (SE) (lower CI, upper CI)	No — Sample size	No — % error rate[a] (SE) (lower CI, upper CI	t-test P-value	Total sample size[b]
Urbanicity						
Household in a rural area	685	11.91 (2.02) [7.93, 15.88]	2,856	9.59 (0.78) [8.05, 11.13]	0.29	3,541
Household in a city	879	8.79 (0.99) [6.83, 10.75]	2,662	10.40 (0.88) [8.67, 12.14]	0.20	3,541
Household in a suburban area	1,559	10.40 (1.10) [8.24, 12.56]	1,982	9.70 (0.92) [7.87, 11.52]	0.61	3,541
Household in a town	418	8.33 (1.79) [4.80, 11.85]	3,123	10.27 (0.76) [8.77, 11.76]	0.30	3,541
Means-tested program participation						
TANF received by someone in household	243	0.31 (0.30) [-0.28, 0.91]	3,238	10.87 (0.78) [9.32, 12.41]	<0.01***	3,481
SNAP received by someone in household	1,368	0.73 (0.35) [0.03, 1.43]	1,872	18.07 (1.28) [15.55, 20.59]	<0.01***	3,240
Medicaid received by someone in household	1,022	17.73 (1.84) [14.11, 21.35]	837	18.63 (2.11) [14.47, 22.78]	0.19	1,859
Household size and income questions - asked only of households not eligible for direct certification and/or categorical eligibility						
Income						
Income relative to poverty: 0 to 130 percent	911	7.50 (1.22) [5.10, 9.89]	963	27.63 (2.07) [23.55, 31.70]	<0.01***	1,874
Income relative to poverty: 131 to 185 percent	504	25.40 (2.63) [20.21, 30.58]	1,370	15.41 (1.50) [12.44, 18.38]	<0.01***	1,874
Income relative to poverty: More than 185 percent	459	30.06 (3.22) [23.71, 36.40]	1,415	14.12 (1.26) [11.63, 16.60]	<0.01***	1,874

Table 7-4. Bivariate analyses of characteristics associated with administrative error (continued)

Characteristics	Presence of characteristic: Yes – Sample size	Yes – % error rate[a] (SE) (lower CI, upper CI)	No – Sample size	No – % error rate[a] (SE) (lower CI, upper CI	t-test P-value	Total sample size[b]
Household size						
1 to 3 people in the household	445	22.29 (2.57) [17.22, 27.35]	1,431	16.91 (1.50) [13.95, 19.86]	0.38	1,876
4 to 6 people in the household	1,204	17.72 (1.68) [14.40, 21.04]	672	18.97 (1.77) [15.49, 22.45]	0.72	1,876
7 to 9 people in the household	191	11.89 (2.58) [6.80, 16.98]	1,685	18.82 (1.40) [16.06, 21.58]	0.21	1,876
10 or more people in the household	36	13.75 (6.34) [1.25, 26.26]	1,840	18.22 (1.31) [15.63, 20.81]	0.76	1,876

Source: APEC-III application record abstraction data, weighted.

Notes: Analysts tested each variable for the significance of the difference between the percentage of students with administrative errors who meet the criteria listed in each row (the "Yes" column) against the error rate for all other students not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: *** p<0.01

[a] The Error Rate is the weighted percentage of students (out of 100) with certification errors due to administrative errors. Standard errors are in parentheses. (Lower CI, Upper CI) are the lower and upper 95% Confidence Intervals.

[b] Sample sizes differ due to skip patterns and item nonresponse.

Household income relative to the poverty level is also strongly associated with administrative error based on the bivariate subgroup analyses. Households with higher income relative to the poverty level had statistically significantly higher administrative error rates on average compared to those with lower incomes. When interpreting the effect of household income on administrative error rates, however, it is important to keep in mind that the household survey assesses income and household size only for households that are not categorically eligible. This means that the average administrative error rates for the household income and household size subgroups are only among households not participating in a means-tested program. With this in mind, households that are not categorically eligible but are at the lowest end of the income distribution (income relative to poverty of 0 to 130%) had a relatively low average administrative error rate of 7.50 percent compared to error rates of 25.40 and 30.06 percent for those with higher income relative to poverty levels.

The multivariate analyses of administrative error appear in Table 7-5. The multivariate analyses include only households that did not indicate that they participated in a means-tested program on the household survey, and completed the income portion of the survey. The reasoning for restricting the multivariate analysis to those not participating in means-tested programs is that many administrative errors categorically cannot occur if the household participates in a means-tested program.[48]

Table 7-5. The effect of selected characteristics on the likelihood of administrative error

Characteristic	Among those completing the income portion of household survey
Participation in means-tested programs	
Participates in a means-tested program[a]	3.32% (3.13%)
Age of youngest child in household (base=less than 5 years old)	
Youngest child in household 5 to 8 years old	0.79% (2.92%)
Youngest child in household 9 to 13 years old	4.95% (3.21%)
Youngest child in household 14 to 18 years old	2.84% (3.98%)

[48] Furthermore, the survey did not collect information on household income and size if the household participated in a means-tested program. This means that models of administrative error that include means-tested program participation cannot include these covariates. The results of these models (not shown) draw the same conclusions as the bivariate analyses: that means-tested program participation significantly reduces the likelihood of an administrative error.

Table 7-5. The effect of selected characteristics on the likelihood of administrative error (continued)

Characteristic	Among those completing the income portion of household survey
Household size (base=1 to 3 people in the household)	
4 to 6 people in the household	-1.97% (2.99%)
7 to 9 people in the household	-4.72% (4.67%)
10 or more people in the household	1.82% (8.74%)
Income relative to poverty (base=less than or equal to 130 percent)	
Income relative to poverty: 131 to 185 percent	20.17%*** (3.13%)
Income relative to poverty: greater than 185 percent	24.03%*** (3.39%)
School meal program participation	
NSLP total meals received	0.01% (0.02%)
SBP total meals received	0.02% (0.03%)
Sample size (students)	1,854

Source: APEC-III household survey and application record abstraction data, weighted.

Notes: The dependent variable is certification error due to administrative error (1=administrative error, 0=no administrative error). Cell entries are marginal effects generated from weighted logistic regressions with standard errors in parentheses. The marginal effects represent the estimated percentage point change in the likelihood of a reporting error due to the corresponding variable, holding all else constant. Estimates were generated using Stata's svy: logit and margins procedures.

[a] Households skipped the income portion of the survey if they received TANF, SNAP, or FDPIR benefits. Households receiving Medicaid benefits completed the income portion of the survey despite participating in a means-tested program.

*** p<0.01

Compared to those with a baseline income of less than or equal to 130 percent FPL, higher income households were significantly more likely to have a certification error due to administrative error. If they had household income of 131 to 185 percent FPL, their error rate was 20.17 percentage points higher than the lowest income group's error rate. Similarly, if they had an income of greater than 185 percent FPL, their error rate was 24.03 percentage points higher than the lowest income group's rate. Higher error rates in these upper income bands may relate to the increased difficulty in assessing eligibility.

There are a number of reasons that administrative errors may occur more often among households with higher income. One reason is that staff may have found it more difficult to determine eligibility status accurately when households were close to the income and household size requirements to

qualify for a specific certification status. Alternatively, staff may have incorrectly marked the student as directly certified when they did not receive benefits from a means-tested program; this means that administrative errors among households reporting higher income on the household survey may occur due to "missing direct certification documentation." For example, consider these circumstances resulting in an administrative error: (a) staff recorded the student as directly certified, (b) staff lacked or did not maintain documentation of direct certification, (c) the survey indicated that the household did not participate in a means-tested program, and (d) the household income was too high to qualify for certification at the free rate.

Overall, the analyses of characteristics associated with administrative error rates suggest that lower income households and households participating in means-tested programs are less prone to administrative errors. This finding may follow from the relatively straightforward process of certifying students in very low-income households compared to students in higher income households.

7.5 Certification Error in CEP Schools

Certification errors in CEP schools occur due to errors in calculating the ISP. The analyses examined potential characteristics that may relate to higher or lower CEP certification error rates. The subgroups for these comparisons were defined based on characteristics of CEP schools, such as the region, grade level, and student enrollment. We also examined potential differences between schools in terms of the policy and procedural characteristics that may relate to the determination of the ISP. These included the number of sources that the school used to determine the ISP and whether the SFA consisted entirely of CEP schools or a mix of CEP and non-CEP schools.

The bivariate subgroup comparisons suggest that there may be significant differences in the CEP error rates based on some of the characteristics examined. Table 7-6 summarizes the average CEP certification error rates for specified subgroups. Schools in some regions, such as the Mid-Atlantic, Southwest, and Mountain Plains, appeared to have lower CEP certification error rates than others. Schools in SFAs in which only some of the schools used CEP to certify students appeared to have lower CEP certification error rates compared to SFAs that used CEP in all schools.

