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**ABSTRACT**

Reported in this document are findings of a preliminary analysis of congressionally mandated changes in the application process for government-sponsored school meal benefits and an examination of low-cost quality assurance procedures implemented in Phase I of the Income Verification Pilot Project (IVPP). Discussion is based on an analysis of two of three data sources used to evaluate Phase I quality assurance procedures: (1) meal benefit program eligibility and participation records, and (2) abstracts of meal benefit applications. Six chapters respectively provide a review of the background and current status of Phase I; an analysis of the effects of congressionally mandated application changes and experimental quality assurance procedures on program eligibility and costs to the Federal government; an analysis of the effects of congressionally mandated application changes and experimental quality assurance procedures on meal benefit applications; a summary of findings; a discussion of implications of findings; and appendices describing the statistical methods used in estimating effects and providing sample meal benefit applications. (RH)

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INCOME VERIFICATION PILOT PROJECT  
(IVPP)

FINDINGS ON SCHOOL MEAL PROGRAM PARTICIPATION  
AND LEGISLATIVE IMPACT

1981-82 School Year

Pursuant to:

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## EXECUTIVE SUMMARY

This report presents preliminary findings from Phase I of "A Demonstration and Evaluation of Quality Assurance Procedures for the School Nutrition Programs." The project's mandate (contained in PL 97-35) is to develop and validate methods of preventing and detecting the misreporting of income and family size information on school meal benefit applications. The project is being conducted in two phases corresponding to the 1981-82 and 1982-83 school years. Each phase will test a different set of quality assurance procedures. Phase I of the project involves an experiment carried out in 13 School Food Authorities (SFAs) designed to (1) examine the effects of changes in the school meal application process mandated by PL 97-35, (2) assess the impact of two low-cost quality assurance procedures, and (3) discover reasons for applicant misreporting. Phase II, being conducted during the 1982-83 school year, will test more complex income documentation and verification procedures on a large sample of SFAs.

Analysis of the Phase I data has, to this point, been directed toward providing preliminary indications of the impact of Congressionally-mandated changes in the school meal application process and testing two quality assurance procedures. This is one of several reports on Phase I findings. A subsequent report will present findings from in-home audit interviews that were conducted in the spring of 1982 on a sample of program participants in the Phase I SFAs. The in-home audits assessed the completeness and veracity of income and family size information reported on applications, examined reasons for misreporting, and developed and validated a model that predicts characteristics of applicants who misreport (an "error-prone model"). The model is similar to models used by the IRS and other agencies for targeting audits and case reviews.

Phase I uses an experimental design which allows analysis of the effects within participating SFAs of the quality assurance procedures and changes in the application process. However, because the participating SFAs were not selected in a manner that assures that the sample is representative of all SFAs in the nation, no strong inferences can be made concerning the national impact of changes mandated by PL 97-35 or the two low-cost quality assurance procedures.

## Findings Associated with Application Changes

Three Congressionally-mandated changes in the application procedure were reviewed: removal of the free meal benefit guidelines from application materials; a new application form that requires a list of all adult household members with Social Security numbers and a detailed breakdown of income sources; and the elimination of hardship income deductions.

A 1980 study conducted by the USDA Inspector General's Office, which has responsibility for detecting and preventing fraud and abuse in FNS programs, concluded that a portion of applicants adjust their reported income on the basis of eligibility guidelines to assure themselves of meal benefits. An important change in the meal benefit application process mandated by PL 97-35 was that the application materials sent to parents include the reduced-price income eligibility guidelines only, and not the free-meal guidelines. Removal of free-meal benefit guidelines from application materials resulted in no discernible change in the percentage of program eligibles reporting incomes on or just under the free-meal eligibility cutoff point. In school year 1980-81, when free-meal benefit guidelines were included, 2.2 percent of free-meal benefit recipients reported annual incomes within \$200 or less of the free-meal eligibility cutoff point. For school year 1981-82, when the free-meal guidelines were removed from the application materials, the figure remained constant at 2.2 percent.

The new model application form for school year 1981-82, which requires Social Security numbers of all adults in the household and income by source, was shown to have a variety of effects on applicant income reporting, program participation, and program costs to the Federal government. Program reapplicants using the new application form reported an average annual increase in income more than \$500 greater than program reapplicants using the prior-year (1980-81) model USDA application form. This finding strongly suggests that the new application form has been at least partially successful in preventing income from being under-reported on meal benefit applications.

The number of eligibles approved to receive meal benefits was approximately 10 percent lower in schools using the new application form than in schools using the prior-year form. Similarly, reduced-price lunch eligibility was approximately 15 percent lower in new application schools than in prior-year application schools.<sup>1/</sup> The reduction in program eligibility associated with the new application form translates into lower program costs for the Federal government. In schools using the new application form, Federal lunch subsidies averaged 52.5 cents per student per day.

In contrast, the average daily per student subsidies were 56.8 cents for schools using the prior-year application form.<sup>2/</sup>

Another Congressionally-mandated change in the application procedure was the removal of allowable income deductions for special hardships when determining program eligibility. The special hardship deduction was removed in mid-school year 1980-81 following requirements of PL 96-499. The hardship income deductions were found to affect the eligibility status of less than 2 percent of program recipients for school year 1980-81 in the Phase I SFAs. Associated with elimination of the hardship deductions in school year 1981-82 was a slight decrease in overall number of program eligibles and a slight increase in the percentage of recipients reporting incomes on or near the reduced-price eligibility guideline.

#### Findings Associated with the Quality Assurance Procedures

The two quality assurance procedures were (1) a notice accompanying program benefit applications warning that a sample of applicants would be audited, and (2) a notice accompanying program benefit applications specifying in detail the sources of income to report and how to determine household size.

The quality assurance treatments, used in association with the new applications, had the same impact as the new application alone. However, they had no discoverable additional effect on applicant reporting behavior, program participation, or program costs in Phase I SFAs.

One of the Phase I sites, San Diego, did not adopt the new application form. As a result, the quality assurance procedures were used in conjunction with the prior-year form that did not require social security numbers or itemized income. In San Diego the quality assurance procedures (used in conjunction with the prior-year application) were associated with lower rates of program eligibility and lower Federal program costs. One hypothesis that may explain this finding is that the new application form is a stronger procedure than either of the quality assurance notices. Therefore, the notices may be effective when used with the prior-year application form, but have no additive effect when used with the new form.

