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Evaluation of the National School Lunch Program Application/Verification Pilot Projects:

Volume II: Data Collection, Study Methods and Supplementary Tables on Certification Impacts

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Volume II: Data Collection, Study Methods, and Supplementary Tables on Certification Impacts

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I. INTRODUCTION

This is Volume II of the report on the evaluation of the NSLP Application Verification Pilot Projects. It supplements Volume I, which presents the evaluation findings. Volume II has two objectives: (1) to provide a detailed description of the methods used to conduct the study, and (2) to present tabulations that supplement and extend the analyses reported in Volume I.

To provide context for the discussions in subsequent chapters, it is useful to keep in the forefront the main features of the study design:

- Comparison districts, which were carefully matched to each pilot district, provide a benchmark for measuring the impacts of the Up-Front Documentation and Graduated Verification Pilot Projects on the certification of students from eligible and ineligible families for free and reduced-price school meals, and on the participation of students in the NSLP.

- Stratified, scientifically selected samples of all families (with the exception of those directly certified) in each school district provide the basis for drawing inferences about impacts.

- Surveys of sample students' families used carefully structured questionnaires to derive independent measures of household size and income, with which to assess the income eligibility of each student family selected for the study.

- We used data provided by school districts on the meal price status of each selected student as of October 31, 2002, to measure certification for free and reduced-price meals.

- We drew inferences about impacts of the pilot procedures by comparing the experiences of the sampled student families in the pilot and comparison districts, and by using statistical models to control for the effects of family characteristics that both influence the experiences of interest and differ between pilot and comparison districts.

- We obtained data on implementation of the pilot procedures and the costs of administering the NSLP application and verification processes through semistructured interviews with staff who conduct these activities in each district.

In each district, we selected a stratified sample that was designed to achieve precision objectives for three groups: (1) students whose family income made them *ineligible* for free or reduced-price benefits (issue of deterrence); (2) students whose family income made them eligible for benefits (issues of barriers); and (3) students who were certified for free and reduced-price meals (issues of accuracy). Survey data collection used a two-step process designed to determine accurately the income eligibility of each student's family, while minimizing the burden on respondents and the costs of data collection. We used a part 1 interview administered primarily by telephone to make a rough estimate of income relative to poverty level. Households whose income was 400 percent or more of the federal poverty level according to this rough estimate were classified as having income above 185 percent of poverty. For households whose income based on the part 1 interview was less than 400 percent of the federal poverty level or who did not complete the part 1 interview, we administered a part 2 interview in person and gathered detailed information on income and household composition.

The sampling and data collection schedule was designed so as to meet the objective providing FNS with preliminary tabulations of the data by the end of February 2003. To allow time for processing the data and preparation of the tabulations, this end point required that data collection be conducted between October 15, 2002, and December 15, 2002. On the other hand, key lists necessary for constructing sample frames became available only when school opened in August or September 2002. These constraints shaped our approaches to sampling and data collection in important ways, as explained in Chapter III and Chapter IV of this second volume of the report.

II. COMPARISON SITE SELECTION AND RECRUITMENT

A critical step in the success of the NSLP Application/Verification Pilot Projects Evaluation involved selecting comparison districts that were very similar to each of the pilot districts originally included in the evaluation. The remainder of this chapter describes the general strategy used for selecting comparison districts, summarizes the details of the comparison district selection process for each of the pilot districts, and describes the success of efforts to recruit the comparison districts selected as the best matches for each pilot.

A. GENERAL PROCESS FOR SELECTING COMPARISON DISTRICTS

In the Request for Proposal published by FNS in January 2002, the study included 14 pilot sites for which comparison districts had to be selected, and our general design called for selecting one comparison district for each pilot district. The strategy for selecting pilot districts consisted of three steps: (1) restricting the choice set of potential comparison districts, (2) ranking these potential comparison districts in terms of the similarity of their measurable characteristics (at baseline) to those of the pilot districts using a quantitative similarity index (QSI), and (3) refining the ranking of potential comparison districts based on conversations with individuals familiar with the area in which the potential comparison and pilot districts are located. Once we selected the best candidates for comparison districts, we contacted them to recruit them to participate in the evaluation.

One of the original pilot districts—St. Mary's School in Paterson, NY—was dropped from the evaluation prior to the selection of a comparison district because of difficulties it experienced in implementing the Graduated Verification model.[1] In particular, because of limited staff resources at St. Mary's, they were unable to complete all of the second round verifications in the 2001-2002 school year. Furthermore, the district did not have the data systems necessary to implement the requirement that students whose benefits were reduced or terminated in the previous school year submit income documentation with their certification application in the current school year. Thus, FNS decided that the level of pilot implementation in St. Mary's was so low that they would not be able to provide a meaningful test of the basic model, and the school was dropped.

1. Restricting the Choice Set

In order to limit the range of possible comparison districts, we first excluded districts that did not share a few key characteristics with the pilot district. The underlying assumption here was that matching pilot and comparison districts on these characteristics was so critical that it was not worth considering districts that did not match on these characteristics. Using data from the Common Core of Data (CCD) from the National Center for Education Statistics (NCES), we selected as potential comparison districts those that matched the pilot in the following ways:

- They were from the same state;
- They were public school districts, like the pilots[2]
- They served the same grade levels[3]

[1]A second pilot district—Morenci, AZ—was dropped because we could not identify an appropriate comparison district. This situation is discussed below.

[2]St. Mary's School District was the only private district among the original 14. Since St. Mary's was dropped, we were left with only public districts as pilots in the evaluation.

[3]In other words, we wanted to match to pilot districts containing only high schools comparison districts with only high schools covering the same grades. However, we did allow

Originally, we had intended to restrict the choice set to potential comparison districts that matched pilot districts in terms of whether they were located in an urban, suburban, or rural location. In the course of restricting the choice set of potential comparison districts, however, we found that the urbanization classification of some pilot districts seemed to provide relatively little useful information, in that they appeared to be less similar to other districts in their urbanization category than to districts in other categories. As a result, restricting the choice set to only districts with the same level of urbanization would have excluded many potentially good comparison districts.

In addition to the characteristics listed above, it would also have been desirable to have restricted the choice set to districts that matched the pilot in terms of whether they used direct certification and whether they included any provision 2 or 3 schools (none of the pilots included provision 2 or 3 schools). Unfortunately, no data were available for potential comparison districts that would have allowed us to exclude those districts that did not match the pilots along these dimensions. Instead, we decided to wait until we had selected a small number of good matches for each pilot district based on observable characteristics and determine whether the comparison and pilot districts also matched in terms of direct certification and provision 2/3 status.

The number of potential comparison districts in the choice sets of each pilot varied widely, depending on their state and the other relevant characteristics. The smallest choice set was for

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potential comparison districts to differ from pilot districts with respect to whether they served preschool students.

Oak Park/River Forest, a high school district in Illinois, for which there were 71 potential comparison districts. The largest choice set was 600, for Dunkirk, in New York.

2. Creating the Quantitative Similarity Index

The second step in the process of selecting a comparison district for each pilot was to create a quantitative similarity index (QSI). The purpose of this QSI was to measure how similar in measurable baseline characteristics each potential comparison district was to the pilot to which it was being matched. The QSI was calculated as a weighted sum of a set of QSI components. Each QSI component represented a dimension on which we wanted to match the comparison district to the pilot district. The weight assigned to each component reflected the relative importance assigned to each dimension in ensuring the similarity of the comparison and pilot districts.

We measured the district characteristics used as QSI components using information for 1999 and obtained from the CCD. The individual QSI components, grouped into categories, included:

- District Size
  - Number of schools in the district
  - Average number of students per school[4]
- Race/Ethnicity
  - Percentage of students who were non-white[5]

[4]Originally, we defined this component as the total number of students enrolled in the district. However, we felt that by including both the number of schools and average number of students per school we could better capture both the overall size of the district and the size of the individual schools in the district (which would be relevant if the district administered the NSLP in a decentralized fashion).

[5]In cases where the pilot district had substantial proportions of more than one group of non-white students, more than one race/ethnicity category was used. For example, several pilot districts included substantial proportions of black students and Hispanic students, and in these cases we included both “percentage white” and “percentage black” or “percentage Hispanic”

- Percentage of students who were limited English proficient[6]

- Proximity
    - Number of miles between pilot and comparison district
- Poverty
    - Percentage of children ages 5 to 17 in district who were in households with income below 100 percent of the Federal Poverty Level in 1997
- Certification Rates
    - Percentage of students certified for free meals
    - Percentage of students certified for free or reduced-price meals[7]
- Participation Rates[8]
    - Participation rate among students certified for free meals
    - Participation rate among students certified for reduced-price meals
    - Participation rate among students not certified

For each of these district characteristics, we calculated the value of the QSI component reflecting that characteristic using two steps. First, we measured the difference between the value of the characteristic for the potential comparison district and for the pilot district. Second,

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components. Also, in one state data on race/ethnicity was not available in the CCD, so we used Census data.

[6]Information on limited English proficiency was not available for all states. In cases in which it was not available for a substantial number of districts, it was not used as a QSI component.

[7]Originally, we included separate components for the percentage of students certified for free meals and the percentage certified for reduced-price meals. However, we decided against including the percentage certified for reduced-price meals alone so that it would not contribute too strongly to the overall QSI (since a fair amount of variation in the percentage certified for reduced-price meals appeared to be somewhat random).

[8]Information on NSLP participation was not available from FNS administrative data for all states. For districts in states without participation data, we dropped the participation components and re-weighted the remaining components so that the weight originally assigned to participation was given to the certification components.

we normalized this difference. The normalization process consisted of dividing the absolute comparison-pilot difference in the characteristic by the total range in the value of the characteristic across all districts. The advantage of this procedure is that if the pilot district has the maximum/minimum value on the characteristic, a comparison district with the minimum/maximum value will receive a relative difference value of 1.0, which represents a 100 percent deviation from the pilot district. With this approach, the values of each QSI component can range from 0 to 1 and can be interpreted as the departure of the comparison district to the pilot district with respect to that characteristic. Formally, the QSI component value for district characteristic X was calculated as follows:

$$\text{QSI\_X} = \frac{\left|X_c - X_p\right|}{X_{\max} - X_{\min}}$$

Once the QSI component values for each district characteristic listed above had been calculated, we calculated the overall QSI value. To do this, we used the weighted average of the individual QSI components. Although we examined several different weighting schemes, the one we ultimately chose was based on our desire to match the pilot and comparison districts closely on their baseline certification and participation rates, since these would be key outcome measures in our analysis. We also wanted to match closely on the poverty rate in the district. For both theoretical and operational reasons, the proximity of the pilot and comparison districts was also important, though not quite as important as certification, participation, and poverty.

Thus, we settled on a weighting scheme that assigned weights to the QSI components as follows:[9]

- 25 percent of the overall weight to the three participation components
- 25 percent of the overall weight to the two certification components
- 25 percent of the overall weight to the poverty component
- 15 percent of the overall weight to proximity
- 5 percent of the overall weight to the race/ethnicity components
- 5 percent of the overall weight to the two district size components

After generating the value of the overall QSI for each potential comparison district in the choice set, we ranked these districts according to their QSI values. Districts with the lowest overall QSI scores were considered the best matches for the pilot district and were ranked highest. We then selected a smaller set of potential comparison districts with the highest rankings for further consideration. In most cases, we selected the top ten potential comparison districts for this purpose. In some cases, however, we determined that there were not ten districts that would make suitable matches for the pilot district and so we reduced the number of potential comparison districts selected for further consideration.

[9]Aside from the final weighting scheme, we tried six other weighting schemes. These alternative schemes gave different weights to the different components. These included one scheme that gave each of the components equal weight, another scheme that gave each category of components equal weight, and various schemes that were similar to the final weighting scheme in giving relatively large weights to certification, participation, and poverty, but varied as to the exact amount of weight placed on each. We settled on the weighting scheme presented here because it resulted in a ranking of potential comparison districts that had the greatest face validity.

3. Refining the Ranking of Potential Comparison Districts

To obtain further information on the suitability of the top ranked potential comparison districts, we spoke with individuals familiar with both the pilot district and potential comparison districts. These individuals included state-level NSLP administrators along with staff at the pilot district. In a few cases we consulted with individuals at nearby colleges or universities whose areas of expertise made them knowledgeable about the local area.[10] For some of the pilot districts, we held these conversations by phone. In other cases, we visited the pilot districts and/or potential comparison districts.

In our conversations with these state and local staff, we typically presented them with a list of the top ranked potential comparison districts and asked them to assess the comparability of these districts with the pilot district. We asked specifically whether these districts matched the pilot districts in terms of their direct certification and Provision 2 or 3 status. We also asked whether they were similar to the pilot in terms of their administration of the school lunch program. For example, we asked whether the comparison and pilot districts matched in terms of their degree of centralization and their use of food service management companies. Finally, we asked the state/local staff to point out any important factors that might not have been apparent in the CCD data we used to calculate the QSI and rank potential comparison districts.[11]

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[10]This strategy was employed in the comparison district selection process for the Morenci, Dunkirk, Dilworth-Glyndon-Felton, and three eastern Pennsylvania pilot districts.

[11]In one case, for example, we were told that while the potential comparison districts might have matched the pilot in terms of district size, it was not clear that they matched in terms of the growth of the school district in recent years. In that case, the pilot district was located in an area that had been experiencing rapid population growth, while the areas in which some of the potential comparison districts were located were not growing rapidly. Since information on the rate of population growth was not one of our QSI components, we would not have known this without the input from the state and local staff.

Typically, the conversations with state and local staff resulted in the selection of a small number of districts that were clearly above the rest as the best matches for the pilot district in question. In a few cases, there was only one potential comparison district that emerged from these discussions as a suitable match. And in a couple of cases, none of the potential comparison districts identified by our initial QSI analysis were thought to be good matches, so additional work was required to find appropriate districts. Ultimately, however, we settled on one district that we thought to be the most promising candidate as a comparison district, along with one or more backup districts that we would turn to if the original district declined to participate in the evaluation.

In this process of refining the ranking of potential comparison districts and targeting one or more for our recruitment efforts, we took two other factors into account. First, although free or reduced-price certification rates and the poverty rate were included in the original set of QSI components, we also came to the conclusion that the ratio of these two factors was important. In particular, in cases where the certification and poverty rates of potential comparison districts deviated somewhat from those of the pilot district, we would favor districts in which the ratio of the certification rate to the poverty rate was close to that of the pilot district. Second, as we proceeded with the selection and recruitment of potential comparison districts, we began to take into account the overall balance of characteristics between all pilot districts and all comparison districts. In other words, if the mean baseline certification rate of all comparison districts that had already agreed to participate in the evaluation was greater than the mean baseline certification of the pilot districts to which they were matched, this would influence our selection of subsequent comparison districts. In particular, this situation would lead us to favor a potential comparison district whose baseline certification rate was slightly below that of the pilot district over a potential comparison district whose baseline certification rate was slightly above that of the pilot district. In this way, we could bring the overall certification rate among all comparison districts a bit closer to that of all pilot districts.

4. Recruiting Comparison Districts

Selection and recruitment of comparison districts was a joint activity carried out by the FNS project officer and senior MPR project staff (project director, principal investigator, and survey director). In the discussions with individual candidate districts, the FNS project officer explained the importance of the study and described the role it would play in the policy process. He also described in general terms what district participation would involve. The MPR representative explained the structure of the study, answered more detailed questions about what participation would involve, and addressed the primary concern about participation expressed in every district, confidentiality of data. Sometimes these discussions were conducted by telephone, sometimes in person.

Initial contacts with candidate districts occurred in one of two ways: either a representative of the state education agency initiated the contact or the superintendent or business administrator in a neighboring pilot district initiated the contact. The decision as to which of these routes to follow was usually decided by the state education agency representative.

The substance of the initial contact and associated follow-up also followed one of two patterns. In some instances, the official making the initial contact explained the study and secured agreement. The role of the study team was then to work out the details. In other instances, the person making the initial contact had the more limited role of introducing the idea of participation to senior district representatives, and securing their agreement to receive a visit or phone call from the study team to learn more about it. The study team then provided detailed information about the study, which senior district staff then used to make their decision about whether the district would participate in the study.

B. COMPARISON DISTRICT SELECTION AND RECRUITMENT FOR EACH PILOT DISTRICT

In the course of selecting and recruiting comparison districts for the thirteen pilot districts remaining after St. Mary's was excluded, we faced unique challenges with each case. These challenges could not always be adequately addressed using the general strategy described in Section A. In this section, we describe the details of the comparison district selection and recruitment process for each of the thirteen pilot districts.

1. Blue Ridge School District (Pennsylvania)

- Initially, there were 466 potential comparison districts in the restricted choice set.
- Our QSI analysis generated a list of ten potential comparison districts for further consideration.
- Discussions with state and local staff led us to select Montrose as the best choice for a comparison district. They were ranked 1st on our original ranking of potential comparison districts.
- To recruit Montrose, we relied on the superintendent from Blue Ridge to make our initial contact, which was successful. We then contacted Montrose to discuss the details of their involvement in the evaluation and they confirmed their commitment to participate.

2. Stroudsburg, East Stroudsburg, and Pleasant Valley School Districts (Pennsylvania)

- We grouped these three pilot districts together because of their proximity and similarity to one another in a number of dimensions. The similarity of the three was highlighted by the fact that our initial QSI ranking implied that for each, the other two pilot districts would have been selected as the top two comparison districts if they had not been a pilot district.
- Initially, there were 464 potential comparison districts in the restricted choice set.
- There was substantial overlap in the top ranked comparison districts for these three pilots. We identified 15 districts that jointly made up the top10 lists of the three pilot districts.
- We gave this list of 15 potential comparison districts to knowledgeable state and local staff and also visited the pilot districts to discuss which of the comparison districts would be best. These conversations led us to identify the top three candidates (Bangor, Delaware Valley, and Pocono Mountain School Districts), along with several back-ups.

- We contacted the top three districts after an initial contact by a staff person at one of the pilot districts. Delaware Valley and Pocono Mountain School Districts declined. The status of Bangor was uncertain. We then contacted Easton, one of the back-ups, which agreed to participate.

- One of the factors that local staff convinced us was important to consider in the matching process and that was not on our original list of QSI components was population growth. The area of eastern Pennsylvania in which the pilot districts are located grew more rapidly than the state as a whole during the 1990s. Because not all of our top ranked potential comparison districts were in equally high growth areas, we consulted with experts on Pennsylvania development and re-considered potential comparison districts located in two other high-growth areas in the state—southeast/south central Pennsylvania and the area near Pittsburgh. Although these districts had not been highly ranked in the original QSI ranking because of the proximity component, we re-examined the data to assess their comparability with respect to QSI components other than proximity.

- This process led to a number of new candidates, and we made initial contacts with several districts in southeast Pennsylvania near the Maryland border. However, none of these districts proved to be suitable as a match for any of the pilot districts, and in the end we turned back to our original list of highly ranked comparison districts.

- We then contacted Bangor again to confirm its willingness to participate. We also contacted Pottsgrove School District, which was on the original high ranking candidates based on the QSI, and Pottsgrove agreed to participate.

- The three comparison districts ultimately selected and recruited are well matched to the three pilot districts in terms of the district characteristics used as QSI components. However, these districts do not as closely match the pilots in terms of their growth rates throughout the 1990s, as well as between 1999 and 2001.

3. Maplewood School District (Ohio)

- Initially, there were 567 potential comparison districts in the restricted choice set.

- Our QSI analysis generated a list of ten potential comparison districts for further consideration. These ten districts were very well matched to the pilot district, with the tenth potential comparison district on the list not that much more different from the pilot district than the first potential comparison district in terms of the district characteristics used as QSI components.

- Discussions with state and local staff led us to select a top ranked candidate district along with several back-up choices.

- State officials contacted the top candidates (South Range School District and Matthews School District), but these districts declined to participate in the evaluation.

- We then turned to our third choice for the evaluation—Newton Falls School District. With assistance from the FNS Midwest regional office and state officials, we arranged a visit to Newton Falls School District and requested their participation in the evaluation. Newton Falls agreed to participate. They were ranked 8^{th} on our original QSI ranking of top candidates.

4. Salem City School District (Ohio)

- Initially, there were 567 potential comparison districts in the restricted choice set.

- Our QSI analysis generated a list of ten potential comparison districts for further consideration. Again, these ten districts were very well matched to the pilot district, with the tenth potential comparison district on the list not that much more different from the pilot district than the first potential comparison district in terms of the district characteristics used as QSI components.

- Discussions with state and local staff led us to select a top ranked candidate district along with several back-up choices.

- State officials contacted the top candidates, Beaver School District, but this district declined to participate in the evaluation. The FNS project officer and MPR project director contacted Niles School District, and that district also declined to participate.

- We then turned to our third choice for the evaluation—Lisbon School District. With assistances from the FNS regional office and state officials, we arranged a visit to Newton Fall School District and requested their participation in the evaluation. Newton Falls agreed to participate. They were ranked 2^{nd} on our original QSI ranking of top candidates.

5. Creve Couer School District 76 (Illinois)

- Initially, there were 211 potential comparison districts in the restricted choice set. This choice set was restricted to K-8 districts.

- Our QSI analysis generated a list of ten potential comparison districts for further consideration.

- We held a discussion of potential comparison districts with the food service director at Creve Couer. We did not send a list of the top ten potential comparison districts to her in advance, but presented the names of the best few matches to her orally. This discussion led us to identify one district that was clearly the best match—North Pekin and Marquette Heights School District 102—along with two back-ups. These choices were also confirmed through discussions with the Illinois State Child Nutrition Director. North Pekin/Marquette Heights was ranked 7^{th} on our original QSI ranking.

- With the assistance of the food service director at Creve Couer, we contacted North Pekin & Marquette Heights and they agreed to participate in the evaluation.

6. Oak Park and River Forest School District 200 (Illinois)

- Initially, there were 71 potential comparison districts in the restricted choice set. The relatively small number of districts in the choice set was due to the fact that Oak Park and River Forest is a single high school district.

- None of the top ranked districts from our initial QSI analysis seemed appropriate as a match for Oak Park and River Forest. The main matching problem was that Oak Park/River Forest had an unusual combination of three characteristics: (1) a low baseline poverty rate (3 percent), (2) low certification rate (less than 10 percent certified for free meals) and (3) a relatively large proportion of black students (31 percent). The districts that matched well on the poverty rate and certification rates tended to have very small proportions of students who were black.

- We next held discussions with both state officials and the pilot district food service director. These discussions led us to identify a potential comparison district—Evanston Township High School District 202—that appeared to be a relatively good match. Evanston had a much larger proportion of black students than the top ranked comparison districts. It was ranked 37th in the original QSI ranking. Although its poverty rate and certification ratio were substantially higher than those of Oak Park and River Forest, its ratio of the free certification rate to the poverty rate was close to that of Oak Park/River Forest. In addition, the pilot district's food service direct or felt that Evanston was similar to Oak Park/River Forest in several other respects. Thus, we contacted Evanston and asked them to participate in the evaluation. Although they initially expressed interest in participation, they ultimately declined.

- Next, we visited the Chicago area and visited several potential comparison districts. These visits along with discussions with state and local officials led us to identify four additional comparison districts that would make adequate matches for Oak Park/River Forest. We approached these four districts—Zion Benton Township High School District 126, Niles Township High School District 219, Homewood Flossmoore High School District 233, and Mundeleine Consolidated High School District 120—all declined to participate as well.

- We then visited a meeting of suburban Chicago area food service directors, hoping to recruit two districts that were not on our original list of candidates. These two districts—Arlington Heights Township High School District 214 and Palatine Township High School District 211—also declined our invitation to participate.

- Finally, we expanded our search of possible comparison districts to include districts that were not just high-school-only districts. In particular, we began looking for K-12 districts that included high schools whose characteristics were similar to those of Oak Park/River Forest High School. Through this approach, we identified Boling Brook High School in the Valley View School District 365U. With assistance from the State Child Nutrition Director and the FNS Midwest Regional Office Special Nutrition Program Director, we secured their participation.

7. Williamson County School District (Tennessee)

- Initially, there were 123 potential comparison districts in the restricted choice set.
- Our QSI analysis produced only one potential comparison district—Wilson County School District—that appeared to be a good match for Williamson County. Other potential comparison districts either were smaller or had much higher poverty and certification rates.
- Independent of our QSI analysis, we held discussions with state and local officials during a visit to Williamson County to get their views on which district in the state was most similar to Williamson. Without seeing our ranking, they also identified Wilson County as the most appropriate comparison district.
- A representative of the Tennessee state education agency approached Wilson County and they agree to participate in the evaluation. Although the pilot project was implemented in 9 of 21 schools in the Williamson County School District, it was impractical to identify and recruit a matching subset of schools in Wilson County and the entire Wilson County district served as the comparison for the pilot schools in Williamson County.

8. Dilworth-Glyndon-Felton School District (Minnesota)

- Initially, there were 275 potential comparison districts for Dilworth-Glydon-Felton (DGF) in the restricted choice set.
- Our QSI analysis generated a list of ten potential comparison districts for further consideration.
- We spoke with staff in DGF about our the few potential comparison districts at the top of our rankings. We identified Lake Park Audubon School District, a small district east of DGF, as the best match. Discussions with staff there revealed that while Lake Park Audubon was similar to Glyndon and Felton, the easternmost towns in the DGF district, it did not have the same incidence of low-income and Hispanic families as Dilworth, due to its proximity to the Red River Valley where sugar beet farming is a major industry and employer of migrant laborers. This led us to invite East Grand Forks School District, which had a comparable population of these groups, to participate, but they declined.
- We then decided to try to use two districts jointly as a comparison for DGF, one located on the Red River (and thus similar to Dilworth) and one located to the east of the river (and thus more similar to Glyndon and Felton). Using two districts also had the advantage of reducing for any one district the percentage of students whose families would need to be asked to participate in the study, a source of particular concern to the officials from these small school districts. This strategy led us to keep Lake Park Audubon (east of the river) as a comparison district and to select Breckenridge (on the Red River).

- We approached these districts with this newly developed proposal to participate in the evaluation and they both agreed.

9. Dunkirk City School District (New York)

- Initially, there were 600 potential comparison districts in the restricted choice set.
- Our initial QSI analysis generated no potential comparison districts that appeared to be suitable as matches for Dunkirk. The problem was the combination of being a relatively small district but having a large Hispanic population (32 percent of students) and high poverty and certification rates. The top ranked districts all had much smaller Hispanic populations, while districts with comparable Hispanic populations were far away. In particular, these districts were located in the Hudson River Valley or near New York City. Discussions with local experts led us to conclude that these far-away districts would have little face validity as comparisons to Dunkirk.
- Another strategy we employed to try to locate a comparison district was to expand the choice set to include districts located in parts of Pennsylvania or Ohio that were reasonably close to Dunkirk. We found several districts in northeast Ohio that matched Dunkirk in the proportion Hispanic and several other dimensions but each also differed from Dunkirk along some important dimension.
- Ultimately, we decided that Jamestown City School District, a district close to Dunkirk, would be the most appropriate comparison district. Although Jamestown had a much smaller Hispanic population than Dunkirk (7 percent), its Hispanic population was larger than those of other top ranked comparison districts and it was also well matched in terms of its poverty, certification, and participation rates (it was ranked 7th in our original QSI ranking). It also had substantial face validity in the eyes of local officials. Part of our decision to invite Jamestown to participate involved a strategy in which we would oversample Hispanic students in Jamestown so that their representation in our students samples would more closely match that of Dunkirk.
- A representative of the New York State Education Agency contacted Jamestown City on behalf of the study and they agreed to participate.

10. Grandview Consolidated School District Number 4 (Missouri)

- Initially, there were 289 potential comparison districts in the restricted choice set.
- Our QSI analysis generated only three districts that we felt were suitable as comparison districts to Grandview. Grandview School District is a district within the Kansas City metropolitan area, and approximately half of the district students are African American. The three top ranked potential comparison districts were similarly situated, but the districts after the top three had predominantly white student populations.

- In an effort to identify a larger pool of potential comparison districts for further consideration, we began considering districts outside of close proximity to Grandview. In particular, we examined districts in the St. Louis metropolitan area. This process led us to identify three additional districts whose original QSI ranking was low because of the proximity component but that were otherwise similar to Grandview.

- We presented the list of these six potential comparison districts to state officials and discussed the suitability of these districts. These discussions led us to identify one of the Kansas City metropolitan area districts—Hickman Mills C-1 School District—as the best match.

- With the assistance of the Missouri state officials, we approached Hickman Mills and they agreed to participate in the evaluation.

11. Morenci School District (Arizona)

- Initially, there were 87 potential comparison districts in the restricted choice set.

- Our initial QSI analysis generated no districts that would be suitable comparison districts. The features of Morenci that made it a difficult pilot district to match were the combination of a very high Hispanic population (54 percent), a fairly low poverty rate (10 percent), and a very low certification rate (10 percent certified for free meals). In addition, Morenci is a small mining town in a rural area of Arizona. Other potential comparison districts that matched Morenci in terms of its poverty and certification rates had smaller Hispanic populations. Those with similar Hispanic populations tended to have much higher poverty rates.

- In an attempt to find a suitable comparison district for Morenci, we spoke with the Morenci superintendent and food service director and with state officials. After considerable discussion they agreed with our judgment that none of our top ranked comparison districts would make credible comparison districts. They suggested that we examine the school districts in other small mining towns in Arizona. We identified five or six such school districts, but none of these districts was a good match for Morenci, since most of them had high poverty and certification rates.

- Next, we expanded our search to school districts in neighboring states. First, we examined districts in mining towns in New Mexico, but these districts had the same limitations as those in Arizona. We then conducted a wider search across all school districts in New Mexico and Colorado. This search did not identify any districts that matched the characteristics of Morenci very well.

- Because the QSI analysis failed to produce any good matches for Morenci, and because alternatives suggested by our subsequent discussions and analysis were uniformly believed to be not credible by individuals familiar with the area, we suspended our search for a comparison district in Arizona, and dropped Morenci from the evaluation.

III. SAMPLE DESIGN AND SAMPLE SELECTION

This chapter describes the sample design and sample selection process.

A. SAMPLE DESIGN

The pilot districts each volunteered to test one of several approaches to modifying the application and verification process that FNS designed. Because of the voluntary nature of district participation, the pilot districts are self-selected and not a representative sample of all districts nationwide. As described in the previous chapter, the comparison districts were carefully matched to each pilot district, and therefore are also not representative of districts nationwide.

Each pilot district and its matched comparison district are essentially a "case study." The test of Up-Front Documentation is essentially nine case studies; the test of Graduated Verification is three. We measure the average impact of Up-Front Documentation as the average of the impacts across the nine site pairs, and the average impact of Graduated Verification as the average of the impacts across the three site pairs. The sample of students was designed with this analytic goal paramount.

1. Summary of the Design

In each of the 25 study districts, the household survey sample was selected to represent all students enrolled at the beginning of school year 2002–2003 who were (1) not approved for free meals through direct certification in school year 2002–2003, and (2) enrolled in the district at the time of the data collection in October to December 2002. The sample for the household interviews was stratified into 75 strata by district (25) and meal price status (3).

We selected each district sample from lists of students who were approved for free meals by application and approved for reduced-price meals and from lists of all students enrolled at the start of school year 2002–2003. We then combined and unduplicated these lists to form three sampling strata for each district:

1. Students who are approved for free meals but not directly certified
2. Students approved for reduced-price meals
3. All other students, or the balance of the district population

Because we conducted sample selection using lists provided near the beginning of the school year 2002, the meal price status used for sample selection did not in all cases reflect the meal price status according to the SFA on October 31, 2002. Therefore, after survey data collection was conducted, we determined each student's final meal price status by matching our sample members against a meal price status list that reflected each student's status on (or about) October 31, 2002.[1] Table III.1 shows target sample sizes by meal price status and district stratum, released sample by sampling frame meal price stratum, and released samples by final meal price status.

The study objective is to draw inferences about all students in the study districts, excluding students directly certified, and our sampling objective is to select a representative sample. However, because students are embedded in households, we needed to decide how to handle the situation in which a household contains more than one student. One consideration is that the income eligibility of students in the same family is the same. Furthermore, keeping the interview simple and the burden on households low required asking parents to report about their income one time and to report on the lunch programs experiences of one child. We decided to select

[1]Chapter VI describes this post-sample frame matching and provides related population estimates.

TABLE III.1

SUMMARY OF STUDENT SAMPLE SIZES

		Target Interviews				Released Sample Size, by Frame Meal Price Status				Released Sample Size, by Final Meal Price Status			
District	Pilot/ Comparison District	Free	Reduced	Paid	Total	Free	Reduced	Paid	Total	Free	Reduced	Paid	Total
Up-Front Documentation													
Blue Ridge, PA	P	21	16	60	97	30	16	86	132	42	11	79	132
Montrose, PA	C	21	16	60	97	28	22	84	134	32	16	86	134
East Stroudsburg, PA	P	21	16	60	97	29	24	83	136	23	22	91	136
Easton, PA	C	21	16	60	97	26	21	83	130	26	23	81	130
Pleasant Valley, PA	P	21	16	60	97	29	22	84	135	22	12	101	135
Bangor, PA	C	21	16	60	97	34	29	97	160	34	29	97	160
Stroudsburg, PA	P	21	16	60	97	28	22	85	135	26	15	94	135
Pottsgrove, PA	C	21	16	60	97	28	21	87	136	29	21	86	136
Maplewood, OH	P	21	16	60	97	28	20	84	132	23	10	99	132
Newton Falls, OH	C	21	16	60	97	30	20	77	127	34	20	73	127
Salem, OH	P	21	16	60	97	31	20	80	131	33	20	78	131
Lisbon, OH	C	21	16	60	97	30	17	82	129	34	18	77	129
Creve Coeur, IL	P	21	16	60	97	18	21	80	119	19	20	80	119
North Pekin and Marquette Heights, IL	C	21	16	60	97	26	12	81	119	28	7	84	119
Oak Park and Forest River, IL	P	21	16	60	97	21	20	84	125	18	8	99	125
Valley View, IL	C	21	16	60	97	29	23	86	138	29	23	86	138
Williamson County, TN	P	21	16	60	97	31	22	80	133	31	22	80	133
Wilson County, TN	C	21	16	60	97	28	19	81	128	26	16	86	128
Graduated Verification													
Dilworth-Glyndon-Felton, MN	P	61	23	56	140	65	24	84	173	52	20	101	173
Lake Park Audubon/Breckenridge, MN	C	62	22	56	140	80	28	84	182	77	30	76	182
Grandview, MO	P	76	28	69	173	107	27	98	232	102	22	108	232
Hickman Mills, MO	C	76	28	69	173	106	40	97	243	100	42	101	243
Dunkirk, NY	P	76	28	69	173	105	29	98	232	105	29	98	232
Jamestown City, NY	C	76	28	69	173	111	35	98	244	106	27	111	244
		806	**440**	**1,469**	**2,715**	**1,078**	**554**	**2,053**	**3,685**	**1,051**	**483**	**2,151**	**3,685**

and interview one student per household. Therefore, we grouped students in households and selected one per household for the student sample. Sample weights used in the analysis account for the higher selection probabilities of students from households with more students.

We considered varying the allocation of sample to districts and meal price groups within districts in a manner that satisfied variance constraints on key outcomes and took account of the differing costs of data collection among families whose incomes fell above and below 400 percent of the federal poverty level (FPL). Using sample optimization methods (described in the next section), we determined that equal samples per district within each pilot type were close to optimal.[2] Because equal allocations by district and meal price status group greatly simplified both the sampling process and survey operations, we decided to use equal allocations rather than the optimal ones.

2. Analysis of Sample Allocation

Several factors in addition to schedule created a very challenging problem for stratification and allocation of the sample. This study is unusual because the research questions focus on subgroups of households defined in terms of their income for household size and meal price status rather than on the population as a whole. For example, the deterrence issues focus on students whose family incomes are above 185 (or 130) percent of poverty; the barrier issues focus on students whose family incomes are below those thresholds; and issues surrounding accuracy focus on students who are certified for free or reduced-price meals (and asks what percentage of them are above or below the eligibility thresholds). While these subgroups were to be identified using the data on household income obtained through the survey, the information

[2]In the end, we used different sample sizes in some districts after the final comparison districts were selected.

available before the survey for sample stratification was only indirectly related to the analytic groups. Furthermore, the analytic groups overlap in such a manner that the number of sample points allocated to one group affects the number allocated to others. Consequently, the sampling process had to assign differential sampling rates to various groups in a way that ensured a sufficient sample size in each domain while avoiding allocating more than necessary to other domains. Finally, because the interview costs differed by household income level, efficient sample allocation had to take these cost differences into account.