Table 7-6. Bivariate analysis of the characteristics associated with CEP error

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Region						
Northeast	15	7.86 (5.21) [-2.31, 18.13]	115	1.78 (0.76) [0.28, 3.28]	0.25	130
Mid-Atlantic	5	0.00 (0.00) [0.00, 0.00]	125	2.84 (1.05) [0.76, 4.91]	0.01***	130
Southeast	52	3.36 (1.88) [-.34, 7.06]	78	2.39 (1.16) [0.10, 4.68]	0.66	130
Midwest	15	2.14 (1.94) [-1.7, 5.96]	115	2.77 (1.13) [0.55, 5.00]	0.78	130
Southwest	21	0.00 (0.00) [0.00, 0.00]	109	3.34 (1.22) [0.93, 5.76]	0.01***	130
Mountain Plains	7	0.00 (0.00) [0.00, 0.00]	123	2.80 (1.03) [0.76, 4.83]	0.01***	130
Western	15	2.91 (1.62) [-.28, 6.10]	115	2.63 (1.05) [0.57, 4.69]	0.89	130
School grade level						
Elementary	83	2.26 (0.84) [0.59, 3.92]	47	3.61 (1.86) [-.06, 7.27]	0.42	130
Middle	21	5.51 (3.28) [-.96, 12.0]	109	2.20 (0.79) [0.64, 3.75]	0.29	130
Secondary/combined/ungraded	26	1.92 (0.87) [0.21, 3.63]	104	2.78 (1.07) [0.67, 4.89]	0.37	130

Table 7-6. Bivariate analysis of the characteristics associated with CEP error (continued)

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI]	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Number of sources used to calculate ISP						
Sources: 3 or less	7	2.72 (2.18) [-1.6, 7.02]	103	2.64 (1.10) [0.47, 4.81]	0.97	110
Sources: 4 to 6	40	3.84 (1.78) [0.33, 7.36]	70	1.84 (1.51) [-1.1, 4.83]	0.42	110
Sources: Greater than 6	63	1.75 (1.66) [-1.5, 5.03]	47	3.71 (1.57) [0.60, 6.81]	0.43	110
Specific sources used to calculate ISP[c]						
TANF	109	2.66 (1.05) [0.59, 4.72]	1	0.00 (0.00) [0.00, 0.00]	0.01***	110
Migrant	101	2.09 (1.14) [-.16, 4.34]	9	10.1 (5.29) [-.38, 20.5]	0.15	110
Homeless	103	2.76 (1.16) [0.48, 5.04]	7	1.54 (1.17) [-.77,3.84]	0.46	110
Runaway	103	2.64 (1.10) [0.47, 4.81]	7	2.72 (2.18) [-1.6, 7.02]	0.97	110
Medicaid	57	2.78 (1.70) [-.57, 6.14]	53	2.50 (1.23) [0.06, 4.93]	0.89	110

Table 7-6. Bivariate analysis of characteristics associated with CEP error (continued)

Characteristics	Presence of characteristic: Yes – Sample size (schools)	Yes – % error rate[a] (SE) (lower CI, upper CI]	No – Sample size (schools)	No – % error rate[a] (SE) (lower CI, upper CI]	t-test P-value	Total sample size[b]
School enrollment						
School enrollment: Less than 500	39	2.88 (1.71) [-.49, 6.25]	91	2.40 (0.81) [0.81, 4.00]	0.8	130
School enrollment: 500 to 999	70	2.01 (0.73) [0.56, 3.46]	60	3.10 (1.63) [-.11, 6.31]	0.55	130
School enrollment: 1,000 to 1,999	20	5.09 (2.40) [0.36, 9.83]	110	2.49 (0.96) [0.59, 4.39]	0.23	130
School enrollment: Greater than 2,000[d]	1	0.00 (0.00) [0.00, 0.00]	129	2.66 (0.98) [0.72, 4.60]	–	130
CEP participation						
All schools in SFA are CEP	49	5.09 (2.05) [1.05, 9.14]	54	0.38 (0.23) [-.07, 0.83]	0.02**	103
Some schools in SFA are CEP	54	0.38 (0.23) [-.07, 0.83]	49	5.09 (2.05) [1.05, 9.14]	0.02**	103

Source: APEC-III CEP data collection.

Notes: Analysts tested each variable for the significance of the difference between the average CEP error rate in schools that meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: *** p<0.01, ** p<0.05. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals of the weighted mean.

[a] The Error Rate is the weighted average error in the free claiming percentage of CEP schools (observed versus actual). Standard errors are in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[b] Sample sizes may differ due to item nonresponse.

[c] SNAP is not included in these bivariate analyses because all sampled schools used SNAP as a source to calculate the ISP.

[d] T-tests do not provide reliable tests of significance when one subgroup is very small; therefore, T-test results are not shown when one subgroup has an n less than 5. For tests of significance for all subgroups see the multivariate analyses.

Summary: This table provides the bivariate analyses of certification error rates in CEP schools by selected school and SFA characteristics. Yes= with characteristic. N = without characteristic.

The results of the multivariate model of CEP certification error appear in Table 7-7. The model estimates the effect of each characteristic on CEP certification error rates using weighted Ordinary Least Squares (OLS) regression. We use OLS regression for multivariate analyses of CEP certification errors because these errors are percentage points (a continuous outcome), and OLS is an appropriate estimation method for models with continuous outcome variables.[49] When controlling for each specified characteristic simultaneously, only a couple of characteristics have a significant relationship with CEP certification error rates. Schools in SFAs in which only some schools use CEP had significantly lower error rates (by an average of 3.2 percentage points) compared to schools in SFAs in which all schools used CEP. Compared to schools in the Northeast region, schools in the Southwest region had lower CEP certification error rates (by an average of 16 percentage points). None of the other regions and no other characteristics showed significantly different CEP error rates when controlling for all of the characteristics in the multivariate model.

Table 7-7. The effect of selected characteristics on certification error rates in CEP schools

Characteristics	CEP error rate
Region (base=Northeast)	
Mid-Atlantic	-12% (12.5%)
Southeast	-7.3% (11.9%)
Midwest	-13% (11.8%)
Southwest	-16%* (9.03%)
Mountain Plains	-14% (9.76%)
Western	-7.9% (11.5%)
School grade level (base=Elementary)	
Middle	-2.3% (4.56%)
Secondary/combined/ungraded	-4.4% (2.91%)

[49] OLS is appropriate for dependent variables that are continuous and normally distributed. CEP error rates are continuous but not perfectly normally distributed because they include a large proportion of observations below 10 percent. We attempted to use another regression method, Fractional Probit regression, which is more appropriate for estimating continuous dependent variables bounded between 0 and 100 percent (using the fracreg probit command in STATA 16). However, due to the small number of observations (130 CEP schools) and low variability in the outcome variable, the Fractional Probit regression did not converge and therefore cannot produce reliable coefficient estimates. OLS is a more appropriate estimation technique for smaller samples such as the sample of CEP schools. Therefore, we show the OLS regression estimates because they provide a reasonable approximation of the multivariate relationship between the characteristics and error rates.

Table 7-7. The effect of selected characteristics on certification error rates in CEP schools (continued)

Characteristics	CEP error rate
Number of sources used to calculate ISP (base=3 or less)	
Sources: 4 to 6	4.39% (4.95%)
Sources: Greater than 6	-.17% (3.98%)
CEP participation (base=all schools in SFA are CEP)	
Some schools in SFA are CEP	-3.2%* (1.94%)
School enrollment (base=less than 500)	
School enrollment: 500 to 999	-.40% (3.14%)
School enrollment: 1,000 to 1,999	2.94% (5.75%)
School enrollment: Greater than 2,000	<0.01% (0.00%)
Model Intercept	
Intercept	13.7% (12.9%)
Sample size (schools)	110
R-square	0.35%

Source: APEC-III CEP data, weighted.

Notes: The dependent variable is the percentage error rate in the free claiming percentage in CEP schools. Cell entries are weighted OLS regression coefficients with standard errors in parentheses. The coefficients represent the estimated average percentage point change in error due to the corresponding variable, holding all else constant. Estimates were generated using SAS PROC SURVEYREG.

* p<0.1

Summary: This table provides the results of the multivariate analyses of characteristics expected to relate to certification error in CEP schools.

7.6 Meal Claiming Error

Meal claiming errors occur due to incorrect assessments of the reimbursable status of a tray by cafeteria staff. The nature of these errors suggest that characteristics of the school, such as staff training, use of OVS, and the number of cashier lines may relate to the prevalence of meal claiming errors at a school. The subgroup analyses examine the relationship between the use of OVS, the number of cashiers, use of a food service management company, staff training, and school enrollment and meal claiming error rates. The meal claiming error rates in this section are gross error rates (any error, whether an underclaim or an overclaim.)

Tables 7-8 and 7-9 summarizes the average NSLP and SBP gross meal claiming error rates for schools by subgroup, and report the results of bivariate tests of significance. Table 7-10 provides the

results of multivariate analyses of NSLP and SBP meal claiming error rates, controlling for all characteristics of interest simultaneously. The bivariate tests reveal some potentially significant differences among subgroups. For NSLP meal claiming error (Table 7-8), cafeterias not using OVS had a higher than average meal claiming error rate, and cafeterias with higher than average numbers of cashiers had lower than average meal claiming error rates. For SBP meal claiming error (Table 7-9), cafeterias using a food service management company had higher meal claiming errors than others.

Multivariate analyses of meal claiming error rates reveal statistically significant relationships while controlling for multiple characteristics simultaneously. Meal claiming errors are percentage points, a continuous outcome; therefore, as we did for the multivariate analyses of certification rates in CEP schools, we used weighted OLS regressions. Table 7-10 presents the results of two multivariate OLS regression for meal claiming errors for NSLP lunches and SBP breakfasts. The multivariate analyses reveal that, when controlling for each of the characteristics simultaneously, few characteristics are significantly related to meal claiming error rates. The use of OVS has no significant relationship with either NSLP or SBP meal claiming error rates when controlling for the other characteristics in the model. For NSLP lunches, schools using more cashiers on average had lower average meal claiming error rates for NSLP lunches, but did not have statistically different error rates from others for SBP breakfasts. This may reflect the fact many more children participate in lunch than breakfast, which may create a time pressure on the cashiers that does not exist during breakfast. Thus, more cashiers provide more resources and support to manage the meal period efficiently. Compared to elementary schools, secondary/combined/ungraded schools had higher meal claiming error rates, on average, for both NSLP and SBP meals. In the multivariate analyses, the use of a food service management company and staff training had no significant relationship with meal claiming error rates in either program. Furthermore, the percentage of students certified for free or reduced-price meals had no significant relationship with meal claiming errors.