#### Conclusions

While the new application form appears to have been at least partially successful in preventing income under-reporting and preventing ineligible individuals from obtaining program benefits, two major issues have not been addressed fully.

Findings to date do not distinguish between reductions in eligibility due to the prevention of fraud and abuse and reductions due to the new application creating barriers to participation by eligible individuals; nor do the findings determine how much of the problem of applicant misreporting remains.

The experience gained from conducting Phase I is being used to improve the design and execution of Phase II, with special emphasis on testing a variety of quality assurance measures, including requiring documentation with the application and follow-up verification procedures. Phase II will go beyond Phase I in several ways. Phase II will test and refine error-prone models of applicant misreporting to permit the cost-effective targeting of application verification efforts. Phase II will conduct cost-benefit analyses of quality assurance procedures and assess the burden these procedures may place on states and local SFAs. Finally, Phase II will distinguish between reductions in program participation due to a procedure preventing fraud and abuse and reductions in program participation due to a procedure creating barriers to participation by eligible individuals.

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#### NOTES

- 1/ An "eligible" student is defined as a student who has a current, completed and approved meal benefit application on file.
- 2/ Average daily student lunch subsidy was defined as the total Federal lunch program subsidy for a month divided both by the number of days in the month lunch was served and by the average daily attendance for the month.

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## OVERVIEW

This report presents findings from preliminary analysis addressing the impact of Congressionally-mandated changes in the school meal benefit application process and of the low-cost quality assurance procedures implemented in Phase I of the Income Verification Pilot Project (IVPP). The presentation is based on an analysis of two of the three data sources being used to evaluate the Phase I quality assurance procedures: meal benefit program eligibility and participation records and abstracts of meal benefit applications. Later analyses will enrich and extend the evaluation using in-home audit data obtained from applicants. The report is divided into six chapters:

- A review of the background and current status of Phase I of the IVPP project;
- An analysis of the effects of Congressionally-mandated application changes and experimental quality assurance procedures on program eligibility and program costs to the Federal government;
- An analysis of the effects of Congressionally-mandated application changes and experimental quality assurance procedures on meal benefit applications;
- A summary of findings to date;
- A discussion of the implications of the finds to date; and
- Appendices on the statistical methods used in estimating effects, and sample applications.

## BACKGROUND AND CURRENT STATUS OF PHASE I OF THE SNAP PROJECT.

FNS implemented two inexpensive low-burden quality assurance procedures for the free and reduced-price school meal application process on a trial basis during the 1981-82 school year. These procedures were: (1) a written warning to applicants that they might be audited, and (2) a guideline that identified income sources to be listed and described how family size should be reported on the application. In July of 1981, 13 school food authorities (SFAs) were recruited to participate as pilot sites in Phase I. Exhibit 2.1 lists the SFAs that volunteered to participate in Phase I of the project. Shortly thereafter (in August), PL 97-35 was enacted by Congress. PL 97-35 introduced significant changes in the application procedure for free and reduced-price school meals. USDA responded to PL 97-35 by introducing a new recommended application form shown in the Appendix B. This new application differed from previous applications in that it required the applicant to list total monthly family income by source (rather than total income only); and required the names and Social Security numbers of all adults. Although there was not sufficient time to publish regulations before the 1981-1982 school year, states responded by modifying existing application forms.

The Phase I study design was modified to include these legislated application changes. The result was the creation of as many as four different applications to be used by the Phase I pilot SFAs:

- (1) 1981-82 School Year Application only (Treatment Group 1). This application was similar to applications used by most SFAs throughout the country for the 1981-82 school year. It requires that the applicant list monthly family income by source and the Social Security number of each adult family member and provide other information needed to process the application.

**EXHIBIT 2.1: CHARACTERISTICS OF PHASE I SCHOOL FOOD AUTHORITIES**

SCHOOL FOOD AUTHORITY	URBAN/RURAL LOCATION	FNS REGION <sup>1/</sup>	ENROLLMENT SIZE (1978-79) <sup>2/</sup>	PERCENT MINORITY ENROLLMENT (1978-79) <sup>2/</sup>	FOCUS OF ELIGIBILITY DETERMINATION <sup>3/</sup>
<u>Non-Computerized School Food Authorities</u>					
Palm Beach, FLA	Urban	Southeast	20,723	36	Decentralized (School)
Lake County, FLA	Rural	Southeast	17,621	22	Decentralized (School)
Cokler County, FLA	Rural	Southeast	14,797	26	Decentralized (School)
Duval County, FLA	Urban	Southeast	105,971	36	Decentralized (School)
Isabella County, FLA	Mixed Urban and Rural	Southeast	41,652	81	Decentralized (School)
Syracuse, NY	Urban	Northeast	22,749	36	Centralized (SFA)
Utica, NY	Urban	Northeast	11,076	20	Centralized (SFA)
Lewiston, ME	Rural	Northeast	6,302	1	Centralized (SFA)
Lawrence, KS	Rural	Mountain Plains	7,346	11	Decentralized (School)
<u>Computerized School Food Authorities <sup>4/</sup></u>					
Akron, OH	Urban	Midwest	42,917	34	Decentralized (School)
Dayton, OH	Urban	Midwest	36,622	65	Decentralized (School)
Portland, ME	Urban	Northeast	9,901	2	Centralized (SFA)
San Diego, CA	Urban	West	115,007	79	Decentralized (School)

1/ There are seven FNS regions responsible for providing technical assistance to state agencies, monitoring the state agencies, and administering programs in private schools where state laws prohibit the state from doing so.

2/ Source: Office of Civil Rights, U.S. Department of Health and Human Services, 1980.

3/ The focus of eligibility determination refers to a place in the organizational structure of a school district that the application is reviewed and certified for free meals or reduced price meals or denied as ineligible.

4/ These districts utilize computers in some aspect of the application process -- either to actually determine eligibility or as a management information tool.

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- (2) 1981-82 School Year Application and Audit Warning (Treatment Group 2). This application was identical to the application described above. In addition, a warning was attached advising that a sample of applicants would be audited. This is the first of the inexpensive, low-burden quality assurance procedures pilot tested by the study. (Exhibit 2.2 is a copy of the warning notice.)
- (3) 1981-82 School Year Application and Income/Household Size Guideline (Treatment Group 3). Again the application was identical to that described in (1) above. In addition, guidelines were attached that specified income sources to be included on the application and the definition of the family size. This is the second inexpensive low-burden quality assurance procedure pilot tested in the study. (Exhibit 2.3 is a copy of the guideline notice.)
- (4) 1980-81 School Year Application (Treatment Group 4). The application used by treatment group 4 differed from that used by treatment groups 1, 2, and 3 in that it did not require Social Security numbers and an itemized breakdown of income. This application was identical to the application used in the 1980-81 school year with two exceptions: the hardship deduction was removed and only reduced-price eligibility guidelines were provided with the applications. (In past years applicants were provided with both free and reduced-price eligibility guidelines.)