To assess alternative allocations, we assumed that we would obtain from each participating district a list showing each student's meal price and then select a single-stage stratified sample under a specified allocation plan. We first defined sampling strata that would correspond as closely as possible to the key analytic groups. Because the available lists contained information on district membership and meal price status, we planned originally to stratify the sample into 84 explicit sampling strata based on district membership (28 total, made up of 10 Up-Front Documentation districts plus their matched comparison districts, and four Graduated Verification pilot districts plus their matched comparisons) and the student's meal status (approved for free meals [excluding direct certified], approved for reduced-price, and remaining non-meal program students designated as "paid"). The final sample included 25 school districts, with three meal price categories, for a total of 75 sampling strata.[3]

Because the strata did not correspond to the analytic subgroups, the second major step was to estimate the percentage of each stratum group that belonged to each analytic group. This

[3]The RFP called for including 14 pilot SAFAs in the evaluation of these two were dropped (Morenci, AZ and St. Mary's in Paterson, NJ). Eleven of the included pilot districts were matched to a single comparison district. For the Dilworth Glyndon-Felton School District in Minnesota two comparison districts were selected for a total of 25 districts.

mapping from sampling strata to analytic groups allowed us to estimate how changes in the allocation of the sample across the strata would affect sample sizes for each analytic group. We used data provided by FNS about the rate of benefit reduction and termination in the standard verification process during the pre-pilot period in the pilot districts to estimate these mappings.[4] The final strata profiles used for assessing sample allocation are shown in Table III.2A and Table III.2B, which also show initial estimates of the population counts in each stratum for each analytic group and the percentage of these cases represented in each stratum. Because the available district level data were insufficient to support district-specific estimates, we assumed that the mapping would be the same across all districts in each pilot type.

An example from the Up-Front Documentation pilot districts will help to clarify the structure of Table III.2A and Table III.2B. We first estimated the percentage of each stratum group in each analytic group. For example, for the analytic group "income >185 percent FPL," we estimated that 19 percent of free-certified students, 19 percent of reduced-price-certified students, and 91 percent of paid students would have income >185 percent FPL. Second, applying these percentages to the population counts for free, reduced-price, and paid produced estimated populations of 535 free-certified with income >185 percent FPL, 327 reduced-price certified with such income, and 23,053 paid with such income. Finally, from these estimated populations we computed the percentage of each analytic group belonging to each stratum group: among students with income >185 percent FPL, 2.2 percent were estimated to be free, 1.4 percent reduced-price, and 96.4 percent paid.[5]

[4]Modification to RFP FNS-02-008JMC transmitted from Michael Rich to Jim Ohls on February 6, 2002.

[5]The distribution by stratum within analytic group helped to show how allocating more (or less) sample to the free stratum affected the number of sample in each analytic group.

TABLE III.2A

EXPECTED MAPPING OF SAMPLING STRATA INTO THE ANALYTIC GROUPS—
UP-FRONT DOCUMENTATION

	Stratum Group				
Analytic Group	Free	Reduced	Paid	Total Population[a]	Percentage of Population in Analytic Group
Population Count	2,816	1,719	25,333	29,868	
Percentage of Population	9.4	5.8	84.8	100	
Certified Free Not Directly Certified					
Percentage of Stratum Group in This Analytic Group	95	4	1		
Estimated Population	2,675	69	253	2,997	10.0
Percentage of Analytic Group in Each Stratum Group	89.3	2.3	8.5	100.0	
Certified Reduced-Price					
Percentage of Stratum Group in This Analytic Group	2	90	1		
Estimated Population	56	1,547	253	1,857	6.2
Percentage of Analytic Group in Each Stratum Group	3.0	83.3	13.6	100.0	
Income >185 Percent FPL					
Percentage of Stratum Group in This Analytic Group	19	19	91		
Estimated Population	535	327	23,053	23,914	80.1
Percentage of Analytic Group in Each Stratum Group	2.2	1.4	96.4	100.0	
Income >130 Percent FPL					
Percentage of Stratum Group in This Analytic Group	39	92	97		
Estimated Population	1,098	1,582	24,573	27,253	91.2
Percentage of Analytic Group in Each Stratum Group	4.0	5.8	90.2	100.0	
Income ≤130 Percent FPL					
Percentage of Stratum Group in This Analytic Group	61	8	3		
Estimated Population	1,718	138	760	2,615	8.8
Percentage of Analytic Group in Each Stratum Group	65.7	5.3	29.1	100.0	
Income ≤185 Percent FPL					
Percentage of Stratum Group in This Analytic Group	81	81	9		
Estimated Population	2,281	1,393	2,280	5,953	19.9
Percentage of Analytic Group in Each Stratum Group	38.3	23.4	38.3	100.0	

[a]Population Counts include all students not directly certified in the 10 Up-Front Documentation districts specified for inclusion in the RFP for the study. Data pertain to the year prior to each districts' first year of pilot operation. Figures are totals across districts in the group.

TABLE III.2B

EXPECTED MAPPING OF SAMPLING STRATA INTO THE ANALYTIC GROUPS—GRADUATED VERIFICATION

	Stratum Group				
Analytic Group	Free	Reduced	Paid	Total Population	Percentage of Population in Analytic Group
Population Count[a]	2,052	751	4,306	7,109	
Percentage of Population	28.9	10.6	60.6	100	
Certified Free Not Directly Certified					
Percentage of Stratum Group in This Analytic Group	95	4	1		
Estimated Population	1,949	30	43	2,023	28.5
Percentage of Analytic Group in Each Stratum Group	96.4	1.5	2.1	100.0	
Certified Reduced-Price					
Percentage of Stratum Group in This Analytic Group	2	90	1		
Estimated Population	41	676	43	760	10.7
Percentage of Analytic Group in Each Stratum Group	5.4	88.9	5.7	100.0	
Income >185 Percent FPL					
Percentage of Stratum Group in This Analytic Group	19	19	91		
Estimated Population	390	143	3,918	4,451	62.6
Percentage of Analytic Group in Each Stratum Group	8.8	3.2	88.0	100.0	
Income >130 Percent FPL					
Percentage of Stratum Group in This Analytic Group	39	92	97		
Estimated Population	800	691	4,177	5,668	79.7
Percentage of Analytic Group in Each Stratum Group	14.1	12.2	73.7	100.0	
Income ≤130 Percent FPL					
Percentage of Stratum Group in This Analytic Group	61	8	3		
Estimated Population	1,252	60	129	1,441	20.3
Percentage of Analytic Group in Each Stratum Group	86.9	4.2	9.0	100.0	
Income ≤185 Percent FPL					
Percentage of Stratum Group in This Analytic Group	81	81	9		
Estimated Population	1,662	608	388	2,658	37.4
Percentage of Analytic Group in Each Stratum Group	62.5	22.9	14.6	100.0	

[a]Population counts include all students not directly certified in the 3 Graduated Verification districts specified for including in the RFP for the study. Data pertain to the year prior to each district's first year of pilot operation. Figures are totals across districts in the group.

To be optimal, or nearly so, for this study's objectives, the sample allocation had to meet precision objectives for three analytic groups: (1) students approved for free meals by application, (2) students in households with incomes above 185 percent of the FPL, and (3) students in households with incomes of 185 percent or less of the FPL.[6] Within these three analytic groups, it was important to be able to detect difference in proportions between the pooled pilot and comparison districts of 10 to 12 percentage points or less. This required oversampling some groups and undersampling others, which created design effects due to differential selection probabilities and reduced the effective sample size for any nominal sample size generated.[7] Accordingly, for each allocation plan tested, we calculated the corresponding precision levels, given the design effects created by the specific sample allocation plan.

In addition to the general precision objectives for designing an optimal allocation, we needed to consider the data collection costs and the planned pooled district data analysis. In this study, the cost of conducting the survey varies with the allocation plan, because the paid strata were expected to have a lower cost per complete, as they would contain more households with

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[6]Table V.2A and Table V.2B present our analysis of sample precision for the final design and compare planning targets with actual precision achieved.

[7]The design effect due to unequal selection probabilities in a stratified sampling plan is the ratio of the variability in the estimates that is obtained from a specific sample allocation relative to the variability that would result with a sample that is allocated in proportion to the strata population sizes. For example, a design effect of 1.2 indicates that the design selected introduces 20 percent more variation in the survey results than would a design that uses simple random sampling with a proportional allocation. Dividing the sample size by the design effect determines the effective sample size that should be used to gauge the precision level of the estimates using simple random-sampling-theory-based confidence intervals. We note that in the absence of actual survey outcomes, one can estimate a survey design effect due to weighting by computing the $1+ CV^2$ of the weights (the square of the coefficient of variation, which is equal to the standard deviation of the weights divided by the mean weight value). This approximation to the true design effect estimates the relative increase in the variation in the survey outcomes from the planned sample allocation, but it does not account for the effects of stratification (which would reduce the design effect) or clustering (which would increase it).

incomes over 400 percent of the FPL that would not require a part 2 interview. Therefore, while a variety of allocation schemes may yield the desired precision levels, we wanted to find the one that minimized the survey costs.

To account for these constraints, we used a mathematical technique based on a methodology developed by Chromy (1987). The allocation algorithm can be described as a two-step process for a stratified non-geographically clustered sample directed to:

(1) Minimize cost $(C) = \Sigma c_h \; n_h$

(2) Subject to precision constraints ($Var*_k$) on variance estimates (V_k)

$$Var_k \leq Var*_k \text{ where } Var_k = \Sigma \; \{W_h \, Var_{k\,h}\} / \{n_h \; p_{k,h}\}$$

where $Var*_k$ is the statistical precision constraint for the *k*th estimate (in the algorithm this constraint is entered as the value of the desired standard error of the estimate being the square root of the value of $Var*_k$), the $Var_{k,h}$'s are the estimated variance components (the expected variability in the outcomes) associated with the *k*th estimate and the *h*th stratum, and these are then weighed by relative stratum population counts, W_h and divided by a sample size factor to sum to the resulting sampling variances for each domain Var_k . The sample size factor, $n_h \; p_{k,h}$, takes into account that only a portion $p_{k,h}$ of the sample selected, n_h, in our situation from stratum *h* will be a member of analytic group *k*.

To apply the method for our application, we composed the variance components to reflect variation in a binomial outcome. We defined this statistic to have a mean value of *p*, implying a variance equal to $p*(1–p)$. Across the six analytic groups the value of *p* with the smallest variance was .1, and the value of *p* with the largest variance was .63. Values assumed for the comparison districts from which the pilot impacts would be measured are presented in Table V.2A and Table V.2B. Given the plan to compare equally weighted averages of the district outcomes, we set up the algorithm so that *h* above indexed the originally specified 42 districts by meal status combinations for the pilot districts and *k* defined the combinations of 14 districts by the six analytic groups (84 constraints).[8] Separately for the Up-Front Documentation and Graduated Verification study districts, we specified that the precision for each district should be equal and have an average value that would yield the desired minimum detectable difference (MDD) between the pilot and comparison districts. For example, all 10 originally specified Up-Front Documentation pilot districts received the same precision constraint for each analytic group. Therefore, when these districts were pooled using an equally weighted average approach, that would produce a standard error of about .035 (translating to an individual district standard error constraint of .246), which would equate to an MDD of 10 percentage points at 80 percent power. While the algorithm did not allow us to specify a constraint that the district sample sizes within each program should be equal, we believed this equal-by-district variance constraint model would nearly achieve that objective and would form the constraints on the variances to parallel the planned analysis. We set the values of $p_{k,h}$ to be equal across districts, but to vary by meal price status. For the W_h values we used the district-by-meal-status population counts as presented in the RFP. Finally, for the paid stratum group in each district, we assumed the average interview cost would be about one-half that of the cost of interviewing in the other strata since we would not have to conduct in-person interviews with those having incomes more than 400 percent of the FPL.

We conducted several exploratory applications of the sample optimization model. We initially imposed an MDD of 10 percentage points or lower between the combined comparison

[8] As noted above, the RFP for the study specified 10 Up-Front Documentation districts and four Graduated Verifications. These specifications were used in sample planning.

site estimate and the combined pilot site estimate at 80 percent statistical power and 95 percent confidence for each of the three key analytic groups. For each of the remaining objectives, we set less-stringent requirements—MDDs of 12 to 15 percentage points. We then began relaxing constraints as needed until we obtained an overall sample size of about 2,800. The final allocation suggested a total of 1,740 interviews to be allocated across each of the 10 Up-Front Documentation pilot district and their comparison districts (87 per district) and 1,040 across the four Graduated Verification pilot districts and their comparison districts (130 per district).

Because the methods were applied at the district level and accounted for differences among districts in the population distribution by meal price status, the algorithm did not produce an optimal sample allocation in which sample sizes were equal across districts. However, the differences by district were small for the optimum allocation. We used the algorithm[9] to compute how the precision would change if each district's optimal total sample size was adjusted so that sample sizes were equal by district within each set of pilots. Adjusting the totals to be equal by district had very small effects on the precision. As a final step, we evaluated the effects of allocating equal numbers of free, reduced-price, and paid students in each district, and found it to have only a small impact on the precision (it increased the MDDs by about 1 percentage point). Accordingly, we set the sample sizes at 19 free, 14 reduced-price, and 54 paid (87 total per site) in each Up-Front Documentation pilot and comparison site, and at 57 free, 21 reduced-price, and 52 paid (130 total) for the Graduated Verification pilot and comparison sites.

As planning proceeded, two pilot sites were excluded from the evaluation: Morenci School District in Arizona (an Up-Front Documentation plot district) and St. Mary's School in Paterson,

[9] The algorithm we used was designed to allow the user to specify a starting or alternative sample allocation for which it computes the resulting precision estimates for comparison to the optimal allocation suggested to meet the specify precision targets.

New Jersey (a Graduated Verification pilot district). To compensate for this reduction in the number of districts from 28 to 24, we increased the sample sizes in each remaining district. The final allocation consisted of 21 free by application, 16 reduced-price, and 60 paid (97 total) per Up-Front Documentation district. In the Graduated Verification districts, the sample sizes varied from 31 free, 11 reduced-price, and 28 paid (70 total) to 76 free, 28 reduced-price, and 69 paid (173 total).

B. DESCRIPTION OF THE SAMPLE SELECTION PROCESS

Forming the sampling strata required placing all students enrolled in each participating district into four categories: (1) directly certified for free meals, (2) certified for free meals by application, (3) certified for reduced-price meals, and (4) not certified for free or reduced-price school meals. Nineteen districts provided four separate lists, which included (1) students approved for free meals, (2) students approved for reduced-price meals; (3) students approved for free meals by direct certification (if applicable), and (4) a full enrollment listing for the current school year. We constructed the sample frame by identifying and eliminating duplicate entries and then merging the meal price status list with the full enrollment list. Six districts provided a full enrollment listing with meal status information, which included meal price status information for each student, and thus provided the necessary sampling frame.

Sample selection entailed a two-, three-, or four-stage stratified process, depending on the nature of the sample frame and whether the district chose to use a passive consent process and/or provide contacting information only for sampled students. Stage 1 used an interval sampling method to reduce the size of hard-copy lists for data entry. Stage 2 used stratified systematic sampling to reduce the list/sample resulting from Stage 1 for five districts that requested limiting the contact information provided to a sample of their student body. After grouping students selected in stages 1 and 2 who lived in the same household, Stage 3 consisted of selecting a sample of households. Stage 4 involved selecting one student from each household group selected in Stage 3.

We based the stratification for each of the sampling stages 2 through 4 on district membership and meal price status. In one Graduated Verification comparison district, the sample was also stratified by Hispanic surname, and students with Hispanic surnames were oversampled in order to align the sample's ethnic composition better with that of its pilot district.

To achieve the desired study schedule, we conducted the sampling frame development, the sample selection, and the interviewing process on a flow basis as we received information from the districts. In the next two subsections, we provide details on the list acquisition and processing and sample selection steps.

1. List Acquisition and Processing

As noted, most districts furnished three or four different lists of students from which we developed sampling frames. Table III.3 provides an overview of the sampling lists received from each district. It shows (1) the medium of the full enrollment list (whether in electronic format or in hard copy) and, if in hard copy, the sampling interval used to select an initial sample for data entry; (2) the medium of the list of students approved for free and reduced-price meals; (3) the point at which the meal price status list was generated (prior school, current school year before 30th day, current school year after 30th day); (4) the medium of the list of directly certified students (if applicable); (5) the variables used to match the free and reduced list to the direct certification list; and (6) the variables used to match the meal price status list to the full sample. All the direct certification lists and the full enrollment lists reflected the status of students at the start of the 2002–2003 school year.

TABLE III.3

SAMPLING FRAME SUMMARY: CHARACTERISTICS OF LISTS PROVIDED AND PROCESSING METHODS

		Full Enrollment List	List of Students Approved for Free and Reduced-Price Meals		List of Directly Certified Students	Variables Used to Match	
Processing Order	Pilot Comparison Status	Medium (Sampling Interval); HC = Hardcopy, Elec. = Electronic	Status[a]	Medium; HC = Hardcopy, Elec. = Electronic	Medium; HC = Hardcopy, Elec. = Electronic	Free and Reduced List to Direct Cert. List	Meal Price Status to Full Enrollment List
Up-Front Documentation							
Blue Ridge, PA	P	HC (2)	P	HC	NA	NA	ID
Montrose, PA	C	HC (4)	P	HC	HC	ID	ID
East Stroudsburg, PA	P	HC (10)	P	Elec.	Elec.	NA	DC: Name and birth date, F&R: Name, grade
Easton, PA	C	Elec.	C>30	HC	HC	Name (No dups)	Name, grade
Pleasant Valley, PA	P	HC (6)	P	HC	HC	Name and grade	Name, grade
Bangor, PA[b]	C	Elec.	NA	NA	NA	NA	NA
Stroudsburg, PA	P	HC (5)	P	HC	NA	NA	Name, grade, school
Pottsgrove, PA	C	Elec.	C>30	Elec.	NA	NA	Name, street number
Maplewood, OH	P	HC (1)	P	HC	NA	NA	Name only
Newton Falls, OH	C	HC (1)	C<30	HC	NA	NA	Name, grade
Salem, OH	P	HC (2)	C>30	Elec.	NA	NA	Name (grade partial)
Lisbon, OH	C	HC (2)	C<30	HC	NA	NA	Name, grade
Creve Coeur, IL[c]	P	Elec.	NA	NA	NA	NA	NA
North Pekin and Marquette Heights, IL	C	Elec.	P	HC	NA	NA	Name, grade
Oak Park and Forest River, IL	P	Elec.	P	HC	NA	NA	Name only
Valley View, IL[b]	C	Elec.	NA	NA	NA	NA	NA
Williamson County, TN[a]	P	HC (2)	NA	NA	NA	NA	NA
Wilson County, TN[d]	C	HC (11)	C<30	HC	NA	NA	Name (grade partial)

TABLE III.3 (*continued*)

		Full Enrollment List	List of Students Approved for Free and Reduced-Price Meals		List of Directly Certified Students	Variables Used to Match	
Processing Order	Pilot Comparison Status	Medium (Sampling Interval); HC = Hardcopy, Elec. = Electronic	Status[a]	Medium; HC = Hardcopy, Elec. = Electronic	Medium; HC = Hardcopy, Elec. = Electronic	Free and Reduced List to Direct Cert. List	Meal Price Status to Full Enrollment List
Graduated Verification							
Dilworth-Glyndon-Felton, MN	P	HC (1)	P	HC	HC	Name and grade	Name, grade
Breckenridge, MN[d]	C	HC (2)	C<30	HC	HC	NA	Name only
Lake Park Audubon, MN[d]	C	HC (2)	C<30	Elec.	NA	NA	Name, grade
Grandview, MO	P	HC (5)	C<30	HC	HC	Name and grade	Name, grade
Hickman Mills, MO	C	HC (11)	C<30	HC	HC	NA	DC-ID, F&R- ID
Dunkirk, NY[f]	P	HC (5)	NA	NA		NA	NA
Jamestown City, NY[e]	C	Elec.	NA	NA	HC	ID	ID

[a]Status: P indicates lists was for prior school year; C<30 indicates list was for current school year, but generated less than 30 days after the start of the current school year; C>30 indicates list was generated more than 30 days after the start of the current school year; NA means not applicable no separate list supplied, but meal price status was indicated on enrollment list.

[b]The full enrollment list or file identified the meal status: free, reduced-price, and directly certified.

[c]For Creve Coeur, the full enrollment list identified the free and reduced-rice, but did not indicate which free certified students were directly certified.

[d]The free and reduced-price list identified directly certified students

[e]For Dunkirk, the full enrollment file identified the meal status: free and reduced; however the district provided only 1 in 5 sample but also provided total counts.

[f]Free and reduced-price list and direct certification list were each matched separately to full enrollment list by ID number.

Eight of the 25 districts provided electronic lists, which we converted to a standard SAS data set format with standardized data field names for subsequent processing. Seventeen of 25 districts provided a full enrollment list in hard-copy format. The first processing step was to enter the data into electronic files. To reduce costs and perform the sampling more quickly, we selected a sample of each full enrollment list for data entry. Because we planned to match the meal price status lists to this full enrollment sample to produce a single sampling frame for the study, we set the sampling interval for the full enrollment list to ensure they would contain enough free and reduced-price students. We established the sampling interval by calculating the interval necessary to meet sample targets for the lowest incidence stratum, and then doubled the sampling rate to allow for loss due to nonresponse and other reasons. After setting the interval, we selected a random integer within the interval as the start point, and then selected every *k*th case (where *k* is the sampling interval). In most cases the hard-copy lists were ordered by student last name, which we felt would not introduce any periodicity effects (such as biases in the selection process) from the use of an interval sampling method. If districts provided the free and reduced-meal price lists in hard copy, we entered data for all students on these lists.

The second major task in preparing the sampling frame was to match the free, reduced-price, and directly certified lists to the full enrollment lists. Nineteen of the school districts[10] maintained the list of students approved for free and reduced-price meals separately from the full enrollment records and consequently could not provide a single list that met our needs.

[10]Of the 25 districts, 19 provided completely separate lists. The Jamestown (NY) and Creve Coeur (IL) school districts provided a list that identified free and reduced students but omitted direct certification, which they supplied on a separate list at a later date. The Bangor (PA), Valley View (IL), Williamson (TN), and Dunkirk school districts provided a list that identified meal status among the full enrollment (Dunkirk provided only a sample) for free, reduced, and direct certification.

Furthermore, only 3 of the 19 districts provided an identification number that allowed us to link the entries across the lists. Consequently, in 16 districts, we matched the lists showing the student's meal price status to the full enrollment list (or the sample selected from it) for creating the sampling strata. In most districts, the information available to perform this match was limited to the student's name and grade.

We used an electronic matching process to classify the students by meal price status for sampling purposes. We chose this method for two reasons. First, we believed that extensive visual matching to create the sample frames would have created delays in the start of data collection, which would not have been acceptable given the tight schedule for completing the data collection effort. Second, we anticipated that electronic matching methods would be accurate enough for sample stratification purposes, which could tolerate some classification errors without seriously diminishing the benefits of stratification in the sample. Third, we planned to perform a visual matching of our sample to lists of students approved for free and reduced-price meals as of the end of October. For 16 of the districts, the meal price status lists that they provided in time for sampling were not final, and we acquired a more current list to support the data analysis.[11] Because manual matching would have to have been repeated, we decided to limit our matching efforts in preparing the sampling frame and to expend the resources to conduct a more careful visual review on the updated lists received after October 31, 2002 (discussed in Chapter IV).

The first step in the matching process was to combine the free, reduced-price, and direct certification lists into a single file. While the free and reduced lists usually were provided

[11]In 9 of the 16 districts, the lists provided for the free and reduced-price students were from the previous school year. In the other 7 districts, the lists were more than 30 days old at the time interviewing began.

separately, a sorting and review process on the records by name revealed little if any duplication, and therefore we were able to combine these without the need for a formal matching process. In some districts, as Table III.3 indicates, if the district used direct certification, direct certification status of the student was indicated on the free certified listing, and combining the free and reduced-price lists yielded a single list of students approved for free (non-directly certified), reduced and directly certified for free meals. However, four districts provided separate direct certification lists, of which one provided a linking identification number and the other three required a name and grade matching process (see below) to eliminate across-list duplication.[12] After preparing a combined free/reduced-price/direct-certification list, we matched this list to the full enrollment file to create the sampling frame.

If name and grade were used to match student records electronically, we used a two-stage process in which the second stage helped mitigate the effects of misspellings and other errors in the data. For the first step, we identified via SAS those students on both files whose names matched exactly. We checked these to determine whether the grade level (when available—3 of the 16 districts did not provide grade-level information on the meal status lists, and 2 others had high levels of missing grade data) was within one year and printed for visual review those cases in which the grade differed by more than one year.[13] From the remaining names from each source, we then applied a SAS Soundex matching process[14] to link any records that were true

[12]Among the duplicates, membership on the direct certification lists took priority for the final classification.

[13]In general, many of these sets had a missing grade value from one source (to which we considered them to be a match) or were clearly related siblings (which we considered to be a non-match).

[14]The SoundEx matching algorithms are methods of matching components that sound alike but have different spellings. Both methods are fairly effective in locating misspellings, particularly those due to typographical errors.

matches the exact matching process had missed because of typographical errors or misspellings. We then applied the same review of grade level as was used for the exact matches to finalize the meal status for sampling. We used these methods in 3 districts to match the free and reduced-meal list to the direct certification lists and in 16 districts to match the combined meal price status listing to the full enrollment list/sample. Ultimately, linked records on the full enrollment list received the meal status from the combined free/reduced/direct certification file. We then removed directly certified students from the enrollment list to finalize the sampling frame.

Table III.4 shows sampling frame counts by district, and the estimated proportion of students certified for free and reduced-price meals that we could match to the current year enrollment list/sample. The match rate is the total number actually matched divided by the expected number that would match (the number on the resolved list of students certified free and reduced-price multiplied by the initial rate at which names were selected from the full enrollment list for initial data entry).[15]

In general, the match rates were lower than we hoped for, with a low of 61.2 percent in Grandview, MO and a match rate below 90 percent in 13 of the 25 districts. Among these 13 districts, 8 provided an initial listing of meal price status for the prior school year. Use of a prior year caused new entrants to the district's schools (including new kindergarten students) to be assigned a status of paid, which for some was almost certainly incorrect and reduced the efficiency of the sample stratification. For the other five districts, including Grandview, MO, we could not identify a reason for the low matching rate.

[15]For example, if we conducted a 1-in-5 sampling process on the full enrollment list prior to data entry, we would have expected only one-fifth of the meal status students to have linked successfully to the full enrollment sample.

TABLE III.4

SAMPLING FRAME COUNTS BY DISTRICT

District	Pilot/ Comparison District	Full Enrollment Fall 2002	Resolved List of Students Certified for Free Meals and Not Directly Certified[a]	Resolved List of Students Certified for Reduced Price Meals[b]	Number of Students on Direct Certification List After Removing Duplicates	Number of Students on Original List of Students Approved for Free and Reduced-Price Meals	Difference Between Resolved Free and Reduced-Price and Original List Count	Match Rate Percentage[c]
Up-Front Documentation Districts								
Blue Ridge, PA	P	1,240	212	95	0	307	0	99.7
Montrose, PA	C	1,792	306	199	74	573	68	84.3
East Stroudsburg, PA	P	7,790	1,267	473	617	1,740	0	100.0
Easton, PA	C	7,829	950	427	421	1,377	0	87.2
Pleasant Valley, PA	P	6,720	802	290	159	1,096	4	69.1
Bangor, PA	C	3,677	345	239	82	584	0	100.0
Stroudsburg, PA	P	5,235	749	257	0	966	-40	85.4
Pottsgrove, PA	C	3,306	305	104	0	409	0	91.4
Maplewood, OH	P	1,147	75	49	0	158	34	70.3
Newton Falls, OH	C	1,600	286	120	0	406	0	92.4
Salem, OH	P	2,458	377	77	0	454	0	87.2
Lisbon, OH	C	1,178	297	90	0	387	0	86.8
Creve Coeur, IL	P	687	219	75	MS	294	0	100.0
North Pekin and Marquette Heights, IL	C	660	149	30	MS	179	0	74.9
Oak Park and Forest River, IL	P	2,971	132	70	MS	202	0	86.6
Valley View, IL	C	1,862	309	91	17	400	0	100.0
Williamson County, TN	P	6,574	208	100	376	318	10	100.0
Wilson County, TN	C	12,177	1,042	447	304	1,489	0	73.0
Total: UFD Pilot Districts	P	34,822	4,041	1,486	1,152	5,535	8	
Total: UFD Comparison Districts	C	34,081	3,989	1,747	898	5,804	68	
Graduated Verification Districts								
Dilworth-Glyndon-Felton, MN	P	1,352	164	80	152	343	99	77.8
Breckenridge, MN	C	996	138	68	63	206	0	88.5
Lake Park Audubon	C	692	133	79	34	212	0	94.3
Grandview, MO	P	4,380	1,156	310	551	1,794	328	61.2
Hickman Mills, MO	C	7,821	3,484	870	1,035	4,354	0	98.0
Dunkirk, NY	P	1,825	619	187	MS	806	0	100.0
Jamestown City, NY	C	5,397	2,029	449	772	2,478	0	100.0
Total: GV Pilot Districts	P	7,557	1,789	577	703	2,943	427	
Total: GV Comparison Districts	C	14,906	5,784	1,466	1,904	7,250	0	
Total		**88,063**	**15,753**	**5,276**	**4,657**	**21,532**	**503**	

[a]Duplicates have been removed from the list. Duplicates and directly certified students have been removed from the list of free approved students.
[b]MS indicates missing either due to an error in understanding that the district was using direct certification (Creve Coeur, N.Pekin/Marquette Heights, Oak Park/River Forest) or because the district never provided a list (Dunkirk).
cMatch rate percentage =
[Number of students approved free and reduce price and matched to the full enrolment list] / [Full enrolment count * 1/K] where K is the sampling interval from the full enrollment list.

As a check on our electronic two-step matching procedures, we manually reviewed the listings in several districts and found that many of the students on the free and reduced-price list simply were not listed on the full enrollment list. This suggested to us that the free and reduced-price lists include some students who no longer attend district schools, and therefore the actual percentage of students certified for free and reduced-price meals is lower than that inferred from the list counts. Grandview is a good example of this problem in that the weighted sample estimates the number of students certified free by application is 856 compared to the provided initial list size of 1,156 (noting that the updated list also contained an even larger listing of free students, 1,443 (Table III.4).

Finally, we note several problems related to identifying directly certified students. Staff at Creve Coeur, Oak Park and River Forest, and North Pekin and Marquette said they did not use direct certification at the time we were preparing the sample frame. However, this turned out to be incorrect, because in 2002 the state of Illinois began requiring all state districts to accept as directly certified all students who brought to school a letter indicating their eligibility based on food stamp or TANF receipt. As a result, we selected into the sample and interviewed some directly certified students who ended up being ineligible for the study. Because we could not replace these students with additional students who were free by application, this error produced smaller-than-planned samples for Creve Coeur and Oak Park.[16]

We also misinterpreted the indicator of direct certification status in the data file provided by Jamestown City, and selected into the sample and interviewed 31 directly certified students. However, we detected this error during the data collection period and replaced these students with others certified free by application to maintain the desired sample size.

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[16]No directly certified students were selected and interviewed in North Pekin and Marquette.

2. Sampling Steps

The sampling steps varied from district to district, with a maximum of four sampling stages conducted, depending on the situation. The first step, when needed, was an interval sample selection of the students listed on the full enrollment list to reduce data entry. In five districts desiring to limit the release of the contact information to a sample of their students, we also conducted a secondary stratified sample selection process. Following these list reduction steps are the primary sampling steps for the selection of the student records, which we will refer to as the household selection step and the subsequent student-within-household selection.

Table III.5 summarizes the sampling steps conducted for each district. Five districts—Montrose (PA), Creve Coeur (IL), North Pekin and Marquette Heights (IL), Williamson (TN), and Wilson (TN)—required that we select a sample of students so that they would need to provide MPR with contacting information only for the sample rather than for all students.[17] For UFD comparison district 1 and UFD pilot district 9, we selected an interval sample from the entire full enrollment file to reduce the keying; in the other two districts, the full listing was keyed. From the full list/sample we then selected a stratified sample based on meal status using an allocation that roughly inflated the number of targeted interviews presented in Table III.1 by 40 percent to account for refusals. We sent this sample to the district, and they returned the address information to allow us to proceed to the household selection stage.

[17]We note that UFD comparison district 3, GV pilot district 3, UFD pilot district 6, and UFD comparison district 8 required passive consent, but they provided us with street addresses on the full enrollment list to eliminate the need for a pre-household sampling step. GV pilot district 3 basically provided us with a 1-in-5 sample of their students (365 students) for which they obtained passive consent and then returned to us the names and addresses for the consenting students (352 students) to merge to the sample file.

TABLE III.5

OVERVIEW OF SAMPLING STEPS CONDUCTED ON EACH DISTRICT

		Stage 1		Stage 2		Stage 3			Stage 3/4
						Household Selection Method			
District	Pilot Comparison Status	Interval (1 = NA)	Sample Size	Special Situation	Sample Size	Free	Reduced	Paid	Households/Students Sample Size
Up-Front Documentation									
Blue Ridge, PA	P	2	620			Equal	Equal	PPS	241
Montrose, PA	C	4	448	No addresses provided	281	Equal	Equal	Equal	261
East Stroudsburg, PA	P	10	779			Equal	Equal	PPS	283
Easton, PA	C	1	7,829			PPS	PPS	PPS	291
Pleasant Valley, PA	P	6	1,120			PPS	PPS	PPS	284
Bangor, PA	C	1	3,677	Passive consent	NA	PPS	PPS	PPS	160
Stroudsburg, PA	P	5	1,047			PPS	Equal	PPS	279
Pottsgrove, PA	C	1	3,306			PPS	Equal	PPS	291
Maplewood, OH	P	1	1,147			PPS	PPS	PPS	243
Newton Falls, OH	C	1	1,600			PPS	Equal	PPS	291
Salem, OH	P	2	1,229	Passive consent	NA	PPS	Equal	PPS	264
Lisbon, OH	C	2	589			PPS	Equal	PPS	231
Creve Coeur, IL	P	1	687	No addresses provided	291	PPS	PPS	PPS	229
North Pekin and Marquette Heights, IL	C	1	660	No addresses provided	303	Equal	Equal	Equal	251
Oak Park and Forest River, IL	P	1	2,971			Equal	Equal	PPS	291
Valley View, IL	C	1	1,862	Passive consent	NA	PPS	PPS	PPS	233
Williamson County, TN	P	2	3,287	No addresses provided	320	Equal	Equal	Equal	297
Wilson County, TN	C	11	1,107	No addresses provided	297	Equal	Equal	Equal	170

TABLE III.5 (*continued*)

		Stage 1		Stage 2		Stage 3			Stage 3/4
						Household Selection Method			
District	Pilot Comparison Status	Interval (1 = NA)	Sample Size	Special Situation	Sample Size	Free	Reduced	Paid	Households/Students Sample Size
Graduated Verification									
Dilworth-Glyndon-Felton, MN	P	1	1,352			Equal	Equal	Equal	240
Breckenridge, MN	C	2	498			Equal	Equal	PPS	165
Lake Park Audubon	C	2	346			Equal	Equal	PPS	165
Grandview, MO	P	5	876			PPS	PPS	PPS	355
Hickman Mills, MO	C	11	711			Equal	Equal	PPS	432
Dunkirk, NY	P	5	365	Passive consent	NA	Equal	Equal	Equal	347
Jamestown City, NY	C	1	5,397			PPS	PPS	PPS	519
Total			**43,510**		**1,492**				**6,813**

We wanted to interview each household only once in each phase of the survey, and about only one student. Because a fully student-based sample could yield more than one student selection from a household, we attempted to group the students by household. From the resultant listing, we selected a sample of households and then selected one child at random from each. Since we did not have any specific household linkage information from the school districts, we had to rely on the student's address and parent's name (when provided) to form the linkages. As a result, the household relationships created were not completely accurate, but this process greatly reduced the chance that we would end up with two students from the same household in the sample. During the interview, if two sample students were identified as members of the same household, the student that was discussed on first contact with the household became the student selected for the interview,[18] and we inflated this student's survey weight to compensate for this selection process.

We created the household groups using either the Double-Take software or an exact match on parent's last name and address. We decided which method to use depending on the time available to prepare the sample. As time permitted, we conducted a household identification process using the Double-Take[19] software package to parse the address information and to link records phonically if they had common addresses or parent last names. However, when we received the sampling lists shortly before the scheduled start of the field period for a district, we used exact matches on parent's last name or address rather than the more time-consuming but

[18]While this selection step was not completely random, the samples were originally sorted in a random replicate order, and only 51 such students were identified in the released sample of 3,806.

[19]From Peoplesmith Software, 50 Cole Parkway, Suite 34, Scituate, MA 02066-1337. [www.peoplesmith.com].

more accurate Double-Take methods. After we developed a set of tentative linkages using either method, we visually reviewed households that had three or more member students to confirm the linkage or to reject it if the information provided indicated that one or more of the linked students were not related.