Table 7-8. Bivariate analysis of the characteristics associated with meal claiming error, NSLP

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Offer versus serve						
Uses offer versus serve	629	7.50 (0.01) [5.25,9.75]	26	19.44 (0.05) [9.25,29.63]	0.03**	655
Average number of cashiers						
Average number of cashiers: 1[c]	428	8.19 (1.33) [5.55,10.8]	227	8.48 (1.52) [5.49,11.5]	0.89	655
Average number of cashiers: 2 or 3	197	9.05 (1.62) [5.86,12.2]	458	8.04 (1.30) [5.48,10.6]	0.62	655
Average number of cashiers: 4 or 5	24	3.12 (1.65) [-0.14,6.38]	631	8.35 (1.09) [6.20,10.5]	0.01***	655
Average number of cashiers: 6 or more	3	0.96 (1.17) [-1.4,3.27]	652	8.28 (1.08) [6.15,10.4]	<0.01***	655
Use of food service management company						
Uses food service management company	113	10.1 (3.51) [3.23,17.1]	439	5.75 (0.79) [4.19,7.30]	0.22	552
Staff training						
SFA required mandatory staff training during the past 12 months	458	7.23 (1.28) [4.70,9.75]	27	5.23 (2.98) [-0.65,11.1]	0.52	485
School enrollment						
School enrollment: Less than 500	192	7.86 (1.70) [4.51,11.2]	451	8.44 (1.01) [6.45,10.4]	0.76	643
School enrollment: 500 to 999	305	7.75 (1.20) [5.37,10.1]	338	8.34 (1.47) [5.43,11.2]	0.74	643

Table 7-8. Bivariate analysis of the characteristics associated with meal claiming error, NSLP (continued)

Characteristics	Presence of characteristic: Yes – Sample size (schools)	Yes – % error rate[a] (SE) (lower CI, upper CI)	No – Sample size (schools)	No – % error rate[a] (SE) (lower CI, upper CI)	t-test P-value	Total sample size[b]
School enrollment (continued)						
School enrollment: 1,000 to 1,999	99	10.5 (1.95) [6.70,14.4]	544	7.92 (1.16) [5.63,10.2]	0.24	643
School enrollment: Greater than 2,000	47	11.7 (3.93) [3.97,19.5]	596	8.04 (1.10) [5.87,10.2]	0.37	643
School grade level						
Elementary	355	7.04 (1.18) [4.71,9.37]	300	10.22 (1.76) [6.74,13.69]	0.11	655
Middle	126	8.67 (1.31) [6.08,11.27]	529	8.17 (1.26) [5.69,10.65]	0.78	655
Secondary/combined/ungraded	174	11.44 (2.92) [5.68,17.19]	481	7.39 (0.96) [5.49,9.29]	0.16	655
Percentage of students certified for free/reduced meals						
Less than or equal to 25 percent	41	7.13 (2.13) [2.93,11.33]	614	8.43 (1.19) [6.08,10.79]	0.60	655
26 to 50 percent	142	8.81 (2.63) [3.62,13.99]	513	7.99 (1.02) [5.98,10.00]	0.77	655
51 to 75 percent	193	10.01 (1.90) [6.26,13.76]	462	7.60 (1.29) [5.05,10.15]	0.30	655
Greater than 75 percent	279	6.32 (1.13) [4.10,8.55]	376	8.95 (1.41) [6.17,11.73]	0.14	655

Source: APEC-III study, weighted.

Notes: Analysts tested each variable for the significance of the difference between the average NSLP meal claiming error rate in schools that meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: *** p<0.01, ** p<0.05. Standard errors are in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[a] Error rates are calculated as the average percentage of trays in error by school.

[b] Sample sizes may differ due to item nonresponse to survey questions.

[c] Meals with one cashier include meals served in nontraditional settings such as classrooms.

Table 7-9. Bivariate analysis of the characteristics associated with meal claiming error, SBP

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Offer versus serve						
Uses offer versus serve	597	12.45 (0.01) [9.69,15.22]	48	19.75 (0.06) [7.91,31.59]	0.24	645
Average number of cashiers						
Average number of cashiers: 1[c]	508	13.0 (1.59) [9.82,16.1]	137	14.7 (1.97) [10.8,18.5]	0.49	645
Average number of cashiers: 2 or 3	99	12.9 (2.01) [8.91,16.9]	546	13.2 (1.54) [10.2,16.2]	0.9	645
Average number of cashiers: 4 or 5	20	24.3 (10.4) [3.83,44.8]	625	13.0 (1.44) [10.2,15.9]	0.29	645
Average number of cashiers: 6 or more	14	14.2 (4.84) [4.69,23.8]	631	13.1 (1.44) [10.3,16.0]	0.82	645
Use of food service management company						
Uses food service management company	112	21.9 (4.77) [12.4,31.3]	430	11.0 (1.46) [8.09,13.9]	0.03**	542
Staff trainings						
SFA required mandatory staff training during the past 12 months	451	13.9 (1.73) [10.5,17.3]	25	12.8 (9.23) [-5.4,31.0]	0.91	476
School enrollment						
School enrollment: Less than 500	188	12.3 (2.12) [8.11,16.5]	445	14.3 (1.27) [11.8,16.8]	0.34	633
School enrollment: 500 to 999	301	13.9 (1.56) [10.8,16.9]	332	12.9 (1.81) [9.28,16.4]	0.61	633

Table 7-9. Bivariate analysis of the characteristics associated with meal claiming error, SBP (continued)

Characteristics	Presence of characteristic: Yes – Sample size (schools)	Yes – % error rate[a] (SE) (lower CI, upper CI)	No – Sample size (schools)	No – % error rate[a] (SE) (lower CI, upper CI)	t-test P-value	Total sample size[b]
School enrollment (continued)						
School enrollment: 1,000 to 1,999	98	17.0 (2.86) [11.3,22.6]	535	12.9 (1.57) [9.81,16.0]	0.22	633
School enrollment: Greater than 2,000	46	11.8 (2.59) [6.69,16.9]	587	13.3 (1.49) [10.3,16.2]	0.63	633
School grade level						
Elementary	353	12.14 (1.77) [8.65,15.63]	292	14.78 (1.83) [11.18,18.39]	0.24	645
Middle	122	14.28 (2.13) [10.07,18.49]	523	12.94 (1.72) [9.55,16.33]	0.64	645
Secondary/combined/ungraded	170	15.17 (3.11) [9.04,21.31]	475	12.60 (1.43) [9.78,15.43]	0.41	645
Percentage of students certified for free/reduced meals						
Less than or equal to 25 percent	38	15.15 (3.57) [8.10,22.20]	607	12.94 (1.50) [9.99,15.89]	0.56	645
26 to 50 percent	140	14.25 (3.34) [7.66,20.84]	505	12.61 (1.35) [9.95,15.27]	0.64	645
51 to 75 percent	190	13.02 (2.17) [8.75,17.30]	455	13.22 (1.73) [9.82,16.63]	0.94	645
Greater than 75 percent	277	11.22 (1.37) [8.52,13.92]	368	13.89 (1.87) [10.20,17.59]	0.23	645

Source: APEC-III study, weighted.

Notes: Analysts tested each variable for the significance of the difference between the average NSLP meal claiming error rate in schools that meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: ** p<0.05 Standard errors are in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[a] Error rates are calculated as the average percentage of trays in error by school.

[b] Sample sizes may differ due to item nonresponse to survey questions.

[c] Meals with one cashier include meals served in nontraditional settings such as classrooms.

Table 7-10. The effect of selected characteristics on meal claiming error rates

Characteristics	NSLP	SBP
Offer versus serve		
Uses Offer versus serve	-3.20% (3.64%)	-7.13% (8.17%)
Average number of cashiers (base=1)		
Average number of cashiers: 2 or 3	-0.75% (2.99%)	1.78% (2.76%)
Average number of cashiers: 4 or 5	-5.10%* (2.34%)	13.61% (13.28%)
Average number of cashiers: 6 or more	-10.24%* (3.67%)	2.21% (7.17%)
Use of food service management company		
Uses food service management company	5.12% (4.37%)	8.83% (7.23%)
Staff training		
SFA required mandatory staff training during the past 12 months	1.31% (2.99%)	2.17% (7.81%)
School enrollment (base=less than 500)		
School enrollment: 500 to 999	1.89% (1.82%)	-0.11% (3.07%)
School enrollment: 1,000 to 1,999	0.53% (3.01%)	1.47% (5.21%)
School enrollment: Greater than 2,000	0.51% (3.68%)	-6.10% (5.81%)
School grade level (base=Elementary)		
Middle	2.72% (1.73%)	3.41% (3.03%)
Secondary/combined/ungraded	5.41%* (2.69%)	7.50%* (4.14%)
Free/reduced certified students		
Percentage students free/reduced certified	-0.04% (0.05%)	-0.11% (0.08%)
Model Intercept		
Intercept	11.18%* (6.56%)	27.53%* (16.31%)
Sample size (schools)	485	476
R-square	0.06%	0.08%

Source: APEC-III meal observation data and SFA Director Survey data, weighted.

Notes: The dependent variable is a percentage of trays in error due to meal claiming error for the school (gross error, i.e., including both overclaims and underclaims). Cell entries are weighted OLS regression coefficients with standard errors in parentheses. The coefficients represent the estimated average percentage point change in error due to the corresponding variable, holding all else constant. Estimates were generated using SAS PROC SURVEYREG.

* p<0.1

Summary: This table provides the results of multivariate analyses of characteristics expected to relate to meal claiming error in the NSLP and SBP.

7.7 Aggregation Error

Aggregation errors are math errors that occur in the process of summing and transmitting meal counts from schools to SFAs and from SFAs to State agencies. Although the nature of this type of error suggests that many of the mistakes are random, it is possible that certain types of schools and SFAs are more prone to aggregation errors than others. For example, larger SFAs containing many different schools may face a more complex task in tallying and submitting meal counts, presenting more of an opportunity for aggregation error. The processes used to sum and report meal counts may also relate to the incidence of aggregation error; for example, schools and SFAs may use manual, automated, or a combination of manual and automated processes to sum and report meal counts. The following analyses examine the relationships between these selected characteristics and the level of aggregation error, separately for NSLP and SBP meal counts.

Tables 7-11 and 7-12 summarize the average error rates due to aggregation error for NSLP and SBP meal counts, respectively. The average error rates reported in these tables are the true aggregation error rates. Recall that the true aggregation error rate is the comparison between the school meal count recorded by the SFA and the State agency's record of the meal count. The true aggregation error rate is the outcome of interest for these analyses because this measure provides the best estimate of aggregation errors that resulted in improper payments. This is because errors made at the intervening aggregation levels may cancel out.

The tables show analyses of average aggregation error rates by subgroups reflecting SFA student enrollment, Provision 2/3 status, number of schools in the SFA, the process for aggregation, receipt of additional subsidies as part of the reimbursement, and the percentages of meals reimbursed at the free rate. The comparisons reveal no statistically significant differences in the error rates for any of the subgroups of interest. Generally, this finding is consistent with an interpretation of aggregation error as a random occurrence that is not directly related to any of the examined characteristics of schools or SFAs.