The applications were then distributed and used in the fall of the 1981-82 school year in a sample of schools in each of the Phase I SFAs. In nine of the 13 SFAs that process applications manually (non-computerized sites), all four applications were used in a sample of elementary schools. Two elementary schools were assigned at random to each of the four treatment groups.

Four of the 13 SFAs use computers in some aspect of the free and reduced-price school meal application/certification process. Computerized form processing procedures made it necessary for these four districts to use only the 1981-82 school year applications. (The use of divergent application forms would have impeded their certification process.) Therefore all schools in the computerized districts were assigned to one of the three groups that used the 1981-82 applications. As a result, the 1981-82 Application only, the 1981-82 Application/Warning, or the 1981-82 Application Guideline were distributed to all elementary and secondary students.

Due to real world constraints, it was not possible to implement the treatments uniformly in all Phase I SFAs. The treatments as implemented in the computerized SFAs varied significantly from the non-computerized SFAs. In the computerized SFAs all schools in the district participated in the project; in the non-computerized SFAs, eight elementary schools per district were selected to participate. One computerized SFA, San Diego, introduced several changes in the study procedures.



NOTICE TO APPLICANTS

PLEASE FILL OUT THE ATTACHED APPLICATION FORM VERY CAREFULLY. DURING THE COMING SCHOOL YEAR WE WILL CHECK SOME OF THE APPLICATIONS. YOUR APPLICATION MAY BE REVIEWED. WE WILL CHECK THE CORRECTNESS OF FAMILY INCOME AND FAMILY SIZE INFORMATION THAT WAS REPORTED ON THE APPLICATION. YOU MAY BE CALLED FOR A HOME INTERVIEW TO REVIEW YOUR APPLICATION.

NOTICE TO APPLICANTS

THE ATTACHED APPLICATION FORM ASKS YOU TO REPORT YOUR FAMILY INCOME AND THE NUMBER OF PERSONS IN YOUR FAMILY. WHEN YOU REPORT THIS INFORMATION, PLEASE PAY CAREFUL ATTENTION TO THESE HELPFUL GUIDELINES:

FAMILY INCOME

YOU MUST REPORT income for you and all other members of your family. Income from the following sources should be included:

- wages, salaries, tips, commissions, or income from self-employment
- net farm income
- pensions, annuities, or other retirement income including Social Security retirement benefits
- public assistance and welfare payments (AFDC)
- unemployment compensation
- Supplemental Security Income (SSI) or Social Security Survivor's Benefits
- alimony or child support payments
- disability benefits, including workmen's compensation
- veteran's subsistence benefits
- interest or dividend income
- cash withdrawn from savings, investments, trusts and other resources, which would be available to pay for a child's meals
- other cash income

DO NOT REPORT:

- scholarships or other educational benefits
- food stamps

FAMILY SIZE

You should count in your family any person, related or unrelated, who lives in your household and who shares household expenses or meals.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL YOUR CHILD'S SCHOOL PRINCIPAL.

San Diego did not approve the use of in-home audits and used a noncomparable application form that does not require Social Security numbers, a listing of adult household members, or detailed income sources. Another computerized SFA, Dayton, assigned schools to treatment groups in a nonrandom fashion so that two treatment groups consisted almost exclusively of public elementary schools while the third treatment group consisted of public high schools, private religious schools, and special education public schools. Dayton also modified study procedures by using an application requiring employer name and address, a second application with an audit warning notice, and a third application containing income and household size guidelines.

Phase I SFAs volunteered to participate in the study and were not selected randomly. Therefore, the sample is not necessarily representative of all SFAs in the nation. No strong inferences concerning the national impact of the new application form on the school meal program can be made from Phase I of the IVPP project.

To test the effects of the new application form and the quality assurance procedures on the participating SFAs, three data collection efforts were planned. First, for participating schools in the nine non-computerized SFAs, meal benefit applications for the 1980-81 and 1981-82 school years were abstracted and matched across the two school years. For all applications, date of application, income by source, and reported family size were recorded. In total, over 35,000 applications were abstracted. Once abstracted, the data were keyed, verified, structured into a common form across SFAs, aggregated to the school level, and converted to a computer analysis file. The application data allows an assessment of the impact of the quality assurance treatments on who applies for benefits and what they report on their applications. Analysis of the application abstract data is reported in Section 4 of this paper.

The second data collection effort involved meal benefits program eligibility and participation records. To test the effects of the new application and the quality assurance procedures on aggregate program participation, the following data were collected for the months of November 1980 and November 1981 from all participating schools in the 13 Phase I SFAs:

- number of complete operating days for breakfast and lunch service;
- number of full price, reduced-price, and free breakfasts served;
- number of complete full price, reduced-price, and free lunches served;

- average daily attendance or average daily membership;
- total number of students certified for free meal benefits and total number of students certified for reduced-price meal benefits.

Once collected, the data were keyed, verified, and converted into a computer analysis file. The analysis was conducted in two stages: variable and model specification and testing; and model computation and interpretation. Sections 4 and 5 present the results of these analyses.

The third data collection effort is in-home audits with a sample of program participants in participating SFAs. The audits are currently being analyzed with an expected completion date in December, 1982. The in-home audits will assess the completeness and veracity of income and family size information reported on applications, examine reasons for misreporting, and develop and validate a model that predicts characteristics of applicants who misreport (an "error-prone model"). Findings from the in-home audits will be the subject of a later report.

**EFFECTS OF THE NEW APPLICATION FORM AND EXPERIMENTAL  
QUALITY ASSURANCE PROCEDURES ON PROGRAM ELIGIBILITY,  
PARTICIPATION, AND COSTS TO THE FEDERAL GOVERNMENT**

This section describes the preliminary findings of an analysis of Phase I SFA program eligibility and participation records. There are three subsections:

- 3.1 The conceptual model used to analyze the program eligibility and participation data;
- 3.2 The effects of the new application form and experimental quality assurance procedures on program eligibility and participation; and
- 3.3 The effects of the new application form and experimental quality assurance procedures on program costs to the Federal government.