With the pseudo household linkages in place, for the next step we assigned a meal status designation to each household for stratification purposes. In most cases the household linkages identified students with the same meal status; however, for those that did not, we assigned a meal status to the household based on the highest level of benefit approved among the member students. We then also assigned to each household the number of student records associated with each and reduced the student listing to a single record per household for the sample selection process. We note that because in many districts we selected an initial interval sample of the full enrollment lists, few multiple student households were identified and the number of students listed reflected a sample count rather than the actual number present in the household.

For the household selection step (Table III.5), for many districts we conducted an equal probability sample selection of the households in each free or reduced-price stratum and selected a probability-proportionate-to-size (PPS) sample of households in the paid stratum. For the free and reduced-price strata, the number of households available for sampling tended to be low, and we needed to select nearly all of the households, which precluded use of PPS sampling. In contrast, the base for the paid stratum was quite large, which allowed the use of a PPS selection process. When we were able to use a PPS approach, we used the number of students listed/sampled in these pseudo household groups as the measure of size. The use of a PPS sampling process for the households, coupled with the selection of one student at random from the selected households, produces a design that within each stratum gives the students the same probability of selection, which increases the precision in the survey estimates. In contrast with an equal probability selection of households and selection of one student per household, selection probabilities vary among students as the result of differences in the number of students per household.

As the final sampling and processing steps, we selected one student from each selected household and divided the sample of students into random replicates to allow for the possibility of making multiple sample releases. To select the students, we assigned a random-generated number between 0 and 1 to each and then sorted the students within each household based on the value of the random number. We then selected the first student from each household to complete the sample. In those districts with passive consent, we merged to the sample the passive consent outcomes and the contact information obtained. From the full sample we divided the sample into random replicates on a stratum basis. This process allowed us to generate a random subset of the sample to be released initially for interviewing and to supplement this release with another random subset as needed. With the short field period involved, we would be able to make only one sample release, and we used the replicates in each stratum to generate a sample equal to about 1.4 times the interviewing target (using the full sample if its size was smaller than this value) under the assumption that survey would yield a 70 percent response rate. One exception to a single sample-release occurred, in Jamestown (NY), where we released supplemental sample to replace some direct certification cases erroneously included in the initial release.

C. MATHEMATICAL SUMMARY OF THE STUDENT SELECTION PROBABILITIES

The value of the probability of selection of a student in this study can be mathematically expressed as product of multiple components associated with each stage of the student selection process as given in (1)

$$(1)\quad \pi_{D,h,i} = SR_D^1 \times SR_{D,h}^2 \times H_{h',hsld} \times ST_{i|hlsd}$$

$$= \frac{n_D^1}{N_D} \times \frac{n_{D,h}^2}{n_{D,h}^1} \times \frac{n_{D,h'}^H \times MOS_{D,h',hsld}}{\sum_{hsld}^{N_{D,h'}} MOS_{D,h',hsld}} \times \frac{1}{n_{D,hlsd}}$$

In (1), school districts are indexed by *D*, the meal status of the student is indexed by *h*, and the meal status assigned to the household by *h'*. The two *SR* terms reflect, respectively, the optional first-stage simple interval sampling methods to reduce the size of the list for keying and a second optional stratified systematic sampling process to reduce the sample further when the district did not want to furnish addresses for the full frame. The *H* term is associated with the household grouping and selection process using either a PPS or an equal probability selection process as discussed in Section B. In essence, the *H* term reflects the probability that a student selected during the initial sampling phases would remain in the sample during the household selection process. With an equal probability selection of households the measure of size (MOS)[20] is equal to 1. The *ST* term reflects the selection of one of the students (previously selected) from each selected household.

[20]MOS equals the number of students in the household, or if the initial list was sampled, the number of students sampled in the household at this point.

IV. SURVEY DATA COLLECTION

A. SURVEY DESIGN

The primary objectives of the Evaluation of National School Lunch Application/Verification Pilot Projects were addressed through a survey conducted with representative samples of students' families in pilot and comparison SFAs. The survey was implemented in two parts:

- ***Part 1.*** We used a short telephone interview to obtain data on the characteristics of households, as well as information on gross income and household size—information that allowed us to determine whether a household was ineligible for free or reduced-price school meals. Households determined to have incomes above 400 percent of the federal poverty level (FPL) during the telephone interview participated only in this first screening stage of the data collection.
- ***Part 2.*** We conducted an in-person interview with households whose incomes were found, during the part 1 interview, either to be less than 400 percent of FPL or to be undeterminable as a result of lack of contact or refusal. We administered this second survey module to collect detailed income information and to review income documentation so that we could form an accurate independent estimate of the household's eligibility for free or reduced-price meals. Households not interviewed by telephone in the first phase of data collection completed the part 1 interview at this time, and if their income based on part 1 was above 400 percent of FPL, they did not complete the detailed part 2 portion of the survey.

We administered both parts of the survey using computer-assisted telephone interviewing (CATI) and computer-assisted personal interviewing (CAPI). We offered a two-tiered financial incentive to respondents at each stage of data collection. Sample members who completed part 1 by telephone received $10 for that interview and an additional $20 for completing part 2 in person. Sample members who completed both parts of the survey in person received $20. Parents or guardians of students who were approved to receive free or reduced-price meals, as well as parents of students who were not approved for these meal discounts (either because they were not eligible or because they did not apply), were targeted for this survey effort. The sample selection process is described in Chapter III. Figure IV.1 shows the flow of cases from part 1 (telephone interviewing) to part 2 (in-person interviewing) for a typical study district.

B. INSTRUMENT DESIGN

We developed two instruments to carry out the required data collection for this project. The part 1 instrument gathered basic information about the family and identified high-income households whose income eligibility for free or reduced-price meals could be established accurately through a brief series of simple questions. The part 2 instrument was developed to collect detailed income information.

As specified in the RFP, the instruments were based on ones previously developed for WIC and other studies that examined application processes for means-tested programs. However, modifications in approach and content were necessary to meet the needs of the current evaluation.

The part 1 interview was designed to take 15 minutes and was intended to be completed through either CATI or CAPI. The part 2 instrument was designed to take 30 minutes and to be completed using CAPI.

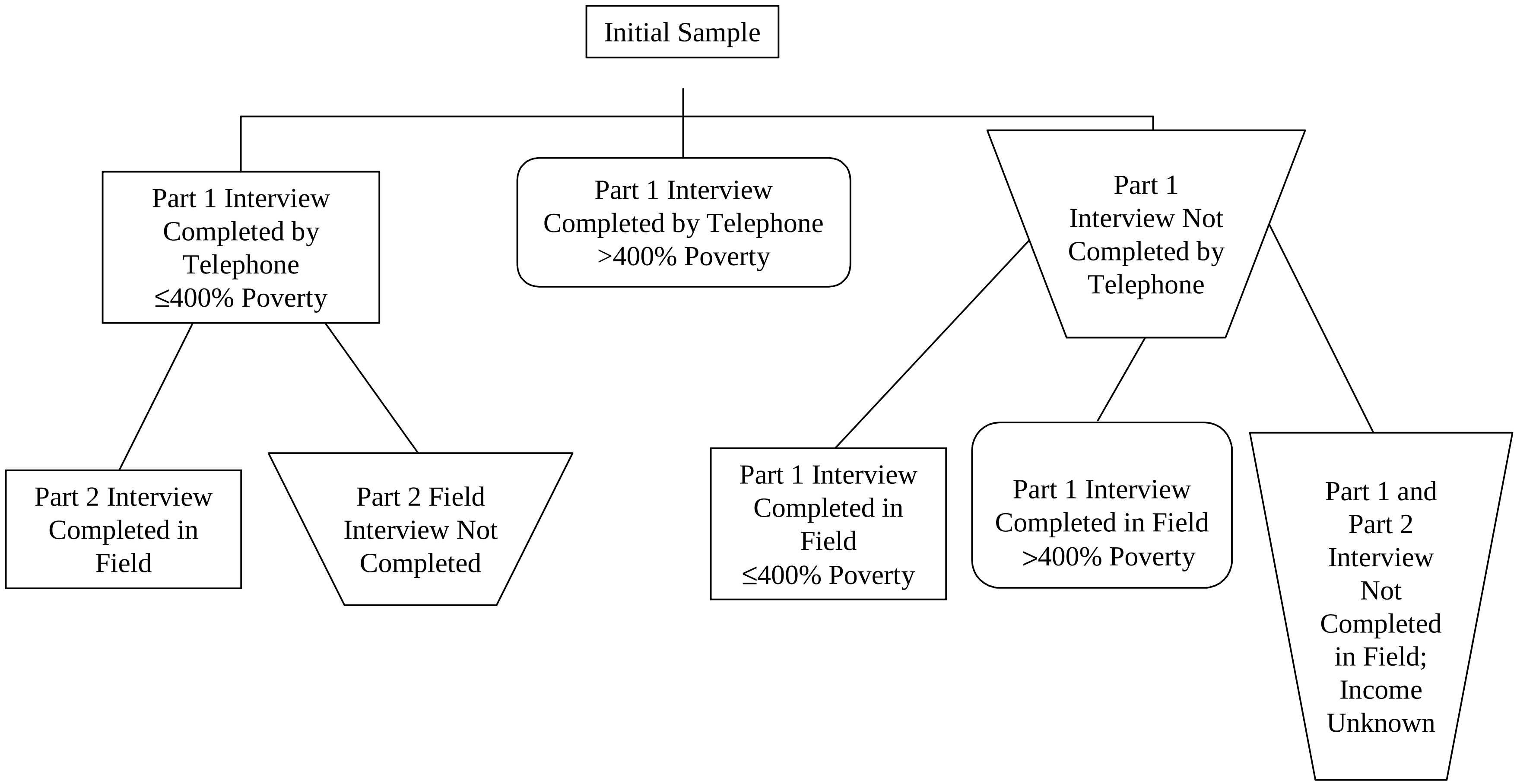
Each instrument went through a rigorous, iterative development process leading up to and following the pretests, until the start of the main data collection effort. Internal reviews involving research and survey staff and external reviews involving the FNS Project Officer were ongoing.

1. Part 1 Instrument

The instrument developed for the part 1 survey collected basic demographic and household background, school lunch participation information, and gross income measures. Because collecting gross income information was key at this juncture, we asked about income in two

FIGURE IV.1

SUMMARY OF DATA COLLECTION IN A TYPICAL STUDY DISTRICT



ways. First, respondents were asked to select their household income from among ranges that were read. These income ranges allowed classifying the household's income according to FPL. Respondents were then asked to give their total household income (before taxes and other deductions) for the previous month.

Traditionally, these income questions are asked alternately, with the range question typically following the specific question for respondents who resist disclosing a specific income amount. The way income questions were asked in the part 1 survey was unusual in two ways: (1) both questions were mandatory, and (2) the range question was asked first. We chose this sequencing because we judged that asking the less invasive range question first would lead to fewer refusals. Also, since the opportunity to collect precise income information existed for all but those with incomes over 400 percent of FPL, it was important to establish good rapport and to avoid alienating respondents who would be asked to participate further.

2. In-Home Survey Instrument

The instrument developed for part 2 interviewing was designed to be administered in the homes of selected sample members, where they would have access to income documents. In a small number of cases, these surveys were conducted in places other than the home (such as workplaces, libraries, and other public locations) and even by telephone.

For sample members who completed the part 1 interview by telephone, selected data from that interview were pre-loaded into the CAPI instrument. For example, the name of the sampled child and number of household members were noted on the file. As part of the in-home data collection, household members were listed, and their ages, relationship to the respondent, and genders were recorded. Financial relationships among household members and employment history was also ascertained for those over the age of 18. The remainder of this instrument collected detailed income information about sources for every household member over the age of

18, including earned and unearned income. We assumed that respondents who provided documentation of their current certification for either Temporary Assistance for Needy Families (TANF) or the Food Stamp Program automatically qualified for free school meals, so for them no additional income information was sought. The part 2 interview for this group was shorter than for those who did not receive TANF or food stamps.

Respondents who reported income from wages and other sources were asked a series of questions about a comprehensive list of potential income sources. Questions included whether they or any household member received income from the source, the amount received during the past month, and the period covered by that income. After they answered these questions, they were asked to retrieve and refer to documents that showed the amount of income and to report this amount. Structuring the instrument in this way was important, because if respondents were reminded that documents would be requested at this point in the interview (the confidentiality acknowledgment noted this), the potential for underreporting income sources was thought to be higher. Respondents did, of course, have the option to decline to use the documents.

3. Interviewer Observations

The final part of the in-home survey was a set of six questions through which interviewers were asked to report on the interviewing experience. These questions asked about their perceived accuracy of responses, the respondent's reaction to the request for documentation, and use of documentation to answer questions.

C. SURVEY PRETESTS

We conducted nine pretests of the telephone and in-person surveys prior to beginning data collection with the survey sample. The goals of the pretest were (1) to test the clarity, flow, and sequence of questions, (2) to determine respondent burden for both the telephone and in-person portions of the survey, (3) to gauge respondent willingness to report income information, (4) to explore the incidence at which documentation is available, and (5) to determine respondent compliance with requests for verification documentation.

Pretest respondents were diverse. They were from three New Jersey counties; their children attended schools in five different school districts; and they varied in terms of race/ethnicity, income, urbanization of their community, school lunch eligibility status, and household size.

Procedures planned for the main study were replicated to the extent possible. The primary exception, necessitated by time constraints, was the use of paper-and-pencil methods to collect pretest data, unlike the computer-assisted approach used in the main survey. Pretests were also conducted by regular MPR project staff, rather than by on-call interviewers. Pretest respondents were paid $25 for completing both the telephone and the in-home portions of the survey.

The pretest experience provided input for interviewer training and improvements to the data collection instruments.

D. SURVEY IMPLEMENTATION

1. Part 1—Telephone Interviewing

We attempted to interview all 3,685 sample members by telephone from MPR's Princeton Survey Operations Center. The interviews were conducted by staff trained specifically for this project. Telephone interviewing began in mid-October and continued for about eight weeks, through early December. An average of five (5.3) calls was required to reach a sample member by telephone. Once the connection was made, the interview took an average of 15 minutes.

The sample was released and worked in four waves for both stages of data collection. Cases were worked exclusively by telephone for 9 to 14 days, depending on the size of the sample, and then moved to part 2, field data collection.

Between each data collection stage there were two or three days during which contact sheets, checks, and other site specific materials were generated. Contact sheets contained appointment preference information collected during the telephone interview to help in-person interviewers schedule their work assignments. Separate $10 and $20 checks were generated for each sample member whose income was less than 400 percent of FPL, as well as for sample members for whom FPL was not determined in the Part 1 interview by telephone. We believe that hand-delivering the check for completing the part 1 telephone interview helped legitimize the in-person interviewer's visit and contributed to increasing the response rate for the in-person interviews. We mailed $10 checks to sample members whose incomes were determined during the part 1 call to be above 400 percent of FPL.

2. Part 2 Data Collection—In-Person Interviews

The second survey stage, in-person data collection, began in late October and continued through mid-December. Seven data collection teams whose members were trained in Princeton, NJ in mid-October conducted the in-home interviews. Each team included 4 or 5 interviewers overseen by an on-site Team Leader, who was responsible for the assigning of cases and for the day-to-day on-site management of data collection activities. The Team Leader reported directly to MPR's central office project staff, and interviewers reported to the Team Leader. Data collection staff conducted interviews at each district area for 7 to 11 days, depending on the size of the sample.

As noted earlier, the in-person part 2 interviews were conducted using CAPI. Each interviewer was assigned a laptop that contained the part 2 survey instrument in CAPI format, as well as the CAPI version of the part 1 interview. In addition, each laptop contained SurveyTrak, a software program for electronic transmission of data. SurveyTrak automatically updated the status of cases completed in CAPI and, via telephone connection, sent MPR daily productivity updates by site and interviewer. Reports this system generated allowed MPR project staff and Team Leaders to target problem sites and interviewers and take corrective action.

For this data collection effort, MPR used a system whereby each member of an interviewing team was given access to all cases assigned to that team. While each team member was assigned specific cases to work, this arrangement provided flexibility in making mid-field changes in assignments as necessary. At the same time, limiting the laptops on which cases were loaded to site/team specific assignments kept interviewers from accessing cases erroneously. This flexible approach to assigning cases allowed team leaders to move cases among team members, as attrition occurred for a range of reasons, from illness to poor performance.

As noted, the part 2 in-home interview collected more detailed information about the sources of income for all adult household members. During the in-home interview, respondents were asked whether documentation of each source of income was available and if so to retrieve it. They were then asked to refer to the documentation in reporting the amount of income from each source. Because of the sensitivity of this data collection, confidentiality was especially important. The next section describes the measures we took to ensure data confidentiality.

While most interviews were conducted in sample members' homes, some were conducted in other locations, such as libraries and work places, at the request of the sample member. A few part 2 interviews were also conducted by telephone. The average time for an in-home interview was about 30 minutes.

3. Confidentiality Assurances

Respondents to both stages of the study were assured that their participation in and answers to study questions would be treated confidentially. Confidentially was ensured by employing standards set by MPR for all data collection and by complying with the Privacy Act of 1974. Specifically, everyone hired by MPR is required to sign an oath of confidentiality as a condition of employment. Physical safeguards, such as locked file cabinets, provide further protection for sample member contact information and survey data.

An advance letter printed on FNS letterhead and signed by the FNS Project Officer provided written assurances to sample members that their participation was voluntary and confidential. This letter included a telephone number sample members could call to speak directly with the FNS Project Officer, as well as a toll-free number at which to call MPR with questions. The OMB clearance number was also displayed on the advance letter. These assurances were repeated as part of the introductory script to both stages of interviewing.

To enhance the study's legitimacy further, MPR solicited and received letters of support for the study from each participating pilot and comparison SFA or school district. These letters were mailed along with the USDA letter to each sample member in advance of any contact attempt. An information brochure was also included as part of the initial mailing.

Finally, respondents to in-person interviews signed a Confidentiality Acknowledgment document (Figure IV.2), which restated the purpose of the study and allowed the respondent to acknowledge that information regarding their participation, their payment, the survey content, and confidentiality was explained. The document, which was printed on 3-ply NCR paper, was also signed by the interviewer. The respondent retained a copy of the document, and the original and one copy were filed with MPR.

Photo identification badges worn by in-person interviewers provided an additional source of reassurance for sample members. The ID badges were printed on MPR labels and contained the interviewer's name and MPR identification number, the name of the study, and the name of the sponsoring agency.

FIGURE IV.2

NATIONAL SCHOOL LUNCH PROGRAM EVALUATION

CONFIDENTIALITY ACKNOWLEDGEMENT

I understand that the evaluation is being conducted by Mathematica Policy Research, Inc. of Princeton, New Jersey for the U.S. Department of Agriculture (USDA).

The purpose of the study is to help the USDA understand why some people apply to participate in the National School Lunch Program while others do not. It will also help the USDA understand difficulties people may have meeting program requirements or with the application process.

During the interview I will be asked questions about my household, my children's participation in the school lunch program, and about sources of income for my household. In order for the results of the study to be meaningful, I should, to the best of my ability, provide accurate responses to the questions.

I understand that I have the right to refuse to answer any question I don't want to answer and that my participation in this study is completely voluntary.

I also understand that all of the information collected as part of this survey will be treated confidentially and used for research purposes only. My name will never appear in any reports and my answers will never be linked to my name. All of the answers given by people who participate in this survey will be combined and summarized for research purposes.

I have been told that all researchers on this project have signed a Confidentiality Pledge which states that they cannot disclose any confidential information including names or identifying facts provided by individuals or families participating in this project.

I also understand that both the interviewer and I will sign this agreement to show that the purpose of the study and its requirements have been explained to me and that I understand them. I will keep a copy of this agreement for my records.

If I have any questions or concerns about my rights as a participant in this survey, I understand that I can call Sarah Lewis, toll free, at (800) 273-6813.

I understand that I will receive $20 for completing the in-home survey.

______________________________	______________________________
Printed Name of Respondent	Printed Name of Interviewer
______________________________	______________________________
Signature of Respondent	Signature of Interviewer
______________________________	______________________________
Date	Date

4. Passive Consent

Most districts participating in the study provided contact information for sampled families based on school district assurances from FNS and MPR that data would be held confidential and would not be used for any purpose other than the study. However, for four participating districts—Easton (PA), Dunkirk (NY), Maplewood (OH), and Valley View (IL)—a passive-consent process was used. In these districts, school staff sent the equivalent of the study's advance letter and information packet to families selected for the sample in their district. In addition to the study information, the materials also instructed the families to call or indicate in writing if they wished to be excluded from the study. Families who made this request were then removed from the sample. In some cases, we received only ID numbers to identify the families before the consent process and received contact information only after the period for responding had expired. In other cases, the contact information was provided in advance, and we were told which names to remove from the sample. A total of 27 student families out of 661 released cases across the four districts opted out of the survey.

E. SURVEY OUTCOMES

1. Response Rates

Response to the survey is summarized in Table IV.1. A total of 3,806 students were selected for the sample, of which 3,685 were released for interviewing (eliminated were students directly certified, and one student in each households in which two students were selected). Of the sample released for interview, we determined that 163 were in fact ineligible for interview, 24 did not provide their consent to be contacted, 478 did not complete the part 1 interview, and 3,020 did complete the part 1 interview. Of these 3,020 respondents, 494 did not complete part 2. The key survey response rate is the proportion of the eligible sample who completed the

TABLE IV.1

SUMMARY OF SURVEY OUTCOMES

Description	Subtotals	Students
Starting Sample to Be Released for Interviewing		3,806
Eliminated:		
Directly certified in initial sample[a]	63	
Students found to be direct certified after sample prepared	7	
Households with 2 students selected[b]	51	
Final Sample Released for Interviewing		3,685
Reduction:		
Identified as ineligible during interview	163	
Refused during passive consent	24[c]	
Survey nonrespondents to part 1 interview	478	
Completed Part 1		3,020
Survey nonrespondents to part 2, completed part 1	494	
Completed Part 2		2,526
Unweighted Overall Response Rate to Part 1)[d]		86.3
Unweighted Overall Response Rate to Part 2)		72.2

[a]Includes 31 from Jamestown who were identified initially as directly certified but erroneously retained in the sample frame and 32 from various districts that were identified as directly certified after sampling (9 from Oak Park, 3 from North Pekin, 13 from Creve Coeur, 5 from Dilworth, Glyndon, Felton, and 2 from Wilson County).

[b]While we attempted to identify household relationships from last name and address information of the students and parents as provided on the districts enrollment frame provided, in some cases we were not successful, and we selected two students from 50 households that were not identified until interviewing was attempted. For these cases, we identified the household involved, eliminated the second student sampled, and doubled the original sampling weight of the remaining student to compensate for the duplicate household selections.

[c]In total we had 27 refusals during passive consent for three of these, but we inadvertently completed an interview.

[d]Eligibility is known for all sample released for interviewing less nonrespondents to part 1, or 3,207 cases (=3,685 – 478), of whom 3,044 are eligible (=3,207 – 163). The unweighted eligibility rate is .94917. Applying the eligibility rate to the full release sample of 3,685 gives 3,498 eligible released sample. The unweighted response rate is 86.3 percent (=3,020/3,498). The weighted response rate is calculated similarly but weights each observation by 1/base sampling rate.

part 1 interview. The unweighted part 1 response rate was 86 percent. This group formed the basis for estimating the program impacts reported for the evaluation.[1]

Tables IV.2A and IV.2B provide additional detail on survey outcomes. Table IV.2A shows weighted and unweighted response rates to the part 1 interview, by district and meal price status. Table IV.2B shows the same data for the part 2 interview. The response rates were similar across pilot types and within each pilot type across pilot and comparison groups. For example, the unweighted part 1 response rates for the full sample were 86 percent in the pilot sites and 85 percent in the comparison sites in the Up-Front Documentation evaluation, and 89 and 87 percent for the pilot and comparison sites, respectively, in the Graduated Verification evaluation. Weighted response rates tended to be slightly lower than the unweighted rates in the Up-Front Documentation evaluation but were nearly identical overall in the Graduated Verification evaluation.

Response rates vary considerably by meal status and district. For example, the part 1 response rate for free certified students varies by site from 74 percent to 100 percent, for reduced-price students from 71 to 100, and for paid students from 73 to 100. The part 1 response rates for the full sample by site also vary considerably: from 79 to 98 percent.

2. Survey Validations

We attempted to validate all interviews completed in person. We sent a thank-you letter to each respondent, asking them to complete and return an addressed, stamped postcard to MPR indicating whether and how they completed the interview. Exhibit IV.1 shows the content of the

[1]We used the sample who completed the part 2 interview to examine the sensitivity of key estimates to the decision to base the analysis on the part 1 sample. See Chapter IX.

validation postcard. Letters and postcards were prepared in both English and Spanish, and respondents received the validation packet in the language they used to complete the survey.

Thirty-five percent (812) of part 2 survey completers returned the validation postcards to MPR. One hundred percent of those returning the postcards confirmed their participation in the study. The overwhelming majority had very positive remarks about the survey and the interviewers.

TABLE IV.2A

PART 1 SURVEY RESPONSE RATES, BY DISTRICT AND MEAL PRICE STATUS

District	Pilot/ Comparison District	Free Meal Status		Reduced Meal Status		Paid Meal Status		Full Sample	
		Part 1 Unweighted[a]	Part 1 Weighted[a]	Part 1 Unweighted	Part 1 Weighted	Part 1 Unweighted	Part 1 Weighted	Part 1 Unweighted	Part 1 Weighted
Up-Front Documentation									
Blue Ridge, PA	P	100.0	100.0	100.0	100.0	96.2	95.9	97.7	97.2
Montrose, PA	C	75.0	76.9	100.0	100.0	84.9	84.3	84.3	84.2
East Stroudsburg, PA	P	100.0	100.0	90.9	94.5	82.4	82.1	86.8	85.0
Easton, PA	C	76.9	76.9	100.0	100.0	86.4	85.5	86.9	85.3
Pleasant Valley, PA	P	86.4	91.6	100.0	100.0	80.2	80.8	83.0	82.3
Bangor, PA	C	88.2	88.7	89.7	87.8	72.9	72.5	79.2	75.2
Stroudsburg, PA	P	76.9	72.7	80.0	87.3	87.2	88.4	84.4	86.3
Pottsgrove, PA	C	82.8	82.6	95.2	95.0	83.7	84.0	85.3	84.3
Maplewood, OH	P	91.3	94.9	90.0	91.7	83.8	81.9	85.6	83.1
Newton Falls, OH	C	97.1	97.3	95.0	96.6	87.7	86.8	91.3	89.6
Salem, OH	P	84.8	82.6	80.0	81.8	82.1	81.8	82.4	82.0
Lisbon, OH	C	73.5	74.1	88.9	86.9	92.2	92.6	86.8	88.0
Creve Coeur, IL	P	89.5	88.9	90.0	90.1	85.0	85.1	86.6	86.7
North Pekin and Marquette Heights, IL	C	100.0	100.0	71.4	88.8	94.0	95.0	94.1	95.6
Oak Park and Forest River, IL	P	83.3	80.4	87.5	88.8	78.8	78.5	80.0	78.6
Valley View, IL	C	85.9	85.9	87.0	85.4	74.3	74.1	78.8	76.6
Williamson County, TN	P	87.1	88.2	95.5	93.6	80.0	80.0	84.2	80.5
Wilson County, TN	C	76.9	81.7	87.5	89.8	83.7	84.6	82.8	84.6
Total: UFD Pilot Districts[a]	P	89.5	88.7	90.0	93.4	83.8	82.4	85.7	83.5
Total: UFD Comparison Districts[a]	C	84.2	82.9	91.9	92.7	84.1	83.3	85.2	83.8
Graduated Verification									
Dilworth-Glyndon-Felton, MN	P	98.1	99.3	100.0	100.0	95.1	96.2	96.5	96.8
Breckenridge, MN	C	94.6	95.6	88.2	88.3	100.0	100.0	95.6	98.7
Lake Park Audubon, MN	C	95.0	94.4	100.0	100.0	94.7	94.8	95.6	95.3
Grandview, MO	P	91.2	94.0	90.9	94.6	82.4	86.2	87.1	88.3
Hickman Mills, MO	C	90.0	89.2	90.5	91.0	83.2	84.5	87.2	87.0
Dunkirk, NY	P	85.5	87.1	96.6	96.9	84.5	84.8	86.5	86.9
Jamestown City, NY	C	75.5	75.6	85.2	87.5	82.0	86.4	79.5	83.3
Total: GV Pilot Districts[a]	P	90.3	91.8	95.8	96.5	87.2	87.9	89.4	89.4
Total: GV Comparison Districts[a]	C	85.9	84.6	89.9	90.4	86.4	87.4	86.7	86.9
Total		**87.3**	**86.2**	**91.5**	**92.6**	**84.7**	**83.7**	**86.3**	**84.6**

[a]In calculating the totals for pilot and comparison districts, each pilot or comparison district in the group was weighted equally.

TABLE IV.2B

PART 2 SURVEY RESPONSE RATES, BY DISTRICT AND MEAL PRICE STATUS

District	Pilot/ Comparison District	Free Meal Status		Reduced Meal Status		Paid Meal Status		Full Sample	
		Part 2 Unweighted[a]	Part 2 Weighted[a]	Part 2 Unweighted	Part 2 Weighted	Part 2 Unweighted	Part 2 Weighted	Part 2 Unweighted	Part 2 Weighted
Up-Front Documentation									
Blue Ridge, PA	P	90.5	89.8	100.0	100.0	78.8	80.5	84.4	84.3
Montrose, PA	C	71.9	74.9	75.0	73.1	56.6	55.8	62.5	60.3
East Stroudsburg, PA	P	87.0	89.2	59.1	56.9	64.1	64.3	67.1	66.0
Easton, PA	C	60.7	60.7	81.8	80.2	65.1	64.0	67.2	64.4
Pleasant Valley, PA	P	81.6	89.0	100.0	100.0	61.2	62.3	68.0	65.6
Bangor, PA	C	82.4	83.0	79.3	77.8	63.2	62.8	70.3	66.0
Stroudsburg, PA	P	53.8	50.3	73.3	84.5	78.4	78.4	73.0	75.0
Pottsgrove, PA	C	82.8	82.6	79.4	72.6	72.8	72.9	76.1	73.7
Maplewood, OH	P	78.3	88.4	67.5	63.7	68.7	67.4	70.4	69.0
Newton Falls, OH	C	90.8	89.5	90.0	89.7	64.6	63.2	76.0	70.6
Salem, OH	P	84.8	82.6	58.7	57.8	62.9	62.4	67.8	65.7
Lisbon, OH	C	63.9	64.8	83.3	78.1	79.0	79.9	75.7	76.3
Creve Coeur, IL	P	68.4	69.1	65.0	65.4	68.3	68.5	67.7	68.2
North Pekin and Marquette Heights, IL	C	82.1	76.4	57.1	46.3	73.8	76.7	74.8	75.3
Oak Park and Forest River, IL	P	66.7	63.6	62.5	55.2	69.3	70.0	68.5	69.8
Valley View, IL	C	75.2	75.2	68.7	67.9	64.5	64.3	67.5	66.3
Williamson County, TN	P	76.2	78.4	90.2	90.1	73.1	73.1	76.6	73.6
Wilson County, TN	C	65.4	61.3	68.8	78.6	66.0	67.5	66.3	67.6
Total: UFD Pilot Districts[a]	P	77.7	77.9	73.5	72.2	69.3	68.7	71.5	69.8
Total: UFD Comparison Districts[a]	C	75.5	70.7	77.7	77.5	67.2	66.4	70.6	67.4
Graduated Verification									
Dilworth-Glyndon-Felton, MN	P	91.7	93.2	77.8	81.7	82.1	82.3	84.5	83.6
Breckenridge, MN	C	88.5	88.2	69.3	69.6	86.5	86.5	83.9	85.5
Lake Park Audubon, MN	C	79.2	77.1	76.9	77.8	89.3	89.4	83.1	85.8
Grandview, MO	P	76.1	80.5	72.7	70.2	69.4	71.9	72.6	73.7
Hickman Mills, MO	C	72.9	72.9	75.4	76.9	67.4	68.4	71.0	71.1
Dunkirk, NY	P	74.6	76.5	82.8	84.3	65.5	64.2	71.8	70.5
Jamestown City, NY	C	72.6	74.2	70.4	62.1	62.4	65.3	68.4	68.2
Total: GV Pilot Districts[a]	P	78.5	80.1	78.4	78.0	72.2	72.4	75.5	74.6
Total: GV Comparison Districts[a]	C	75.7	74.0	73.2	72.4	71.2	70.5	73.5	71.8
Total		**76.8**	**74.9**	**75.6**	**74.5**	**69.2**	**68.3**	**72.2**	**69.6**

[a]In calculating the totals for pilot and comparison districts, each pilot or comparison district in the group was weighted equally.

EXHIBIT IV.1

VALIDATION POSTCARD (SIDE 2)

1. Did an interviewer complete a survey about the school lunch application process in your home?

1 ☐ YES 0 ☐ NO

2. Did you complete a survey by telephone? 1 ☐ YES 0 ☐ NO

3. Was the interviewer polite and professional?

1 ☐ YES 0 ☐ NO

4. How much were you paid for your participation? $________________

5. Please provide any comments about the survey or interview process below.

____

____

____

THANK YOU FOR COMPLETING THIS POSTCARD. PLEASE DROP IT IN THE MAIL.

V. COMPARING PLANNED AND ACTUAL SAMPLE SIZES AND PRECISION

In this chapter, we examine the extent to which the sampling and data collection procedures produced the planned sample sizes and precision levels.

Table V.1 shows, by district and meal price status, the target number of interviews, the number of part 1 completed interviews, and the number of part 2 completed interviews. Overall, the total of 3,020 part 1 completed interviews exceeded the planning target of 2,718.[1] Within the Up-Front Documentation districts, total completed part 1 interviews for the free and paid strata exceeded the targets in pilot and comparison sites, while the number of completed reduced-price interviews was below target in the pilot sites, slightly above target in the comparison sites, and below target overall. Considerable variation is apparent across districts in whether the targets were met, especially for reduced price (where 10 districts were over the targets and 12 were under) but also for free (where 6 of 18 were under). The Graduated Verification pilot and comparison districts exhibit very similar patterns.

The precision levels achieved were broadly consistent with expectations, although our planning assumptions in some domains proved incorrect. Tables V.2A shows, for the Up-Front Documentation pilots, the planned and actual number of sample points per analytic group, the population proportion for the comparison group, and the minimum difference detectable using 80 percent power and a two-sided 95 percent hypothesis test. The analytic groups are numbered for reference in the discussion.

The minimum detectable difference is the smallest true difference for which we will reject the hypothesis that the proportions are the same, using a 95 percent two-tailed test in 80 percent of the identically selected random samples from the population. A smaller MDD reflects greater

[1] Chapter III describes how the planning target was established.