Table 7-11. Bivariate analysis of characteristics associated with true aggregation error, NSLP

Characteristics	Presence of characteristic: Yes — Sample size (schools)	Yes — % error rate[a] (SE) (lower CI, upper CI)	No — Sample size (schools)	No — % error rate[a] (SE) (lower CI, upper CI)	t-test P-value	Total sample size[b]
Student enrollment (SFA)						
Student enrollment: Fewer than 1,000	14	5.52 (7.36) [-9.0,20.0]	380	-0.07 (0.34) [-0.75,0.61]	0.45	394
Student enrollment: 1,000 to 4,999	104	0.27 (0.62) [-0.95,1.48]	290	1.37 (1.73) [-2.0,4.79]	0.55	394
Student enrollment: 5,000 to 9,999	45	0.38 (0.91) [-1.4,2.18]	349	1.09 (1.30) [-1.5,3.66]	0.66	394
Student enrollment: 10,000 to 19,999	53	-0.69 (1.26) [-3.2,1.79]	341	1.24 (1.33) [-1.4,3.87]	0.29	394
Student enrollment: 20,000 to 49,999	84	-0.33 (0.72) [-1.8,1.10]	310	1.27 (1.40) [-1.5,4.03]	0.31	394
Student enrollment: 50,000 or more	94	-0.38 (0.25) [-0.86,0.11]	300	1.22 (1.35) [-1.5,3.89]	0.25	394
Provision 2/3 status						
Provision 2/3 for NSLP	21	0.16 (0.17) [-.18,0.50]	485	1.57 (1.21) [-0.81,3.95]	0.25	506
Number of schools in SFA						
SFA administers NSLP/SBP for more than one school district or local entity	25	-0.68 (1.75) [-4.1,2.77]	391	2.01 (1.50) [-0.94,4.96]	0.24	416
Total number of schools offering either NSLP or SBP greater than 5	337	-0.08 (0.47) [-1.0,0.84]	48	0.02 (0.02) [-0.02,0.06]	0.83	385

Table 7-11. Bivariate analysis of the characteristics associated with true aggregation error, NSLP (continued)

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Aggregation process						
POS aggregation - Manual process	3	0.00 (0.00) [0.00,0.00]	407	1.07 (1.22) [-1.3,3.49]	0.38	410
POS aggregation - Automated process	220	0.08 (0.42) [-0.76,0.91]	190	2.51 (2.89) [-3.2,8.20]	0.41	410
POS aggregation - Combination of manual and automated processes	187	2.63 (3.03) [-3.3,8.60]	223	0.08 (0.41) [-0.73,0.89]	0.41	410
School-to-SFA aggregation - Automated process	280	-0.07 (0.34) [-0.75,0.61]	123	3.86 (4.05) [-4.1,11.9]	0.33	403
School-to-SFA aggregation - Combination of manual and automated processes	123	3.86 (4.05) [-4.1,11.9]	280	-0.07 (0.34) [-0.75,0.61]	0.33	403
SFA-to-State aggregation - Manual process	6	0.00 (0.00) [0.00,0.00]	396	1.09 (1.24) [-1.4,3.52]	0.38	402
SFA-to-State aggregation - Automated process	324	1.50 (1.52) [-1.5,4.50]	78	-0.69 (0.47) [-1.6,0.24]	0.17	402
SFA-to-State aggregation - Combination of manual and automated processes	72	-0.72 (0.49) [-1.7,0.25]	330	1.48 (1.51) [-1.5,4.46]	0.16	402
Additional subsidies						
SFA receives additional 2 cent subsidy for NSLP	301	1.92 (1.61) [-1.3,5.10]	205	1.21 (1.62) [-2.0,4.41]	0.76	506

Table 7-11. Bivariate analysis of the characteristics associated with the true aggregation error, NSLP (continued)

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Percentage of lunches reimbursed at free rate						
Less than 50 percent free lunches	90	2.45 (2.80) [-3.1,7.98]	416	1.03 (1.07) [-1.1,3.15]	0.63	506
Greater than 50 percent free lunches	416	1.03 (1.07) [-1.1,3.15]	90	2.45 (2.80) [-3.1,7.98]	0.63	506

Source: APEC-III study, weighted (SFA Director Survey combined with meal count data).

Notes: Analysts tested each variable for the significance of the difference between the average NSLP aggregation error rate in schools who meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. Standard errors are in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[a] Error rates are calculated as the average net improper payments due to aggregation error by school for NSLP.

[b] Sample sizes may differ due to item nonresponse to survey questions.

Summary: This table provides bivariate analyses of characteristics expected to relate to improper payment rates due to aggregation error in the NSLP by selected characteristics. Yes= with characteristic. N = without characteristic.

Table 7-12. Bivariate analysis of the characteristics associated with the true aggregation error, SBP

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Student enrollment (SFA)						
Student enrollment: Fewer than 1,000	14	7.02 (10.7) [-14,28.1]	392	0.79 (0.56) [-0.32,1.90]	0.56	406
Student enrollment: 1,000 to 4,999	104	1.15 (0.94) [-0.71,3.00]	302	2.03 (1.79) [-1.5,5.56]	0.66	406
Student enrollment: 5,000 to 9,999	48	1.06 (1.48) [-1.9,3.97]	358	1.85 (1.42) [-0.95,4.65]	0.7	406
Student enrollment: 10,000 to 19,999	57	0.25 (1.20) [-2.1,2.62]	349	2.00 (1.46) [-0.89,4.88]	0.35	406
Student enrollment: 20,000 to 49,999	90	1.31 (2.00) [-2.6,5.25]	316	1.86 (1.49) [-1.1,4.80]	0.83	406
Student enrollment: 50,000 or more	93	-.27 (0.18) [-0.63,0.09]	313	2.11 (1.50) [-0.85,5.08]	0.12	406
Provision 2/3 status						
Provision 2/3 for SBP	27	2.56 (1.91) [-1.2,6.33]	491	1.10 (1.14) [-1.1,3.34]	0.51	518
SFA size						
Total number of schools offering either NSLP or SBP greater than 5	350	0.54 (0.64) [-0.73,1.81]	47	1.05 (1.12) [-1.2,3.26]	0.69	397
SFA administers NSLP/SBP for more than one school district or local entity	25	0.95 (1.40) [-1.8,3.72]	402	1.31 (1.41) [-1.5,4.09]	0.86	427

Table 7-12. Bivariate analysis of the characteristics associated with the true aggregation error, SBP (continued)

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Aggregation process						
POS aggregation - Manual process	3	2.18 (2.94) [-3.6,7.98]	421	1.30 (1.37) [-1.4,4.00]	0.79	424
POS aggregation - Automated process	232	-0.00 (1.09) [-2.2,2.16]	192	3.14 (2.76) [-2.3,8.58]	0.29	424
POS aggregation - Combination of manual and automated processes	189	3.18 (2.88) [-2.5,8.87]	235	0.07 (1.06) [-2.0,2.16]	0.31	424
School-to-SFA aggregation - Automated process	287	-0.10 (0.93) [-1.9,1.74]	130	4.62 (3.84) [-3.0,12.2]	0.23	417
School-to-SFA aggregation - Combination of manual and automated processes	130	4.62 (3.84) [-3.0,12.2]	287	-0.10 (0.93) [-1.9,1.74]	0.23	417
SFA-to-State aggregation - Manual process	6	-0.11 (0.15) [-0.42,0.19]	410	1.35 (1.39) [-1.4,4.09]	0.29	416
SFA-to-State aggregation - Automated process	339	1.32 (1.68) [-2.0,4.65]	77	1.43 (1.49) [-1.5,4.36]	0.96	416
SFA-to-State aggregation - Combination of manual and automated processes	71	1.49 (1.55) [-1.6,4.54]	345	1.31 (1.67) [-2.0,4.60]	0.94	416
Additional subsidies						
School eligible to receive additional SBP Severe Needs reimbursement	441	2.14 (1.38) [-0.57,4.86]	77	-1.2 (1.37) [-3.9,1.51]	0.09*	518

Table 7-12. Bivariate analysis of the characteristics associated with the true aggregation error, SBP (continued)

Characteristics	Presence of characteristic				t-test P-value	Total sample size[b]
	Yes		No			
	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)	Sample size (schools)	% error rate[a] (SE) (lower CI, upper CI)		
Percentage of lunches reimbursed at the free rate						
Less than 50 percent free breakfasts	32	7.78 (8.27) [-8.5,24.1]	486	0.34 (0.62) [-0.89,1.57]	0.37	518
Greater than 50 percent free breakfasts	486	0.34 (0.62) [-0.89,1.57]	32	7.78 (8.27) [-8.5,24.1]	0.37	518

Source: APEC-III study, weighted (SFA Director Survey combined with meal count data).

Notes: Analysts tested each variable for the significance of the difference between the average SBP aggregation error rate in schools that meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: * p<0.1. Standard errors are in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[a] Error rates are calculated as the average net improper payments due to aggregation error by school for SBP.

[b] Sample sizes may differ due to item nonresponse to survey questions.

Summary: This table provides a bivariate analyses of characteristics expected to relate to improper payment rates due to aggregation error in the SBP by selected characteristics. Yes= with characteristic. N = without characteristic.

7.8 Summary

The subgroup analyses presented in this chapter examined characteristics of households, schools, and SFAs as they relate to each type of error. These subgroup analyses were new to APEC-III and were not conducted in prior APEC studies. They suggest some potential strategies to reduce errors in the future:

1. **Certification error due to reporting error in non-CEP schools:** Households with higher household incomes were significantly more likely to have a certification error due to reporting error. These errors likely occurred due to households making mistakes in reporting all income sources on the application. This finding suggests that improvements to the application process that clarifies the types of income to report may reduce reporting errors. Also, encouraging households to report participation in means-tested programs that may confer categorical eligibility may also reduce reporting errors. Volume 2 on Qualitative Analyses provides further discussion on household perception on the types of income to report.

2. **Certification error due to administrative error in non-CEP schools:** Households that participated in a means-tested program that confers categorical eligibility or eligibility for direct certification were much less likely than other households to have a certification error due to administrative error. Also, among those not participating in means-tested programs, households with higher incomes relative to the poverty level were more likely to have an administrative error. This suggests that many administrative errors are due to staff incorrectly recording a student as directly certified or improperly assessing household income. Providing more detailed instructions and/or automated procedures when verifying and documenting direct certification status, as well as when assessing information on the application regarding household income and size, may reduce administrative errors in future years. Volume 2 on Qualitative Analyses includes a discussion of common challenges for SFAs with application processing and direct certification.