**3.1 The Conceptual Model**

The purpose of the school meal application process is to make program benefits accessible to eligible individuals and to deny access to ineligible individuals. The Phase I quality assurance treatments and Congressionally-mandated application changes were designed to deter applicants from misreporting information used to determine program eligibility. If the procedures are effective, they can be expected to reduce the total number of eligibles certified for the program and program participants. In fact, the Office of the Inspector General estimated that in school year 1979-80, 28.9 percent of all approved free and reduced-price school meal applications were sufficiently in error to alter true eligibility. If this estimate is correct, the potential for reductions in program participation and Federal costs are considerable.

Although an effective quality assurance procedure will reduce total program participation, a reduction in program participation associated with a quality assurance procedure does not necessarily prove that the procedure has deterred ineligible applicants from applying or misreporting their eligibility status. The procedure may instead act as a barrier to eligible individuals--a barrier that prevents them from applying or motivates them to under-report their true eligibility

status when applying. Both the barrier and deterrence effects of quality assurance procedures reduce overall program participation. That is, reduction in program participation associated with a quality assurance procedure is the sum of barrier and deterrence effects.<sup>1/</sup> Because of this, the inferences possible about effectiveness of the Phase I experimental quality assurance procedures on the basis of aggregate program participation data are asymmetrical--no reduction in program participation is strong evidence of treatment ineffectiveness, whereas a reduction in program participation is not direct evidence of significant deterrence effects.<sup>2/</sup>

In contrast, aggregate program participation data does provide strong direct evidence of cost savings associated with the quality assurance procedures. Because the Federal government reimburses SFAs a fixed amount by benefit category per meal served, any reduction in number of meals served has an associated cost savings. Although it is desirable to maximize savings from deterrence and minimize savings from barriers, total savings associated with a treatment derive from the sum of barrier and deterrence effects and are unaffected by the relative contribution of barrier and deterrence effects. As a result, aggregate program participation data can be used to estimate cost savings arising from the experimental treatment and new application form.

### 3.2 Effects of the New Application Form and Experimental Quality Assurance Procedures on Program Participation

Effects of the new application form and quality assurance procedures were estimated through tests of three a priori hypotheses:

1. Program participation in the schools employing the new application form is lower than in schools employing prior-year forms.
2. Program participation in schools using both the new application form with either the warning notice or the income guideline is lower than in schools using only the new application form.
3. Program participation for schools using the warning notice is unequal to participation in schools using the income guideline notice.

The first hypothesis tests whether the new application form affected program participation. The second hypothesis tests whether the income guideline notice or warning notice had any additional effect on participation over and beyond effects of the new application form. The third hypothesis tests whether one or the other of the two notices had a greater effect on program participation.

All three hypotheses were independently tested to determine treatment effects in the nine non-computerized Phase I SFAs for each of six participation categories

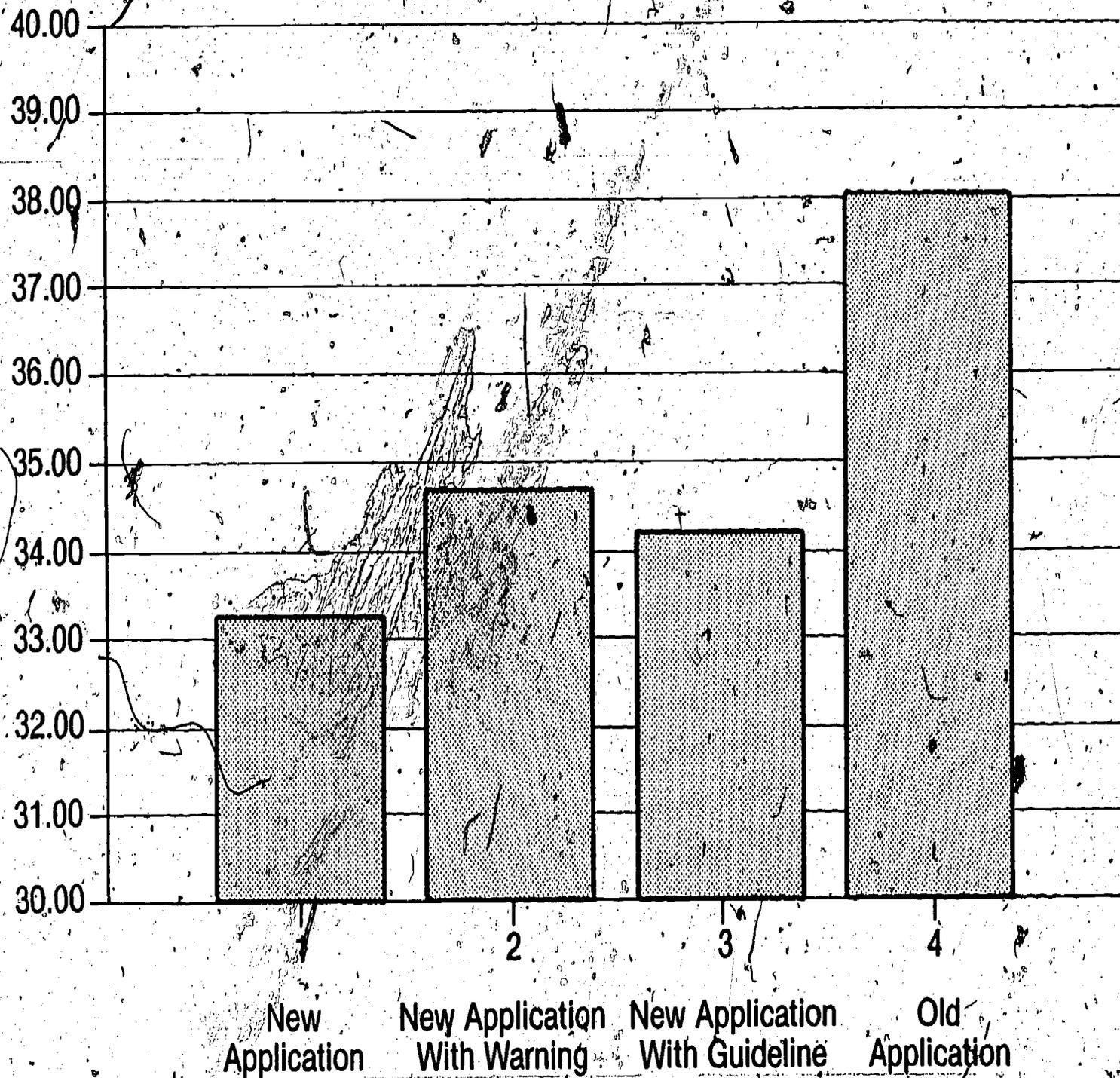
in November 1981: free lunch, reduced-price lunch, full price lunch, free breakfast, reduced-price breakfast, and full price breakfast. Rate of program participation was defined for the Income Verification Pilot Project as the proportion of average daily enrollment receiving lunch or breakfast benefits. It should be noted that this definition of program participation differs from others used by previous research. For instance, program participation has been defined in the National Evaluation of the School Nutrition Programs as the percent of eligibles regardless of whether they have an application on file.