TABLE V.1

COMPARISON OF ORIGINAL ALLOCATION PLAN TO REALIZED SURVEY OUTCOMES

		Free			Reduced			Paid			Total		
District	Pilot/ Comparison District	Target Interviews	Part 1 Completes	Part 2 Completes	Target Interviews	Part 1 Completes	Part 2 Completes	Target Interviews	Part 1 Completes	Part 2 Completes	Target Interviews	Part 1 Completes	Part 2 Completes
Up-Front Documentation													
Blue Ridge, PA	P	21	42	38	16	11	11	60	72	59	97	125	108
Montrose, PA	C	21	24	23	16	16	12	60	72	48	97	112	83
East Stroudsburg, PA	P	21	23	20	16	20	13	60	72	56	97	115	89
Easton, PA	C	21	19	15	16	22	18	60	69	52	97	110	85
Pleasant Valley, PA	P	21	18	17	16	11	11	60	76	58	97	105	86
Bangor, PA	C	21	30	28	16	26	23	60	68	59	97	124	110
Stroudsburg, PA	P	21	20	14	16	12	11	60	79	71	97	111	96
Pottsgrove, PA	C	21	24	24	16	18	15	60	69	60	97	111	99
Maplewood, OH	P	21	21	18	16	8	6	60	72	59	97	101	83
Newton Falls, OH	C	21	31	29	16	19	18	60	57	42	97	107	89
Salem, OH	P	21	26	26	16	15	11	60	60	46	97	101	83
Lisbon, OH	C	21	23	20	16	16	15	60	70	60	97	109	95
Creve Coeur, IL	P	21	17	13	16	18	13	60	66	53	97	101	79
North Pekin and Marquette Heights, IL	C	21	28	23	16	5	4	60	79	62	97	112	89
Oak Park and Forest River, IL	P	21	15	12	16	7	5	60	75	66	97	97	83
Valley View, IL	C	21	24	21	16	19	15	60	61	53	97	104	89
Williamson County, TN	P	21	24	21	16	18	17	60	58	53	97	100	91
Wilson County, TN	C	21	20	17	16	14	11	60	71	56	97	105	84
Pilot Total		189	202	174	144	122	103	540	627	517	873	951	794
Comp Total		189	227	205	144	153	126	540	619	496	873	999	827
Total		378	429	379	288	275	229	1,080	1,246	1,013	1,746	1,950	1,621
Graduated Verification													
Dilworth-Glyndon-Felton, MN	P	61	46	43	23	18	14	56	88	76	140	152	133
Breckenridge, MN	C	31	31	29	11	14	11	28	37	32	70	82	72
Lake Park Audubon, MN	C	31	36	30	11	13	10	28	35	33	70	84	73
Grandview, MO	P	76	91	76	28	20	16	69	76	64	173	187	156
Hickman Mills, MO	C	76	84	68	28	36	30	69	79	64	173	199	162
Dunkirk, NY	P	76	86	75	28	28	24	69	80	62	173	194	161
Jamestown City, NY	C	76	78	75	28	23	19	69	71	54	173	172	148
Pilot Total		213	223	194	79	66	54	194	244	202	486	533	450
Comp Total		214	229	202	78	86	70	194	222	183	486	537	455
Total		427	452	396	157	152	124	388	466	385	972	1,070	905
Total		**805**	**881**	**775**	**445**	**427**	**353**	**1,468**	**1,712**	**1,398**	**2,718**	**3,020**	**2,526**

TABLE V.2A

PLANNED VS. REALIZED OUTCOMES AND PRECISION LEVELS IN UP-FRONT DOCUMENTATION DISTRICTS

		Expected Outcomes Used for Sample Design			Realized Survey Outcomes			
	Analysis Group, Outcome Measure for Analysis Group	Analysis Group Sample Size (Pilot and Comparison Districts)	Proportion (Percent)	Minimal Detectable Difference Between Pilot and Comparison[a]	Total Part 1 Completed Interviews	Survey Estimate Proportion in Comparison Districts	Standard Error of Impact Estimate[b]	Minimum Detectable Difference[c]
1*	Students Approved for Free Meals (excluding directly certified), Proportion Under 130 Percent of Poverty	376	80	11.9	426	77.5	5.2	14.6
2*	Students from Households Above 185 Percent of Poverty: Proportion Approved Free and Reduced Meals	1,108	10	5.2	1,057	4.0	.75	2.1
3	Students from Households >130 Percent of Poverty: Proportion Approved For Free Meals	1,450	30	7.3	1,377	3.9	.78	2.2
4	Students from Households Above 185 Percent of Poverty: Proportion Applied Free and Reduced Meals	1,108	15	6.2	1,057	6.8	1.32	3.7
5	Students from Households <130 Percent of Poverty: Proportion Approved Free Meals	286	80	15.7	561	53.9	4.46	12.5
6*	Students from Households <185 Percent of Poverty: Proportion Approved For Free or Reduced Price Meals	629	63	13.3	881	50.5	3.61	10.2
	Total Sample	**1,736**			**1,938**			

Note: The sample size and allocation among strata were determined on the basis of analysis group and outcomes #1, #2, and #6. These key analysis group and outcomes are designated with a * next to the number. We devoted considerable effort to estimating the corresponding proportions accurately. Less effort was invested in estimating the proportions for #3, #4, and #5. Indeed we believe the estimate of the population proportion of .30 for group #3 was inconsistent with the estimate of .10 for group #2.

[a]MDD = square root $\left[\left(\frac{p*(1-p)*deff1}{n1} + \frac{p*(1-p)*deff2}{n2}\right)\right] * 2.806$; deff1 and deff 2 were estimated from the sample allocation model described in Chapter III.

[b]Standard errors are computed to be representative of the pilot and comparison districts as if the populations are drawn from super populations of these places.

[c]MDD = standard error of impact estimate * 2.806.

sample precision. The MDD is calculated as the sampling error of the difference in the two proportions we are comparing times 2.806 (which reflects the two-tailed 95 percent hypothesis test and 80 percent power). For our planning estimates the sampling error of the difference was calculated as: square root of [(p*(1-p)*deff1)/ n1 + (p *(1-p)*deff2) /n2] where p is the average value of the two proportions being compared and n1 and n2 are the sample sizes of the pilot and comparison districts. Deff1 and deff2 are design effects associated with these two groups that resulted from a differential sample allocation. The sample allocation model described in Chapter III was used to estimate the deff terms by district based on the planned allocation of the sample. These terms were then averaged for the four groups created by crossing pilot type and pilot vs. comparison status for each of the analytic domains.

We had mixed success in predicting the number of sample points per analytic group and the relevant proportion in the comparison group.[2] For example, in the Up-Front Documentation districts, we overestimated the population proportions for groups 2*, 3, and 4 (students in households with income above the eligibility cut-offs) and underestimated the sample sizes (offsetting deviations from plan). For groups 5 and 6* we underestimated the proportions (increasing the variance since the actual proportion was closer to .5 than the planning estimate) and underestimated the sample sizes (again offsetting deviations from plan). For analytic group 1, the realized sample was 13 percent larger than planned, and the population proportion was approximately the same as our planning assumption. Yet the MDD was nearly 25 percent larger than our planning estimate. This occurred because we incorrectly had assumed a simple

[2]The sample size and allocation among strata were determined on the basis of analysis group and outcomes #1, #2, and #6. These key analysis group and outcomes are designated with a * next to the number. We devoted considerable effort to estimating the corresponding proportions accurately. Less effort was invested in estimating the proportions for #3, #4, and #5. Indeed we believe the estimate of the population proportion of .30 for group #3 was inconsistent with the estimate of .10 for group #2.

comparison of proportions in our planning, which did not properly account for the complex, nonlinear estimation of the accuracy outcomes.

Table V.2B presents similar data for the Graduated Verification pilot and comparison districts. Our predictions of sample sizes and proportions were somewhat more accurate, but not much. We underestimated the number of sample points in groups 2*, 3, and 4 and overestimated the numbers in groups 5 and 6*. Our projections of the proportions were fairly accurate, except for group 3 (students above 130 FPL), which we overestimated substantially.[3] Analysis of the relationship of the standard errors of the proportions to the MDDs indicates that stratification improved precision in group 4 (income over 185 FPL), but design effects reduced it in group 6* (income under 185 FPL). Comparing the ratios of standard errors with the ratios of MDDs suggests that for groups 3, 4, and 5 small precision losses due to smaller than expected samples may have been offset by modest gains from stratification.

The precision achieved appears to be roughly in line with our planning assumptions. The differences in proportions (or percentage points) detectable with our actual design were smaller than the detectable differences in our original sample planning for most groups. Two exceptions to this general finding that the minimum detectable differences from our actual sample were smaller than our planning estimates are for households with income below 130 percent FPL and for households with incomes below 185 percent FPL. For these groups the MDDs were larger. Relatively large within-group differences in weights produced design effects, which caused this pattern.

[3] As noted in the note to Table V.2B, we believe our estimate for group 3 was inconsistent with the estimate for group 2*.

TABLE V.2B

PLANNED VS. REALIZED OUTCOMES AND PRECISION LEVELS IN GRADUATED VERIFICATION DISTRICTS

		Expected Outcomes Used for Sample Design			Actual Survey Outcomes			
	Analysis Group, Outcome Measure for Analysis Group	Analysis Group Sample Size (Pilot and Comparison Districts)	Proportion (Percent)	Minimal Detectable Difference Between Pilot and Comparison[a]	Total Part 1 Completed Interviews	Survey Estimate Proportion in Comparison Districts	Standard Error of Impact Estimate[b]	Minimum Detectable Difference[c]
1*	Students Approved for Free Meals (excluding directly certified), Proportion Under 130 Percent of Poverty	460	80	10.8	450	73.0	5.2	14.6
2*	Students from Households Above 185 Percent of Poverty: Proportion Approved Free and Reduced Meals	480	10	8.3	423	9.7	1.75	4.9
3	Students from Households >130 Percent of Poverty: Proportion Approved For Free Meals	726	30	10.5	629	8.6	2.25	6.3
4	Students from Households Above 185 Percent of Poverty: Proportion Applied Free and Reduced Meals	480	15	9.9	423	16.3	3.42	9.6
5	Students from Households <130 Percent of Poverty: Proportion Approved Free Meals	316	80	14.3	436	69.1	6.14	17.2
6*	Students from Households <185 Percent of Poverty: Proportion Approved For Free or Reduced Price Meals	562	63	12.9	642	72.2	5.33	15.0
	Total Sample	**1,042**			**1,065**			

Note: The sample size and allocation among strata were determined on the basis of analysis group and outcomes #1, #2, and #6. These key analysis group and outcomes are designated with a * next to the number. We devoted considerable effort to estimating the corresponding proportions accurately. Less effort was invested in estimating the proportions for #3, #4, and #5. Indeed we believe the estimate of the population proportion of .30 for group #3 was inconsistent with the estimate of .10 for group #2.

[a]MDD = square root $\left[\left(\frac{p*(1-p)*deff1}{n1} + \frac{p*(1-p)*deff2}{n2}\right)\right] * 2.806$; deff1 and deff 2 were estimated from the sample allocation model described in Chapter III.

[b]Standard errors are computed to be representative of the pilot and comparison districts as if the populations are drawn from super populations of these places.

[c]MDD = standard error of impact estimate * 2.806.

VI. UPDATING MEAL PRICE STATUS

For analysis purposes, our goal was to classify all sampled students according to their meal price status as of October 31, 2002. However, as described in Chapter III, many of the meal price status lists used for sample selection did not reflect each student's status on that date. For some districts, the sampling list reflected meal price status at the end of the previous school year. In others, the list was generated before the 30th school day of the 2002-2003 school year (when students who had been certified for the prior year but who had not submitted applications and been approved for the current school year would still have been certified). Furthermore, our use of electronic matching procedures for sampling purposes could have led to inaccurate classifications of some students. To determine meal price status as of October 31, 2002, we obtained new lists for those districts that had initially provided a listing generated before the 30th day of the current school year, and we matched students on these lists with the entire sample of students selected for interviews. Also, as a check on the accuracy of the classifications determined from the electronic process used for sampling, we visually matched the initial lists received from districts that provided such lists after the 30th school day in fall 2002. We used this meal price status as of October 31, 2002, for preparing the survey weights and the data analysis.

Table VI.1 shows for each district whether we obtained an updated list and whether we visually matched the list to our sample list (column labeled "list status").[1] As with the initial lists, most updated lists were received in hard-copy format and were entered to electronic files.

[1]We did not conduct a rematch with the direct certification lists, which would not have been updated. In districts in which the free and reduced-price listing also identified the direct-certification cases, we compared these cases to our sample and, if we found a match, made the sample member's final status "ineligible for the study."

TABLE VI.1

UPDATED LIST MEAL STATUS COUNTS AND TRANSITIONS

							Meal Price Status at Sampling									
							Free			Reduced			Balance			
				Counts of Students on Updated Lists			Meal Price Status on October 31, 2002									
District	Pilot/ Comparison District	Total Enrollment At Sampling	List Status[a]	Free	Reduced Price	Total Released Sample	Free	Reduced	Balance	Free	Reduced	Balance	Free	Reduced	Balance	Percentage of Released Sample with Meal Price Status Unchanged
Up-Front Documentation																
Blue Ridge, PA	P	1,240	1	290	94	132	26	2	2	4	6	6	12	3	71	78.0
Montrose, PA	C	1,792	1	319	178	134	21	5	2	6	11	5	5	.	79	82.3
East Stroudsburg, PA	P	7,790	1	1,364	503	136	19	2	8	3	16	5	1	4	78	83.1
Easton, PA	C	7,829	2	974	433	130	26	.	.	.	21	.	.	2	81	98.5
Pleasant Valley, PA	P	6,720	1	705	254	135	16	3	10	2	8	12	4	1	79	76.3
Bangor, PA	C	3,677	3	345	239	160	34	.	.	.	29	.	.	.	97	100.0
Stroudsburg, PA	P	5,235	1	715	278	135	19	3	6	2	9	11	5	3	77	77.8
Pottsgrove, PA	C	3,306	2	305	104	136	28	.	.	.	21	.	1	.	86	99.3
Maplewood, OH	P	1,147	1	90	39	132	17	.	11	3	9	8	3	1	80	80.3
Newton Falls, OH	C	1,600	2	286	120	127	30	.	.	.	20	.	4	.	73	96.9
Salem, OH	P	2,458	2	377	77	131	31	.	.	.	20	.	2	.	78	98.5
Lisbon, OH	C	1,178	2	297	90	129	30	.	.	.	17	.	4	.	77	96.1
Creve Coeur, IL	P	687	1	175	93	119	17	.	1	1	19	1	1	1	78	95.8
North Pekin and Marquette Heights, IL	C	660	1	138	38	119	16	2	8	5	3	4	7	2	72	76.5
Oak Park and Forest River, IL	P	2,971	1	141	50	125	17	.	4	1	8	11	.	.	84	87.2
Valley View, IL	C	1,862	3	309	91	138	29	.	.	.	23	.	.	.	86	100.0
Williamson County, TN	P	6,574	3	208	100	133	31	.	.	.	22	.	.	.	80	100.0
Wilson County, TN	C	12,177	2	1,190	512	128	21	3	4	3	11	5	2	2	77	85.2
Graduated Verification																
Dilworth-Glyndon-Felton, MN	P	1,352	1	179	99	173	43	7	15	5	10	9	4	3	77	75.1
Breckenridge, MN	C	996	1	208	72	91	37	2	1	.	15	.	.	.	36	96.7
Lake Park Audubon, MN	C	692	1	184	79	91	40	.	.	.	13	.	.	.	38	100.0
Grandview, MO	P	4,380	1	1,443	309	232	90	.	17	2	19	6	10	3	82	81.5
Hickman Mills, MO	C	7,821	1	3,656	899	243	88	6	12	6	33	1	6	3	88	86.0
Dunkirk, NY	P	1,825	3	619	187	232	105	.	.	.	29	.	.	.	98	100.0
Jamestown City, NY	C	5,397	1	2,160	457	244	86	5	20	9	17	9	11	5	82	75.8
Total		**88,063**		**16,677**	**5,395**	**3,685**	**917**	**40**	**121**	**52**	**409**	**93**	**82**	**34**	**1,937**	**88.4**

[a]1 = Updated meal price status listing was obtained, 2 = No updated meal price status listing was obtained; the original listing was manually re-matched to the enrollment list, 3 = Original list and match was judged accurate.

Two clerks independently visually matched the updated meal price status listing to a list of all sample released cases for interviewing, and marked on the sample listing the meal price status of each student (free, reduced-price, or not on the free or reduced-price listing and therefore paid). The updated free and reduced-price listings and the released sample of students were preprinted in order by last name and first name for the review process. When available, the printed versions provided the grade of the student, parent names, and addresses. The clerks matched names and considered a match as valid if (1) the grades on the released sample list and the updated free and reduced-price lists were within one year of each other, or (2) the grade was missing on either source. If any potential matches were questionable, the clerk marked the updated status as unknown. After each clerk matched the new lists to the sample, we compared the updated meal price status information, and printed out all cases that contained any disagreements in the status values or to which either clerk had assigned a status of unknown. The clerks and a supervisor reviewed the cases with disagreements and unknown statuses and assigned a final status to the sample record.

Table VI.1 shows the number of records by meal price status at sampling process and by their meal price status on October 31, 2002, based on the updated list and clerical review. For example, at Blue Ridge, PA, 26 cases were classified free at sampling and their status on October 31 was free, 2 were free at sampling and their status on October 31 was reduced-price, and 2 were free at sampling and their status on October 31 was paid. The final column shows the percentage of cases in which the original meal price status classification is the same as the final classification. Overall, the agreement rate was 88.4 percent. It ranged from 75.1 percent to 100 percent.

The large number of status transitions underscores the importance of having acquired the updated lists and manually reviewed meal price status. Among the 15 districts for which we both acquired a new list and conducted a manual match, 84 percent of cases remained unchanged, and the percentage unchanged varied from a low of 75 percent to a high of 100 percent. Among five of the six districts where we did not acquire a new list but did conduct a manual review of the initial list, the percentage of cases unchanged was at least 96 percent. However, in one of these six districts, the percentage with unchanged status was just 85 percent. The impact of these adjustments on the population estimates is discussed in conjunction with the weights in Chapter VII.

VII. SURVEY WEIGHTING PROCEDURES AND POPULATION ESTIMATES

A. OBJECTIVES AND OVERVIEW OF THE WEIGHT CALCULATIONS

We developed survey weights that account for the complex nature of the sample design and the multi-stage data collection. The weights are based on sample selection probabilities and adjusted for nonresponse of some sampled households to the study interview. The survey weights are projection weights: when they are applied to the data for the sample, they produce estimated totals similar to the totals that would be obtained from a complete enumeration of the study population (defined as all students enrolled in districts in the study except those directly certified for free meals). The weights also align the characteristics of the sample to match those of the study population. Therefore, they provide unbiased estimates of population means, proportions, and totals for the various analytic groups.

Nonresponse adjustments are an important element of the weights. The data collected for this study are subject to unit nonresponse and item nonresponse. Unit nonresponse occurs when none of the survey items are collected because the sampled student/parent refuses directly to complete the interview or is unreachable during the survey period. Item nonresponse occurs when the person participates in the survey but does not answer all the questions. The nonresponse components of the weights adjust for *unit nonresponse* to both the part 1 and part 2 interviews. Accordingly, we prepared two sets of weights: one supports the analysis of the sample who completed the part 1 interview, the other supports analysis of the sample who completed the part 2 interview.[1]

[1]Item nonresponse to the part 2 data was handled by the use of data imputation as discussed in Chapter VIII.

1. Overview

The population represented by our sample includes all students who were enrolled at the start of the 2002–2003 school year in the pilot and comparison districts and who were not directly certified for free meals. The weights for respondents to part 1 consist of the product of the first three components listed below. The weights for respondents to part 2 consist of the product of all four components:

1. ***A base projection weight*** for each student in the eligible released sample (n=3,685), which is the inverse of the student's probability of selection. It accounts for differences in the sample selection rates. This component actually consists of four sub-components associated with the four potential stages of sample selection (see expression [1] in Chapter III.C for a discussion and mathematical summary of these factors).

2. ***An eligibility rate adjustment*** deflates the sum of the base weights, and the corresponding estimate of the study population, to account for the fact that some sampled students were found to be ineligible for the study during the interviewing process.

3. ***A part 1 nonresponse adjustment*** to account for differences between the part 1 respondents and the released sample of students. This component was based on information about the sample members obtained from the sampling frame, and used the CATI interviewing outcomes to further subdivide the part 1 completes into CATI respondents and nonrespondents in forming the adjustments.

4. ***A part 2 nonresponse adjustment*** to account for differences between the part 1 respondents who did and did not complete the part 2 interview. This component was based on information in the part 1 interview.

To finalize the weights for the survey completes, we realigned the weighted distributions to the estimated population totals.

These weights provide unbiased estimates of means, proportions, and totals for the target population if two assumptions hold true. First, we assume that each district provided a complete list of their enrolled students at the start of the 2002–2003 school year. From this list we selected a scientifically based, stratified sample of students with known probabilities of selection. While the data used to stratify the sample were subject to error, the base weights project to the total population of students on the lists. Second, we assume that the list updating and matching process described in Chapter VI enabled us to classify accurately each sampled student's meal price status as of October 2002. If these two assumptions are correct, the weighted sample count is an unbiased estimate of the population of non-directly-certified students in each district by meal status (free on the basis of an application, reduced-price, and paid).

2. Illustrative Calculations of the Weights for One District

To illustrate the computations, we use data from tables III.1, III.4, V.1, and VI.1, which provide counts for the associated sampling, data collection, and data processing or operational procedures. We will use as our example the Blue Ridge school district (Table VII.1 displays the data). We received a full enrollment list from this district that contained 1,240 students. Based on our initial processing, we stratified the students into three groups—212 certified free based on application, 95 certified reduced-price and 933 balance paid (this district did not have any students directly certified for free meals).[2]

We ultimately released a stratified sample of 132 cases, which included 30 free students, 16 reduced and 86 paid. The base weight component accounts for the multistage sampling process used. Dividing the number of free students (212) by the number selected (30) yields 7.06, which is close to the average base weight of 6.93. Similarly, the number of reduced-price students divided by the number selected is 5.94, close to the average weight for the group of 4.50. The number of paid students divided by the number selected is 10.84, which is close to the

[2]In this district we initially selected a 1-in-2 sample from the initial enrollment list, which yielded 107 free, 46 reduced-price, and 467 paid students.

TABLE VII.1

EXAMPLE COMPUTATION OF POPULATION ESTIMATES FOR BLUE RIDGE, PA, SCHOOL DISTRICT

					Updated Meal Price Status			Adjusted Population Estimates[e]		
Original Stratification	Sampling Frame Count[a]	Cases Sampled and Released[b]	Average Base Weight	Original Weighted Estimates of Population Counts[c]	Outcome	Cases[d]	Weighted Count	Free	Reduced	Paid
Free	212	30	6.93	208	Free	26	180	180		
					Reduced	2	14		14	
					Paid	2	14			14
Reduced	95	16	4.5	72	Free	4	18	18		
					Reduced	6	27		27	
					Paid	6	27			27
Paid	933	86	11	946	Free	12	132	132		
					Reduced	3	33		33	
					Paid	71	781			781
Total	1,240	132		1,226		130	1,226	330	74	822

[a]Source is Table III.4.

[b]Source is Table III.1.

[c]Weighted estimates of population counts differ from sampling frame counts due to sampling from the enrollment list.

[d]Source is Table VI.1.

[e]The totals free, reduced-price, and paid shown for Blue Ridge in Table VII.2 differ from the figures shown here because we found one case that was a duplicate of a second interview with the same household (which was removed) and because there was variation of weights.

average weight of 11.[3] When the weights are summed for the sample in each group, these sums are close to the original sampling frame counts of 212, 95, and 933. However, because of the variation from sampling from the initial enrollment list, the sums of weights are 208, 72, and 946, for a total of 1,226.

The sum of base weights provides estimates of the population sizes that are subject both to sampling variation and to error in the classifications according to meal price status. To correct for the error in classification, we conducted a matching process of the sample cases to updated lists of students approved for free and reduced-price meals, as discussed in Chapter VI. As shown in Table VI.1 of the 132 cases in Blue Ridge, about 78 percent had the same classification according to the initial list and the updated list. Of the 30 free cases, 26 remained as free, 2 changed to reduced price, and 2 changed to paid. Similarly, among the 16 initially reduced price, 4 changed to free, 6 stayed reduced, and 6 changed to paid. Of the 86 initially classified as paid, 12 changed to free, 3 changed to reduced-price, and 71 remained paid. Applying the base weight to the new meal price classification produces a revised estimate of the populations by meal status group. With these changes in meal price status, summing the weights gives a final population estimate of 330 free approved, 74 reduced-price approved, and 822 paid, for a total of 1,226.

Based on subsequent review of the data collection outcomes we found that one of the initially free cases that stayed free was actually the second interview for household in which the second child had changed to paid status. We determined that the record which changed to paid

[3]The sums of weights are not the same as the frame values because they are subject to sampling variability. Given the small size of the sample of reduced-price students in this district, the differences between the sums of the weights and the frame values were larger for this group.

status contained the correct information on the household. Therefore, we doubled the weight on that paid status case and eliminated the free case to produce the final population estimates that are shown in Table VII.2—321 free, 78 reduced-price, and 833 paid, for a total of 1,232.

The nonresponse adjustments—components three and four—use a ratio adjustment that inflates the sum of the base weights for completed interviews for part 1 or 2 to the sum of the base weights for the full sample. In our example above, the sum of the base weights for the 132 released sample cases in Blue Ridge is 1,232, and we had 125 that completed part 1 of the survey and 108 that completed part 2 (see Table V.1). The sum of base weights for the 125 part 1 completes is 1,152, which produces an average adjustment of 1,232 divided by 1,152, or 1.07. As discussed in Section C below, the part 1 nonresponse adjustments were actually calculated on a cell basis using the analytic meal price status, education level, and CATI outcomes status to reduce the potential for bias in the survey estimates.

To finalize the weights, we aligned the sum of the weights (without applying the eligibility adjustment) for the part 1 and part 2 completes (using the product of components [1] one and three, or [2] one, three, and four, respectively) to match the population totals estimated from the full released sample (3,685) presented in Table VII.2. We then applied the second component, the eligibility adjustment, to deflate the sum of these weights to account for the fact that a small percentage of our released sample was found to be ineligible for the study during interviewing (for example, because the child was no longer enrolled in the study school district). In Blue Ridge, we determined eligibility for the survey for 129 of the 132 sampled cases, and found that 96.2 percent were eligible for the survey, to produce an estimate of the population as it existed at data collection of 1,185.

TABLE VII.2

ESTIMATED POPULATION DISTRIBUTION OF MEAL STATUS, BY DISTRICT

District	Pilot/Comparison District	Direct Certification Count[a]	Population Estimates Method 1 Weighted Sample Counts (n=3,685)				Population Estimates Method 2 Weighted Completed Part 1 Interviews Adjusted for Ineligibility (n=3,020)			
			Total	Free	Reduced	Paid	Total	Free	Reduced	Paid
Up-Front Documentation										
Blue Ridge, PA	P	NA	1,232	321	78	833	1,184	321	78	785
Montrose, PA	C	74	1,654	283	117	1,254	1,637	283	117	1,237
East Stroudsburg, PA	P	421	7,604	749	678	6,176	7,332	749	678	5,904
Easton, PA	C	617	7,237	797	327	6,113	7,136	757	314	6,065
Pleasant Valley, PA	P	159	6,492	535	218	5,739	6,182	473	193	5,516
Bangor, PA	C	82	3,606	366	243	2,997	3,479	366	243	2,870
Stroudsburg, PA	P	NA	5,132	684	301	4,147	5,056	684	301	4,070
Pottsgrove, PA	C	NA	3,291	252	112	2,926	3,155	252	100	2,802
Maplewood, OH	P	NA	1,115	85	21	1,009	985	84	20	881
Newton Falls, OH	C	NA	1,570	328	99	1,143	1,436	309	99	1,028
Salem, OH	P	NA	2,448	415	50	1,983	2,291	387	47	1,857
Lisbon, OH	C	NA	1,172	266	84	821	1,140	251	80	809
Creve Coeur, IL	P	NA	531	128	64	335	521	128	67	326
North Pekin and Marquette Heights, IL	C	NA	644	114	28	502	644	114	28	502
Oak Park and Forest River, IL	P	NA	2,985	64	20	2,902	2,975	64	20	2,891
Valley View, IL[b]	C	17	1,863	305	96	1,462	1,781	294	91	1,396
Williamson County, TN[b]	P	376	6,176	213	103	5,861	5,595	192	92	5,311
Wilson County, TN	C	304	10,385	799	477	9,109	10,249	799	477	8,974
Total: UFD Pilot Districts	P	956	33,715	3,194	1,533	38,094	32,121	3,082	1,496	27,541
Total: UFD Comparison Districts	C	1,094	31,422	3,510	1,583	26,327	30,657	3,425	1,551	25,683
Graduated Verification										
Dilworth-Glyndon-Felton, MN	P	152	1,244	144	90	1,010	1,191	137	81	973
Breckenridge, MN	C	63	937	103	69	765	923	94	63	765
Lake Park Audubon, MN	C	34	670	115	82	473	653	113	80	460
Grandview, MO	P	551	3,909	856	198	2,855	3,565	844	198	2,523
Hickman Mills, MO	C	1,035	6,643	2,282	883	3,478	6,284	2,143	840	3,300
Dunkirk, NY	P	NA	1,827	622	192	1,013	1,764	593	192	979
Jamestown City, NY	C	772	4,813	1,407	398	3,008	4,259	1,283	379	2,598
Total: GV Pilot Districts	P	703	6,980	1,622	480	4,878	6,520	1,574	471	4,475
Total: GV Comparison Districts	C	1,904	13,063	3,907	1,432	7,724	12,119	3,633	1,362	7,123
Total		**4,657**	**85,181**	**12,234**	**5,028**	**67,916**	**81,416**	**11,715**	**4,878**	**64,823**

[a]As assessed at sampling. We obtained current year direct certification lists from all districts. These counts reflect the original list count adjusted for observed duplication.
[b]The totals for these districts reflect only the schools included in the evaluation. Some of these districts' schools were not included in the evaluation and are excluded here.

B. POPULATION ESTIMATES

As discussed, using the final meal price status, we estimated district student populations by meal price status at the time of sampling and interviewing. Table VII.2 presents two sets of estimates. The first is based on the updated outcomes for the full released sample of 3,685 students weighted by the baseline weight. The second, which is limited to the cases with completed part 1 interviews (n=3,020), accounts for the observed ineligibility of the sampled cases as determined from the interviewing process. These counts are weighted by the product of the baseline weight (component one), a nonresponse adjustment factor to compensate for survey nonresponse in part 1 (component three), and an eligibility adjustment (component two), to account for the fact that some of the students no longer attended school in the districts at the time of interviewing.

As a check on the sampling process, it is useful to compare administrative counts of relevant population parameters with estimates of the corresponding data items based on the weighted study sample. The left portion of Table IV.3 shows administrative counts of selected data items, measured as of October 31, 2002, for schools participating in the study: (1) total number of students enrolled, (2) number of students approved for free meals (including students directly certified), (3) number of students approved for free meals by direct certification, (4) number of students approved for free meals by application (excluding directly certified), (5) number approved for reduced-price meals. These data were furnished to FNS either directly by the district or by the state agency administering the NSLP in the state in which the district is located. Data on the number of students directly certified in the comparison districts were not available to us from this source.

The table presents two comparisons: (1) a comparison of total number of students enrolled as measured by the administrative data and as measured by the weighted study sample, and (2) a comparison of the percentage of all students enrolled who are approved for free or reduced-price meals (including those directly certified under both approaches). Details of the calculations of the sample based estimates are presented in the footnotes to Table VII.3.

Column 8 presents the difference between the administrative data total enrollment and the Total Sample Population by Method 1 (all students in the district except those directly certified for free meals) plus the number directly certified expressed as a percentage of the total enrollment as reported by the district in administrative reports. We anticipate some differences in these two estimates of total enrollment because of the differences between the date the enrollment list for sampling was created and the count for October 31. In 15 districts, the absolute value of the percentage difference is less than 5 percent, in 7 districts it is 5 to 7 percent, and in 2 districts it exceeds 7 percent. In Creve Coeur, where the administrative-based estimate is 25 percent greater than the sample-based estimate, the enrollment list contained a smaller number of names than the administrative data (687 compared to 750); subsequent processing also identified students to further reduce the estimate of total enrollment. In Montrose, administrative data show 11 percent more students than the sample-based estimate. Overall, the differences are in line with our expectations.

To examine the extent to which the administrative data and sample-based estimates provide estimates of the percentage of students who are certified for free or reduced-price meals, we calculated this percentage for the sample (column 9) and for the administrative data (column 10). The difference in percentages expressed as a percentage of the administrative based estimate is shown in column 11. Finally, column 12 presents an estimated standard error of the sample-based estimate. The difference is less than one standard error of the sample proportion in 14 of 24 districts, between one and two standard errors in 9 districts, and greater than two standard

TABLE VII.3

ADMINISTRATIVE DATA REPORTED BY DISTRICTS AND COMPARISONS WITH SAMPLE-BASED ESTIMATES

	Counts Reported by District as of October 31, 2002[a]											
	1	2	3	4	5	6	7	8	9	10	11	12
	Total Enrollment	Students Approved Free (Including Directly Certified)	Students Approved Directly Certified	Number Approved Free Excluding Directly Certified	Number Approved Reduced Price	Sample Total Population Estimate Method 1 Plus Number Directly Certified[b]	Sample Population Estimate Free and Reduced Method 1 Plus Number Directly Certified[c]	Percentage Difference Between MDS Total Enrollment and Total Pop 1 + Directly Certified[d]	Sample Based Percentage Free and Reduced (Including Directly Certified)[e]	Administrative Based Percentage Free and Reduced (Including Directly Certified)[f]	Difference[g]	Standard Error of Sample Estimate[h]
Up-Front Documentation												
Blue Ridge Area School District	1,238	286	0	286	96	1,232	399	0.5	32.4	30.9	1.5	4.0
Montrose School District	1,925	319	na	na	178	1,728	474	11.4	27.4	25.8	1.6	3.8
East Stroudsburg Area School District	7,504	914	295	619	443	8,025	1,848	-6.5	23.0	18.1	4.9	3.6
Easton Area SD	7,887	1,441	na	na	437	7,854	1,741	0.4	22.2	23.8	-1.6	3.6
Pleasant Valley School District	6,676	673	159	514	254	6,651	912	0.4	13.7	13.9	-0.2	3.0
Bangor Area School District	3,455	417	na	na	232	3,688	691	-6.3	18.7	18.8	0.0	3.4
Stroudsburg Area School District	5,336	676	0	676	290	5,132	985	4.0	19.2	18.1	1.1	3.4
Pottsgrove School District	1,989[i]	289	na	na	84	3,291	364	1.5	11.1	11.2	-0.1	2.7
Maplewood Local School District	1,097	102	0	102	46	1,115	106	-1.6	9.5	13.5	-4.0	2.5
Newton Falls School District	1,600	299	na	na	122	1,570	427	1.9	27.2	26.3	0.9	3.8
Salem City Public Schools	2,481	498	0	498	98	2,448	465	1.3	19.0	24.0	-5.0	3.4
Lisbon Ex Vill School District	1,191	316	na	na	84	1,172	350	1.6	29.9	33.6	-3.7	3.9
Creve Coeur School District #76	750	247	68	179	88	599	260	25.2	43.4	44.7	-1.3	4.3
North Pekin & Marquette Heights	605	157	na	na	39	644	142	-6.1	22.0	32.4	-10.3	3.6
Oak Park and Forest River HS	2,962	140	33	107	50	3,018	117	-1.9	3.9	6.4	-2.5	1.7
Valley View	1,774	313	na	na	93	1,880	418	-5.6	22.2	22.9	-0.7	3.6
Williamson County (Pilot schools only)	6,296	455	182	273	131	6,552	692	-3.9	10.6	9.3	1.3	2.6
Wilson County School District	10,837	1,383	na	na	455	10,689	1,580	1.4	14.8	17.0	-2.2	3.1
Graduated Verification												
DGF School District #2164	1,331	319	116	203	104	1,396	386	-4.7	27.7	31.8	-4.1	3.3
Breckenridge/Lake Park Audubon	1,616	378	na	na	136	1,704	466	-5.2	27.3	31.8	-4.5	3.3
Grandview CSD 4	4,212	1,372	491	881	288	4,460	1,605	-5.6	36.0	39.4	-3.4	3.2
Hickman-Mills	7,477	3,397	na	na	822	7,678	4,200	-2.6	54.7	56.4	-1.7	3.2
Dunkirk City School District	2,202	1,021	263	758	191	2,090	1,077	5.4	51.5	55.0	-3.5	3.3
Jamestown City School District	5,430	2,336	na	na	468	5,585	2,577	-2.8	46.1	51.6	-5.5	3.2

Table VII.3 (*continued*)

na = administrative counts not available.

[a]Counts reported to FNS or to the state agency administering the district's NSLP program.

[b]Calculated at Total Population Estimate Method 1 (Table VI.2) plus number directly certified as measured by sampling (Table III.4). For Creve Coeur, Oak Park and Forest River, North Pekin and Marquette Heights, and Dunkirk we used administrative counts of the number directly certified.

[c]Calculated as Sample Population Estimate Free and Reduced Price Estimated by Method 1 (Table VI.3) plus number directly certified (see footnote b).

[d]Calculated as {column 1 – column 6/column 1}.

[e]Calculated as column 7/column 6.

[f]Calculated as {column 2 + column 5/column 1}.

[g]Calculated as column 9 – column 10.

[h]Calculated as = square root [(column 9) * (1 – column 9)/N] where N is the approximate sample size for the district, 135 for all UF Districts, 180 for DGF and its comparison site, 23 for Grandview and Dunkirk, and 243 for Hickman Mills and Jamestown.

[I]This estimate appears to be incorrect. The Common Core Data reports total enrollment of 3,340 for Pottsgrove in school year 1999-2000. The CCD figure is used for the comparisons of administrative and sample-based estimates.

errors in 1 district (and therefore statistically significantly different from zero). Again, the magnitude and standard errors of these differences indicate that the differences are within the range of what we would expect because of sampling variation.

C. WEIGHTING METHODOLOGY

This section provides details on the computation of each of the weighting components, which the reader may wish to skip after reviewing the overview presented in sections A and B.