3. **Certification error in CEP schools:** Only one characteristic that may relate to CEP schools' certification process has a significant relationship with CEP error rates. Schools located in SFAs that participate in CEP districtwide had a higher CEP certification error rate, on average, compared to schools located in SFAs in which individual schools, or groups of schools participate in CEP. It is possible that SFAs that participate in CEP districtwide use different or generic processes that are more prone to error compared to SFAs in which only individual or groups of schools participate in CEP. The latter may use school-specific processes to make their own determination of the ISP. For example, schools that calculate an ISP for their own students may be better able to detect and correct errors, such as changes in enrollment or incorrect matches. On the other hand, if an SFA determines ISP for the entire district, that SFA may have more trouble detecting and correcting errors due to the large numbers of school and student records that the staff must match with means-tested program records.

4. **Aggregation error:** None of the examined characteristics related significantly to aggregation error. Efforts to reduce aggregation error, therefore, may focus on additional staff training to reduce math errors, but the findings do not suggest that these efforts should focus on any specific type of school or SFA or that any specific procedure results in greater aggregation error rates. Volume 2 on Qualitative Analyses presents a discussion on how increased automation has contributed to reduced aggregation error.

5. **Meal claiming error:** For NSLP meals, schools that had more cashiers on average tended to have lower meal claiming error rates than schools that used one cashier. Additional cashiers provide more resources and help manage the demands of the meal period more efficiently. Schools may use one cashier in smaller cafeteria settings, and when serving meals in a nonstandard setting such as a classroom or hallway. This suggests that these smaller and nonstandard settings are more prone to meal claiming errors than larger cafeteria settings, or cafeterias with more cashiers. Increased guidelines, staff training, resources, and automated processes when serving meals in nonstandard settings may reduce meal claiming error rates. Volume 2 on Qualitative Analyses includes a discussion of common challenges for meals served outside of the classroom. Furthermore, the multivariate analyses indicate that secondary schools have higher meal claiming error rates on average than elementary schools, suggesting that older students and secondary school cashiers may have more difficulty following the meal pattern requirements than younger students and elementary school cashiers. More targeted guidance for secondary schools may reduce the incidence of meal claiming error in these schools.

8. Substudy Among SFAs Using Different Implementation Strategies for Certification

Assessing the certification status of students is a complex task. School Food Authorities (SFAs) face different challenges to accommodate diverse household backgrounds. Therefore, SFAs adopt different implementation strategies, such as the use of online versus hard-copy (paper) applications, different administrative software solutions, and the provision of assistance for households during the application process. This diversity provides an opportunity to examine potential factors that may lead to higher or lower error rates, which in turn may suggest strategies to reduce error rates in the future.

This chapter examines the relationship between SFA implementation strategies and certification error rates due to household reporting and administrative error. The analytic approach in this chapter allows for a direct analysis of SFA implementation characteristics and their association with error rates. Specifically, the analyses use **aggregate error rates calculated at the SFA level,** in contrast to those presented in Chapter 7, which examine errors at the student and school level, depending on the type of error.

8.1 Methodology

We explore the relationships between SFA-level characteristics of the application and certification process and observed reporting and administrative errors in non-Community Eligibility Provision (CEP) schools. The intent of these analyses is to provide insight in to the SFA characteristics and procedures that are associated with lower error rates.

Table 8-1 summarizes the variables used to define SFA characteristics of interest. We estimated SFA-level error rates that parallel our student and school-level reporting and administrative error rates. The SFA-level Reporting Error (REPERR) is the percentage of students in the SFA with a reporting error and the Administrative Error (ADMERR) is the percentage of students in the SFA with an administrative error. Both error rates are based on gross errors; that is, they consider any reporting or administrative error as an error, whether the error resulted in an overcertification or an undercertification.

The first group of variables, Household Application Experience (APPEXP), in theory, may relate to the ease or difficulty of the application process. These include factors such as the percentage of households that speak English at home, had difficulty with the application, and used an online application (e.g., online/electronic, hard-copy paper). We expect that these characteristics may affect reporting error rates.

The second group of variables, SFA Policy (POL), describe the SFA's process of collecting and assessing information used in the determination of certification status. These processes may relate to the occurrence of administrative error.

The third group of variables, SFA Policy –Verification, are drawn from the Food and Nutrition Service-742 (FNS-742) Verification Collection Report (VCR) data. These variables describe the SFA's verification procedures and results of the verification process (percentage changes in certification status, percentage did not respond). These characteristics may affect both reporting and administrative error rates.

Table 8-1. Summary of household application experience and SFA policy variables

Variable	Error rate analysis	
	REPERR	ADMERR
Household application experience (APPEXP)		
Percentage English is primary language spoken at home	X	
Percentage that used an electronic/online application	X	
Percentage that had a school official assist with completing application	X	
Percentage that found the application difficult	X	
Percentage of parents with more than high school education	X	
SFA Policy (POL)		
Accepts online applications		X
Accepts paper applications		X
Accepts a combination of online and paper applications		X
Uses Meals Plus software		X
Uses Horizon software		X
Uses other software		X
Direct certification method (district-level matching, letter method)		X
SFA Policy (POL) – Verification		
Used standard or alternative sampling for verification	X	X
Percentage changes by verification outcome (change in certification status, nonresponse, etc.)	X	X

Notes: X indicates that the variable is included in the bivariate and multivariate analyses of the error rate.

REPERR=Certification error due to reporting error in non-CEP schools.

ADMERR=Certification error due to administrative error in non-CEP schools.

We use bivariate and multivariate analyses to assess the relationships between the variables of interest and the error rates. The bivariate analyses compare the average error rates of the subgroups,

and make statistical comparisons using weighted t-tests. For variables of interest that are continuous, we defined categories based on ranges of the variable to form subgroups for comparison (e.g., 0%, 1% to 5%, etc.). This step was necessary for the bivariate analyses because these analyses compare the mean error rates for two groups based on a characteristic; therefore, we needed to define subgroups for comparison based on any characteristic measured as a continuous variable (e.g., percentages) prior to conducting the bivariate tests.

The multivariate analyses use weighted ordinary least squared (OLS) regressions to assess the simultaneous effects of the variables of interest on the error rates. The multivariate analyses are a more rigorous test of the statistical significance of the relationship between the variables of interest and the error rate than the bivariate analyses because the multivariate analyses account for the possibility that multiple factors influence error rates simultaneously. This multivariate approach provides a test of the relationship between each characteristic and the error rate, holding constant the other characteristics in the model.

8.2 Reporting Error

Table 8-2 presents the results of the bivariate analyses of reporting error. Table 8-3 provides the results of the multivariate analyses. For variables of interest that are continuous, the multivariate models indicate the average effect of a one-unit increase in the variable. For an explanatory variable that is a percentage, for example, the associated coefficient represents the average increase or decrease in the error rate associated with a one-percentage point increase in that variable.

Household Application Experience

Only one household application characteristic, the perceived difficulty of the application, has a **significant** relationship with reporting error rates at the SFA-level from both the bivariate and the multivariate analyses: the perceived difficulty of the application was the only variable tested that had a significant relationship with reporting error rates in both the bivariate and multivariate analyses. SFAs with higher percentages of parents who found the application process difficult also had higher reporting error rates, on average, than other SFAs. For each percentage point increase in the percentage of households that found the application difficult, the reporting error rate was 0.66 percentage points higher, on average. This means, for example, that an SFA with 10 percent

more households that found the application difficult had a reporting error rate 6.66 percentage points higher, on average, than other SFAs. No other household application experience variables had a significant relationship with reporting error rates in both the bivariate and the multivariate analyses, including the percentage of households within an SFA that applied online.

Table 8-2. Bivariate analysis of the association between SFA reporting error and household application experience and verification policy

Application experience or SFA policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)		
Household application experience - Applied online						
Percentage applied online: 0%	33	5.27 (4.50) [-3.63,14.17]	111	8.29 (1.28) [5.75,10.83]	0.52	144
Percentage applied online: 1% to 25%	34	11.24 (1.73) [7.81,14.67]	110	5.54 (3.12) [-0.64,11.73]	0.11	144
Percentage applied online: Greater than 25%	77	6.38 (1.68) [3.06,9.70]	67	6.31 (3.94) [-1.49,14.12]	0.99	144
Household application experience - Received assistance in completing the application						
Received assistance in completing application: 0%	57	2.13 (1.64) [-1.13,5.38]	87	14.54 (3.22) [8.17,20.92]	<0.01***	144
Received assistance in completing application: 1% to 25%	75	14.81 (3.46) [7.95,21.67]	69	2.81 (1.93) [-1.02,6.64]	<0.01***	144
Received assistance in completing application: Greater than 25%	12	12.81 (10.06) [-7.09,32.72]	132	6.02 (2.94) [0.19,11.84]	0.52	144
Household application experience - Parents with less than high school education						
Parent's education: Less than high school - 0%	29	2.50 (2.43) [-2.31,7.32]	116	11.91 (2.49) [6.99,16.84]	0.01**	145
Parent's education: Less than high school - 1% to 25%	67	13.13 (3.45) [6.30,19.95]	78	3.91 (2.61) [-1.26,9.08]	0.03**	145
Parent's education: Less than high school - greater than 25%	49	9.71 (2.52) [4.73,14.69]	96	5.76 (3.24) [-0.67,12.18]	0.33	145
Household application experience - Found the application difficult or very difficult						
Perceived difficulty of application: Very difficult or difficult - 0%	58	2.62 (1.89) [-1.13,6.36]	86	14.53 (3.34) [7.91,21.15]	<0.01***	144
Perceived difficulty of application: Very difficult or difficult - 1% to 5%	20	5.72 (3.21) [-0.64,12.07]	124	6.38 (3.24) [-0.02,12.79]	0.88	144

Table 8-2. Bivariate analysis of the association between SFA reporting error and household application experience and verification policy (continued)