The most substantively and statistically significant impact of the new application form and experimental treatments was discovered to be on participation in free-lunch benefits. This was not unexpected because free lunches represent the largest of the six benefit categories and therefore is the category in which treatment effects could be most easily detected.

As noted above, three hypotheses were tested. First, participation data for schools using the old application form were contrasted with participation data for schools using the new application form. This contrast allowed estimation of the effects of adding Social Security numbers, income sources, and a listing of adult household members to the application form. Once adjustments were made for the rate of program participation in the prior year, the average free lunch participation rate was approximately 38 percent for schools employing the prior-year application form and 34 percent for schools employing the new application form.<sup>3/</sup> Stated differently in the Phase I non-computerized sites, the new application form was associated with a reduction of approximately 10 percent in the number of free lunches served ( $100 \times (1 - 34/38)$ ).<sup>4/</sup> (A difference of this magnitude has a probability of having occurred by chance of less than one in a thousand. We can represent this fact by the equation  $p < .001$ .) This stage of the analysis found no significant interaction between SFA and effect of application form. That is, the impact of the new application form was nearly constant across SFAs except for random sampling variance.

Tests of the second and third hypotheses could uncover no additional impact of the quality assurance procedures on program participation in free lunches beyond the effects of the new application form. Exhibit 3.1 summarizes the findings. As can be seen, all three experimental groups using the new application form had lower than average daily percentages of students receiving free lunches than did schools using the prior-year application form. However, the groups using the experimental

# EXHIBIT 3.1: FREE LUNCH PARTICIPATION IN NON-COMPUTERIZED SFAs BY TREATMENT GROUP\*



Average Daily Percent of Students Receiving A Free Lunch (Controlling for Prior Year Participation)

\*Participation is defined as the proportion of children receiving free lunches relative to school enrollment, not as the proportion of eligibles receiving benefits.

quality assurance procedures have only minor differences in participation rate from the group using only the new application form. Moreover, the direction of the difference in participation rate is the opposite of that hypothesized; the participation rates were higher in the quality assurance treatment groups.

Identical analyses were conducted for the remaining five program benefit categories: reduced-price lunch, full price lunch, free breakfast, reduced-price breakfast, and full price breakfast. In only one case were any of the three hypotheses confirmed at a level of statistical significance of .05. The one case was program participation in reduced-price lunches. After adjusting for 1980 program participation, an average reduced-price lunch participation rate of 6.8 percent was found for schools using the prior-year application form and a 5.8 percent participation rate for schools using the new application form ( $p < .05$ ). As was the case in free lunch participation analysis, no additional effect was discovered for the experimental quality assurance procedures. No significant treatment differences were found for the remaining four categories of program participation: full price lunch, free breakfast, reduced-price breakfast, and full price breakfast.

It is not surprising that no treatment effects were discovered in the school breakfast program. Less than half of the Phase I schools are in the breakfast program and in those schools breakfast program participation averages 25 percent, less than lunch program participation. As a result, treatment effects in the breakfast program would have had to have been much larger than those found in the lunch program to be detectable by the Phase I experimental design. Therefore it would be false to conclude that the new application affected participation in the lunch program and not the breakfast program. The most that can be concluded is that the effects were only detectable for the lunch program.

The analysis of participation data conducted for the nine non-computerized SFAs was independently replicated in two of the four computerized SFAs.<sup>5/</sup> In Akron, the one computerized SFA that fully implemented the new application form and the two quality assurance procedures, no differential effects of the procedures on program participation were discoverable. Therefore the Akron analysis repeated the findings from the nine non-computerized SFAs. (It is important to remember that group 4—prior-year form—was not implemented in the computerized SFAs, therefore comparisons of new form and prior-year form schools could not be conducted.) However, in San Diego, significant differences were discovered in program participation rates across the treatment groups.

As noted above, San Diego did not use the new Federally recommended application form in any of the three treatment/groups. The three treatments as implemented in San Diego are:

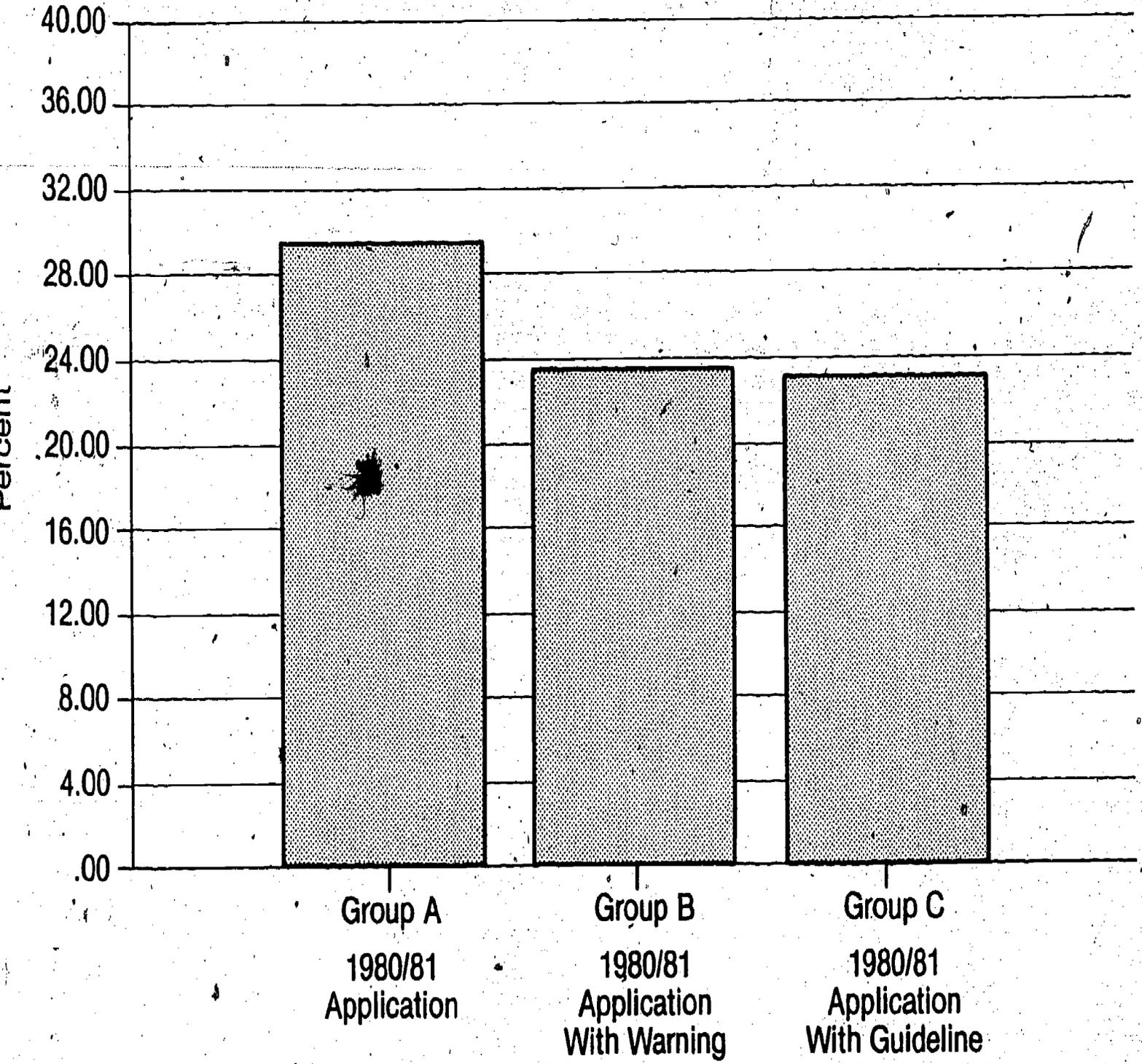
- (A) 1980-81 School Year Application (Treatment Group A). This application required only total monthly income and total number of household members. It did not require a listing of family income by source, the Social Security number of each adult family member, or a listing of all adult family members.
- (B) 1980-82 School Year Application and Audit Warning (Treatment Group B). This application is identical to the application described above. In addition, a warning was attached advising that a sample of applicants would be contacted by telephone to verify reporting income information.
- (C) 1980-81 School Year Application and Income/Household Size Guideline (Treatment Group C). Again the application is identical to that described in (A) above. In addition, a guideline was attached specifying in detail income sources to report and the definition of household size.

In summary, San Diego implemented the quality assurance procedures in conjunction with the prior-year application form rather than in conjunction with the new Federally recommended form. Therefore San Diego created an opportunity to test the effects of the quality assurance treatments as separated from the new application.

Analysis of San Diego school lunch program participation records showed a significantly lower rate of participation in free lunches in treatment groups B and C than treatment group A ( $p < .01$ ). Exhibit 3.2 graphically presents this finding. As can be seen, the warning notice and the income guideline notice appear to have had equal and substantial effects on free lunch participation. Average free lunch participation in schools using only the prior-year form (group A) was approximately 30 percent, whereas average participation for schools using either the warning or income guideline notice was slightly under 24 percent. No interaction was found between school type—elementary, junior high, high school, or special education—and treatment group effect. That is, the effects of the warning and guideline notices were nearly identical for the four types of schools except for small random differences.<sup>6/</sup>

This finding raises the question of why the experimental quality assurance procedures affected program participation in San Diego but not in any of the other Phase I SFAs. One possible explanation is that the new Federally recommended application form that requires income sources and Social Security numbers is a

# EXHIBIT 3.2: SAN DIEGO FREE LUNCH PARTICIPATION BY TREATMENT GROUP\*



 Average Daily Percent of Students Receiving a Free Lunch (Controlling for Prior Year Participation)

\* Participation is defined as the proportion of children receiving free lunches relative to school enrollment, not as the proportion of eligibles receiving benefits.

stronger treatment than the experimental quality assurance notices and therefore the notices are effective when used with the old application form but have no additive effect when used with the new form. At this time, available evidence is insufficient to regard this explanation as anything more than a working hypothesis.

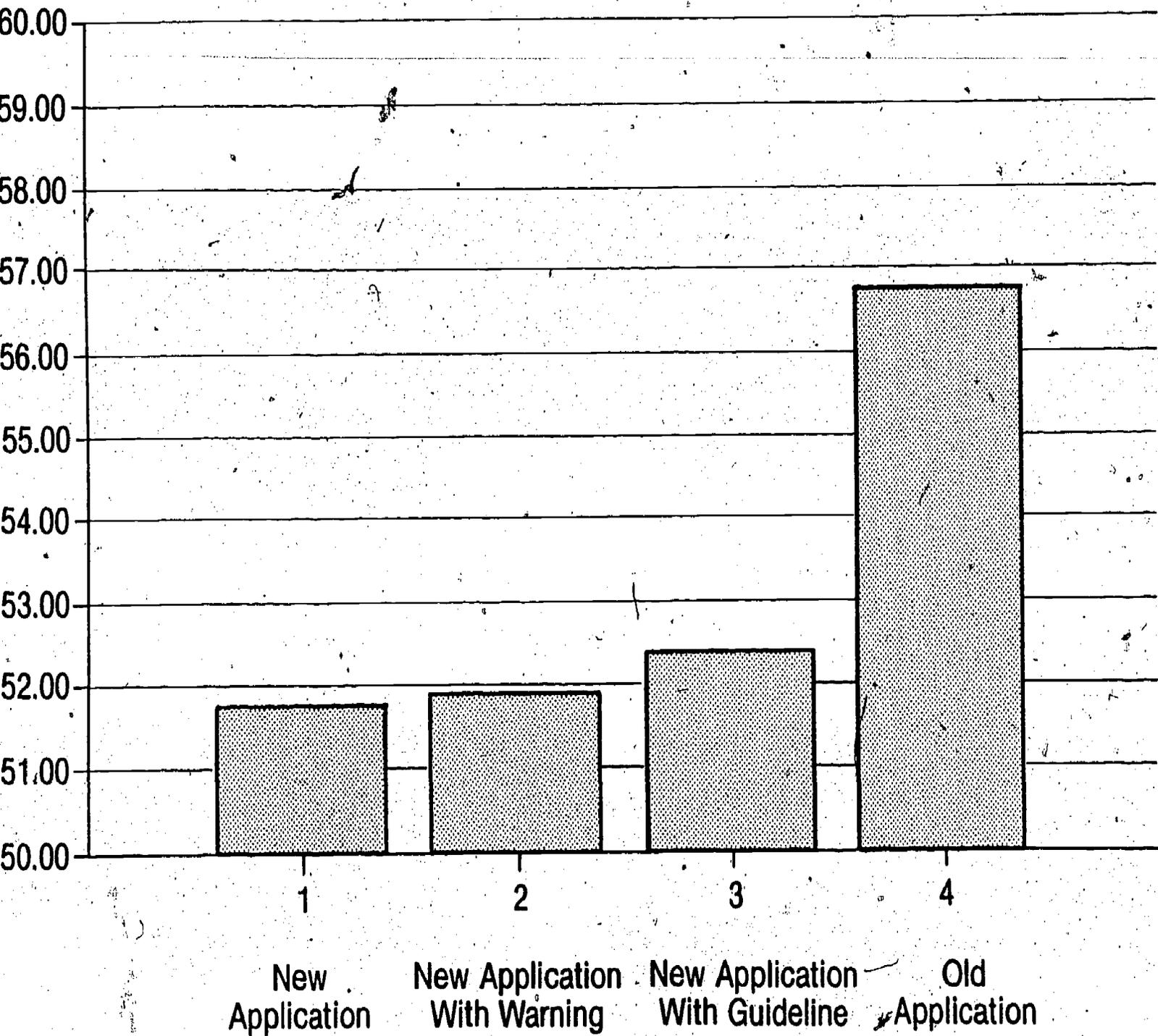
### 3.3 Effects of the New Application Form and Experimental Quality Assurance Procedures on Program Costs to the Federal Government