1. Component One: Sample Selection

The first component is based primarily on the sample selection probabilities. It is the product of (1) the inverse probability of selecting the student, which was a four-component probability; and (2) a ratio adjustment factor to account for the fact that only a random subset of the total sample selected was in fact released. Initially, we selected a relatively large sample and divided it into random replicates. We then released initially a random subset of the sample that would yield the desired number of interviews if we achieved a 70 percent response rate. We planned that, if the actual response rate was below 70 percent, we could supplement the initially released sample with some of the unused replicates to achieve the targeted number of interviews. However, the high response rate of 86.3 percent for the part 1 completes rendered the additional replicates unnecessary. Because only a random subset of the full sample was released, we computed the ratio adjustment factor based on district and meal price status (at time of sampling) by setting it equal to the number of replicates released divided by the total number created.[4]

[4] For a few districts, we set this ratio equal to the number of sampled cases divided by the number released rather than the number of replicates, since the samples in some districts were found to contain directly certified students, as discussed in Chapter III.

2. Component Two: Eligibility Rate Adjustments

To develop the second and third weight components, we assigned each sampled case to one of nine weighting groups based on their CATI and CAPI interviewing outcomes and key data items, as follows[5]:

1. Part 1 and 2 complete (part 1 income less than 400 percent of FPL; part 2 income less than, equal to, or greater than 400 percent of FPL)
2. Part 1 complete and income at least 400 percent of FPL; part 2 not applicable
3. Part 1 complete and income less than 400 percent of FPL, part 2 nonrespondent
4. Found to be ineligible at CATI or CAPI interviewing stage
5. Refused during district passive consent process
6. No interview completed, part 1 contacted, part 2 contacted
7. No interview completed, part 1 contacted, part 2 not contacted
8. No interview completed, part 1 not contacted, part 2 contacted
9. No interview completed, part 1 not contacted, part 2 not contacted

We defined groups 1 to 3 as part 1 completes, groups 1 and 2 as part 2 completes, and groups 1 to 5 as having a known eligibility status for purposes of determining eligibility rates.

Using this classification, we calculated the eligibility rate adjustment component to compensate for the observed ineligibility of some sampled cases. Initially, we formed 75 cells by combining district (25 groups) and meal price status (3 groups) to account for possible differences along these domains. Within each cell, we computed a ratio adjustment equal to the number of students known to be eligible (weighting groups 1 to 3 and 5 above) as weighted by the first weight component divided by the number of students with a known eligibility status (groups 1 through 5). To avoid creating an adjustment factor for a cell with less than 20 sampled

[5]Complete status is assigned to a questionnaire for which the income data were sufficiently complete to use in the corresponding part of the data analysis.

cases, we collapsed the original cells by combining the free and reduced-price groups into a single category as needed to obtain at least 20 sampled cases in the final adjustment cell. We combined free and reduced-price status in 12 of the 25 districts to produce a total of 63 cells for the eligibility adjustment process. The adjustment factors ranged from .812 to 1.00, with a mean of 0.96. Overall, we estimated the eligibility rate of the sample to be 95.57 percent (weighted by the component 1 sample probability-based weight).

3. Component Three: Part 1 Survey Nonresponse

a. The Data Collection Steps as They Relate to Nonresponse

To take best advantage of the information obtained at each stage of data collection for reducing the potential for survey nonresponse bias, the weighting components discussed in this and the following section recognize that the data collection methods do not directly overlap with the part 1 and part 2 analytic groups. In particular, the part 1 completed interviews included some cases that were done by telephone and some that could not be thus interviewed but completed the interview in person, a factor that we anticipated would be related to other socioeconomic characteristics of the household important for consideration in the nonresponse adjustments.

For purposes of calculating weights, the data collection process encompassed three stages and used two methods. First, we attempted to interview each sampled student's household by telephone using CATI methods. This interview obtained basic information to classify households into two groups, those with very high income (more than 400 percent of the federal poverty level [FPL]) and those with income below this threshold. This initial stage produced three outcomes: (1) nonresponse or non-complete with unknown eligibility status, (2) ineligible status, if the student was found to be a member of a group home or was no longer attending school in the district (for which interviewing terminated), or (3) completion of the part 1 interview. If the household's income was 400 percent of FPL or greater, no additional data collection was required. If income was less, we attempted a part 2 in-person interview.

As stage 2, if the household had not completed the CATI interview (or income status had not been determined), we attempted to obtain the missing part 1 data in the in-person interview. This interview resulted (as in the CATI interviewing) in either the successful collection of the data (a determination that household income was at, over, or under 400 percent of FPL) or a nonrespondent outcome.

As stage three, if the student's household income was determined to be less than 400 percent of FPL in the part 1 interview, the interviewer administered the part 2 detailed income battery. For the CATI completes, because the part 1 data had already been collected by telephone, the in-person interview began at stage three to obtain the part 2 data.

b. Methods

In preparing the nonresponse adjustments, our goal was to identify and use all available characteristics that were related to key survey outcomes and exhibited different patterns of nonresponse to the part 1 interview. Meal price status, grade, and district are the only student characteristics available. In addition, we also examined as discussed above the outcomes of the CATI data collection process as a proxy for potentially important but unavailable characteristics. Failing to make contact with a sampled household during the CATI stage may indicate a higher likelihood that the household does not have a telephone or experiences lapses in phone coverage. Lack of phone coverage in turn tends to be related to socioeconomic standing. Thus, lack of contact by telephone may distinguish the most severely economically disadvantaged households from a broader low-income group. By combining contact or lack of contact by telephone in the CATI phase with the sampling frame characteristic of free, reduced, and paid meal status and grade level, we expected to be able to reduce the potential for bias in the survey relative to that provided by using the meal status and grade alone.

We prepared the part 1 nonresponse adjustment using a weighting class approach similar to that for the eligibility rate adjustment. The sampled cases are assigned to cells that have homogeneous response patterns so that, within a cell, survey nonresponse is basically random. Within each cell, a simple ratio adjustment is calculated, which equals the weighted count of all cases in the sample (weighed by the base weights) divided by the weighted count of the part 1 respondents (groups 1 to 3). For the final part 1 nonresponse factor, this is multiplied by the second component (the eligibility rate adjustment) to deflate the count in the numerator of this adjustment for observed ineligibility.

As shown in Table VII.4, nonresponse patterns for the part 1 completion status showed some minor variation in the unweighted cooperation rates by meal price status, with the free and the paid categories having somewhat lower rates than the reduced-price students. High school students showed a lower completion rate than the other groups. The largest difference was based on CATI contact status: cases not contacted in CATI had much lower response rates to the part 1 interview. This same pattern is evident in each meal price status group.

In light of these findings, we created an initial set of adjustment cells by combining district membership, grade range (high school vs. other), and CATI contact status, which produced 253 cells with 14.5 sample points per cell on average (3,685 released cases divided by 253 cells). We note that selecting a minimum cell size must balance two competing objectives: (1) the need to minimize the bias in the estimates (which argues for as many cells as possible), and (2) the need to minimize differences across cells due to sampling variation rather than real differences (which argues for fewer cells with more cases). We decided to collapse the categories to attain a minimum of 20 sample members per cell, subject to two constraints. First, because meal price

TABLE VII.4

SURVEY PART 1 COOPERATION RATES, BY STUDENT CHARACTERISTICS[a]

	Up-Front Documentation Districts				Graduated Verification Districts					
	Pilot		Comparison		Pilot		Comparison		Total	
Student Characteristic/ Category (from Sampling Frame)	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]
Final Meal Price Status		0.0057**		0.036*		0.0084**		0.1142		<.0001**
Free	86.9		82.0		86.1		80.9		83.8	
Reduced	85.7		89.6		93.0		86.9		88.4	
Paid	78.7		81.5		79.5		77.4		79.6	
Sample Meal Price Status		0.4245		0.0667		0.1653		0.0003**		0.0022**
Free	82.9		80.7		80.2		73.4		79.1	
Reduced	83.4		88.6		91.3		88.4		87.2	
Paid	80.0		82.1		85.0		84.8		82.1	
Grade Range		0.0349*		0.0074**		0.1865		0.0145*		<.0001**
0 – Missing	80.9		83.3		66.7		66.7		80.4	
1 – Elementary	85.2		84.7		84.4		84.2		84.7	
2 – Middle	79.1		86.6		87.5		80.8		83.5	
3 – High	77.1		77.6		79.4		72.5		76.9	
Gender		0.4773		0.4777		0.5272		0.4808		0.4664
Missing	81.1		82.5		83.7		79.8		81.6	
Female	78.9		80.8		86.5		88.9		81.6	
Male	83.6		85.3		81.0		85.7		83.8	
CATI Contact Status[c]		<.0001**		<.0001**		<.0001**		<.0001**		<.0001**
Not contacted	52.5		58.7		61.5		49.4		55.4	
Contacted	88.5		87.5		92.4		90.6		89.1	
By Meal Status										
Free approved		<.0001**		<.0001**		<.0001**		<.0001**		<.0001**
Not contacted[c]	61.8		56.7		68.6		60.4		62.2	
Contacted[c]	94.5		90.2		94.8		90.6		92.4	
Reduced price		<.0001**		0.1038		0.0008**		<.0001**		<.0001**
Not contacted[c]	58.6		81.8		73.3		45.5		65.7	
Contacted [c]	92.8		91.4		98.2		98.7		94.3	
Paid		<.0001*		<.0001**		<.0001**		<.0001**		<.0001**
Not contacted[c]	48.1		52.1		51.3		32.7		47.5	
Contacted[c]	86.1		85.8		89.1		87.9		86.6	

[a]Part 1 cooperation rate is number of completed interviews divided by number of sample released.
[b]Significance tests indicate whether the completion rates of the alternative categories within each student characteristic are significantly different from each other at the 0.05 (*) or 0.01 (**) level.
[c]CATI contact status indicates whether any member of the student's household was ever reached by telephone in the attempt to complete the part I survey.

status was a primary analytical domain, we did not collapse across the final meal price categories. Second, by not collapsing across districts, we established a minimum of 75 cells (25 districts by 3 meal price status groups).

By district and meal price status, we combined cells across the grade range (collapsing high school and other to a single cell for all grades), or CATI contact status (collapsing from not contacted vs. contacted to a single cell of all cases), or both grade and CATI contact status, as necessary, to obtain a minimum cell size of 20, subject to the two constraints above. Because CATI status was more highly correlated with completion status, we collapsed the grade ranges first. If collapsing on grade did not meet the cell size requirements, we collapsed on CATI contact status (leaving the two grade range cells intact). If neither option provided a minimum cell size of 20, we then created a single cell based on district and meal price status membership.

This process produced a total of 91 adjustment cells for the 3,020 part 1 completed interviews. These 13 cells have fewer than 20 members, of which 11 were for the reduced-price group. The minimum cell size overall is 7, and the minimum sample size across the 66 free or paid meal status cells is 18. The adjustment factors vary from 1.00 to 2.03. While these adjustments are expected to reduce the potential bias in the study estimates, they had only a small adverse impact on survey precision.[6]

4. Component Four: Part 2 Survey Nonresponse

We used a propensity modeling approach for the part 2 nonresponse adjustments to take maximum advantage of the best available data from the part 1 interview. The propensity score

[6]We examined the design effects due to adjusting the weights for nonresponse by comparing the coefficient of variation in the weights before and after applying the nonresponse adjustments. Nonresponse adjustments to the part 1 interview imparted less than a 10 percent loss in relative precision, except in the Graduated Verification Comparison districts, where the loss was about 13 percent.

methodology uses a logistic regression model to predict part 2 response status among part 1 completes based on indicator variables that describe the student's characteristics. We then use the inverse of the predicted probability of response from the model as the initial adjustment (subject to some trimming for outliers) to the weights for the part 2 completes.[7]

As a starting point for developing the modeling procedures as for the part 1 adjustments, we reviewed the part 2 response profiles (among part 1 completes) across the various sampling frame and part 1 survey outcomes to isolate the factors that appeared to be related to part 2 nonresponse (Table VII.5). With a propensity-based technique, one needs to consider that the relationship between survey response and a student's characteristic may not be the same across categories of another student characteristic. For example, the response rates of free certified students in households in which the parent respondent has less than a high school education may differ from those of free certified students in households where the parent has some college or a college degree. In this circumstance, using one variable for free certified and one variable for education level does not adequately compare the variation. To account for such interactions under a propensity modeling approach, we can either include interaction terms in the model or estimate separate models for the groups.

Because of the large number of observed characteristics and possible interactions, we focused on possible interactions of district membership and meal status with the other characteristics in predicting part 2 completion status. We focused on these two characteristics because the socioeconomic status of the students and their related meal status are highly

[7]We decided against the weighting class approach for the past 2 nonresponse adjustments, because the large number of characteristics available would have created more cells than we had observations. The propensity model approach uses all the data, and in fitting the model gives the various characteristics different weights depending on their association with nonresponse.

TABLE VII.5

SURVEY PART 2 COOPERATION RATES, BY STUDENT/HOUSEHOLD CHARACTERISTICS[a]

	Up-Front Documentation Districts				Graduated Verification Districts				Total	
	Pilot		Comparison		Pilot		Comparison			
Student Characteristic/Category	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]	Comp. Rate (Percent)	Chi-Squared Sign. Level[b]
Final Meal Price Status		0.3159		0.0033**		0.3753		0.1505		0.0002**
Free	86.9		89.7		87.0		88.2		88.0	
Reduced	81.7		84.5		81.8		81.4		82.7	
Paid	82.7		79.9		82.8		82.4		81.7	
Sample Meal Price Status		0.0800		0.0151*		0.1408		0.0136*		0.0001**
Free	87.7		88.5		86.3		89.9		88.1	
Reduced	78.9		85.3		83.6		78.0		81.6	
Paid	83.3		80.2		83.1		82.5		82.0	
Grade Range		0.0617		0.1873		0.0108*		0.1662		<.0001**
0 – Missing	84.3		80.0		100.0		75.0		84.0	
1 – Elementary	86.5		85.8		88.7		88.0		87.0	
2 – Middle	83.2		79.5		85.0		81.8		82.0	
3 – High	78.2		81.7		76.2		80.7		79.6	
Gender		0.5564		0.5754		0.7800		0.9365		0.7116
Missing	84.3		82.5		85.3		84.7		84.0	
Female	80.8		85.7		83.3		87.5		83.3	
Male	83.2		81.6		82.7		83.3		82.5	
Race		0.7604		0.1958		0.6687		0.8801		0.9709
White	83.2		82.7		85.2		85.0		83.6	
Black/other	85.6		80.0		85.0		84.9		84.0	
Hispanic	82.1		90.9		81.7		82.5		83.8	
Parent Education		0.1469		0.0089**		0.5012		0.1011		0.0598
Below high school	86.4		93.1		81.3		87.5		87.6	
High school graduate	80.8		81.8		86.9		80.8		82.0	
Some college	83.4		80.3		82.8		88.6		83.5	
College graduate	87.9		81.6		87.3		79.6		84.8	

TABLE VII.5 *(continued)*

Student Characteristic/Category	Up-Front Documentation Districts: Pilot Comp. Rate (Percent)	Up-Front Documentation Districts: Pilot Chi-Squared Sign. Level[b]	Up-Front Documentation Districts: Comparison Comp. Rate (Percent)	Up-Front Documentation Districts: Comparison Chi-Squared Sign. Level[b]	Graduated Verification Districts: Pilot Comp. Rate (Percent)	Graduated Verification Districts: Pilot Chi-Squared Sign. Level[b]	Graduated Verification Districts: Comparison Comp. Rate (Percent)	Graduated Verification Districts: Comparison Chi-Squared Sign. Level[b]	Total Comp. Rate (Percent)	Total Chi-Squared Sign. Level[b]
Marital Status		0.0547		0.1452		0.4474		0.9954		0.0174*
Married	81.4		81.7		82.7		84.9		82.3	
Living with someone	91.7		94.4		82.9		88.2		89.2	
Widowed	88.2		66.7		90.0		88.9		83.3	
Divorced	82.9		83.3		83.1		84.6		83.3	
Separated	89.3		82.7		84.1		83.7		85.1	
Never married	94.0		89.4		82.3		83.6		89.8	
Own Home		0.1732		0.4891		0.6468		0.4146		0.0742
Yes	86.0		84.0		85.2		86.3		85.3	
No	82.4		82.3		83.8		83.7		82.8	
Own or Pay on Vehicle		0.6651		0.1910		0.7220		0.9919		0.5923
Yes	84.6		79.0		83.5		84.8		82.9	
No	83.2		83.5		84.8		84.7		83.8	
Number of Working Adults		0.4637		0.5659		0.1252		0.1854		0.0320*
0	83.5		81.9		92.9		93.2		87.5	
1	85.2		84.3		84.7		83.2		84.5	
2	82.1		82.3		82.3		83.6		82.4	
3 or more	78.2		77.6		77.6		83.3		78.5	
Household Size		0.8556		0.9229		0.1464		0.1390		0.2249
2	80.4		80.9		75.9		72.4		78.3	
3	85.7		84.2		90.5		82.1		85.6	
4	82.7		82.1		85.1		84.8		83.3	
5 or more	83.6		83.0		82.4		87.3		83.9	
Government Support		0.1772		0.1084		0.1733		0.3554		0.0071**
Yes	83.2		82.4		83.7		84.3		83.2	
No	91.7		92.3		90.3		89.4		90.8	
Respondent Employed		0.2089		0.6667		0.6132		0.0077**		0.0223*
Yes	85.7		83.6		85.7		91.1		86.0	
No	82.4		82.5		83.9		82.1		82.7	
Years in Home		0.0738		0.1594		0.1819		0.0896		0.0030**
1 or less	89.1		84.6		89.3		89.2		87.9	
2	79.5		89.7		81.7		89.5		85.5	
3	84.9		81.0		77.3		88.4		83.2	
4 or more	81.8		81.3		83.6		81.1		81.8	

[a]Part 2 cooperation rate = number of part 2 completed interviews divided by number of part 1 completed interviews.

[b]Significance tests indicate whether the cooperation rates of the alternative categories within each student characteristic are significantly different from each other at the 0.05 (*) or 0.01 (**) level.

correlated with the key study outcome. Furthermore, the percentage of free and reduced-price students varied across the districts, and districts exhibited different demographic profiles and program participation characteristics. The sample sizes by district were small (less than 100 in most cases), so to keep the level of review manageable, we collapsed the districts into four groups for this review, defined by the combination of the two types of pilot programs (Up-Front Documentation or Graduate Verification) and pilot status (pilot or comparison). Our results indicated that the response patterns by the four district groups were more similar than the response patterns by meal price status categories (see Table VII.5), with paid status students always showing a lower cooperation rate than the free students. Therefore, we decided to estimate three models—one for free, one for reduced-price, and one for paid meal price status—and to include main effect indicators for each characteristic category. Because the cases identified as over 400 percent of FPL in part 1 could not be nonrespondents to part 2, we assigned a part 2 nonresponse adjustment factor of one to these cases, and applied the models only to the cases under 400 percent of FPL.

To form the final nonresponse adjustment for the part 2 completes, we began with a full variable weighted logistic regression model for each of the three meal price status groups. We included in the model estimation all part 1 completes, except those with income exceeding 400 percent of FPL, assigning a dependent variable that was equal to 1 if the case completed the part 2 interview, and 0 otherwise. We estimated the models using the Sudaan software procedures, which accounts for the complex sample design in the estimation process. Data were weighted by the inverse of the product of the three weighting components developed above. From the full models we eliminated nonsignificant factors individually or in groups in succession until we achieved a model that contained a set of factors that were significant at about a p-value of .30. Because a few of the variables with high, not statistically significant p-values (between

.10 and .35) appeared to improve the r-squared values of the model when they were included, we retained these variables in the models for the adjustment process.

We also reviewed the resulting propensity scores for large, potentially influential values. We found the maximum values to be 3.02/14.3/1.99 for the free/reduced/paid meal status models. Given the large value for the reduced-price meal cases, we explored these adjustments further and found that only two scores were above 4 (one at about 6 and another at 14.3). While these two values did not appear to adversely affect the variation in the weights, we trimmed them to a value 3.90 (the next lower value in the ranking) to prevent any other undo influence on the analysis. Overall, the part 2 survey nonresponse adjustments reduced the relative precision in the survey estimates by less than 10 percent for all but the Graduated Verification comparison districts (in which the relative loss in precision was about 17 percent among the combined meal status categories).[8]

Table VII.6 provides a summary of the three models used to create the final part 2 nonresponse adjustments for the cases under 400 percent of FPL. The table presents a listing of the characteristics considered in the models and indicates for each meal status group which factors appeared to be influential on the response patterns along with the model coefficients and their associated significance levels. The table also presents the Lemeshow goodness-of-fit statistic, the significance level, and the r-squared value for each final model, as well as, for comparison, the r-squared for the full model prior to variable reduction.

[8]Based on a comparison of the CV of the weights before and after adjustment.

TABLE VII.6

PART 2 NONRESPONSE ADJUSTMENT MODELS

Characteristic Variable Evaluated in the Models	Free Model		Reduced Model		Paid Model	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Intercept	1.330**	0.0005	1.053	0.2005	2.424**	0.0000
Middle School Student			-0.916	0.0612		
High School Student	-0.766*	0.0256	-1.251	0.0086**	-0.549**	0.0060
Missing Grade Level					-0.685	0.0802
Black Race					0.463	0.0985
Hispanic Race	-0.489	0.2199				
Other Race or Missing	0.883	0.1520				
Less than High School Education			0.895	0.1456		
Some College	0.514	0.1801			-0.187	0.3504
College Degree	-0.920	0.1935				
Previously Married			1.048	0.0279*	0.268	0.3198
Never Married	0.937*	0.0232	1.657	0.0212*		
Own Home	-0.350	0.3313			-0.478	0.0552
Own Car			1.254	0.0035**		
Number of Working Adults			-0.595	0.1005		
Household Size 1 or 2			-1.136	0.1664	-0.708	0.0685
Household Size 3			-1.288	0.0228*		
Household Size 5+	0.501	0.1545	0.801	0.1284		
Receives Govt. Support			1.539	0.1670		
Parent Employed			0.915	0.0861		
Years in Home			-0.291	0.0603	-0.220*	0.0256
District Pair 1[a]	1.378*	0.0159	0.829	0.1816		
District Pair 2					-0.319	0.2047
District Pair 3	1.101	0.1120	1.023	0.2183		
District Pair 5	1.222	0.0772	0.932	0.2091	0.602	0.0869
District Pair 6	1.567*	0.0162				
District Pair 7						
District Pair 8						
District Pair 9	1.697*	0.0125	2.128	0.0018**		
District Pair 10			2.058	0.0029**	0.329	0.2777
District Pair 11	0.773	0.0991			0.873**	0.0039
District Pair 12	1.725**	0.0000				
Sample Size (exc >400% FPL)	874		422		1,323	
Part 2 Completes	768		348		1,009	
R-Squared Full Model	0.088		0.1963		0.0649	
R-Squared Reduced Model	0.082		0.1772		0.05478	
Lemeshow Test Statistic	20.714		27.81		11.853	
Lemeshow P-value	0.008		0.0005		0.1579	

TABLE VII.6 *(continued)*

	Free Model		Reduced Model		Paid Model	
Characteristic Variable Evaluated in the Models	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
Maximum Propensity Score	3.05		14.30 (2 Trimmed to 3.9)		1.99	
CV Weights Prior to Adjustment	97.27		123.07		97.42	
CV Weights Post Adjustment	101.72		115.24 (Trimmed to 114.91)		103.23	

[a]District pairs are indicators to denote membership in each paired pilot comparison districts.

*Coefficient estimate is significantly different from zero at the .05 level, two-tailed test
** Coefficient estimate is significantly different from zero at the .01 level, two-tailed test.

5. Final Adjustments

After calculating the nonresponse adjustments for part 1 and part 2, we prepared a ratio adjustment to align the sum of the final weights for the completed part 1 and part 2 interviews to match the sum of the weights obtained for larger full released sample using the product of the first and second weight components (the inverse probability of selection and the eligibility rate adjustment). With the part 2 propensity modeling approach that adjusts the weights on an individual-student basis based on their estimated probability of response, the sum of adjusted weights does not always reproduce the original estimates of the population sizes from the released sample. Therefore, we used this process to adjust the weights for the completed interviews to ensure that they summed to our best estimate of the eligible population. For the part 1 completes, since the weighting class approach was designed to reproduce the population estimates, this step served merely as a check on the implementation; the adjustment value was found to be 1 for all the part 1 completes.

As a final step in preparing the weights, we applied a ratio adjustment to the completed part 1 and part 2 interviews in the graduated verification comparison district 3 so that the cases reporting to be of Hispanic origin would match in percentage in the comparison district of GV pilot district 3. Based on the weights developed above, we found that the pilot district showed about 37/34 percent (unweighted/weighted) of the part 1 completes to be of Hispanic origin, with the comparison district at 22/17 percent. Therefore, to better align the two districts for comparative purposes, we adjusted the part 1 and part 2 weights by a ratio adjustment equal to weighted proportion of students in GV pilot district 3 by meal status and four racial categories (White non-Hispanic, Black non-Hispanic, Hispanic, and Other, as reported in the part 1 interview) divided by the equivalent proportion in GV comparison district 3.

The final weights for the part 1 completes consisted of the product of the first three components—the inverse probability of selection, the eligibility rate adjustment, the part 1 nonresponse adjustment—and the final ratio-stratification adjustment. Likewise, the final weights for the part 2 completes consisted of the product of all five components. For GV comparison district 3, as indicated above, the weights also received an adjustment to align the weighted sample distribution to match that in GV pilot district 3 by meal status and racial profile.

VIII. IMPUTATION OF MISSING INCOME DATA

A primary goal of the survey for the Evaluation of the NSLP Application Verification Pilot Projects was to develop an accurate, independent estimate of the income eligibility status of each student in the sample. It was critical to classify each household as having income (1) less than 130 percent of the federal poverty level (FPL) (eligible for free NSLP meals), (2) between 130 and 185 percent of FPL (eligible for reduced-price NSLP meals), or (3) greater than 185 percent of FPL (not eligible for free or reduced-price meals).

To minimize respondent burden and maximize household participation in the survey, we conducted the study survey in two parts. In the part 1 interview, which was conducted by telephone with most respondents and in person with some, respondents reported on their experiences with the school lunch program, provided data on the characteristics of their family, and estimated their overall income and the total number of persons in their household. From this information, we established whether reported household income was above 400 percent of FPL, because, if it was, we could confidently classify them as having income above 185 percent of FPL (which would make them ineligible for free or reduced-price meals). Households with income above 400 percent of FPL were therefore not interviewed further. Households with income below 400 percent of FPL were asked to complete the part 2 interview, which entailed detailed questions about household composition, economic relationships among persons in the household, and information on income by source for each person 16 or older in the household.

This data collection structure resulted in two different situations in which respondents provided partial data on income. First, some respondents completed both the part 1 and part 2 interview but failed to provide data on one or more items on the part 2 interview necessary to calculate total household income. Due to item nonresponse, these cases have *partially missing* *part 2 income.* Second, some respondents provided information only for the part 1 interview although it was determined in that interview that their income was less than 400 percent of FPL, so a complete set of data for the household should include a part 2 interview. Because of unit nonresponse to the Part 2 interview, these cases have *totally missing part 2 income.*

Of our total sample of 3,685 students, 3,020 students' families completed the part 1 interview. Of these 3,020, 401 had income above 400 percent of FPL, so a part 2 interview was not attempted; 2,125 completed the part 2 interview; and 494 did not complete the part 2 interview, although one was attempted.

In this situation, the analyst can follow one of two courses: (1) use only the completed cases, or (2) use the cases with totally missing part 2 data and the cases with partially missing part 2 data by imputing the missing data item relevant to calculating total household income. Following the first course assures that the data for each case included in the analysis are as accurate as possible. However, the households who completed the part 1 interview but failed to complete the part 2 interview and households who had item nonresponse on the part 2 interview may differ systematically from the households who provided complete part 2 data. Therefore, omitting these households with totally or partially missing income data from the analysis creates a significant risk of causing bias in the estimates of study outcomes.

To avoid this risk and to take full advantage of the data collected, we imputed income for both the group with partially missing part 2 income (item nonresponse) and the group with totally missing part 2 income (unit nonresponse). Section A below describes the imputation process for the cases with partially missing part 2 data. Section B describes the imputation process for the cases with totally missing part 2 data (but complete part 1 data). In Section C, we present the results of the sensitivity analysis we conducted to determine whether our imputation methodology affected our key model estimates.

A. IMPUTING MISSING INCOME AMOUNTS TO ADDRESS ITEM NONRESPONSE

1. Objectives and Considerations

When completing the part 2 interview, the 2,125 parents/guardians were asked a number of questions, including some on income for each household member. In particular, they were asked to list all persons in the household, and then state, for each person 16 or older, whether that person had any income from each of 21 sources during the prior calendar month. For each source that a person received, respondents were asked whether documentation was available; if it was, they were asked to retrieve it. Finally, they were asked the amount of income for each source received. This created a data analysis structure in which the respondent could fail to provide data for up to 42 variables (21 source indicators and values for each source for which income was non-zero for the previous month) for each adult in the household. In addition, each respondent was asked to indicate whether he or she received food stamps or cash assistance for low-income families with children (TANF). We assumed that if a parent received food stamps or TANF benefits, their child was eligible for free meals, so we did not use the income data in our analysis, even if the household provided detailed income data.[1]

In the 2,125 student households who completed part 2, we identified 4,065 adults, among whom current receipt of food stamps/TANF for 774 was reported or documented. Subtracting these 774 adults from the subsample of 4,065 left 3,291 adults for whom a response to the 42 income source and value questions were applicable to our analysis objectives. For 245 sample members, one or more adults was missing one or more income items, and we replaced these missing item responses with imputed values, while leaving unchanged all complete, consistent answers provided for these sample members. We considered responses to the source and value

[1]The rationale for this assumption is that food stamp/TANF receipt connotes automatic eligibility for free meals regardless of household income.

questions to be consistent if income from the source was reported and the amount was non-zero or missing. We deemed a set of source and value responses inconsistent if a source was reported but the value was zero, and we edited these responses to indicate they did not have income from this source.

We applied one of three imputation methods to responses for sample members if the source indicator or the income value was missing: (1) data edits (discussed above), (2) cell-based Bernoulli indicator of income source with median value replacement, and (3) sequential hot-deck imputations for both source and value missing items.[2] Table VIII.1 presents the item-missing counts for each of the 21 income items and shows the methods used to replace the missing values. These specific imputation methods are discussed in the following sections.

Our rationale for selecting either the Bernoulli/median replacement approach or the sequential hot-deck imputation approach was based on the level of missing data observed and the potential impact the method would have on the analytical results.[3] In general, the Bernoulli/ median imputation approach was simple to conduct compared to the hot-deck approach. However, the hot-deck method produces individual variation in imputed value responses that mimic the variation observed in the reported data.[4] In contrast, median value replacement generates the same imputed value for all people in the same imputation group. As a result, in this study in which the income is used to determine eligibility for free or reduced-price meals, if the median value was above/below the threshold, all the missing cases would be assigned under

[2]Chapman(1976), Cox (1980), and Kalton and Kaspryzk (1986) discuss these methods.

[3]We decided for simplicity that if we wanted to use a hot-deck approach for the value imputations for an item, we would use a hot-deck approach for the source imputations for that item as well. Likewise, if we decided to use a median replacement approach for the value imputations for an item, we also used a simpler Bernoulli source imputation process on that item.

[4]The Bernoulli and the hot-deck methods both produce individual variation in the imputed values for the source imputations.

TABLE VIII.1

INCOME ITEM NONRESPONSE AND IMPUTATION METHODS APPLIED
(BASED ON 3,291 APPLICABLE ADULT RESPONSES)

Number	Income Type	Source Indicator and Value Both Missing	Source Reported but Amount Missing	Total Missing Applicable Adult Responses	Inconsistent Responses/Edit	Imputation Method (Hot Deck vs Median Fill)	Characteristics Used in Imputation
1	Income from Primary Job	2	199	201	13 persons indicated had source gave 0 value: edited source to none.	HD Source and Value	**Source:** district, relationship to respondent with sort on work 40 hrs or more per week. **Value:** district and relationship to respondent with sort on work 40 hrs or more per week.
2	Inc/loss from Farming	0	20	20	3 persons indicated had source gave 0 value: edited source to none.	Median Fill for Value	Profit or loss status only given low incidence of such income.
3	Inc/loss from business	4	50	54	16 persons indicated they broke even and had missing income values that were edited to 0.	HD Source and Value	**Source:** relationship to respondent only, no sort variable used **Value:** relationship to respondent and loss or gain with sort on college degree status.
4	Income from unemployment compensation	2	4	6	None	Bernoulli within cell on Source, Median Fill on Value	For Both, Meal Price Status and Relationship
5	Income from Workers compensation	1	2	3	None	"	"
6	Income from Veterans benefits	1	0	1	None	"	"
7	Income from SS or railroad retirement	1	9	10	None	"	"
8	Income from SSI	1	3	4	None	"	"
9	Income from interest and dividends	3	13	16	3 persons indicated had source gave 0 value: edited source to none.	"	"
10	Income from pensions	1	4	5	None	"	"
11	Income from rental property	1	3	4	One person indicated had source gave 0 value: edited source to none.	"	"
12	Income from people outside hh	1	2	3	None	"	"
13	Income from alimony	1	0	1	None	"	"
14	Income from child support	2	9	11	2 persons indicated had	"	"

TABLE VIII.1 (*continued*)

Number	Income Type	Source Indicator and Value Both Missing	Source Reported but Amount Missing	Total Missing Applicable Adult Responses	Inconsistent Responses/Edit	Imputation Method (Hot Deck vs Median Fill)	Characteristics Used in Imputation
					source gave 0 value: edited source to none		
15	Income from financial aid for college	2	11	13	One person indicated had source gave 0 value: edited source to none	"	"
16	Income from royalty, trusts, prize, bonus	1	1	2	None	"	"
17	Income from general assistance	1	1	2	None	"	"
18	Income from non-military housing subsidy	1	0	1	None	"	"
19	Income from black lung benefits	1	0	1	None	"	"
20	Income from other public assistance	1	0	1	None	"	"
21	Income from other sources	2	8	10	2 persons indicated had source gave 0 value: edited source to none	"	"

Note: Counts are based on 4,065 total adults associated with each interviewed student's family of which 774 families were receiving TANF or Food Stamps to form a starting eligible respondent base of 3,291 the median imputation methods as being ineligible/eligible and potentially bias the results; the cell-based application process serves to reduce such a problem. While the median imputation method suffers from introducing an artificially uniform set of responses, the potential for bias depends on the level of missing data. As an example, if the number of missing responses is less than 1 percent, then at worst case, 1 percent of the cases are assigned to be ineligible/eligible when in fact they have the opposite outcome, which would bias the results to the same degree. In this study, if the level of missing data (combined source and value) on an item was less than 0.5 percent (which equates to 16 or fewer missing responses to an item among the 3,291 applicable adults), we decided that the potential bias from a median replacement strategy was acceptable (since it was less than 0.5 percent). We used the simpler technique.

We found that the missing rates were actually quite low on most items, with only three of the 21 income source and value items showing combined missing rates higher than 0.5 percent. For two of these items, income for the primary job (having a missing rate of 6.1 percent: 201 missing source and values among 3,291 adults) and income from a business (having a missing rate of 1.6 percent), we used the more data-processing-intensive hot-deck imputation procedures. For the third item, income from a farm, the missing rate was only 0.6 percent, and since less than 1 percent of the adults reported income from this source, we decided to use the median replacement methods. For the remaining 18 items, the missing rates were less than 0.5 percent and we used the Bernoulli/median replacement approach.

2. Bernoulli and Median Replacement Imputations

For 19 of the 21 income source questions, if a respondent who had income from the source did not answer, we used a random Bernoulli cell/class-based imputation method that assigned a value of 0 (did not have income from the source) or 1 (had income from the source) to impute the missing item source answers. For these 19 items, if the income amount was missing, we replaced the missing amount with the median value, which we computed from adults in the same imputation class with non-missing responses.

To improve the accuracy of the imputation process, we first formed cells or classes with the goal of subdividing the cases with and without missing values into groups that would tend to have similar outcomes. We defined these imputation classes by meal price status. If a meal price status group contained enough cases, we subdivided the meal status classes by the adult's relationship to the household respondent (three values: 1=respondent and presumably the head of the household, 2=a spouse or partner of the respondent, and 3=any other adult). In addition, for the farm income medians, we used information on whether the respondent indicated a profit or loss (when available) to form the classes to produce separate positive and negative median values for these situations.

For the adults in each imputation class who provided a response, we then computed the proportion who received income from the source, and the median amount reported by those who received income from it.