Application experience or SFA policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)		
Household application experience - Found the application difficult or very difficult						
Perceived difficulty of application: Very difficult or difficult - greater than 5%	66	17.85 (3.82) [10.28,25.43]	78	2.96 (1.79) [-0.58,6.50]	<0.01***	144
Household application experience - English as a second language						
English as a second language: 0%	43	4.75 (3.37) [-1.93,11.43]	102	10.77 (1.88) [7.05,14.49]	0.11	145
English as a second language: 1% to 25%	45	12.01 (2.65) [6.76,17.27]	100	5.29 (3.04) [-0.73,11.30]	0.09*	145
English as a second language: Greater than 25%	57	8.98 (2.29) [4.45,13.51]	88	6.01 (3.19) [-0.31,12.32]	0.45	145
SFA policy - Changed during verification (all changes)						
Percentage changed during verification - 0%	12	8.47 (4.68) [-0.78,17.73]	133	5.33 (3.78) [-2.16,12.82]	0.6	145
Percentage changed during verification – 1% to 24.9%	48	13.50 (4.13) [5.33,21.67]	97	5.45 (2.96) [-0.41,11.31]	0.12	145
Percentage changed during verification – 25% to 49.9%	55	7.03 (1.83) [3.42,10.65]	90	6.16 (3.72) [-1.20,13.52]	0.84	145
Percentage changed during verification - 50% to 74.9%	25	7.93 (1.45) [5.07,10.80]	120	6.19 (3.15) [-0.05,12.43]	0.62	145
Percentage changed during verification - 75% or greater	5	0.66 (8.50) [-16.17,17.49]	140	8.81 (2.35) [4.16,13.46]	0.36	145
SFA policy - Did not respond during verification						
Percentage did not respond during verification: 0%	24	4.32 (4.20) [-3.99,12.63]	121	9.61 (1.61) [6.43,12.79]	0.25	145
Percentage did not respond during verification: 1% to 24.9%	25	11.08 (3.89) [3.37,18.78]	120	6.07 (2.96) [0.21,11.93]	0.3	145
Percentage did not respond during verification: 25% to 49.9%	43	7.60 (2.44) [2.77,12.43]	102	6.11 (3.46) [-0.73,12.95]	0.73	145
Percentage did not respond during verification: 50% to 74.9%	38	10.91 (3.12) [4.73,17.10]	107	5.56 (3.18) [-0.74,11.86]	0.25	145

Table 8-2. Bivariate analysis of the association between SFA reporting error and household application experience and verification policy (continued)

Application experience or SFA policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)	Sample size (SFAs)	Error rate (SE) (lower CI, upper CI)		
SFA policy - Did not respond during verification						
Percentage did not respond during verification – 75% or greater	15	10.48 (1.84) [6.84,14.13]	130	6.16 (2.96) [0.30,12.01]	0.21	145

Source: APEC-III data, weighted.

Notes: Analysts tested each variable for the significance of the difference between the average certification error rate due to reporting error for students who met the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference was significant. P-values below 0.1 are highlighted with asterisks: *** p<0.01, ** p<0.05, * p<0.1. Standard errors (SE) are in parentheses. (Lower CI, Upper CI) are the lower and upper 95% Confidence Intervals.

[a] Sample sizes may differ due to item nonresponse to survey questions.

Table 8-3. Multivariate analyses of the association between SFA reporting error and household application experience and verification policy

Application experience or verification policy	Reporting error[a]
Household application experience	
Percentage applied online	-0.03 (0.05)
Percentage received assistance with application	0.11 (0.32)
Percentage parents with less than high school education	0.16 (0.12)
Percentage who found the application difficult	0.66* (0.36)
Percentage English as a second language	-0.17 (0.11)
Verification results and methods	
Percentage verified applications, benefits changed	-4.82 (5.37)
Percentage applications did not respond during verification	3.54 (7.39)
Used alternate random verification sample	-1.81 (4.11)
Constant	6.73* (3.75)
R-squared	0.35
Sample size (SFAs)	144

Source: APEC-III data, weighted, and FNS-742 Verification Data.

Notes:

[a] The dependent variable is certification error rate to reporting error. Cell entries are coefficients generated from weighted OLS regressions with standard errors in parentheses. Estimates were generated using Stata's svy: reg procedures.

* p<0.1

A few variables were positively related to the error rate and statistically significant in the bivariate analysis but not in the multivariate analysis. These variables included the percentage of household that received application assistance and the percentage of parents who did not have at least a high school education. There also was a very weak relationship between the percentage for whom English is a second language, and higher error rates.

In the case of assistance with the application process, the bivariate analyses suggest that a higher assistance level is associated with higher error rates. This does not necessarily mean that assistance results in higher error rates, for example, households that need assistance face more complex circumstances, and these circumstances may motivate them to seek assistance. When controlling for other aspects of the household application process in the multivariate analyses, the relationship between assistance and reporting error is no longer significant, suggesting that the receipt of assistance in the application process is not a driver of the error rate.

Based on the bivariate analyses, SFAs with more parents who did not have at least a high school education, had higher reporting error rates than others, on average. However, when controlling for the other aspects of the household application experience in the multivariate models, the relationship between parent's education and reporting error rates was no longer significant. This suggests that parent's education level does not affect reporting error rates when controlling for other SFA characteristics.

SFA Policy Verification Variables

Only the small subset of SFA policy variables associated with verification are likely to impact reporting errors. Neither of the two SFA policy verification variables had a strong relationship with reporting error rates, either independently or in the multivariate analyses controlling for other SFA characteristics. This suggests that responses to the verification process may not strongly predict overall reporting error percentages for the entire SFA. Instead, these variables may be more relevant at the individual level. Further, it is important to note that verification of applications occurred both before and after the household survey sampling for APEC-III, and applications were selected for verification both randomly and selectively for targeted subgroups. As a result, any potential relationship may have been diminished.

8.3 Administrative Error

Administrative errors result from errors made by staff during the determination of the certification status. These errors may occur due to a variety of issues, including making mistakes when assessing the information on the application, missing applications, or missing direct certification documentation. The processes the SFA uses to collect information from households and assess certification statuses may relate to administrative error rates.

Table 8-4 shows the results of the bivariate subgroup analyses of SFA policy characteristics that may relate to administrative error rates. Table 8-5 summarizes the results of the multivariate analyses of administrative error among SFAs using the same set of SFA policy characteristics.

To identify characteristics with a significant relationship with administrative error rates, we interpret the results of the bivariate and the multivariate analyses together. Characteristics that have a significant relationship with administrative error rates in both analyses are considered significant predictors of administrative error rates.

SFA Policy Variables

One SFA policy characteristic, the procedures for processing applications, showed a **significant** relationship with administrative error rates. SFAs that process hard-copy (paper) applications using a combination of manual and electronic processes have significantly higher administrative error rates compared to those that process applications either entirely electronically or entirely by paper. On average, when comparing subgroups, SFAs that process applications using a combination of paper and electronic methods have an administrative error rate of 16.64 percent, compared to 5.37 percent for SFAs that strictly use either paper or electronic methods instead of a combination.

The types of applications that the SFA accepts had a significant relationship with administrative error rates based on the multivariate analysis. The results of the multivariate analysis of administrative error rates (Table 8-5) indicate that SFAs that accepted applications via a vendor website had administrative error rates that were 12.32 percentage points lower on average compared to other SFAs.

The other SFA policy characteristics examined using the bivariate and multivariate analyses did not show a significant relationship with administrative error rates at the SFA level. These include direct

certification matching methods and software. The procedures that the SFA uses for direct certification matching (State-level matching, district-level matching, and/or the letter method) did not relate significantly to administrative error rates. SFAs use different software tools to assess student eligibility, such as Meals Plus, Horizon, and other options. The choice of software did not relate significantly to administrative error rates.

SFA Verification Policy Variables

Similarly, we found that SFA verification policy did not relate directly to administrative error rates at the SFA level.

Table 8-4. Certification error due to administrative error by SFA Policy variables and verification results

SFA Policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]		
SFA Policy (POL) – Application types accepted						
SFA accepts paper applications	135	8.24 (4.31) [-0.28,16.77]	8	11.64 (3.41) [4.89,18.39]	0.52	143
SFA accepts applications on website	82	14.06 (1.01) [12.05,16.07]	61	6.33 (5.08) [-3.73,16.38]	0.13	143
SFA accepts online applications via a vendor website	54	11.31 (2.36) [6.63,15.98]	89	7.86 (4.96) [-1.96,17.68]	0.53	143
SFA Policy (POL) – Software used						
SFA uses Horizon software	8	4.19 (2.41) [-0.58,8.96]	137	7.42 (3.22) [1.05,13.79]	0.43	145
SFA uses Meals Plus software	2	3.64 (21.37) [-38.66,45.94]	143	7.43 (3.24) [1.02,13.84]	0.86	145
SFA uses other software to process applications	48	12.32 (2.34) [7.69,16.96]	97	6.75 (3.46) [-0.09,13.60]	0.19	145
SFA Policy (POL) – Paper application processing						
SFA processes paper applications electronically	40	7.40 (1.41) [4.60,10.20]	102	8.45 (4.75) [-0.95,17.85]	0.83	142
SFA processes paper applications manually	41	5.23 (5.65) [-5.95,16.42]	101	14.00 (1.52) [10.98,17.01]	0.15	142

Table 8-4. Certification error due to administrative error by SFA Policy variables and verification results (continued)

SFA Policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]		
SFA Policy (POL) – Paper application processing						
SFA processes paper applications using a combination of electronic and manual processing	55	16.64 (1.65) [13.37,19.91]	87	5.37 (4.59) [-3.71,14.46]	0.03**	142
SFA Policy (POL) – Direct certification matching methods						
Direct certification method: State-level matching	131	8.23 (4.31) [-0.31,16.77]	8	10.09 (4.14) [1.89,18.29]	0.75	139
Direct certification method: district-level matching	86	7.09 (5.47) [-3.75,17.92]	54	12.85 (2.74) [7.44,18.27]	0.37	140
Direct certification method: letter method	47	5.61 (5.90) [-6.08,17.29]	92	12.92 (3.48) [6.04,19.80]	0.31	139
SFA Policy – Percent changed during verification (all changes)						
Percent changed during verification – 0%	12	8.71 (3.86) [1.06,16.35]	133	6.79 (4.96) [-3.03,16.62]	0.76	145
Percent changed during verification – 1% to 24.9%	48	7.10 (2.69) [1.77,12.43]	97	7.44 (3.72) [0.08,14.79]	0.94	145
Percent changed during verification – 25% to 49.9%	55	12.12 (1.63) [8.88,15.35]	90	6.30 (3.67) [-0.96,13.56]	0.16	145
Percent changed during verification – 50% to 74.9%	25	15.80 (3.37) [9.14,22.47]	120	6.68 (3.23) [0.28,13.08]	0.05*	145
Percent changed during verification – 75% or greater	5	1.03 (13.62) [-25.93,28.00]	140	10.19 (2.09) [6.06,14.33]	0.51	145
SFA Policy – Percent did not respond during verification						
Percent did not respond during verification – 0%	24	4.55 (4.07) [-3.50,12.60]	121	12.06 (1.20) [9.68,14.43]	0.07*	145
Percent did not respond during verification – 1% to 24.9%	25	13.56 (3.48) [6.68,20.45]	120	7.07 (3.27) [0.61,13.54]	0.17	145
Percent did not respond during verification – 25% to 49.9%	43	14.38 (2.16) [10.11,18.65]	102	6.20 (3.37) [-0.48,12.88]	0.05*	145
Percent did not respond during verification – 50% to 74.9%	38	9.15 (3.31) [2.60,15.70]	107	7.11 (3.77) [-0.36,14.58]	0.69	145

Table 8-4. Certification error due to administrative error by SFA Policy variables and verification results (continued)

SFA Policy	Yes		No		t-test P-value	Total sample size[a]
	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]	Sample size (SFAs)	Error rate (SE) [Lower CI, Upper CI]		
SFA Policy – Percent did not respond during verification						
Percent did not respond during verification – 75% or greater	15	12.03 (2.56) [6.96,17.09]	130	7.21 (3.28) [0.72,13.71]	0.25	145

Source: APEC-III data, weighted, and FNS742 Verification Data.