The Federal government reimburses SFAs fixed amounts per meal served by program category. For example, the Federal subsidy for reduced-price breakfasts is currently 28.5 cents. Because the Federal government subsidizes individual school meals at a fixed rate, reductions in program participation translate directly into cost savings for the Federal government.<sup>7/</sup>

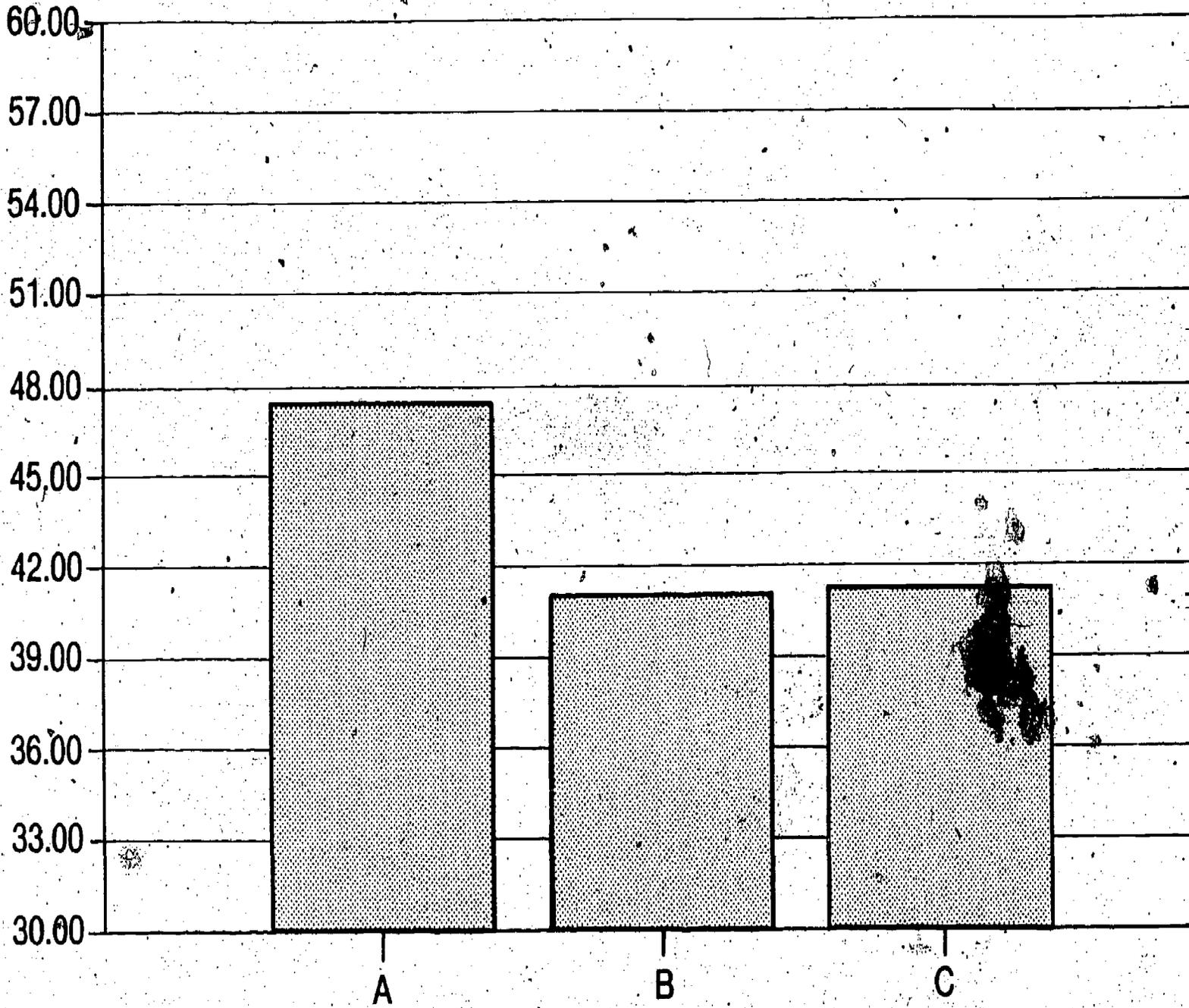
The last stage of our analysis of the Phase I program participation records translated participation data into subsidy costs for the Federal government. The basic unit of the analysis was "average program costs per student per day."<sup>8/</sup> Exhibit 3.3 presents the results. The Federal government spent an average of 56.8 cents per student day for the lunch program in schools using the prior-year application form versus an average of 52.5 cents per day for schools using the new application form ( $p < .0005$ ). Although there were small differences in average daily costs among the three groups using the new application form, these differences were statistically insignificant and in the opposite direction than expected. (The experimental quality assurance procedures were expected to decrease, not increase program costs.) No meaningful differences could be found by contrasting the four groups in terms of average daily costs of the breakfast program (See Appendix A.).