Finally, to impute the missing source items for each imputation class, we used the Bernoulli statistical distribution to generate a sequence of outcomes of 1 or 0 (having or not having the trait) that on average yields a specific proportion possessing the trait. For example, repeated coin tosses are a Bernoulli process in which, on average, half the outcomes will be heads and half tails. We used a Bernoulli random number generator in the SAS software package to generate the required imputed values. For each adult with a missing value, the software generated a value of 0 or 1 that based on our specification of the desired proportion of "1" value outcomes would in repeated value generations produce values of 1 in proportion to the number of adults having the source in the imputation class as observed from the non-missing responses.

3. Sequential Hot-Deck Imputation

For the job and business income items, we used a hot-deck imputation procedure to impute missing responses. For each item to be imputed, a basic random hot-deck procedure selects a "donor" respondent at random from cases with non-missing values and substitutes the donor's response for the missing value for the recipient. As with the median approach, we perform these imputations for classes that are formed in such a manner that the donors and recipients would be expected to have similar outcomes. To reduce the chances that the same donor is used repeatedly (thereby assigning the same imputed outcome to multiple donors), the classes are chosen so that each class has a minimum ratio of donors to recipients. To increase the similarity of the donors and recipients, the sequential hot-deck procedure refines the classing step by using a card-like sorting process to place similar donors and recipients within each cell together. Each recipient is then assigned the value of the donor that precedes it in the "deck." The sequential card-like deck sort and selection process using data from other survey respondents (referred to as a "hot" imputation process as opposed to a "cold" imputation process, which might use data from external survey sources) gives the method its "hot-deck" name.

In establishing the classing and sorting criteria, we considered district membership a key classification variable, because we expected cases in the same district to have somewhat similar income levels. Based on our experience with these imputations, we wanted at least three donors per recipient in a cell to reduce the chance that the same donors would be used repeatedly and because the sort criteria could restrict the donor pool further. However, we found the ratio of donors to recipients was often small in district-based cells. Therefore, we formed the cells either by using district membership by itself (because additional criteria would make the cell sizes too small) or by using characteristics identified through regression analysis as good predictors of the source or income value.

To identify other potential predictors of the source and income values, we pooled data across districts and estimated logistic and linear regression models for each of the two items.[5] We used the available part 1 and 2 household and person characteristics as predictors in these models. We used a logistic model to predict whether the adult had the income source and a linear regression model to predict the value among those with the source. From these analyses, we identified the top two or three predictors and attempted to use them in forming the classing cells. If use of these variables to form the classing cells resulted in cells with three or fewer donors, we collapsed the cell and/or shifted the predictor from classing item to sorting variable.

With the classes and sorting criteria identified, we first imputed the missing values for the cases having non-missing source responses and then jointly imputed the source and value for the cases with both missing source and value responses. Under the joint process, the donor selected provides both the source indicator and the income value to avoid generating inconsistent pairs of responses (such as not having the source yet having a positive value). For the income from the primary job, we used as classing variables district membership and relationship of the adult to the household respondent, and sorted on whether the adult worked 40 or more hours a week (full time vs. part-time) for both the value and joint source and value imputations. For the business income questions, for the value-only imputations, we formed the classes based on relationship and whether they indicated they had a profit or loss, with a sort on whether the adult had completed a college degree. For the source and value imputations, since the relationship of the

[5]We prepared these models using all the available characteristics and from the results ranked the predictors by their significance level as reflected in the Wald chi-squared test statistic. Since these models were prepared to identify the dominate predictors, rather than to form a predictive equation, we did not attempt to refine them using stepwise methods or other variable-reduction techniques.

adult to the respondent dominated the logistic regression model as the predictor of the presence of business income, we based the classes solely on this outcome and did not use sorting.

B. IMPUTATION OF INCOME ELIGIBILITY STATUS FOR CASES TOTALLY MISSING PART 2 INCOME

This section describes the income imputation process for cases for which part 1 income data were complete but all part 2 income data were missing. Part 1 respondents who reported incomes above 400 percent of FPL (and thus were not contacted to complete a part 2 survey) were considered to be ineligible and were assigned to the highest income category (income >400) for the analysis. Part 1 respondents who reported receiving food stamps or TANF but did not respond to the part 2 survey were assumed to be eligible for free meals and were assigned to the lowest income category (income <130) regardless of their reported income amount.[6] The imputation procedures described below were not performed in these two types of cases. The procedures were applied to those households that completed the part 1 survey, reported no food stamp/TANF receipt but did report income below 400 percent of FPL, and did not respond to the part 2 survey. This approach represents an alternative to the weight based approach for addressing unit non-response.

For these households, we adjusted reported income based on analysis of data from households for which we had income based on both the part 1 survey and the part 2 survey, and that did not report receiving food stamps or TANF on the part 1 survey. The focus of the adjustment procedure was to determine—for households responding to the part 1 survey but not the part 2 survey—whether the income category of the household based on part 1 survey data

[6]The procedures we outline below provide no basis for imputing the incomes of these households, because households that completed both the part 1 and part 2 surveys but also reported and documented food stamp or TANF receipt were not asked the full set of income questions on the part 2 survey.

(less than 130 percent of FPL, 131 to 185 percent of FPL, more than 185 percent of FPL) would have been different if we had been able to complete a part 2 survey for the household. This adjustment procedure involved six steps:

1. We determined the subsample with which to examine the relationship between income reported on the part 1 survey and income collected during the part 2 survey. This sample included all sample members whose households completed both a part 1 and a part 2 survey, with two exceptions. First, households that provided incomplete income information in their part 2 survey (and thus were subject to the imputation process described in Section A above) were excluded from this subsample. Second, households that reported receiving food stamps or TANF in the part 1 survey were also excluded.

2. For this subsample, we classified their household income reported on the part 2 survey into one of three categories: (1) income less than 130 percent of FPL and thus eligible for free meals, (2) income between 131 and 185 percent of FPL and thus eligible for reduced-price meals, and (3) income greater than 185 percent of FPL and thus ineligible for free or reduced-price meals.

3. We estimated two binary logit models using the households within the subsample. The dependent variable in the first logit was a binary variable equal to one if the household was ineligible for free or reduced-price meals (that is, had income above 130 percent of FPL) and zero otherwise; the dependent variable in the second logit was a binary variable equal to one if the household was ineligible for free meals (that is, had income above 185 percent of FPL) and zero otherwise. The estimated parameters from each model indicated the effect of the independent variables in the model on the probability of the household being in a higher income category (ineligible) based on the part 2 survey. The independent variables in the model included, most important, a measure of income as reported on the part 1 survey. Other independent variables included factors we felt might be related to students' income classification from part 2 after controlling for part 1 income. We describe this model in greater detail below.

4. We selected a sample of households whose income classification was to be imputed. This sample included most of the households that responded to the part 1 survey but *not* to the part 2 survey. However, as mentioned above, we did not impute income for, or include in the estimation, two groups of households that responded to the part 1 survey but *not* the part 2 survey: (1) those with incomes above 400 percent of FPL (who would automatically be considered income-ineligible), and (2) those who reported receiving food stamps or TANF in the part 1 survey (who would automatically be considered income-eligible).

5. For each household in the group to be imputed, we calculated the following two probabilities using the estimated coefficients from the two binary logit models, along with the household's characteristics: (1) P1, the probability that they would have been classified as ineligible for free or reduced-price meals (with income exceeding

185 percent of FPL) if the part 2 survey had been completed, and (2) P2, the probability that they would have been classified as ineligible for free meals (with income exceeding 130 percent of FPL) if the part 2 survey had been completed. Additional details on the calculation of P1 and P2 are provided below.

6. For each household for which we imputed an income classification, we selected a random number between 0 and 1 (from a uniform distribution). If the random number was less than P1, the household's imputed income classification was ineligible for free or reduced-price meals. If the random number was greater than P1 but less than P2, the household's imputed income classification was eligible for reduced-price meals but not free meals. If the random number was greater than P2, then the household's imputed income classification was eligible for free meals.

1. Estimating the Model

The key to the imputation procedure was estimating the two logit models, pooled across Up-Front Documentation and Graduated Verification sites, and specified as follows:

$$IFRP_{ij}^{*} = X_{FRP_{ij}}\beta_{FRP} + u_{FRP_{ij}}$$

$$\text{where} \quad IFRP_{ij} = 1 \text{ if } IFRP^{*} > 0$$
$$= 0 \text{ otherwise}$$

$$IF_{ij}^{*} = X_{F_{ij}}\beta_{F} + u_{F_{ij}}$$

$$\text{where} \quad IF_{ij} = 1 \text{ if } IF^{*} > 0$$
$$= 0 \text{ otherwise}$$

In these models, IF_{ij}^{*} is an index variable showing student *i*'s propensity for being ineligible for free meals (income >130% FPL), and $IFRP_{ij}^{*}$ is an index variable showing student *i*'s propensity for being ineligible for free or reduced-price meals (income >185% FPL). The student was actually ineligible for free meals according to the part two survey if IF_{ij}^{*} is greater than 0, and this situation is shown by the indicator variable IF_{ij} taking on the value 1. Analogously, the student was actually ineligible for free or reduced-price meals according to the part two survey if $IFRP_{ij}^{*}$ is greater than 0, and this situation is shown by the indicator variable $IFRP_{ij}$ taking on the value 1. The vectors X_{Fij} and X_{FRPij} consist of variables representing household characteristics hypothesized to affect student *i*'s income as reported in the part 2 survey. Finally, β_F and β_{FRP} are parameters to be estimated, and u_{Fij} and u_{FRPij} are random-error terms that are assumed to have a logistic distribution.

The independent variables in the models (X_{ij}) are assumed to influence a student's propensity for being classified in higher-income categories (that is, having higher reported part 2 income). Key variables included in X_{ij} indicate the student's part 1 income classification relative to the FPL—that is, they reflect whether or not a student's income is close to the relevant free/reduced-price income eligibility thresholds.[7] Additional variables included in X_{ij} are:

- Household size and structure
- Employment status of household members
- Free/reduced-price certification status
- Home and vehicle ownership
- Race/ethnicity
- Language spoken at home
- Parents' educational attainment
- Household mobility
- Pre-pilot NSLP certification status among those in grades 3 and above[8]
- Parent's views on the NSLP
- District indicators

[7]We calculated each student's part 1 income relative to the FPL and then created a set of income deviation variables. For the free/reduced-price eligibility model, these variables included a measure of the extent to which income relative to the FPL deviated from the cutoff eligibility value for free or reduced-price meals (185 percent of the FPL). We also included a squared version of this variable. The free eligibility model included an analogous set of variables, except that the 130 percent of the FPL cutoff was used. All other independent variables in the free and free/reduced-price models were the same.

[8]For students in kindergarten through 2nd grade, this variable was set to 0 and a separate missing value indicator variable was included in the model.

2. Imputing Income Categories

As described above, we estimated β_F and β_{FRP} using binary logit models and the sample with valid part 1 and part 2 survey information on income. We then took the sample of students who (1) completed only a part 1 survey, (2) reported income less than 400 percent of FPL on the part 1 survey, and (3) did not report food stamp/TANF receipt in that survey, and imputed their income classification as follows:

1. We calculated $X_{F_{ij}}\hat{\beta}_F$ and $X_{FRP_{ij}}\hat{\beta}_{FRP}$ for each student.
2. We determined
$$\text{P1} = \Pr\left\{IFRP_{ij}=1\right\} = \Pr\left\{IFRP_{ij}^{*}>0\right\} = \Pr\left\{-u_{FRP_{ij}} \le X_{FRP_{ij}}\hat{\beta}_{FRP}\right\} = \frac{e^{X_{FRP_{ij}}\hat{\beta}_{FRP}}}{1+e^{X_{FRP_{ij}}\hat{\beta}_{FRP}}} .$$
3. We determined $\text{P2} = \Pr\left\{IF_{ij}=1\right\} = \Pr\left\{IF_{ij}^{*}>0\right\} = \Pr\left\{-u_{F_{ij}} \le X_{F_{ij}}\hat{\beta}_F\right\} = \dfrac{e^{X_{F_{ij}}\hat{\beta}_F}}{1+e^{X_{F_{ij}}\hat{\beta}_F}}$.
4. We selected a random number R_{ij} from a uniform [0,1] distribution for each student.
5. If $R_{ij} \le P1$, then we set $IFRP_{ij}=1$. The student was classified as ineligible for free or reduced-price meals. Since students ineligible for free/reduced-price meals are also ineligible for free meals ($P1 \le P2$), then $IF_{ij}=1$ as well.[9]
6. Else if $P1 < R_{ij} \le P2$, then we set $IFRP_{ij}=0$, $IF_{ij}=1$. The student was classified as eligible for free/reduced-price meals but ineligible for free meals (in other words, eligible for reduced-price meals).
7. Else if $R_{ij} > P2$, then we set $IFRP_{ij}=0$, $IF_{ij}=0$. The student was classified as eligible for free/reduced-price meals and eligible for free meals.

Suppose, for example, that the household income reported for a given student was 120 percent of FPL. When this characteristic, along with the student's other characteristics, was

[9]Since we estimated the two logit models independently, there were a few cases in which we found that P1 was greater than P2. In each of these cases, however, the values of P1 and P2 were extremely close to one another (that is, P1 was greater than P2 by only a few hundredths or thousandths of a percentage point). In these cases, set re-set P2 to the value of P1.

used in conjunction with the estimated parameters from the logit models, we might estimate the following probabilities for that student:

P1 = $\Pr\left\{IFRP_{ij} = 1\right\}$ = 0.05

P2 = $\Pr\left\{IF_{ij} = 1\right\}$ = 0.25

We would impute that student's income classification for the main impact model as ineligible for free/reduced-price meals if the random number we selected was less than 0.05, as ineligible for free meals but eligible for reduced-price meals if the random number was between 0.05 and 0.25, and as eligible for free meals if the random number was greater than 0.25.[10]

3. Model Performance

In carrying out these imputation procedures, we estimated both the free/reduced-price ineligibility logit model and the free ineligibility logit model using the 1,487 sample members who completed both the part 1 and the part 2 surveys and who met the other conditions described above. The coefficient estimates from these models are presented in Table VIII.2. The variables representing part 1 income were very strong predictors of students' part 2 income eligibility status, but several other variables were also strong predictors even after controlling for part 1 income. For example, students' certification status, household size, the employment status of household members, and parents' educational attainment were all statistically significant at the 1 percent level. We imputed part 2 income status using the methods described in this section for 450 students—112 of these students (25 percent) were classified as free eligible, 100 (22 percent) were classified as reduced-price eligible, and the remaining 238 (53 percent) were classified as free/reduced-price ineligible.

[10] In our sensitivity analysis, we also estimated models that dealt with missing part II income information in alternative ways.

TABLE VIII.2

COEFFICIENT ESTIMATES FROM THE PART 2 INCOME IMPUTATION MODELS
(Standard Errors in Parentheses)[a]

	P1: Income >= 185 Percent of FPL	P2: Income >= 130 Percent of FPL
Intercept	0.768	0.460
	(0.780)	(0.832)
District Pair[b]		
UFD District Pair 1	---	---
UFD District Pair 2	-0.241	0.781*
	(0.423)	(0.466)
UFD District Pair 3	-0.437	0.453
	(0.435)	(0.463)
UFD District Pair 4	0.165	1.203**
	(0.506)	(0.501)
UFD District Pair 5	-0.616	0.541
	(0.435)	(0.455)
UFD District Pair 6	-0.309	0.516
	(0.431)	(0.466)
UFD District Pair 7	-0.312	0.816*
	(0.432)	(0.427)
UFD District Pair 8	-0.453	0.611
	(0.417)	(0.440)
UFD District Pair 9	-0.164	0.560
	(0.452)	(0.459)
GV District Pair 1	0.457	0.753
	(0.414)	(0.439)
GV District Pair 2	0.055	0.781*
	(0.432)	(0.462)*
GV District Pair 3	0.369	1.633***
	(0.446)	(0.480)
Pilot District Status		
Up-Front Documentation Pilot District	0.538**	0.133
	(0.213)	(0.210)
Graduated Verification Pilot District	0.060	-0.703**
	(0.266)	(0.277)
Certification Status		
Certified Free	-1.506***	-1.709***
	(0.238)	(0.255)
Certified Reduced Price	-0.467*	-1.158***
	(0.245)	(0.225)

Table VIII.2 (*continued*)

	P1: Income >= 185 Percent of FPL	P2: Income >= 130 Percent of FPL
Part 1 Income Relative to Poverty		
Income as % of FPL – 185	0.050***	0.034***
	(0.009)	(0.007)
(Income as % of FPL – 185) Squared	0.00028***	0.00013**
	(0.00009)	(0.00005)
(Income as % of FPL – 185) *	-0.034***	-0.011
(Binary Indicator of Whether Income > 185% of FPL)	(0.012)	(0.012)
{(Income as % of FPL – 185) * (Binary Indicator of	-0.00033***	-0.00021***
Whether Income > 185% of FPL)} squared	(0.00009)	(0.00006)
Number of HH members	-0.357**	-0.710***
	(0.142)	(0.145)
Number of children in HH	0.168	0.416***
	(0.151	(0.156)
Two-parent HH	-0.229	0.133
	(0.242)	(0.242)
Respondent employed	-0.459*	-0.302
	(0.249)	(0.275)
# of employed HH members	1.689***	1.712***
	(0.211)	(0.221)
Own home	-0.038	0.051
	(0.188)	(0.197)
Number of vehicles owned	0.045	-0.077
	(0.090)	(0.091)
Certified in the pre-pilot period	-0.105	-0.276
	(0.197)	(0.200)
English primary language	0.203	-0.614
	(0.446)	(0.501)
Respondent's Education		
Lacks HS diploma	-0.043	0.039
	(0.261)	(0.301)
Some postsecondary	0.405**	0.426**
	(0.189)	(0.189)
College degree or more	-0.001	0.837***
	(0.308)	(0.293)
Race/Ethnicity		
Black	-0.194	-0.109
	(0.290)	(0.316)
Hispanic	0.112	-0.434
	(0.339)	(0.370)
Other	-0.000	-0.127
	(0.432)	(0.432)

Table VIII.2 (*continued*)

	P1: Income >= 185 Percent of FPL	P2: Income >= 130 Percent of FPL
School contacted respondent to apply for certification	-0.144 (0.192)	-0.028 (0.120)
Believes application process is fair	0.475 (0.331)	0.402 (0.300)
Moved within past 2 years	-0.068 (0.137)	-0.106 (0.165)
Changed districts within past 2 years	-0.292 (0.293)	-0.219 (0.326)
Mean of Dependent Variable	**0.723**	**0.459**
Sample Size	**1487**	**1487**

FPL = federal poverty level

Note: The model also includes binary variables indicating that the following variables were originally missing and their values have been imputed using the mean value among non-missing observations: pre-pilot certification status, belief that application process is fair, income.

[a]None of the standard errors presented in the table have been adjusted to account for the complex sampling design of the data set, although the estimate of the overall pilot impact presented in Volume I was adjusted to correct for design effects.

[b]Common district pair numbers are used in Chapters III-VIII, and Tables XI.1-XI.8. Chapters IX and X, and Tables XI.9-XI.20 use different common district pair designations.

*Coefficient estimate is significantly different from zero at the .10 level, two-tailed test
** Coefficient estimate is significantly different from zero at the .05 level, two-tailed test.
*** Coefficient estimate is significantly different from zero at the .01 level, two-tailed test.

As a group, the explanatory variables of the model allowed us to predict students' part 2 income status more accurately than our predictions would have been if we had used part 1 income alone. In particular, to test the model, we used it to compute predicted income categories for households that responded to both part 1 and part 2 surveys but without using the part 2 information in the imputation process. We then compared the imputed income categories to the actual income information reported in part 2 for these cases. Our predicted values matched the reported values in 63.8 percent of cases with both part 1 and part 2 income. This was a higher percentage of cases for which the imputation matched actual part 2 income than we would have obtained if we had used the part 1 income data alone, so we proceeded with the imputations.

C. SENSITIVITY ANALYSIS

Since the imputations procedures described in sections A and B were used to construct such an important analysis variable for this study, we conducted a series of sensitivity tests to determine the extent to which the specific procedures used influenced key estimates from the model. Tables VIII.3 through VIII.6 present the results of these sensitivity tests. Table VIII.3 shows the results of the deterrence analysis in Up-Front Documentation districts. Within the first section, the first row shows certification rates among students with income more than 185% FPL in pilot and comparison districts (CD_2) using the final version of the income variable. The next three rows show this same measure using three alternative methods of imputing part 2 income for students who failed to complete part 2. The final three rows in the first section show alternative methods for imputing the income sources of individual household members for households that completed some but not all of part 2. These alternatives include the hot-deck method described in Section A, replacing all missing income sources with zero, and replacing all missing income sources with the 90th percentile among those with valid amounts for that income

TABLE VIII.3

SENSITIVITY OF ESTIMATES OF CERTIFICATION AMONG INELIGIBLE STUDENTS TO ALTERNATIVE ESTIMATES OF MEAL PRICE STATUS AND INCOME UP-FRONT DOCUMENTATI0N PILOT AND COMPARISON DISTRICTS

Group of Students/Alternative Estimate	Pilot Districts	Comparison Districts	Difference
Students with Income More Than 185% FPL	Percentage Approved for Free Meals Among Students with Income >185% FPL (CD_1)[b]		
Main Estimate[a]	3.8	4.0	-0.2
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	3.5	3.7	-0.2
Imputed using model predictions, assigning to income category according to maximum predicted probability	3.5	3.9	-0.4
Drop cases with missing estimate of detailed income	3.1	3.6	-0.5
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	4.0	4.0	0.0
By setting missing person sources amounts to zero	2.9	3.6	-0.7
By setting missing person source amounts to the 90th percentile amount	4.0	4.1	-0.1
Students with Income More Than 130% FPL	Percentage Approved for Free or Reduced-Price Meals Among Students with Income >130% FPL (CD_2)[b]		
Main Estimate[a]	3.4	3.9	-0.5
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	3.2	3.9	-0.7
Imputed using model predictions, assigning to income category according to maximum predicted probability	3.2	4.0	-0.8
Drop cases with missing estimate of detailed income	3.3	3.8	-0.5
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	3.6	3.9	-0.3
By setting missing person sources amounts to zero	3.5	3.6	-0.1
By setting missing person source amounts to the 90th percentile amount	3.5	4.0	-0.5

FPL = federal poverty level; n.a. = not applicable; TANF = Temporary Assistance for Needy Families.

[a]Income status based on detailed reports of income by person and source; income status for cases missing detailed estimates of income imputed using model predictions and assigning to income status probabilistically; meal price status based on school records.

[b]Variables are defined in Table II.2 of Volume I.

TABLE VIII.4

SENSITIVITY OF ESTIMATES OF CERTIFICATION AMONG INELIGIBLE STUDENTS TO ALTERNATIVE ESTIMATES OF INCOME
GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS

Group of Students/Alternative Estimate	Pilot Districts	Comparison Districts	Difference
Students with Income More Than 185% FPL	Percentage Approved for Free Meals Among Students with Income >185% FPL (CD_1)[b]		
Main Estimate[a]	4.8	9.7	-4.9
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	4.7	9.6	-4.9
Imputed using model predictions, assigning to income category according to maximum predicted probability	4.7	9.6	-4.9
Drop cases with missing estimate of detailed income	3.4	10.1	-6.7
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	1.8	2.8	-1.0
By setting missing person sources amounts to zero	1.6	2.9	-1.3
By setting missing person source amounts to the 90th percentile amount	1.8	2.8	-1.0
Students with Income More Than 130% FPL	Percentage Approved for Free or Reduced-Price Meals Among Students with Income >130% FPL (CD_2)[b]		
Main Estimate[a]	7.4	8.6	-1.2
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	7.3	8.3	-1.0
Imputed using model predictions, assigning to income category according to maximum predicted probability	6.9	8.4	-1.5
Drop cases with missing estimate of detailed income	6.8	8.8	-2.0
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	6.8	8.8	-2.0
By setting missing person sources amounts to zero	6.7	8.5	-1.8
By setting missing person source amounts to the 90th percentile amount	6.8	8.7	-1.9

FPL = federal poverty level; n.a. = not applicable; TANF = Temporary Assistance for Needy Families.

[a]Income status based on detailed reports of income by person and source; income status for cases missing detailed estimates of income imputed using model predictions and assigning to income status probabilistically; meal price status based on school records.

[b]Variables are defined in Table II.2 of Volume I.

TABLE VIII.5

SENSITIVITY OF ESTIMATES OF CERTIFICATION AMONG ELIGIBLE STUDENTS TO ALTERNATIVE ESTIMATES OF INCOME UP-FRONT DOCUMENTATION PILOT AND COMPARISON DISTRICTS

Group of Students/Alternative Estimate	Pilot Districts	Comparison Districts	Difference
Students with Income Less Than or Equal to 185% FPL and Not Directly Certified	Percentage Certified for Free or Reduced-Price Meals Among Students with Income ≤185% FPL and Not Directly Certified (CB_3a)[b]		
Main Estimate[a]	42.4	50.5	8.1
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	43.1	51.9	8.8
Imputed using model predictions, assigning to income category according to maximum predicted probability	43.8	53.3	9.5
Drop cases with missing estimate of detailed income	45.5	52.7	7.2
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	40.2	51.1	10.9
By setting missing person sources amounts to zero	40.5	51.1	10.6
By setting missing person source amounts to the 90th percentile amount	42.8	52.2	9.4
Students with Income Less Than or Equal to 130% FPL and Not Directly Certified	Percentage Certified for Free Meals Among Students with Income ≤130% FPL and Not Directly Certified (CB_1a)[b]		
Main Estimate[a]	47.3	53.9	6.6
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	48.3	56.9	8.6
Imputed using model predictions, assigning to income category according to maximum predicted probability	48.8	57.8	9.0
Drop cases with missing estimate of detailed income	50.9	59.2	8.3
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	44.8	54.9	10.1
By setting missing person sources amounts to zero	45.4	54.9	9.5
By setting missing person source amounts to the 90th percentile amount	46.9	58.0	11.1
Students with Income Less Than or Equal to 130% FPL and Not Directly Certified	Percentage Certified for Free or Reduced-Price Meals Among Students with Income ≤130% FPL and Not Directly Certified (CB_2a)[b]		
Main Estimate[a]	53.0	62.4	9.4
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	54.1	65.9	11.8
Imputed using model predictions, assigning to income category according to maximum predicted probability	54.0	66.4	12.4
Drop cases with missing estimate of detailed income	57.3	67.5	10.2
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	50.0	63.9	13.9
By setting missing person sources amounts to zero	50.7	63.9	13.2
By setting missing person source amounts to the 90th percentile amount	52.9	66.1	13.2

FPL = federal poverty level; n.a. = not applicable; TANF = Temporary Assistance for Needy Families.

[a]Income status based on detailed reports of income by person and source; income status for cases missing detailed estimates of income imputed using model predictions and assigning to income status probabilistically; meal price status based on school records.

[b]Variables are defined in Table II.2 of Volume I.

TABLE VIII.6

SENSITIVITY OF ESTIMATES OF CERTIFICATION AMONG ELIGIBLE STUDENTS TO ALTERNATIVE ESTIMATES OF INCOME GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS

Group of Students/Alternative Estimate	Pilot Districts	Comparison Districts	Difference
Students with Income Less Than or Equal to 185% FPL and Not Directly Certified	Percentage Certified for Free or Reduced-Price Meals Among Students with Income ≤185% FPL and Not Directly Certified (CB_3a)[b]		
Main Estimate[a]	60.4	72.2	–11.8
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	61.6	72.2	–10.6
Imputed using model predictions, assigning to income category according to maximum predicted probability	63.3	72.1	–8.8
Drop cases with missing estimate of detailed income	64.6	74.0	–9.4
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	63.5	71.5	–8.0
By setting missing person sources amounts to zero	63.5	71.9	–8.4
By setting missing person source amounts to the 90th percentile amount	65.1	71.6	–6.5
Students with Income Less or Equal to Than 130% FPL and Not Directly Certified	Percentage Certified for Free Meals Among Students with Income ≤130% FPL and Not Directly Certified (CB_1a)[b]		
Main Estimate[a]	55.8	69.2	–13.4
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	56.4	69.3	–12.9
Imputed using model predictions, assigning to income category according to maximum predicted probability	56.7	69.3	–12.6
Drop cases with missing estimate of detailed income	59.2	70.8	–11.6
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	56.5	69.9	–13.4
By setting missing person sources amounts to zero	56.2	70.4	–14.2
By setting missing person source amounts to the 90th percentile amount	61.0	70.4	–9.4
Students with Income Less Than or Equal to 130% FPL and Not Directly Certified	Percentage Certified for Free or Reduced-Price Meals Among Students with Income ≤130% FPL and Not Directly Certified (CB_2a)[b]		
Main Estimate[a]	62.2	81.1	–18.9
Income Status for Cases with Detailed Estimate of Income Missing			
Imputed using simple estimate of total household	62.9	81.4	–18.5
Imputed using model predictions, assigning to income category according to maximum predicted probability	63.1	81.4	–18.3
Drop cases with missing estimate of detailed income	64.1	83.8	–19.7
Include Only Cases with Detailed Estimate of Income Available, and Impute Missing Person Source Amounts			
By hotdecking	62.8	82.5	–19.7
By setting missing person sources amounts to zero	62.6	83.2	–20.6
By setting missing person source amounts to the 90th percentile amount	65.8	83.3	–17.5

FPL = federal poverty level; n.a. = not applicable; TANF = Temporary Assistance for Needy Families.

[a]Income status based on detailed reports of income by person and source; income status for cases missing detailed estimates of income imputed using model predictions and assigning to income status probabilistically; meal price status based on school records.

[b]Variables are defined in Table II.2 of Volume I.

source. In each of these alternatives, we have dropped cases that failed to respond to part 2 entirely, and then reweighted the remaining observations so that they are still representative of the full population of ineligible households. Table VIII.4 presents these same findings for Graduated Verification districts. The second section of Table VIII.3 shows corresponding measures for the variable CD_1 (percentage approved for free meals among students with income less than 130% FPL). Tables VIII.5 and VIII.6 present analogous sensitivity tests focusing on the estimated certification rates among eligible students.

The general result of the sensitivity tests was that the findings presented in Volume I would not have been qualitatively different if we had used different imputation procedures. In particular, although the method of imputation affects the estimated certification rate *levels* among ineligible or eligible students, the estimated *differences* between pilot and comparison districts in these estimated certification rates are similar, regardless of the imputation method employed.

IX. IMPACT ANALYSIS ESTIMATION METHODS

This chapter describes the methods used to determine the impacts of Up-Front Documentation and Graduated Verification on deterrence, barriers, accuracy, and targeting efficiency. Section A presents the econometric models used to estimate the impacts of the pilots on deterrence and barriers. Section B describes how the estimates from the deterrence/barriers models were used to obtain estimates of the impacts of the pilots on accuracy and targeting efficiency.

A. ESTIMATING IMPACTS ON DETERRENCE AND BARRIERS

The logic of the comparison group design calls for estimating the effects of Up-Front Documentation and Graduated Verification by comparing key outcomes in the pilot and comparison districts. At its most basic level, this could be accomplished by presenting the simple mean values of these outcomes in both types of districts. However, outcome differences between the two types of districts may have arisen either from the effects of the pilots or from other differences between pilot and comparison districts, such as differences in the characteristics of the students they served. The process for selecting comparison districts described in Chapter II of this volume was designed to minimize differences between the pilot and comparison districts. However, it is unlikely that this process resulted in identical pilot and comparison districts. Thus, we used a regression model to further account for differences between the characteristics of students enrolled in the two types of districts. After these other factors were accounted for, any remaining differences between pilot and comparison districts in outcomes was attributed to the effect of the pilot.

1. General Model

To estimate the impact of the pilot on both deterrence and barriers, the same general form of the statistical model was used. In each case, the primary outcome measure was an indicator of whether or not a student was certified for free or free/reduced-price meals, and the independent variables were factors hypothesized to influence certification status, including whether the student attended a pilot district. The deterrence and barriers models differed in that the sample for the deterrence models included only those students ineligible for free or free/reduced-price meal benefits, while the barrier models included only groups of students eligible for benefits.

The general model used to estimate impacts on deterrence/barriers was:

$$y_i = c + X_i b + \sum_{j=2}^{K} d_j DP_{ij} + \sum_{k=1}^{K} a_k [DP_{ik} * P_i] + e_i \qquad (1)$$

where:

y_i = outcome of interest for student *i* (free or free/reduced-price certification)

X_i = vector of characteristics of student *i* hypothesized to affect outcome y_i

DP_{ij} = binary indicator of whether student *i* attended to the *j*th pilot-comparison district pair

P_i = binary indicator of whether student *i* attended a pilot district

e_i = random error term

In this model, the outcome of interest (measuring the student's certification status) is regressed on a set of student-level characteristics, a set of binary variables (called *district pair* variables) that each represented a pilot district along with its matched comparison district, and a set of variables formed by interacting the district pair variables with a binary variable indicating whether the student's district was a pilot district. The coefficients to be estimated in the model included a constant term *c*, a vector *b*, d_2 through d_K , and a_1 through a_K (where K represents the number of pilot districts that implemented Up-Front Documentation or Graduated Verification), while e_i is a random-error term representing unobserved factors that influenced the outcome of interest. This model was estimated using sample weights, to account for the oversampling or undersampling of students depending on their preliminary certification status along with differential response rates by different groups of students.[1]

We estimated separate models to determine the impacts of Up-Front Documentation and Graduated Verification. Since there are nine Up-Front Documentation pilot districts (K=9), that model included eight binary district pair variables and nine district pair-pilot status interactions. There are three Graduated Verification pilot districts (K=3), so that model included two district pair variables and three district pair-pilot status interactions.

The general model shown above allowed for differential effects of each of the pilot interventions in each of the districts in which it was implemented. For Up-Front Documentation, for example, the model produced nine different estimates of the impact of the pilot on a given outcome (the coefficients on the district pair-pilot status interactions, or a_1 through a_K), each representing the estimated impact of the pilot in one of the districts in which it was implemented. If a_1 were estimated to be –0.05, for example, this would imply that the intervention in pilot district 1 led to a decrease of 5 percentage points in the outcome measure (the probability of certification). To estimate the overall impact of Up-Front Documentation (or Graduated Verification), we calculated the simple average of all of the pilot district impact estimates. This manner of estimating the overall impact gave equal weight to the effect of the pilot intervention

[1]See Chapter VII of this volume for a discussion of the sample weights.

in each site, regardless of the size of the district or the number of students included in the sample from the district.[2]

In the deterrence and barriers models, the dependent variable was binary variable representing a student's certification status. For the estimates presented in Volume I of this report, we used a linear probability model (Madalla 1983) to estimate the pilot impacts. This model produced an unbiased estimate of the impact of the pilot on the binary indicator of whether a given student is certified. One drawback of a linear probability model is that for individual observations, it allows the predicted probability of an event occurring to be less than zero or greater than one (whereas a model such as a logit model does not allow predicted probabilities to be negative or greater than one). We relied on the linear probability model because the computation of the standard error of the overall impact of the pilot (which is the standard error of the mean of multiple coefficients from the model) was computationally intractable with a non-linear model.[3]

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[2]In calculating the standard error of the overall impact estimate, we took into account the fact that not all sample observations contributed equally to the overall estimate—those observations from districts with larger than average samples were given a bit less weight than observations from districts with relatively small samples in calculating the overall impact estimate.

[3]To assess whether the choice of a linear probability model affected our impact estimates, we estimated a simplified version of the model (with the estimated impact of the pilot assumed to be the same in all pilot districts) using both the linear probability and logit estimation techniques. The results we obtained using the two sets of estimation methods were similar. In particular, for the ten different outcomes we examined, the logit and OLS impact estimates were within 1.5 percentage points of each other in each case and within 1.0 percentage points of each other in seven of ten cases. The level of statistical significance (significant versus not significant at the 0.10 level) from the OLS and logit models was the same in nine of ten cases. In the tenth case, the estimated impact of Up-Front Documentation on the probability that a student applied for benefits, the OLS estimate of the impact (2.9 percentage points, with a t-statistic of 1.87) was significant and the logit estimate of this impact (2.1 percentage points, with a t-statistic of 1.36) was not significant.

A key feature of the model shown in equation (1) was its ability to control for the characteristics of students and their households. By controlling for these characteristics, we could determine whether any differences in outcomes between students in pilot versus comparison districts were due to the effects of the pilot or due to differences in the characteristics of the students attending the two types of districts (or of the students who happened to be selected into our samples). For example, Up-Front Documentation pilot and comparison districts differed somewhat in the racial/ethnic distribution of their samples (see Volume I, Chapter III). If race/ethnicity also affected the likelihood that a student became certified, then controlling for students' race/ethnicity prior to estimating the impact of the pilot on deterrence/barriers was very important. The characteristics controlled for in the model included variables representing the following:

- Household size
- Household structure
- Household income
- Public assistance receipt
- Public housing residence
- Employment status of household members
- Home and vehicle ownership
- Race/ethnicity
- Primary language spoken at home
- Grade level
- Pre-pilot certification status
- Parent/guardian's educational attainment
- Household mobility
- Parent/guardian's views on administration of school lunch program

- Students' perceptions on taste/amount of school meals

All of the variables included as control variables in the model were characteristics of students or their households rather than characteristics of their districts. It is possible that district characteristics, such as their experience using direct certification to certify children for free meals or the extent to which districts promoted certification among their students, could influence the likelihood that students in a given district were certified for free or reduced-price meals. However, since these characteristics had the same value for all students enrolled in a particular district, and since we estimated a separate impact in each Up-Front Documentation or Graduated Verification pilot district, there were no remaining degrees of freedom in the model and district characteristics could not be included as control variables.