Notes: Analysts tested each variable for the significance of the difference between the average certification error rate due to reporting error for students who meet the criteria in each row (the "Yes" column) against the error rate for all other schools not meeting the criteria in the row (the "No" column). P-values below 0.05 suggest that the difference is significant. P-values below 0.1 are highlighted with asterisks: ** p<0.05, * p<0.1. Standard errors in parentheses. [Lower CI, Upper CI] are the lower and upper 95% Confidence Intervals.

[a] Sample sizes may differ due to item nonresponse to survey questions.

Summary: This table provides comparisons of certification error due to reporting error in non-CEP schools by selected household application experience and SFA policy characteristics. Yes= with characteristic. N = without characteristic.

Table 8-5. Multivariate analyses of administrative error by SFA Policy at the SFA level

SFA Policy	Administrative error[a]
SFA Policy (POL)	
SFA accepts applications on website	0.98 (2.89)
SFA accepts online applications via a vendor website	-12.32** (4.94)
Direct certification method: State-level matching	-2.11 (4.73)
Direct certification method: district-level matching	0.77 (6.87)
Direct certification method: letter method	-3.62 (6.87)
SFA uses Meals Plus software	6.71 (18.28)
SFA uses Horizon software	5.81 (5.26)
SFA uses other software to process applications	7.33 (6.24)
Processing of paper applications (Excluded=combination of electronic and manual)[b]	
SFA processes paper applications electronically only	-8.40*** (2.55)
SFA processes paper applications manually only	-7.95** (3.73)
Verification results and methods	
% Verified Applications, Benefits Changed	-4.11 (11.92)
% Applications did not Respond during Verification	1.92 (8.59)
Used Alternate Random Verification Sample	-10.84 (7.80)
Constant	28.68*** (7.94)
R-squared Sample size (SFAs)	0.35 138

Source: APEC-III data, weighted, and FNS742 Verification Data.

Notes:

[a] The dependent variable is certification error rate due to administrative error. Cell entries are coefficients generated from weighted OLS regressions with standard errors in parentheses. Estimates were generated using Stata's svy: reg procedures.

[b] Although some SFAs did not process paper applications, nearly all SFAs did process paper applications using one of the three procedures captured by the survey. The category "SFA processes paper applications using a combination of electronic and manual processes" is excluded due to high levels of collinearity, which lead to inflated coefficient estimates when including all three categories in the model.

*** p<0.01, ** p<0.05

8.4 Summary

The analyses presented in this chapter provide tests of potential relationships between SFA implementation strategies and certification error rates. Two characteristics show strong relationships with error rates across both bivariate and multivariate analyses. First, SFAs with more households reporting that the application was difficult also had higher reporting error rates on average compared to other SFAs. Second, SFAs using a combination of manual and electronic procedures to process hard-copy (paper) applications had significantly higher administrative error rates compared to SFAs that exclusively use electronic or manual processing.

These findings may suggest improvements in the application and administrative processes that could result in lower error rates in the future. For example, reforms focused on improving the application design and process may result in lower reporting error rates. Efforts to reduce administrative error rates, furthermore, may include encouraging SFAs that use both paper and electronic processing to adopt a more streamlined process using only one procedure for all applications.

9. Summary

In the third iteration, Access, Participation, Eligibility, and Certification (APEC-III) provides national estimates of the error rate and the dollar amount of the program error for the National School Lunch Program (NSLP) and School Breakfast Program (SBP) in School Year (SY) 2017-2018 (Objective 1). In addition, APEC-III examines the relationship between error rates and student (household), school, and School Food Authority (SFA) characteristics (Objective 2) and assesses the variation in error rates among SFAs using different implementation strategies in their school meal programs (Objective 3). This chapter provides a summary of the findings and implications for these three objectives, referencing a few relevant findings from the Objective 4 qualitative analyses. Volume 2 of the APEC-III Final Report presents findings from the qualitative analyses.

9.1 Certification Error (Objective 1)

Certification Error in Non-CEP Schools

APEC-III measured certification error as well as certification errors due to household reporting and administrative error. To measure certification error in non-Community Eligibility Provision (CEP) schools due to *administrative errors*, we independently determined certification status based on abstracted application data or documentation of direct certification. To measure certification error in non-CEP schools due to *household reporting errors*, we independently determined certification status based on household survey data. We then compared these independent determinations to the SFA's assigned certification status.

Household reporting error occurs when a student is certified by application but the information provided on the household survey does not support the certification status based on the data reported on the application. Administrative errors occur in the processing of applications and direct certification, the determination of eligibility, and the transmission of the certification status determination to the district's master benefit list.

Table 9-1 summarizes the gross national estimates of certification error rates for non-CEP schools. The gross certification error rate is 20.04 percent. As shown in Table 3-11, the difference in gross certification error rates in APEC-III compared to APEC-II was statistically significant only for

household reporting error, which was 4.46 percentage points lower in APEC-III ($p<0.01$). The differences were not statistically significant for certification error nor administrative error from APEC-II to APEC-III.

Table 9-1. Certification error rates (%) by certification status, non-CEP schools

Type of error	Certification status on SFA master benefit list			All
	Free	Reduced-price	Paid	
Gross certification error rate	14.04 (0.82)	52.76 (3.10)	33.87 (4.95)	20.04 (0.85)
Gross household reporting error rate	7.53 (0.77)	46.22 (3.39)	15.12 (3.08)	12.00 (0.87)
Gross administrative error rate	7.53 (0.64)	20.54 (2.75)	21.85 (4.53)	10.01 (0.73)

Note: Standard errors in parentheses.

It is important to note that among students certified as free, the error rate was much lower for those certified as free by direct certification than those certified as free by application, 8.66 percent versus 25.86 percent respectively (see Table 3-5).

Household reporting error was highest among students certified for reduced-price meals (46.22%). Differences in income accounted for more than half of all household reporting errors. Overall, household reporting error resulted in an overcertification more often than an undercertification, 8.35 percent vs 3.66 percent respectively (see Table 3-7).

As shown in Table 3-9, gross administrative error was lowest among students certified as free (7.53%). Overall administrative error resulted in overcertification more often than undercertification, 7.02 percent versus 2.99 percent respectively.

Certification Error in CEP Schools

In CEP schools, a certification error occurs if the CEP group cannot justify the Identified Student Percentage (ISP) they used (i.e., the observed ISP). We used the data from each CEP school to make an independent estimate of the ISP and free claiming percentage (FCP), based on a review of the documentation. The documentation included primarily reports with the matched list of directly certified students and the type of certification (e.g., Supplemental Nutrition Assistance Program [SNAP], Temporary Assistance to Needy Families [TANF], Medicaid, etc.). In some cases, the sampled students were searched for in a database and the output of the query was provided as

documentation. We determined certification error in CEP schools by verifying the eligibility status of a sample of students used to support their claiming percentage. The "adjusted" (i.e., independently estimated) ISP and claiming percentages were then compared to the "observed" ISP and FCP that the CEP group reported. As shown in Table 3-12, the adjusted ISP is 2.12 percentage points lower than the observed ISP. The adjusted FCP is 2.65 percentage points lower than the observed FCP. This indicates an overcertification rate of 2.65 percentage points for CEP schools, which was found to be a statistically significant difference ($p<0.01$).

Improper Payments Due to Certification Error in All Schools

Table 9-2 provides a summary of the national estimates of improper payment in both non-CEP and CEP schools, separately and combined. Combining CEP and non-CEP schools, the national estimate of gross improper payments for all schools due to certification error is $887 million in NSLP and $271 million in SBP. The total gross improper payment rates are 6.52 percent for the NSLP, and 6.29 percent for the SBP. As shown in the table, the majority of improper payment estimates are due to certification errors in non-CEP schools.

Table 9-2. Improper payments due to certification errors in CEP and non-CEP schools, SY 2017-2018

Improper payment amount and rates	NSLP			SBP		
	CEP schools	Non-CEP schools	All schools	CEP schools	Non-CEP schools	All schools
Total reimbursements (millions of dollars)[a]	4,115	9,490	13,606	1,169	3,144	4,312
Improper payment amounts (millions of dollars)						
Overpayments	99 (34)	627 (58)	726 (67)	26 (10)	196 (22)	222 (24)
Underpayments *(not accessed for CEP)*	–	162 (29)	162 (29)	–	49 (10)	49 (10)
Gross	99 (34)	789 (68)	887 (76)	26 (10)	245 (25)	271 (27)
Net	99 (34)	465 (61)	564 (70)	26 (10)	147 (22)	173 (24)
Improper payment rates (percentages out of 100)						
Overpayments	2.40 (0.82)	6.61 (0.61)	5.33 (1.02)	2.24 (0.85)	6.23 (0.69)	5.15 (1.10)
Underpayments *(not assessed for CEP)*	–	1.70 (0.3)	1.19 (0.3)	–	1.56 (0.3)	1.14 (0.28)

Table 9-2. Improper payments due to certification errors in CEP and non-CEP schools, SY 2017-2018 (continued)

Type of improper payment rate	NSLP			SBP		
	CEP schools	Non-CEP schools	All schools	CEP schools	Non-CEP schools	All schools
Improper payment rates (percentages out of 100) (continued)						
Gross	2.40 (0.82)	8.31 (0.72)	6.52 (1.09)	2.24 (0.85)	7.79 (0.8)	6.29 (1.17)
Net	2.40 (0.82)	4.90 (0.61)	4.15 (1.02)	2.24 (0.85)	4.67 (0.71)	4.01 (1.10)

Source: APEC-III study, weighted data.

Note: Analysis weights are calibrated based on total national reimbursements reported in the FNS national data file. Standard errors are in parentheses.

[a] The data in this table reflects actual amounts from APEC-III using budget calibrated weights. However, the amounts for CEP, and thus all schools, are estimates because it was necessary to estimate the proportion of the reimbursements that went to CEP schools using the meal participation data (FNS 10 and verification data FNS 742).

It is important to note that nearly half of improper payments in non-CEP schools were due to students who were certified as free but should have been certified as paid ($353 million out of $789 million for NSLP, and $109 million out of $245 for SBP). Tables 3-16 and 3-17 provide further details of the distribution of improper payments due to certification errors by certification status in non-CEP schools for the NSLP and the SBP, respectively.

Implications of Certification Error Findings

The increased reliance on direct certification and CEP to certify students reduced the prevalence of household reporting error relative to prior APEC study findings. Continuing this trend may result in even lower certification error rates in the future. Therefore, we recommend technical and programmatic enhancements to the administrative matching process and documentation management for direct certification.

The types of students and households that are most likely to have a certification error are similar to those identified by prior APEC studies. Households that are most prone to certification error are those certified by application, particularly those certified as reduced-price. Households often make mistakes in reporting the sources of income, earners, and overall amounts of income. These findings suggest that reducing the reliance on applications and/or improving the application process may result in lower error rates. For improving the application process, there should be emphasis on ensuring that all types of income for all types of household members are recorded on the application.

9.2 Aggregation Error (Objective 1)

Aggregation errors are summation errors that occur in the process of submitting total meal counts for reimbursement. Aggregation errors occur when there are discrepancies between (1) the school's sum of the daily meal count and the SFA's record of the school meal count (point-of-sale error), (2) the SFA's record of the school's meal count and the meal count the SFA sent to the State agency (school-to-SFA error), and/or (3) the meal count the SFA sent to the State agency and the State agency's record of the meal count submitted to FNS (SFA-to-State error). To generate an estimate of the overall effect of aggregation error on improper payments, we calculated the "true" net aggregation error, which compares the counts recorded by the State agency for reimbursement and school meal count recorded by the SFA. The net improper payment rates due to aggregation error were close to zero because overpayments and underpayments were similar in proportion, largely cancelling each other out. As shown in Table 4-2, the estimated net improper payment rate was -0.06 percent for the NSLP and 0.46 percent for the SBP; the net improper payment rates for both programs, however, were not statistically different from zero. In terms of dollars, the estimates of the improper payments due to "true" aggregation error are an underpayment of $8.37 million and an overpayment of $19.96 million for the NSLP and SBP, respectively. However, these dollar estimates do not differ significantly[50] from zero; therefore, aggregation error does not represent a statistically significant source of improper payments. Although the estimated improper payment rates due to aggregation error differ slightly across the APEC studies, the APEC-III estimates were not statistically different from those estimated by APEC-I or APEC-II. Similar to findings from APEC-II, aggregation errors are concentrated in a minority of schools in the sample, with the majority of schools (>80 %) having no aggregation error.

Implications of Aggregation Error Findings

Aggregation error rates are much lower than certification errors. The increased use of automation and electronic systems, at all levels, may reduce aggregation even further. The increase of out-of-cafeteria meals (grab-and-go, breakfast in classroom, field trips) support the need for increased automation to track and record such meals. In addition, cafeteria and SFA staff interviews suggest

[50] Based on a statistical test using the weighted distributions (the confidence intervals included negative and positive values and zero).

that ongoing technical support for software may be warranted to minimize malfunctions that may contribute to errors.[51]

9.3 Meal Claiming Error (Objective 1)

Meal claiming error occurs when cafeteria staff incorrectly classify a meal served to an eligible student as reimbursable or not reimbursable based on the food items on the student's meal tray. Meal claiming errors are best understood as standard of service errors rather than errors that give rise to improper payments. Thus, they are not included in improper payment estimates. However, meal claiming error provides insight on the extent to which schools are meeting meal pattern requirements. Table 9-3 provides a summary of the meal claiming error rates. Overall, the national estimates of gross meal claiming error is 7.62 percent for NSLP and 12.36 percent for SBP. However, more than half of the schools had no meal claiming errors (49.60% for NSLP and 47.69% for SBP). As discussed in Chapter 6, failure to meet the meal pattern requirements due to missing fruit, vegetable, and/or milk components were the primary reasons for error in both NSLP and SBP. The milk requirement was a dominate factor for SBP meal claiming error. It is important to note that the gross error rates in the observed data (trays)[52] were consistently lower for Offer versus Serve (OVS) compared to non-OVS meals (discussed in Chapter 6), however, OVS did not have a statistically significant effect on error rates.

Table 9-3. Meal claiming error rates in the NSLP and SBP, SY 2017-2018

Type of error	NSLP	SBP
Error rates (percentages out of 100)		
Overclaiming rate for all meals	5.04 (0.53)	11.17 (0.88)
Underclaiming rate for all meals	2.57 (0.49)	1.19 (0.43)
Gross error rate	7.62 (0.70)	12.36 (0.96)
Net error rate	2.47 (0.74)	9.98 (1.00)
Sample size (trays)	18,150	12,142
Sample size (schools; whole number)	655	645

Source: APEC-III meal observation data, weighted.

Note: Standard errors in parentheses.

[51] Refer to Chapter 4 on Aggregation Errors in Volume 2: Qualitative Analyses and Findings.

[52] These findings are based on unweighted observed trays. While schools and SFA can be weighted, it is not feasible to weight observed trays. The findings on OVS vs. non-OVS error rates do not take into account that error rates vary by school.

Implications of Meal Claiming Error Findings

The gross and net meal claiming error rates estimated by APEC-III did not differ significantly from those found in APEC-II. Both studies found higher error rates for SBP than NSLP. The qualitative findings suggest that one possible reason for the higher error rates for breakfast was due to the increased use of "breakfast in the classroom" (and other non-cafeteria settings), which rely on manual or alternative processes to determine if a meal is reimbursable.[53] Thus, improved systems and tracking for meals served outside of the cafeteria are recommended. Given that the fruit, vegetable, and milk requirements are the primary reasons for meal claiming error, increased training and strategies for these requirements should guide future efforts. Finally, the lower error rates for OVS suggest that incorporating options and choice for students makes a difference in minimizing errors.

9.4 Subgroup Analyses of Program Error (Objective 2)

Objective 2 analyses of the APEC-III Study examines the relationships between characteristics of students, households, schools, and SFAs to identify factors potentially associated with higher or lower error rates. Some of the characteristics found significant with bivariate analyses were no longer significant with multivariate analyses, which hold constant the other characteristics in the model. The following are the significant findings from both the bivariate and the multivariate analyses:

- Households participating in means-tested programs that confer eligibility due to either direct certification or categorical eligibility had significantly lower household reporting and administrative error rates.
- Households with higher incomes are significantly more likely to have a household reporting and/or administrative error than those with lower incomes.
- SFAs in which only some schools use CEP had significantly lower error rates compared to schools in SFAs in which all schools used CEP.
- Compared to schools in the Northeast region, schools in the Southwest region had lower CEP certification error rates.
- For NSLP, schools using more cashiers on average had lower average meal claiming error rates.

[53] See Chapter 5 on Meal Claiming Errors of Volume 2: Qualitative Analyses and Findings.

- For NSLP, schools with student enrollment greater than 2,000 had high meal claiming error rates, independent of other characteristics.

- The comparisons reveal no statistically significant differences in the aggregation error rates for any of the subgroups of interest.

9.5 Substudy of SFAs (Objective 3)

We also examined the relationship between SFA implementation strategies and certification error rates due to household reporting and administrative error. These analyses use error rates calculated at the SFA level, instead of the errors at the student or school level. Some of the characteristics found significant with bivariate analyses were not significant in the multivariate analyses, which holds constant the other characteristics in the model. The following are the significant findings from both the bivariate and multivariate analyses:

- SFAs with higher percentages of parents who found the application process difficult also had higher reporting error rates.

- SFAs that process hard-copy (paper) applications using a combination of manual and electronic processes have significantly higher administrative error rates compared to those that process applications either entirely electronically or entirely by paper.

- SFAs that accepted applications via a vendor website had lower administrative error rates than other SFAs.

9.6 Study Strengths and Limitations

A major strength of the APEC-III error estimates is that they are derived from nationally representative probability samples of SFAs, schools, and applications/households (after weighting). For certification error estimates, we determined certification errors based on the in-person household survey data, collecting detailed income and household composition data. Further, 89.3 percent of the survey respondents provided income documentation (such as a pay stub). In addition, the majority of the household surveys were conducted between 6 to 12 weeks of the certification date. However, the household survey response rate of 31.02 percent was a potential limitation. A low response rate *may* have resulted in a lower-than-expected precision, and increased bias in the analysis. The nonresponse bias analyses mitigates the potential for bias because it informs the construction of the analytic weights.

For aggregation error estimates, there are large standard errors and confidence intervals that are associated with true aggregation error estimates. This is because at each aggregation level, the percentage of schools with no error ranges from 80 percent to 90 percent. This type of distribution can lead to wide confidence intervals when estimating population averages with weighted data.

A key strength of the meal claiming error estimates is the use of a random sample of meal periods and actual tray observations in real time. On the other hand, a potential limitation is that the observations do not include the serving sizes of each food component on the tray, which are a part of the meal pattern requirements for the NSLP and SBP.

A key strength of the subgroup analyses is the variety of the data sources available to allow for analyses of many different characteristics of students, households, schools, and SFAs. Nonetheless, the subgroup analyses on the factors that are associated with errors are exploratory and limited by the characteristics available from the data. It is possible that characteristics that are not available from the data relate to error rates, and that these unobserved characteristics correlate with or interact with the observed characteristics in unanticipated ways.