The lack of district characteristics in the model is offset by two factors. First, our selection of comparison districts (described in Chapter II of this volume) was designed so that these comparison districts had characteristics as similar as possible to those of pilot districts. Pilot and comparison districts were matched on the basis of both observable characteristics measured by publicly available data (such as certification rates, participation rates, and race/ethnicity) and by less tangible characteristics provided to us by local observers. Second, some district characteristics can be proxied for by student characteristics. In particular, by controlling for students' pre-pilot certification status, we captured differences between pilot and comparison districts in their propensity to promote certification among their students.[4]

[4]If we had specified the model such that the impact of the pilot was assumed to be the same across all district pairs, we could have included a small number of district characteristics as control variables in theory. We explored the sensitivity of our results to a model such as this in which we controlled for: (1) the pre-pilot certification rate of the district; (2) the pre-pilot poverty rate among students in the district; and (3) the degree of centralization of NSLP administration in the district. In practice, we found that the estimation results became extremely

2. Deterrence

Two separate versions of equation (1) were estimated to examine the impact of Up-Front Documentation on deterrence, and an analogous set of models were estimated to examine the impact of Graduated Verification. These models differed according to the sample on which the model was estimated. The deterrence models were:

1. ***Certification Among Students Not Eligible for Free or Reduced-Price Meals (CD_2).*** The sample for this model included only students ineligible for free or reduced-price meals; that is, those with household incomes exceeding 185 percent of the federal poverty level. Students who had been directly certified were excluded. The model's dependent variable was a binary indicator of whether the student was certified for free or reduced-price meals. This is measure CD_2 shown in Tables IV.1, IV.2, IV.9, and IV.10 of Volume I.

2. ***Certification Among Students Not Eligible for Free Meals (CD_1).*** The sample for this model included students ineligible for free meals; that is, those with household incomes exceeding 130 percent of the federal poverty level (and not receiving food stamp, TANF, or FDPIR benefits), again excluding directly certified students. The model's dependent variable was a binary indicator of whether the student was certified for free meals. This is measure CD_1 shown in Tables IV.1, IV.2, IV.9, and IV.10 of Volume I.

The full set of coefficient estimates from the model are shown in Table IX.1.

As noted above, the coefficients obtained from the estimation of equation (1) include a separate indicator of the impact of the pilot in each of the districts that implemented the pilot. To

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(continued)
unstable when these district characteristics were added. The estimated effect of the pre-pilot certification rate on the likelihood that a student was certified as of our survey varied wildly depending on whether we were looking at the Up-Front Documentation districts or Graduated Verification districts. The estimate of this effect was also negative, which is counterintuitive. We concluded that because the model contained few degrees of freedom (because we had relatively few districts in our sample and were already controlling for the district pair variables), and because we had already matched pilot and comparison districts well as evidenced by our examination of pre-pilot district characteristics in pilot versus comparison districts, there was not sufficient variation in these district characteristics to reliably estimate and control for their effects.

TABLE IX.1

COEFFICIENT ESTIMATES FROM THE MODELS OF DETERRENCE
(Standard Errors in Parentheses)[a]

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)
Intercept	0.159*	0.172**	0.488**	0.437**
	(0.071)	(0.060)	(0.153)	(0.118)
District Pair[b]				
UFD District Pair 1	-0.042	-0.030		
	(0.034)	(0.031)		
UFD District Pair 2	-0.056	-0.021		
	(0.034)	(0.029)		
UFD District Pair 3	-0.042	-0.020		
	(0.035)	(0.030)		
UFD District Pair 4	-0.068*	-0.053*		
	(0.033)	(0.028)		
UFD District Pair 5	-0.059*	-0.039		
	(0.033)	(0.030)		
UFD District Pair 6	-0.071*	-0.022		
	(0.033)	(0.030)		
UFD District Pair 7	-0.053	-0.025		
	(0.035)	(0.032)		
UFD District Pair 8	—	—		
UFD District Pair 9	-0.026	-0.030		
	(0.034)	(0.030)		
GV District Pair 1	—	—	—	—
GV District Pair 2	—	—	-0.005	-0.059
			(0.049)	(0.042)
GV District Pair 3	—	—	-0.044	-0.022
			(0.049)	(0.042)
District Pair-Pilot Interaction				
UFD District Pair 1	-0.001	-0.009		
	(0.036)	(0.031)		
UFD District Pair 2	0.047	0.052*		
	(0.034)	(0.028)		
UFD District Pair 3	0.027	-0.002		
	(0.034)	(0.029)		
UFD District Pair 4	0.015	0.018		
	(0.032)	(0.028)		
UFD District Pair 5	-0.012	-0.015		
	(0.032)	(0.029)		
UFD District Pair 6	0.039	-0.011		
	(0.033)	(0.029)		
UFD District Pair 7	-0.032	-0.032	—	—
	(0.033)	(0.030)		
UFD District Pair 8	-0.050	-0.052		
	(0.034)	(0.030)		

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)
UFD District Pair 9	-0.036	-0.022		
	(0.037)	(0.032)		
GV District Pair 1	—	—	-0.044	-0.015
			(0.042)	(0.036)
GV District Pair 2	—	—	-0.026	0.002
			(0.044)	(0.038)
GV District Pair 3	—	—	-0.004	0.013
			(0.038)	(0.033)
Number of HH members	-0.009	0.002	0.003	-0.024
	(0.011)	(0.009)	(0.026)	(0.021)
Number of children in HH	0.027*	0.015	0.016	0.028
	(0.012)	(0.010)	(0.028)	(0.022)
Two-parent HH	0.013	0.015	-0.065	0.009
	(0.019)	(0.016)	(0.038)	(0.031)
Income				
150-185% FPL	—	-0.135**	—	0.196**
		(0.026)		(0.047)
185-200% FPL	—	-0.128**	—	-0.282**
		(0.036)		(0.059)
200-250% FPL	-0.035	-0.144**	-0.298**	-0.336**
	(0.034)	(0.026)	(0.057)	(0.048)
250-300% FPL	-0.118***	-0.178**	-0.352**	-0.339**
	(0.034)	(0.026)	(0.056)	(0.048)
300-350% FPL	-0.131**	-0.183**	-0.336**	-0.328**
	(0.036)	(0.029)	(0.063)	(0.055)
350-400% FPL	-0.090*	-0.164**	-0.360**	-0.336**
	(0.038)	(0.031)	(0.061)	(0.054)
>400% FPL	-0.120**	-0.170**	-0.362**	-0.340**
	(0.035)	(0.027)	(0.056)	(0.049)
Respondent employed	-0.008	0.005	-0.004	-0.048
	(0.019)	(0.016)	(0.047)	(0.037)
# of employed HH members	0.012	0.004	-0.020	0.019
	(0.013)	(0.012)	(0.028)	(0.023)
Own home	-0.022	-0.034*	-0.017	-0.024
	(0.018)	(0.015)	(0.035)	(0.028)
Number of vehicles owned	-0.008	-0.005	0.013	-0.003
	(0.005)	(0.004)	(0.011)	(0.010)
Grade of Student				
Kindergarten/Pre-K	-0.050	-0.053	-0.017	-0.028
	(0.037)	(0.031)	(0.077)	(0.062
1st to 2nd	-0.051	-0.021	-0.071	-0.097
	(0.031)	(0.026)	(0.069)	(0.057)
3rd to 5th	-0.026	-0.024	0.040	0.011
	(0.018)	(0.015)	(0.035)	(0.030
6th to 8th	-0.010	-0.021	0.018	0.028
	(0.017)	(0.015)	(0.032)	(0.028)

Table IX.1(*continued*)

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)	Free/RP Meal Certification Among Ineligible Students (CD_2)	Free Meal Certification Among Ineligible Students (CD_1)
Certified in the pre-pilot period	0.228**	0.132**	0.120**	0.066*
	(0.022)	(0.017)	(0.036)	(0.029)
English primary language	-0.041	-0.016	-0.149	-0.110
	(0.036)	(0.033)	(0.105)	(0.071)
Respondent's Education				
Lacks HS diploma	0.001	0.003	0.042	0.030
	(0.027)	(0.022)	(0.065)	(0.047)
Some postsecondary	0.006	0.009	0.005	-0.051*
	(0.014)	(0.012)	(0.028)	(0.024)
College degree or more	0.005	0.006	-0.028	-0.062*
	(0.016)	(0.014)	(0.042)	(0.030)
Race/Ethnicity				
Black	0.012	0.005	0.024	0.035
	(0.026)	(0.023)	(0.042)	(0.035)
Hispanic	0.012	0.013	0.092	0.025
	(0.031)	(0.026)	(0.056)	(0.043)
Other	0.002	-0.002	0.009	0.071
	(0.028)	(0.025)	(0.069)	(0.059)
School contacted respondent to apply for certification	-0.015	-0.022	0.021	0.040
	(0.14)	(0.012)	(0.026)	(0.022)
Level of satisfaction with school lunch service	0.009	0.004	-0.013	0.032
	(0.022)	(0.020)	(0.053)	(0.042)
Believes application process is fair	0.047*	0.035	0.079*	0.088*
	(0.023)	(0.019)	(0.039)	(0.035)
Moved within past 2 years	0.026	0.026*	0.055*	0.051*
	(0.014)	(0.012)	(0.025)	(0.021)
Changed districts within past 2 years	-0.041	-0.024	-0.081	-0.053
	(0.028)	(0.024)	(0.064)	(0.052)
R^2	0.198	0.166	0.291	0.263
Mean of Dependent Variable	**0.039**	**0.038**	**0.073**	**0.080**
Sample Size	**1,057**	**1,377**	**423**	**629**

FPL = federal poverty level

Note: Directly certified students were excluded from the model. The model also includes binary variables indicating that the following variables were originally missing and their values have been imputed using the mean value among non-missing observations: pre-pilot certification status, satisfaction with school lunch service, belief that application process is fair, income.

Table IX.1(*continued*)

[a]None of the standard errors presented in the table have been adjusted to account for the complex sampling design of the data set, although the estimate of the overall pilot impact presented in Volume I was adjusted to correct for design effects.

[b]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

*Coefficient estimate is significantly different from zero at the .05 level, two-tailed test
** Coefficient estimate is significantly different from zero at the .01 level, two-tailed test.

determine the overall impact, we calculated the simple mean of these site-specific impacts. We then used the coefficient estimates from the model to calculate the regression-adjusted mean outcome among pilot district students and among comparison district students. To calculate the regression-adjusted mean in pilot districts, we used the following procedure:

1. For each student in any district in the sample, we assumed that the student was in a pilot district by setting the value of P equal to 1 for that student. We did not change any of the other characteristics of that student or his/her household.
2. Again for each student, we multiplied the values of their characteristics (including the assumed value of P=1) by the estimated coefficients from the model according to the formula provided by equation (1).[5] For a given student, the value of this sum of student characteristics times coefficients represented the predicted likelihood of that student's being certified.
3. We calculated the mean (weighted, using sample weights) of this predicted likelihood across all students in the sample to determine the regression-adjusted probability of being certified/applying for benefits among ineligible students in pilot districts.

The regression-adjusted mean in comparison districts was calculated using an analogous methodology, except that the value of P for each was assumed to be 0 instead of 1. The difference between the regression-adjusted mean in pilot districts versus comparison districts for a particular outcome was equal to the estimated impact, by definition.

These relationships can be written in terms of conditional probabilities. As an example, the estimated impact of the pilot on free meal certification among ineligible students can be written:

$$(2) \quad \text{Imp}\{\text{Deterrence}|\text{I}_\text{i} > 130\} = \Pr\left\{CF_i = 1 \mid I_i > 130, P_i = 1\right\} - \Pr\left\{CF_i = 1 \mid I_i > 130, P_i = 0\right\}$$

where:

$$(3) \quad \Pr\{CF_i = 1 \mid I_i > 130, P_i = 1\} = \hat{c} + X_i\hat{b} + \sum_{j=2}^{K}\hat{d}_j DP_{ij} + \sum_{k=1}^{K}\hat{a}_k[DP_{ik} * 1]$$

[5]For the purposes of this calculation, we ignored the random error term, effectively assuming that it was equal to 0 for each student.

(4) $\Pr\{CF_i = 1 | I_i > 130, P_i = 0\} = \hat{c} + X_i\hat{b} + \sum_{j=2}^{K} \hat{d}_j DP_{ij}$

In other words, the impact of the pilot (P) on the rate of free certification (CF) among students ineligible for free meals (I>130; or income above 130 percent of the federal poverty level) is equal to the conditional probability that a given student is certified for free meals given that they are ineligible and in a pilot district minus the conditional probability that they are certified free given that they are ineligible and in a comparison district. For individual students, these conditional probabilities can be calculated by using the coefficient estimates from equation (1) where the dependent variable is a binary indicator of whether the student was certified for free meals and the sample is restricted to those ineligible for free meals.[6]

3. Barriers

To determine the impacts of the pilots on barriers among non-directly certified students, we estimated four models each for Up-Front Documentation and Graduated Verification. These models were:

1. ***Free Certification Among Students with Income ≤ 130% FPL and Not Directly Certified (CB_1a).*** The sample for this model included only students eligible for free meals; that is, those with household incomes of no more than 130 percent of the federal poverty level. Students who had been directly certified were excluded. The model's dependent variable was a binary indicator of whether the student was certified for free meals. This is measure CB_1a shown in Tables IV.3, IV.4, IV.11 and IV.12 of Volume I.

2. ***Free and Reduced-Price Certification Among Students with Income ≤ 130% FPL and Not Directly Certified (CB_2a).*** The sample for this model included only students eligible for free meals; that is, those with household incomes of no more than 130 percent of the federal poverty level. Students who had been directly certified were excluded. The model's dependent variable was a binary indicator of whether the student was certified for free or reduced-price meals. This is measure CB_2a shown in Tables IV.3, IV.4, IV.11, and IV.12 of Volume I.

[6]All of the terms in equations 2 through 4 also are conditional on the student not being directly certified.

3. ***Free and Reduced-Price Certification Among Students with Income ≤ 185% FPL and Not Directly Certified (CB_3a).*** The sample for this model included only students eligible for free or reduced-price meals; that is, those with household incomes of no more than 185 percent of the federal poverty level. Students who had been directly certified were excluded. The model's dependent variable was a binary indicator of whether the student was certified for free or reduced-price meals. This is measure CB_3a shown in Tables IV.3, IV.4, IV.11, and IV.12 of Volume I.

4. ***Free Certification Among FS/TANF Recipients Who Are Not Directly Certified (CB_4a).*** The sample for this model included only students eligible for free meals on the basis of their FS/TANF receipt. Students who had been directly certified were excluded. The model's dependent variable was a binary indicator of whether the student was certified for free meals. This is measure CB_4a shown in Tables IV.3, IV.4, IV.11, and IV.12 of Volume I.

We used the same procedures to calculate the regression-adjusted pilot and comparison district mean outcomes along with the impact as was described above for deterrence. These estimated impacts of the pilots on these measures of barriers are presented in Volume I, Chapter IV. The full set of coefficient estimates from the model are shown in Table IX.2.

In terms of predicted probabilities, the impact of the pilot on barriers (in this case, on free meal certification among non-directly certified students eligible for free meals) can be written:

$$\text{(5)}\quad \text{Imp}\{\text{Barriers}|\text{I}_\text{i} \leq 130\} = \Pr\left\{CF_i = 1 \mid I_i \leq 130, P_i = 1\right\} - \Pr\left\{CF_i = 1 \mid I_i \leq 130, P_i = 0\right\}$$

where:

$$\text{(6)}\qquad \Pr\{CF_i = 1 \mid I_i \leq 130, P_i = 1\} = \hat{c} + X_i\hat{b} + \sum_{j=2}^{K}\hat{d}_j DP_{ij} + \sum_{k=1}^{K}\hat{a}_k[DP_{ik} * 1]$$

$$\text{(7)}\qquad \Pr\{CF_i = 1 \mid I_i \leq 130, P_i = 0\} = \hat{c} + X_i\hat{b} + \sum_{j=2}^{K}\hat{d}_j DP_{ij}$$

In this case, the model parameters shown in equations 6 and 7 are obtained from estimating a version of equation 1 in which the sample is restricted to those eligible for free meals and the dependent variable is a binary variable indicating whether the student is certified for free meals. The impact of the pilots on the other measures of barriers can be determined analogously.

TABLE IX.2

COEFFICIENT ESTIMATES FROM THE MODELS OF BARRIERS
(Standard Errors in Parentheses)[a]

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)
Intercept	0.307	0.316	0.076	0.018
	(0.162)	(0.207)	(0.165)	(0.199)
District Pair[b]				
UFD District Pair 1	0.107	0.178		
	(0.085)	(0.109)		
UFD District Pair 2	0.129	0.135		
	(0.082)	(0.110)		
UFD District Pair 3	-0.036	-0.028		
	(0.085)	(0.111)		
UFD District Pair 4	0.102	0.155		
	(0.081)	(0.110)		
UFD District Pair 5	-0.027	-0.088		
	(0.087)	(0.115)		
UFD District Pair 6	0.179 *	0.279 *		
	(0.086)	(0.112)		
UFD District Pair 7	0.121	0.202		
	(0.104)	(0.137)		
UFD District Pair 8				
UFD District Pair 9	0.048	0.086		
	(0.084)	(0.110)		
GV District Pair 1				
GV District Pair 2			-0.258 **	-0.104
			(0.072)	(0.094)
GV District Pair 3			-0.114	-0.038
			(0.076)	(0.098)
District Pair-Pilot Interaction				
UFD District Pair 1	-0.282 **	-0.267 **		
	(0.080)	(0.102)		
UFD District Pair 2	0.027	0.133		
	(0.073)	(0.101)		
UFD District Pair 3	0.055	-0.018		
	(0.080)	(0.107)		
UFD District Pair 4	-0.131	-0.145		
	(0.085)	(0.115)		
UFD District Pair 5	0.168	0.328 **		
	(0.086)	(0.117)		
UFD District Pair 6	-0.146	-0.211		
	(0.086)	(0.116)		
UFD District Pair 7	-0.197	-0.150		
	(0.103)	(0.139)		
UFD District Pair 8	0.083	-0.034		
	(0.090)	(0.120)		
UFD District Pair 9	-0.229 **	-0.193 *		
	(0.075)	(0.093)		

Table IX.2 *(continued)*

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)
GV District Pair 1			-0.171 **	-0.097
			(0.059)	(0.073)
GV District Pair 2			0.012	-0.049
			(0.058)	(0.072)
GV District Pair 3			-0.112	-0.253 *
			(0.074)	(0.107)
Number of HH members	-0.089 **	-0.072 **	-0.046	-0.255
	(0.022)	(0.028)	(0.028)	(0.138)
Number of children in HH	0.116 **	0.082 **	0.078 *	0.126 **
	(0.024)	(0.031)	(0.031)	(0.038)
Two-parent HH	0.062	0.065	0.065	0.097
	(0.036)	(0.048)	(0.047)	(0.059)
Income				
0-50% FPL	0.099	-0.068	0.087	0.017
	(0.055)	(0.059)	(0.075)	(0.078)
50-100% FPL	0.242 **	0.099 *	0.123 *	0.052
	(0.040)	(0.050)	(0.051)	(0.064)
100-130% FPL	0.231 **		0.071	
	(0.045)		(0.063)	
130-150% FPL	0.203 **		0.046	
	(0.049)		(0.063)	
Respondent employed	-0.014	0.057	0.074	0.092
	(0.039)	(0.051)	(0.052)	(0.066)
# of employed HH members	0.002	0.074	-0.050	-0.051
	(0.030)	(0.040)	(0.042)	(0.054)
Own home	-0.088 *	-0.090	0.029	0.087
	(0.035)	(0.047)	(0.044)	(0.057)
Number of vehicles owned	0.029 *	0.058 **	-0.035	-0.040
	(0.014)	(0.019)	(0.020)	(0.026)
Grade of Student				
Kindergarten/Pre-K	-0.208 **	-0.076	0.130	0.236 *
	(0.078)	(0.100)	(0.093)	(0.118)
1st to 2nd	0.219 **	0.326 **	-0.003	0.298 **
	(0.067)	(0.091)	(0.084)	(0.108)
3rd to 5th	0.145 **	0.239 **	0.210 **	0.177 **
	(0.042)	(0.056)	(0.053)	(0.067)
6th to 8th	0.041	0.124 *	0.098	0.046
	(0.042)	(0.055)	(0.051)	(0.065)
Certified in the pre-pilot	0.297 **	0.245 **	0.278 **	0.175 **
period	(0.036)	(0.048)	(0.047)	(0.060)
English primary language	-0.210 *	-0.212	0.152 *	0.182 *
	(0.102)	(0.129)	(0.069)	(0.084)
Respondent's Education				
Lacks HS diploma	-0.045	0.034	0.010	-0.012
	(0.042)	(0.051)	(0.049)	(0.059)
Some postsecondary	0.042	0.050	-0.023	-0.021
	(0.035)	(0.048)	(0.042)	(0.057)
College degree or more	-0.149 **	-0.113	0.008	0.063
	(0.054)	(0.073)	(0.076)	(0.101)

Table IX.2*(continued)*

	Up-Front Documentation Model		Graduated Verification Model	
	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)	Free/RP Meal Certification Among Eligible Students (CB_3a)	Free Meal Certification Among Eligible Students (CB_1a)
Race/Ethnicity				
Black	-0.009	-0.047	-0.076	0.010
	(0.063)	(0.082)	(0.058)	(0.075)
Hispanic	0.002	-0.070	0.131 *	0.172 *
	(0.066)	(0.089)	(0.063)	(0.082)
Other	-0.107	-0.116	-0.182	0.003
	(0.072)	(0.092)	(0.096)	(0.123)
School contacted respondent to apply for certification	0.001	0.008	-0.030	-0.094
	(0.034)	(0.046)	(0.039)	(0.050)
Level of satisfaction with school lunch service	0.004	0.150 *	0.010	0.211
	(0.055)	(0.073)	(0.067)	(0.089)
Believes application process is fair	0.211 **	0.159 *	0.240 **	0.120
	(0.053)	(0.073)	(0.072)	(0.095)
Moved within past 2 years	0.003	0.024	0.034	0.038
	(0.025)	(0.030)	(0.026)	(0.032)
Changed districts within past 2 years	-0.020	-0.031	0.099	0.079
	(0.051)	(0.065)	(0.060)	(0.072)
Received TANF during previous month	-0.070	-0.088	0.050	0.093
	(0.072)	(0.075)	(0.064)	(0.067)
Received Foodstamps previous month	0.123 **	0.144 **	-0.050	0.022
	(0.041)	(0.045)	(0.051)	(0.055)
Received Public Housing Assistance past month	0.063	0.057	0.130 *	0.148 *
	(0.064)	(0.073)	(0.057)	(0.063)
R^2	0.421	0.398	0.251	0.245
Mean of Dependent Variable	**0.474**	**0.512**	**0.672**	**0.646**
Sample Size	**881**	**561**	**642**	**436**

FPL = federal poverty level.

Note: Directly certified students are excluded from the model. The model also includes binary variables indicating that the following variables were originally missing and their values have been imputed using the mean value among non-missing observations: pre-pilot certification status, satisfaction with school lunch service, belief that application process is fair, income.

[a]None of the standard errors presented in the table have been adjusted to account for the complex sampling design of the data set, although the estimate of the overall pilot impact presented in Volume I was adjusted to correct for design effects.

[b]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

* Coefficient estimate is significantly different from zero at the .05 level, two-tailed test

** Coefficient estimate is significantly different from zero at the .01 level, two-tailed test.

4. Including Directly Certified Students

As noted above, the indicator of barriers we used was the rate of certification among groups of students eligible for free or for free or reduced-price meals, *excluding directly certified students.* In Volume I, we presented information on barriers both without controlling for household characteristics and with such controls for household characteristics. In other words, we presented estimates of the simple mean certification rates among eligible students and the regression-adjusted mean certification rates among eligible students. The simple mean estimates were based on observed certification rates among our sample of non-directly certified students eligible for benefits. Since we assumed that directly certified students are eligible for the benefits they are receiving, however, their exclusion affects the estimated certification rates. If we assumed that all directly certified students were eligible, for example, the certification rate among non-directly certified students would be lower than the certification rate among all eligible students. Excluding directly certified students, in other words, could make the extent of certification barriers appear larger than it is in reality. Thus, to estimate certification rates among eligible students, we used the information available to us on the proportion of students in the district who were directly certified and assumed that all directly certified students were eligible for free meal benefits. Table IX.3 presents the estimates by district.

For the barriers tables in Chapter IV of Volume I, we estimated the probability of being certified for free meals among all students with household incomes below 130 percent of poverty (measure CB_1b in Table II.2 of Volume I), whether directly certified or not, by using the following relationships:

$$
\begin{aligned}
(8)\qquad & \Pr(\text{cert free} \mid \text{inc}<130) = \Pr(\text{cert free \& no DC} \mid \text{inc}<130) + \Pr(\text{DC} \mid \text{inc}<130) \\
& = \Pr(\text{cert free} \mid \text{no DC, inc}<130)*\Pr(\text{no DC} \mid \text{inc}<130) + \Pr(\text{DC} \mid \text{inc}<130) \\
& = \Pr(\text{cert free} \mid \text{no DC, inc}<130)*[1-\Pr(\text{DC} \mid \text{inc}<130)] + \Pr(\text{DC} \mid \text{inc}<130) \\
& = \Pr(\text{cert free} \mid \text{no DC, inc}<130)*\{1-[\Pr(\text{DC})/\Pr(\text{inc}<130)]\} + \Pr(\text{DC})/\Pr(\text{inc}<130)
\end{aligned}
$$

TABLE IX.3

ESTIMATES OF PERCENTAGE OF STUDENTS DIRECTLY CERTIFIED

	Pilot Districts			Comparison Districts		
Pilot/Comparison Districts	Total Enrollment[a]	Students Directly Certified[b]	Proportion of Students Directly Certified Free	Total Enrollment[a]	Students Directly Certified[b]	Proportion of Students Directly Certified Free
Up-Front Documentation						
Blue Ridge/Montrose (PA)	1,238	0	0.000	1,925	74	0.038
East Stroudsburg/Easton (PA)	7,504	421	0.056	7,887	617	0.078
Pleasant Valley/Bangor (PA)	6,676	159	0.024	3,455	82	0.024
Stroudsburg/Pottsgrove (PA)	5,336	0	0.000	1,989	0	0.000
Maplewood/Newton Falls (OH)	1,097	0	0.000	1,600	0	0.000
Salem City/Lisbon (OH)	2,481	0	0.000	1,191	0	0.000
Creve Coeur/North Pekin (IL)	750	68	0.091	605	7	0.012
Oak Park and Forest River/ Valley View (IL)[c]	2,962	33	0.011	1,774	17	0.010
Williamson County/Wilson County (TN)[d]	6,296	376	0.060	10,837	304	0.028
Mean across districts			0.027			0.021
Graduated Verification						
DGF/Breckenridge/Lake Park Audubon (MN)	1,331	152	0.114	1,616	87	0.060
Grandview/Hickman Mills (MN)	4,212	551	0.131	7,477	1,035	0.138
Dunkirk City/Jamestown City (NY)	2,202	263	0.119	5,430	772	0.142
Mean across districts			0.121			0.113

na = not applicable.

[a]Total enrollment for school year 2002-2003 was reported to FNS by each district or the district's state agency.

[b]Counts of students directly certified are from sampling lists (Table III.4), except that counts from administrative records were used for Creve Coeur, Oak Park and River Forest, North Pekin and Marquette and Dunkirk because lists of directly certified students were not provided in the sampling process. Data pertain to school year 2002-2003.

[c]Figures for Valley View are for Bollingbrook High School.

[d]Figures for Williamson County are for the schools participating in the pilot project.

where:

$$\text{(9)} \quad \Pr(\text{inc}<130) = \Pr(\text{Inc}<130 \ \& \text{ no DC}) + \Pr(\text{DC})$$
$$= \Pr(\text{Inc}<130 \mid \text{no DC})*\Pr(\text{no DC}) + \Pr(\text{DC})$$
$$= \Pr(\text{Inc}<130 \mid \text{no DC})*[1 - \Pr(\text{DC})] + \Pr(\text{DC}) .$$

In other words, we first estimated the overall probability of students having income below 130 percent of poverty by using the relationships shown in equation (9)—that is, by summing the probability of being directly certified and the joint probability of having an income in this category and not being directly certified (which we could estimate from our sample). We then estimated our measure of barriers according to equation (8) by using this newly estimated probability of being income eligible for free meals along with the probability of being directly certified and the conditional probability of being certified free given being income-eligible and not directly certified. The latter conditional probability was estimated with sample data using the regression described in the previous section.

We computed the probability of being certified for free or reduced price meals among students with household income less than 185 of poverty (measure CB_3b of Table II.2 of Volume II) using the same logic:

$$\text{(10)} \quad \Pr(\text{cert FRP} \mid \text{inc}<185) = \Pr(\text{cert FRP} \mid \text{no DC, inc}<185) *\{1-[\Pr(\text{DC})/\Pr(\text{inc}<185)]\} + \Pr(\text{DC})/\Pr(\text{inc}<185)$$

where:

$$\text{(11)} \quad \Pr(\text{Inc}<185) = \Pr(\text{Inc}<185 \mid \text{no DC})*[1 - \Pr(\text{DC})] + \Pr(\text{DC}) .$$

We used similar procedures to add the directly certified group to our estimates of the simple rates of accuracy and targeting efficiency. For the accuracy tables, we calculated the conditional probability of being eligible (i.e. having income below the appropriate threshold) given certification. For example:

$$\text{(12)} \quad \Pr(\text{inc}<130 \mid \text{cert free}) = \Pr(\text{inc}<130 \mid \text{cert free, no DC}) *\{1 – [\Pr(\text{DC})/\Pr(\text{cert free})]\} + \Pr(\text{DC})/\Pr(\text{cert free})$$

where:

(13) Pr(cert free) = Pr(cert free | no DC)*[1-Pr(DC)] + Pr(DC) .

Finally, for the targeting efficiency tables, we calculated the unconditional probability of being correctly targeted:

(14) Pr(Correct) = Pr(Correct | no DC)*[1-Pr(DC)] + Pr(DC) .[7]

All of these calculations were performed at the district level. The results presented in the tables are the averages across districts, computed separately for Up-Front Documentation and Graduated Verification sites and by pilot or comparison status.

B. ESTIMATING IMPACTS ON ACCURACY AND TARGETING EFFICIENCY

Accuracy and targeting efficiency are outcomes that are influenced by levels of certification among both eligible and ineligible students. By contrast, deterrence focused entirely on those ineligible for free/reduced-price meal benefits while barriers focused entirely on those eligible for benefits. Thus, accuracy and targeting efficiency are, in effect, summary measures of deterrence and barriers, with the impacts of the pilots on both accuracy and targeting efficiency influenced by their impacts on deterrence and barriers.

1. Accuracy

The accuracy rate is defined as the proportion of certified students who are eligible for the level of benefits they are receiving. We examined one measure of free certification accuracy (CA_1a) and three measures of free and reduced-price certification accuracy (CA_2a, CA_3a, and CA_4a) in the descriptive analysis presented in Volume I (defined in Table II.2 in Volume

[7]Again, we relied on the assumption that all directly certified students are correctly targeted.

I). Our analysis of impacts focuses on the measure of free certification accuracy (CA_1a) and one of the measures of free and reduced price certification accuracy (CA_4a).

Because of the relationship between deterrence/barriers and accuracy, it was possible to use the results from the models of deterrence and barriers (described in Section A) to determine the impacts of the pilots on the accuracy rate. Among non-directly certified students, for example, the estimated impact of the pilot on free meal accuracy (measure CA_1a) can be written:[8]

$$(15)\ \mathrm{Imp}\{\mathrm{Accuracy} \mid \mathrm{CF_i}\} = \Pr\left\{I_i \leq 130 \mid CF_i = 1, P_i = 1\right\} - \Pr\left\{I_i \leq 130 \mid CF_i = 1, P_i = 0\right\}$$

The challenge in calculating this impact is in calculating the terms on the right hand side of equation (15)—the probabilities of being eligible for free meals conditional on being certified for free meals. We cannot use regression analysis to estimate these conditional probabilities because of technical issues concerning the effects of the explanatory variables including pilot status on the composition of the estimation sample. In particular, in the case of the probability of being certified conditional on being ineligible for benefits (as represented in equations 3 and 4), we simply restricted the sample to ineligible students and then regressed certification status on pilot status and a variety of other student characteristics. If we were to pursue the analogous methodology here, we would restrict the sample to certified students and regress income eligibility status (that is, a binary variable indicating whether the students income is no more than 130 percent of poverty) on pilot status and other student characteristics. The problem with a regression model such as this, however, is that the sample in the model is endogenous in that pilot status (and other student characteristics) would affect the sample upon which the regression was based rather than affecting the dependent variable of the model directly.

[8]The logic shown in equation (15) and subsequent equations is for eligibility and certification for free meals only. However, we applied the same logic and developed an analogous set of equations for our analysis of free or reduced-price eligibility and certification.

However, we can use basic probability theory to express the conditional probability of eligibility given certification in terms that we have already determined from the deterrence and barriers models described above. To illustrate this, the first term on the right hand side of equation 15 can be written:

$$\Pr\{\mathrm{I_i} \le 130 | \mathrm{CF_i} = 1, P_i = 1\} = \frac{\Pr\{\mathrm{I_i} \le 130 \,\&\, \mathrm{CF_i} = 1 | P_i = 1\}}{\Pr\{\mathrm{CF_i} = 1 | P_i = 1\}}$$

(16)
$$= \frac{\Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} \le 130, P_i = 1\} \Pr\{\mathrm{I_i} \le 130 \mid P_i = 1\}}{\Pr\{\mathrm{CF_i} = 1 \,\&\, I_i \le 130 \mid P_i = 1\} + \Pr\{\mathrm{CF_i} = 1 \,\&\, I_i > 130 \mid P_i = 1\}}$$

$$= \frac{\Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} \le 130, P_i = 1\} \Pr\{\mathrm{I_i} \le 130 \mid P_i = 1\}}{\Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} \le 130, P_i = 1\} \Pr\{\mathrm{I_i} \le 130 \mid P_i = 1\} + \Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} > 130, P_i = 1\} \Pr\{\mathrm{I_i} > 130 \mid P_i = 1\}}$$

Each of the probabilities on the right-hand side of this equation are either known or can be easily determined. In particular, the conditional probabilities of certification given eligibility and given ineligibility will have already been determined in estimating the impacts of the pilots on deterrence and barriers. The unconditional probability of eligibility for free meals (I<=130), as well as its complement, the unconditional probability of ineligibility for free meals (I>130), can be easily determined by calculating the proportion of non-directly certified students in pilot districts with incomes below (or above) 130 percent of the FPL. Similarly, the second term on the right hand side of equation (15) can be written:

(17)
$$\Pr\{\mathrm{I_i} \le 130 | \mathrm{CF_i} = 1, P_i = 0\} =$$

$$\frac{\Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} \le 130, P_i = 0\} \Pr\{\mathrm{I_i} \le 130 \mid P_i = 0\}}{\Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} \le 130, P_i = 0\} \Pr\{\mathrm{I_i} \le 130 \mid P_i = 0\} + \Pr\{\mathrm{CF_i} = 1 | \mathrm{I_i} > 130, P_i = 0\} \Pr\{\mathrm{I_i} > 130 \mid P_i = 0\}}$$

To summarize, we used the following steps to calculate the impact of the pilot on accuracy:

1. Estimate the impact of the pilot on deterrence by estimating equation 1 based on a sample of students ineligible for benefits and with a binary variable indicating whether the student is certified as the dependent variable.

2. Based on the results of this estimation, calculate the predicted probability of certification conditional on being ineligible among students in pilot districts ($Pr\{CF=1 \mid I>130, P=1\}$) and comparison districts ($Pr\{CF=1 \mid I>130, P=0\}$). These terms are also referred to as the regression-adjusted mean certification rates among ineligible students in pilot and comparison districts.

3. Estimate the impact of the pilot on barriers.

4. Based on these results, calculate the predicted probability of certification conditional on being eligible in pilot ($Pr\{CF=1 \mid I<=130, P=1\}$) and comparison districts ($Pr\{CF=1 \mid I<=130, P=0\}$).

5. Calculate the predicted probability of the student being eligible and ineligible for benefits in both pilot and comparison districts. The predicted probabilities of free meal eligibility/ineligibility in pilot districts, for example, would be $Pr\{I<130 \mid P=1\}$ and $Pr\{I>=130 \mid P=1\}$.

6. Use all of these conditional predicted probabilities as shown in equation 16 to calculate the probability of being income eligible conditional on being certified in pilot districts. Do a similar calculation to determine the probability of being income eligible conditional on being certified in comparison districts.

7. Calculate the impact of the pilot as the difference between the probability of being eligible conditional on being certified in pilot districts versus comparison districts, as shown in equation 15.

To calculate the standard error of this estimate, we used bootstrap methods. In particular, we generated 1,000 replicate samples by sampling from our existing sample *with replacement*. We then estimated the impact of the pilot on accuracy for each replicate sample using the methodology described above. The standard deviation of these 1,000 different estimates was our estimate of the standard error of the estimated impact of the pilot on accuracy.

2. Targeting Efficiency

The rate of targeting efficiency was defined as the proportion of all students in a given district whose free or free/reduced-price eligibility status was consistent with their certification status. In other words, it was the proportion who were either both certified and eligible for benefits or not certified and not eligible for benefits. We defined three measures of targeting efficiency that correspond to the three measures of free and reduced price certification accuracy. Our analysis of impacts on targeting efficiency focuses on the broadest of these three measures--the percentage of students who are in either of the following two categories: (1) have income below 185 percent of the federal poverty level and are certified for free or reduced price meals, or (2) have income above 185 percent of the federal poverty level and are not certified for free or reduced price meals. (This is measure CTE_3a in Table IV.8 and Table IV.16 in Volume I.)

Like the accuracy rate, the rate of targeting efficiency depends upon the certification status among both ineligible students and eligible students. Thus, the impact of the pilot on targeting efficiency was determined by the pilots' impacts on deterrence and accuracy (along with the proportion of students who were income eligible and ineligible). The methodology for calculating this impact was similar to the methodology for estimating the impact of the pilot on accuracy.

Since the rate of targeting efficiency is the probability of being either certified and eligible or not certified and not eligible, the targeting efficiency measures in pilot districts can be written in terms that have already been obtained[9]:

$$\Pr\{TE_i = 1 | \mathrm{P_i} = 1\} = \Pr\left\{CFRP_i = 1 \ \& \ I_i \le 185 \,|\, P_i = 1\right\} + \Pr\left\{CFRP_i = 0 \ \& \ I_i > 185 \,|\, P_i = 1\right\}$$

$$(18) \quad = \Pr\{CFRP_i = 1 \,|\, I_i \le 185\}\Pr\{I_i \le 185\} + \Pr\{CFRP_i = 0 \,|\, I_i > 185\}\Pr\{I_i > 185\}$$

$$= \Pr\{CFRP_i = 1 \,|\, I_i \le 185\}\Pr\{I_i \le 185\} + [1 - \Pr\{CFRP_i = 1 \,|\, I_i > 185\}\Pr\{I_i > 185\}]$$

[9] In the last two lines of equation 18 the conditional term P=1 has been dropped for simplicity.

(All terms are as previously defined, except that $CFRP_i$=1 indicates that a student is certified either for free or for reduced-price meal benefits.)

A similar equation can be written to obtain the estimated rate of targeting efficiency in comparison districts. The difference between these two terms is the estimated impact of the pilot on targeting efficiency.

X. SUPPLEMENTARY TABULATIONS

This chapter presents five sets of tabulations that supplement the findings presented in Volume I. Section A presents analysis of the changes over time that we observed in the pilot and comparison sites. includes supplementary tabulations. Section B presents sample tabulations of characteristics by NSLP certification status. Section C presents selected sample characteristics for each pilot and comparison district pair. Section D presents key outcomes by district for Up-Front Documentation pilot and comparison districts. Section E presents key outcomes by district for the Graduated Verification pilot and comparison districts. The tables in Sections B and C correspond to characteristics discussed in Chapter III of Volume I, and the tables in Sections D and E correspond to outcomes presented in Chapter IV of Volume I.

A. CHANGES IN PILOT AND COMPARISON SITES AFTER THE PRE-PILOT PERIOD

Chapter III of Volume I presented data that indicated the pilot and comparison sites were reasonably well matched on baseline characteristics. However, a concern remains that changes over time may have caused the pilot and comparison sites to become less similar than they were at baseline. To check on this possibility, we examined changes in district characteristics between the pre-pilot period and the pilot period using data covering more recent years from the same data sources as were used in selecting the comparison districts.[1] Our examination focused on factors not likely to have been affected by the demonstration, although we also show changes in

[1]Data sources used in this section are 2002 enrollment and NSLP certification and participation data from FNS Minimum Data Set, 2001 race/ethnicity data from the NCES CCD, and 1999 poverty data from the U.S. Census CPS. Although most of these data are during the pilot period, our measure of poverty is actually a pre-pilot measure but is two years more recent than the measure we used in selecting comparison sites.

certification rates, which may have been influenced by the pilot. Table X.1 shows the changes over time in selected characteristics of the Up-Front Documentation and Graduated Verification pilot and comparison districts. The discussion in this section focuses on characteristics of the districts during the pilot period, based on the most recent data currently available.

Some characteristics of Up-Front Documentation pilot districts diverged from those of their comparison districts over time. The numbers of students enrolled grew in both pilot and comparison sites, but the growth was greater in pilot sites, which had fewer students than comparison districts in 1997 but surpassed comparison enrollments by 1999. The NSLP free and reduced price certification rates in Up-Front Documentation pilots fell (from an average of 23 percent to 19 percent) between 1999 and 2001, while the certification rates in comparison sites rose slightly (from 22 percent to 24 percent).[2] The racial/ethnic distributions of pilot and comparison sites as measured during the pilot period still matched closely.

In the Graduated Verification demonstrations, differences in characteristics between pilot and comparison districts changed only slightly between the pre-pilot and pilot periods. Enrollments in pilot districts fell, while comparison enrollments rose slightly, resulting in a somewhat larger size difference. The percentage of white students fell slightly in both pilot districts and comparison districts, but the change was greater in pilots, resulting in slightly less similar race/ethnicity distributions.

In summary, while the pilot and comparison districts developed differently over time, and were less similar after baseline than they were at baseline, within each pilot alternative the pilot and comparison sites remain well-matched.

[2]This could be a result of changes in poverty rates. However, it could also have been affected by the demonstration, so this change should be interpreted with caution.

TABLE X.1

CHARACTERISTICS OF UP-FRONT DOCUMENTATION AND GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS

Characteristics		Pre-Pilot[a] Pilot Districts	Pre-Pilot[a] Comparison Districts	Pre-Pilot[a] Difference	During Pilot[b] Pilot Districts	During Pilot[b] Comparison Districts	During Pilot[b] Difference
Up-Front Documentation							
District Size Number of Students (Mean)[c]	1999-2002	3,381.0	3,446.2	-65.2	3,815.6	3,473.7	341.9
NSLP Certification Status (Percentage)	1999-2002						
Free		16.5	16.5	0.0	14.7	18.1	-3.4
Reduced Price		5.9	5.9	0.0	5.1	6.3	-1.2
Poverty Rate Among School-Age Children	1997-1999	10.4	10.3	0.1	9.3	9.9	-0.6
Race/Ethnicity (Percentages)	1999-2001						
White, Non-Hispanic		88.4	88.7	-0.3	87.2	87.6	-0.4
Black, Non-Hispanic		6.9	6.9	0.0	7.4	7.2	0.2
Hispanic		3.4	3.0	0.4	4.1	3.8	0.3
Native American		0.2	0.0	0.2	0.2	0.1	0.1
Asian, Pacific Islander		1.1	1.3	-0.2	1.1	1.3	-0.2
Graduated Verification							
District Size Number of Students (Mean)[c]	1999-2002	2,587.0	4,537.5	-1,950.5	2,581.7	4,571.7	-1,990.0
NSLP Certification Status (Percentage)	1999-2002						
Free		34.9	32.2	2.7	34.3	37.3	-3.0
Reduced Price		9.6	9.6	0.0	7.8	9.3	-1.5
Percentage of School-Age Children Below 100 Percent of the Federal Poverty Level[d]	1997-1999	19.4	18.8	0.6	22.4	16.4	6.0
Race/Ethnicity (Percentages)	1999-2001						
White, Non-Hispanic		65.8	70.6	-4.8	62.6	68.7	-6.1
Black, Non-Hispanic		18.3	24.0	-5.7	20.2	24.8	-4.6
Hispanic		14.1	4.0	10.1	15.2	4.9	10.3
Native American		1.3	0.9	0.4	1.4	0.8	0.6
Asian, Pacific Islander		0.5	0.6	-0.1	0.7	0.8	-0.1

[a]Source: 1999 FNS Minimum Data Set; 1999 NCES Common Core of Data; 1997 Census CPS.

[b]Source: 2002 FNS Minimum Data Set; 2001 NCES Common Core of Data; 1999 Census CPS.

[c]Includes students enrolled in schools implementing the pilot.

[d]Change is from one pre-pilot period to later pre-pilot period.

B. SAMPLE CHARACTERISTICS BY NSLP CERTIFICATION STATUS

This section presents sample characteristics by NSLP certification status. Table X.2 displays this data for Up-Front Documentation pilot and comparison districts, and Table X.3 shows this data for Graduated Verification districts.[3] Households certified to receive free or reduced price meals are more likely to be single-parent households and include respondents with lower levels of education and employment than non-certified households. Certified households have lower incomes, higher rates of public assistance receipt, and higher pre-pilot certification rates.

C. SELECTED SAMPLE CHARACTERISTICS BY DISTRICT

This section presents selected sample household characteristics individually for each pilot and comparison district pair.[4] Table X.4 displays survey data on household size and structure, Table X.5 addresses parent's education, Table X.6 shows household income, and Table X.7 presents race/ethnicity data. Table X.8 shows survey data on pre-pilot certification status, for those students old enough to have been in school before the pilot began. In all these tables, households are weighted to adjust for non-response; directly certified students are not included.

There were a few notable differences across sites. Up-Front Documentation Pilot District #9 had very few single-parent households (7.8, compared to 23.5 on average across pilot sites). Up-Front Documentation District Pair #7 included almost no respondents with a college degree (4.8 percent in the pilot and 3.3 percent in the comparison), while the majority of Up-Front

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[3]The tables present the same set of sample characteristics discussed in Volume I, Chapter 3. Each district is weighted equally so the statistics presented are representative of the average district.

[4] In this set of tables, households are weighted to adjust for non-response, so the statistics presented are representative of the survey sample, which excluded directly certified students.

TABLE X.2

CHARACTERISTICS OF SAMPLE MEMBERS IN UP-FRONT DOCUMENTATION PILOT AND COMPARISON DISTRICTS, BY NSLP CERTIFICATION STATUS

	Certified Free		Certified Reduced-Price		Not Certified	
Characteristics	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Household Size						
Number of household members (Mean)	4.3	4.6	4.6	4.5	4.2	4.3
Number of children in household (Mean)	2.7	2.8	2.7	2.7	2.1	2.2
Household Structure (Percentages)						
Two–parent household	48.2	54.3	71.2	63.4	79.7	83.0
Single–parent household	50.1	43.1	26.2	35.3	19.4	15.9
Other household structure	1.8	2.7	2.6	1.4	1.0	1.1
Survey Respondent's Educational Attainment (Percentages)						
Lacks a high school diploma	20.0	21.5	8.7	12.7	4.8	7.8
High school diploma only	45.9	51.4	46.7	52.2	40.7	38.8
Some postsecondary education but lacks a college degree	27.4	22.6	39.0	30.1	27.0	31.9
College degree or more	6.7	4.6	5.6	5.0	27.5	21.5
Employment Status Of Household Members						
Survey respondent is employed (Percentage)	52.3	58.2	54.5	70.3	74.1	77.6
Number of employed adults in household (Mean)	0.8	1.1	1.2	1.3	1.6	1.7
Household Income (Percentages)						
Less than 130 percent of FPL[a]	79.6	77.5	27.4	32.0	10.8	9.5
131 to 185 percent of FPL	10.3	12.2	44.9	45.7	10.8	11.4
186 to 400 percent of FPL	8.1	10.0	25.0	21.3	40.9	49.1
More than 400 percent of FPL	2.1	0.3	2.8	0.9	37.5	30.0
Percentage Receiving Public Assistance						
Percentage receiving food stamp benefits	36.0	32.4	2.5	3.1	2.7	1.8
Percentage receiving TANF	4.5	6.1	1.1	0.8	0.5	0.7
Percentage receiving other benefits	25.1	18.6	11.2	7.7	10.1	6.7
Percentage Residing in Public Housing or Receiving Housing Subsidy	15.5	11.1	3.0	5.7	0.9	0.6
Percentage Who Own Their Home	37.7	43.1	62.0	65.7	84.0	82.4
Vehicle Ownership (Percentage)	65.0	73.4	84.1	83.9	88.6	91.1
Number of Vehicles Owned By All Household Members (Mean)	1.0	1.2	1.4	1.5	1.9	2.0
Household Mobility						
Number of Times Respondent Has Moved During Past Two Years (Means)	0.5	0.5	0.3	0.2	0.2	0.2
Has Moved And Changed School Districts During Past Two Years (Percentage)	21.2	16.8	9.4	12.0	8.6	7.4

TABLE X.2 (*continued*)

Characteristics	Certified Free		Certified Reduced-Price		Not Certified	
	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Race/Ethnicity (Percentages)						
White, Non–Hispanic	71.8	78.1	77.9	74.3	84.5	85.7
Black, Non–Hispanic	17.0	8.8	9.7	12.4	6.4	5.4
Hispanic	4.0	6.8	6.1	3.9	1.5	2.1
Native American	0.7	0.0	0.0	1.0	0.7	0.2
Asian, Pacific Islander	0.3	1.2	0.4	1.1	0.4	1.3
Other	1.7	1.7	1.0	3.6	2.7	2.2
Mixed race	4.5	3.4	4.9	3.7	3.9	3.0
English Primary Language Spoken at Home (Percentage)	96.9	93.7	94.4	96.6	97.5	97.7
Grade Level of Child (Percentages)						
Grade 9 to 12	29.4	22.6	23.5	32.3	39.4	36.7
Grade 6 to 8	19.6	27.0	27.1	20.2	20.2	24.6
Grade 3 to 5	32.4	27.2	27.4	29.7	19.5	21.5
Grade 1 to 2	15.5	18.8	18.8	17.0	13.6	10.7
Kindergarten or Pre–K	3.2	4.3	2.6	0.8	6.7	6.4
Pre–Pilot Free or Reduced–Price Certification Status (Percentage)	77.8	75.0	64.0	53.7	13.5	10.4
Sample Size	**204**	**222**	**115**	**154**	**631**	**612**

[a]The lowest income category (less than 130% of FPL) includes families categorically eligible for free meals (based on receipt of TANF or food stamps or foster child status), regardless of their actual income.

FPL = federal poverty level.

TABLE X.3

CHARACTERISTICS OF SAMPLE MEMBERS IN GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS, BY NSLP CERTIFICATION STATUS

	Certified Free		Certified Reduced-Price		Not Certified	
Characteristics	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Household Size						
Number of household members (Mean)	4.4	4.9	4.5	4.4	4.2	4.4
Number of children in household (Mean)	2.7	3.2	2.6	2.5	2.2	2.2
Household Structure (Percentages)						
Two–parent household	49.1	52.2	65.6	51.6	72.7	82.6
Single–parent household	48.8	44.7	33.3	43.3	26.8	15.5
Other household structure	2.1	3.2	1.1	5.1	0.5	1.9
Survey Respondent's Educational Attainment (Percentages)						
Lacks a high school diploma	25.6	23.9	23.1	7.7	7.1	6.4
High school diploma only	35.2	39.1	24.2	28.7	28.9	31.9
Some postsecondary education but lacks a college degree	31.2	34.2	38.7	56.3	41.8	42.2
College degree or more	8.1	2.8	14.1	7.4	22.1	19.5
Employment Status Of Household Members						
Survey respondent is employed (Percentage)	61.8	51.4	69.8	78.2	83.8	82.5
Number of employed adults in household (Mean)	1.0	0.9	1.3	1.3	1.7	1.7
Household Income (Percentages)						
Less than 130 percent of FPL[a]	71.6	73.0	22.7	24.9	14.8	11.1
131 to 185 percent of FPL	22.4	19.4	61.0	41.3	11.2	9.0
186 to 400 percent of FPL	4.6	7.2	14.6	32.9	48.0	53.6
More than 400 percent of FPL	1.4	0.4	1.7	0.9	26.0	26.3
Percentage Receiving Public Assistance						
Percentage receiving food stamp benefits	37.6	33.3	5.2	2.1	5.3	5.5
Percentage receiving TANF	16.0	15.9	3.0	0.0	1.6	2.5
Percentage receiving other benefits	16.8	22.0	15.6	3.1	9.2	9.6
Percentage Residing in Public Housing or Receiving Housing Subsidy	23.3	19.0	4.1	1.5	2.5	1.6
Percentage Who Own Their Home	41.6	46.3	52.9	60.8	75.9	77.2
Vehicle Ownership (Percentage)	65.8	73.4	77.9	94.3	88.6	87.5
Number of Vehicles Owned By All Household Members (Mean)	1.0	1.0	1.3	1.4	1.8	1.9
Household Mobility						
Number of Times Respondent Has Moved During Past Two Years (Means)	0.6	0.5	0.4	0.3	0.2	0.2
Has Moved And Changed School Districts During Past Two Years (Percentage)	20.4	19.9	10.0	11.2	7.1	3.5

TABLE X.3 (*continued*)

	Certified Free		Certified Reduced-Price		Not Certified	
Characteristics	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Race/Ethnicity (Percentages)						
White, Non–Hispanic	45.3	51.7	65.3	58.0	71.4	61.2
Black, Non–Hispanic	19.5	25.2	9.9	21.0	18.6	24.0
Hispanic[b]	23.5	13.6	16.7	7.4	5.7	6.3
Native American	1.8	1.0	0.0	0.0	0.4	0.0
Asian, Pacific Islander	0.9	0.0	0.0	0.0	0.0	0.9
Other	0.3	1.0	0.0	1.3	0.5	2.8
Mixed race	8.8	7.6	8.0	12.3	3.4	4.9
English Primary Language Spoken at Home (Percentage)	82.8	84.3	91.5	92.9	96.7	93.3
Grade Level of Child (Percentages)						
Grade 9 to 12	15.7	15.1	18.7	15.5	36.0	34.9
Grade 6 to 8	28.9	28.2	23.7	28.0	27.9	21.5
Grade 3 to 5	30.4	28.2	39.5	28.0	17.8	17.0
Grade 1 to 2	20.4	14.3	9.2	8.9	11.0	19.1
Kindergarten or Pre–K	4.7	14.2	8.9	19.0	7.0	7.5
Pre–Pilot Free or Reduced–Price Certification Status (Percentage)	73.2	78.4	74.9	80.9	24.1	19.8
Sample Size	**221**	**229**	**66**	**85**	**243**	**221**

[a]The lowest income category (less than 130% of FPL) includes families categorically eligible for free meals (based on receipt of TANF or food stamps or foster child status), regardless of their actual income.

[b]Hispanic students were oversampled in Jamestown City to make the comparison sample more similar to the Dunkirk City pilot sample in terms of the percentage of students who were Hispanic.

FPL = federal poverty level.

TABLE X.4

HOUSEHOLD SIZE AND STRUCTURE, BY PILOT AND COMPARISON DISTRICT PAIR

	Mean Number of Household Members		Household Structure (Percentage of Households): Two-Parent Household		Single-Parent Household		Other Household Structure	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District
Up-Front Documentation								
District Pair 1	4.4	4.3	73.0	83.0	26.1	12.5	1.0	4.5
District Pair 2	4.5	4.1	76.2	78.7	22.6	19.5	1.2	1.9
District Pair 3	4.4	4.3	80.0	81.2	19.7	18.8	0.2	0.0
District Pair 4	4.3	4.2	83.5	81.1	16.5	18.6	0.0	0.3
District Pair 5	4.4	4.3	80.0	74.0	14.5	24.8	5.6	1.2
District Pair 6	4.2	4.3	66.4	73.3	32.3	26.3	1.3	0.4
District Pair 7	3.9	4.4	64.3	74.2	34.1	22.5	1.5	3.3
District Pair 8	3.7	4.7	62.0	70.8	38.1	28.5	0.0	0.7
District Pair 9	4.4	4.4	92.2	84.2	7.8	15.8	0.1	0.0
Overall for Up-Front Documentation Districts	4.2	4.3	75.3	77.8	23.5	20.8	1.2	1.4
Graduated Verification								
District Pair 1	4.5	4.4	78.1	85.5	21.7	14.2	0.2	0.3
District Pair 2	4.2	4.7	56.3	56.4	42.9	38.6	0.9	5.0
District Pair 3	4.3	4.4	67.5	71.6	30.8	26.5	1.7	1.9
Overall for Graduated Verification Districts	4.3	4.5	67.3	71.2	31.8	26.4	0.9	2.4

[a]Table uses a different designation than tables in Chapter IX and Tables X.9-X.16.

TABLE X.5

PARENT'S EDUCATION, BY PILOT AND COMPARISON DISTRICT PAIR
(Percentage of Sample)

	Lacks a High School Diploma		High School Diploma Only		Some Postsecondary But Lacks Degree		College Degree or More	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District
Up-Front Documentation								
District Pair 1	9.8	5.4	51.1	41.7	27.1	34.2	12.0	18.7
District Pair 2	8.8	11.1	45.7	36.4	30.2	21.0	15.4	31.6
District Pair 3	3.4	12.3	47.6	47.3	33.0	28.0	15.9	12.3
District Pair 4	4.2	6.6	34.6	27.8	27.4	29.7	33.8	35.9
District Pair 5	9.8	10.0	51.2	49.4	22.6	32.2	16.4	8.4
District Pair 6	9.7	17.1	55.7	45.8	23.7	24.9	11.0	12.2
District Pair 7	10.9	9.6	49.9	51.2	34.4	35.9	4.8	3.3
District Pair 8	1.5	10.1	6.7	26.5	22.0	42.6	69.8	20.8
District Pair 9	4.4	8.9	27.7	43.4	21.9	23.9	46.0	23.8
Overall for Up-Front Documentation Districts	7.0	10.1	41.1	41.1	26.9	30.3	25.0	18.6
Graduated Verification								
District Pair 1	4.8	6.1	19.6	23.6	53.0	55.8	22.6	14.5
District Pair 2	11.7	11.0	36.2	36.2	32.2	41.1	19.9	11.7
District Pair 3	22.3	18.3	33.5	40.4	33.1	25.3	11.1	16.1
Overall for Graduated Verification Districts	13.0	11.8	29.8	33.4	39.4	40.7	17.9	14.1

[a]Table uses a different district designation than tables in Chapter IX and Tables X.9-X.16.

TABLE X.6

HOUSEHOLD INCOME AS A PERCENTAGE OF FEDERAL POVERTY LEVEL, BY PILOT AND COMPARISON DISTRICT PAIR
(Percentage of Households)

	Less than 130%		131 to 185%		186 to 400%		More than 400%	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District
Up-Front Documentation								
District Pair 1	25.2	25.5	20.9	17.7	32.5	39.8	21.4	16.9
District Pair 2	21.5	18.9	12.6	14.9	37.5	40.0	28.5	26.3
District Pair 3	15.5	14.8	7.7	16.9	42.0	44.5	34.7	23.8
District Pair 4	17.2	14.1	10.2	10.2	39.2	31.3	33.5	44.5
District Pair 5	19.6	25.6	14.8	13.4	35.9	44.2	29.7	16.9
District Pair 6	35.5	31.5	13.2	14.2	34.3	30.2	17.0	24.0
District Pair 7	29.1	24.6	17.1	14.0	42.5	52.2	11.3	9.2
District Pair 8	3.9	18.8	5.3	7.5	27.5	46.5	63.3	27.2
District Pair 9	11.8	15.0	10.0	10.0	25.0	44.1	53.2	31.0
Overall for Up-Front Documentation Districts	19.9	21.0	12.4	13.2	35.2	41.4	32.5	24.4
Graduated Verification								
District Pair 1	15.9	10.4	16.4	14.7	45.0	47.0	22.8	28.0
District Pair 2	27.6	37.7	13.1	12.5	37.6	39.4	21.7	10.5
District Pair 3	45.0	39.3	18.2	15.8	24.8	30.4	12.0	14.5
Overall for Graduated Verification Districts	29.5	29.1	15.9	14.3	35.8	38.9	18.8	17.6

[a]Table uses a different district designation than tables in Chapter IX and Tables X.9-X.16.

TABLE X.7

RACE/ETHNICITY, BY PILOT AND COMPARISON DISTRICT PAIR
(Percentage of Students)

	White, Non-Hispanic		Black, Non-Hispanic		Hispanic		Other or Mixed Race	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District	Pilot District	Comparison District
Up-Front Documentation								
District Pair 1	98.0	87.0	0.0	2.1	0.0	0.0	2.0	11.0
District Pair 2	64.7	77.9	15.7	5.3	8.2	4.6	11.4	12.2
District Pair 3	85.4	94.1	5.2	1.1	0.7	3.1	8.7	1.7
District Pair 4	63.6	80.0	10.1	8.9	8.5	1.4	17.8	9.6
District Pair 5	95.1	92.4	0.0	2.0	0.0	1.2	4.9	4.5
District Pair 6	97.2	95.6	0.0	1.0	0.0	0.0	2.8	3.4
District Pair 7	93.0	99.7	0.0	0.0	0.0	0.2	7.0	0.2
District Pair 8	64.3	40.4	24.2	31.9	0.0	14.0	11.5	13.6
District Pair 9	89.1	93.2	5.5	2.2	0.1	0.3	5.3	4.4
Overall for Up-Front Documentation Districts	83.4	84.5	6.7	6.1	2.0	2.8	7.9	6.7
Graduated Verification								
District Pair 1	91.0	91.8	0.1	0.0	3.2	0.6	5.7	7.6
District Pair 2	41.3	19.4	50.7	68.9	4.5	3.3	3.5	8.4
District Pair 3	57.6	64.2	5.6	3.1	26.8	21.8	10.5	10.9
Overall for Graduated Verification Districts	63.3	58.5	18.8	24.0	11.5	8.6	6.4	9.0

[a]Table uses a different district designation than tables in Chapter IX and Tables X.9-X.16.

TABLE X.8

PRE-PILOT NSLP CERTIFICATION STATUS OF STUDENTS NOT DIRECTLY CERTIFIED, BY PILOT AND COMPARISON DISTRICT PAIR
(Percentage of Students)

	Certified Free or Reduced-Price		Not Certified	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District
Up-Front Documentation				
District Pair 1	38.9	18.7	61.1	81.3
District Pair 2	26.1	16.2	73.9	83.8
District Pair 3	14.1	23.3	85.9	76.7
District Pair 4	22.6	14.3	77.4	85.7
District Pair 5	15.8	32.6	84.2	67.4
District Pair 6	33.6	28.2	66.4	71.8
District Pair 7	41.0	25.1	59.1	74.9
District Pair 8	18.4	26.8	81.6	73.2
District Pair 9	9.9	9.3	90.1	90.7
Overall for Up-Front Documentation Districts	24.5	21.6	75.5	78.4
Graduated Verification				
District Pair 1	23.7	28.0	76.3	72.1
District Pair 2	35.0	49.3	65.0	50.7
District Pair 3	55.9	40.8	44.1	59.2
Overall for Graduated Verification Districts	38.2	39.3	61.8	60.7

[a]Table uses a different district designation than tables in Chapter IX and Tables X.9-X.16.

Documentation Pilot District #8 respondents (69.8 percent) had a degree. Up-Front Documentation Pilot District #8 households also had relatively high incomes (63.3 percent have incomes above 400% of poverty, compared to 32.5 on average across pilot sites). Graduated Verification District Pair #2 had high proportions of African-American families (50.7 in the pilot and 68.9 percent in the comparison), as did Up-Front Documentation District Pair #8 (24.2 in the pilot and 31.9 percent in the comparison). Graduated Verification District Pair #3 had high proportions of Hispanic families (26.8 in the pilot and 21.8 percent in the comparison). Up-Front Documentation District Pair #9 had low pre-pilot NSLP certification rates (9.9 percent in the pilot and 9.3 percent in the comparison), and Graduated Verification Pilot District #3 was the only site with a certification rate above 50 percent.

D. PRIMARY OUTCOMES FOR UP-FRONT DOCUMENTATION DISTRICTS, BY DISTRICT

This section presents tabulations of each main outcome reported in Chapter IV of Volume 1 for each pilot and comparison district in the Up-Front Documentation evaluation. Tables X.9-X.12 present mean outcomes by district, weighted to adjust for non-response.[5] Sample sizes by district are too small to draw valid conclusions about the district. Consequently, we have not presented standard errors of the estimates. The data are presented to allow the reader of Volume I to assess the variability of the findings at the district level.

E. PRIMARY OUTCOMES FOR GRADUATED VERIFICTION DISTRICTS, BY DISTRICT

This section presents tabulations of the main outcomes for each pilot and comparison district in the Graduated Verification Pilot demonstration. As with the corresponding estimates for the

[5]Thus the statistics presented are representative of the survey sample, which excluded directly certified students.

TABLE X.9

RATES OF CERTIFICATION AMONG STUDENTS INELIGIBLE FOR FREE OR REDUCED-PRICE MEALS IN UP-FRONT DOCUMENTATION PILOT AND COMPARISON DISTRICTS

	Free Certification Rate Among Students with Income >130% FPL (CD_1)[b]		Free or Reduced-Price Certification Rate Among Students with Income >185% FPL (CD_2)[b]	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District
UFD District Pair 1	1.1	5.3	1.3	6.4
UFD District Pair 2	12.7	4.2	8.5	3.1
UFD District Pair 3	5.4	3.5	7.6	1.7
UFD District Pair 4	2.0	1.5	2.7	1.9
UFD District Pair 5	2.0	1.1	2.2	0.5
UFD District Pair 6	5.6	4.2	7.9	2.8
UFD District Pair 7	0.6	6.8	0.7	7.7
UFD District Pair 8	0.7	4.7	1.0	6.3
UFD District Pair 9	1.0	4.1	1.9	5.6

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.10

RATES OF CERTIFICATION AMONG NON-DIRECTLY CERTIFIED STUDENTS
ELIGIBLE FOR FREE OR REDUCED-PRICE MEALS
IN UP-FRONT DOCUMENTATION PILOT AND COMPARISON DISTRICTS

	Free Certification Rate Among Students with Income ≤130% FPL and Not Directly Certified (CB_1a)[b]		Free or Reduced-Price Certification Rate Among Students with Income ≤185% FPL and Not Directly Certified (CB_3a)[b]	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District
UFD District Pair 1	39.6	71.2	28.8	65.0
UFD District Pair 2	70.2	55.4	63.5	52.5
UFD District Pair 3	27.9	42.0	42.4	41.7
UFD District Pair 4	38.7	62.8	37.5	51.0
UFD District Pair 5	69.4	50.9	65.4	43.8
UFD District Pair 6	68.5	58.8	62.8	52.5
UFD District Pair 7	41.7	58.5	24.4	60.5
UFD District Pair 8	23.1	24.1	19.7	30.6
UFD District Pair 9	46.5	61.0	37.4	56.8

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.11

ACCURACY RATES AMONG STUDENTS CERTIFIED FOR FREE OR REDUCED-PRICE MEALS AND NOT DIRECTLY CERTIFIED IN UP-FRONT DOCUMENTATION PILOT AND COMPARISON DISTRICTS

	Free Certification Accuracy Among Free Approved Non-Directly Certified Students (CA_1a)[b]		Not Over 185% FPL Among Free and Reduced-Price Approved Non-Directly Certified Students (CA_4a)[b]	
Site Pair[a]	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Estimates Excluding Directly Certified Students				
UFD District Pair 1	89.9	82.2	92.1	86.7
UFD District Pair 2	65.0	81.8	86.4	92.9
UFD District Pair 3	58.6	73.7	74.2	92.5
UFD District Pair 4	78.4	88.3	80.8	92.4
UFD District Pair 5	88.0	88.2	91.7	96.5
UFD District Pair 6	83.4	82.0	87.3	92.2
UFD District Pair 7	75.7	66.7	78.6	73.6
UFD District Pair 8	80.8	47.3	84.7	61.8
UFD District Pair 9	96.4	87.4	94.9	89.5

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.12

RATES OF TARGETING EFFICIENCY AMONG NON-DIRECTLY CERTIFIED STUDENTS IN UP-FRONT DOCUMENTATION
PILOT AND COMPARISON DISTRICTS

	Targeting Efficiency Measures Among Non-Directly Certified Students (CTE_3a)[b]	
Site Pair[a]	Pilot Districts	Comparison Districts
Estimates Excluding Directly Certified Students		
UFD District Pair 1	74.6	82.5
UFD District Pair 2	78.6	77.7
UFD District Pair 3	75.4	79.2
UFD District Pair 4	83.4	83.1
UFD District Pair 5	88.9	86.0
UFD District Pair 6	78.6	79.9
UFD District Pair 7	92.4	83.9
UFD District Pair 8	81.7	78.0
UFD District Pair 9	68.5	77.2

Note: Efficient targeting is defined as being correctly assigned to either the certified or non-certified group given household income. It is calculated as the percentage of students who are either (a) eligible for benefits and certified, or (b) not eligible for benefits and not certified.

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

Up-Front Documentation districts, sample sizes are not adequate to support district level analysis and standard errors of the estimates are not presented. Tables X.13-X.16 present weighted mean outcomes by district.

TABLE X.13

RATES OF CERTIFICATION AMONG STUDENTS INELIGIBLE FOR FREE OR REDUCED-PRICE MEALS IN GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS

	Free Certification Rate Among Students with Income >130% FPL (CD_1)[b]		Free or Reduced-Price Certification Rate Among Students with Income >185% FPL (CD_2)[b]	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District
GV District Pair 1	8.3	12.4	3.9	13.2
GV District Pair 2	7.2	7.0	6.7	10.5
GV District Pair 3	6.6	6.5	3.8	5.4

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.14

RATES OF CERTIFICATION AMONG STUDENTS ELIGIBLE FOR FREE OR REDUCED-PRICE MEALS IN GRADUATED VERIFICATION PILOT AND COMPARISON DISTRICTS

	Free Certification Rate Among Students with Income ≤130% FPL and Not Directly Certified (CB_1a)[b]		Free or Reduced-Price Certification Rate Among Students with Income ≤185% FPL and Not Directly Certified (CB_3a)[b]	
Site Pair[a]	Pilot District	Comparison District	Pilot District	Comparison District
GV District Pair 1	63.5	71.1	65.8	81.8
GV District Pair 2	66.0	65.9	66.8	62.3
GV District Pair 3	37.8	70.7	48.7	72.6

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.15

ACCURACY RATES AMONG STUDENTS CERTIFIED FOR FREE OR REDUCED-PRICE MEALS
IN GRADUATED VERIFICATION
PILOT AND COMPARISON DISTRICTS

	Free Certification Accuracy Among Free Approved Non-Directly Certified Students (CA_1a)[b]		Not Over 185% FPL Among Free and Reduced-Price Approved Non-Directly Certified Students (CA_4a)[b]	
Site Pair[a]	Pilot Districts	Comparison Districts	Pilot Districts	Comparison Districts
Estimates Excluding Directly Certified Students				
GV District Pair 1	74.5	77.7	92.0	86.2
GV District Pair 2	88.2	86.0	94.5	88.0
GV District Pair 3	52.1	55.5	85.9	81.7

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

TABLE X.16

RATES OF TARGETING EFFICIENCY AMONG CERTIFIED STUDENTS IN
GRADUATED VERIFICATION
PILOT AND COMPARISON DISTRICTS

	Targeting Efficiency Measures Among Non-Directly Certified Students (CTE_3a)[b]	
Site Pair[a]	Pilot Districts	Comparison Districts
Estimates Excluding Directly Certified Students		
GV District Pair 1	83.7	84.3
GV District Pair 2	76.5	74.5
GV District Pair 3	80.9	89.1

Note: Efficient targeting is defined as being correctly assigned to either the certified or non-certified group given household income. It is calculated as the percentage of students who are either (a) eligible for benefits and certified, or (b) not eligible for benefits and not certified.

[a]Common site pair designations are used in all tables in Chapters IX and Tables X.9-X.16.

[b]Definitions of measures are provided in Table II.2 of Volume I.

REFERENCES

Chromy, J.R. "Design Optimization with Multiple Objectives." Proceedings of the Section on Survey Research Methods of the American Statistical Association, 1987, pp. 194-199.