In the computerized SFAs, findings from the analysis of program costs paralleled the findings for program participation. In Akron, no effect of the quality assurance procedures was discovered. In San Diego, average daily lunch program costs for schools using either the warning notice or the income guidelines were lower than in schools using only the prior-year application form ( $p < .05$ ). Average daily lunch program subsidies were 47.5 cents for schools in Group A (1980/81 application form), 41.1 cents for Group B (1980-81 application form with warning notice), and 41.4 cents for Group C (1980-81 application form with income guidelines). Therefore in San Diego the quality assurance procedures were associated with program cost savings. As this finding is limited to a single SFA, generalization is not possible. Exhibit 3.4 shows these results.

# EXHIBIT 3.3: AVERAGE DAILY LUNCH PROGRAM FEDERAL REIMBURSEMENTS PER STUDENT BY TREATMENT GROUP (NONCOMPUTERIZED PHASE I SFAs)



# EXHIBIT 3.4: AVERAGE DAILY LUNCH PROGRAM FEDERAL REIMBURSEMENTS PER STUDENT BY TREATMENT GROUP IN SAN DIEGO



Old Application

Old Application With Warning

Old Application With Guideline

## NOTES

- 1/ Changes in rates of program participation can, of course, result from many different sources, including changes in eligibility guidelines, price changes, demographic changes, and so on. The great advantage of the experimental design used in the Phase I evaluation is that it allows identification of the unique effects of experimental quality assurance procedures employed in the treatment groups. That is, the experimental model permits the evaluation to account for changes that might naturally affect program participation. Therefore in this report, reference to the impact of quality assurance procedures on program participation are to the experimentally determined unique effects over and beyond any impact of prices, guideline changes, etc.
- 2/ In the abstract, a second possible interpretation exists. Deterrence effects may be positive and barrier effects negative and sum to little or no impact on total program participation. This outcome is very unlikely on both theoretical and empirical grounds, however. Empirically, such "suppressor" effects are very rare in quality assurance research. Barrier and deterrence effects are generally strong and positively correlated. In this particular case there is nothing in the experimental treatments that could be reasonably expected to increase the application rates of eligible individuals and thereby result in negative barrier effects.
- 3/ Free lunch participation rate for a school was operationalized as  $F/(E \times D)$  where F is the total number of free lunches served in November 1981, E is the total enrollment, and D is number of days lunch was served.
- 4/ Again, it should be noted that this difference is over and beyond any effects on participation caused by other factors such as price and guideline changes.
- 5/ Results for two computerized SFAs have not been presented. In one SFA, the number of schools was too small. In the second SFA, schools were not assigned to treatments randomly.
- 6/ Analysis of experimental treatment effects in San Diego was limited to a review of program participation records. Applications were not abstracted in the computerized SFAs.
- 7/ Average Federal reimbursements (including Federal lunch commodity donations valued at 11¢ per meal) for the period September 1, 1981 to June 30, 1982 were: Free lunch—\$1.2025, Reduced-price lunch—\$0.8025, Full-price lunch— \$0.215, Free breakfast—\$0.57, Reduced-price breakfast—\$0.285 and Full-price breakfast—\$0.0825.

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NOTES (Continued)

8/ Average daily Federal reimbursements per participant were separately defined for the lunch and breakfast programs. For the lunch program, average daily Federal reimbursements for a given school were operationalized as:

$$(F \times 1.2025 + R \times .8025 + P \times .215)/(E \times D)$$

where:

F is the total number of free lunches served in November 1981;

R is the total number of reduced-price lunches served in November 1981;

P is the total number of full price (paid) lunches served in November 1981;

E is total enrollment; and

D is number of days lunch was served.

Average daily costs of the breakfast program were defined as:

$$(F \times .57 + R \times .285 + P \times .0825)/(E \times D)$$

where F, R, P, and D were defined so as to refer to the breakfast program.

## EFFECTS OF THE EXPERIMENTAL QUALITY ASSURANCE TREATMENTS AND PL 97-35 MANDATED CHANGES ON MEAL BENEFIT APPLICATIONS

This section presents the findings from analyses of the meal benefit applications in the nine non-computerized Phase I SFAs. The analysis addresses four topics:

- 4.1 The effects of removing free meal income eligibility guidelines from applications materials sent to parents;
- 4.2 The effects of the new application form;
- 4.3 The effects of eliminating the hardship income deduction;
- 4.4 The effects of the experimental quality assurance procedures.

### 4.1 Elimination of Free Meal Eligibility Guidelines from Application Materials

An important change in the meal benefit application process mandated by PL 97-35 was that the application materials sent to parents include the reduced-price income eligibility guidelines only and not the free meal guidelines. This change was made following a nationwide study conducted by the USDA Inspector General in 1980 to investigate allegations that a number of applicants refer to income eligibility guidelines and adjust their reported incomes to assure themselves of meal benefits. The study concluded that in approximately 3 percent of the 5,000 applications examined, households may have used the income guidelines provided with the application form to derive their reported family income.

As a preliminary and partial test of the effects of the elimination of the free meal guidelines from application materials, a comparison was made of the percentage of free meal benefit eligibles who reported an annual income within \$200 of the free meal eligibility cutoff point in school year 1980-81 (when free and reduced price meal guidelines were supplied with applications) with the percentage of free meal eligibles who reported an annual income within \$200 of the free meal

eligibility cutoff point in school year 1981-82 (when free meal guidelines were not supplied with applications).<sup>1/</sup> For school year 1980-81, 2.2 percent of free meal benefit eligibles reported an annual income on or less than \$200 under the free meal eligibility cutoff point. For school year 1981-82, the figure remained constant at 2.2 percent, therefore the analysis was unable to detect any effect of removal of the free meal guidelines on the proportion of applicants who reported incomes on or very near the cutoff point in the free meal eligibility guidelines.<sup>2/</sup>

#### 4.2 Effect of the New Application Form

In response to PL 97-35, the Department designed a new recommended meal benefit application form. The new form differed from the previously recommended form in two substantive ways. The new model form:

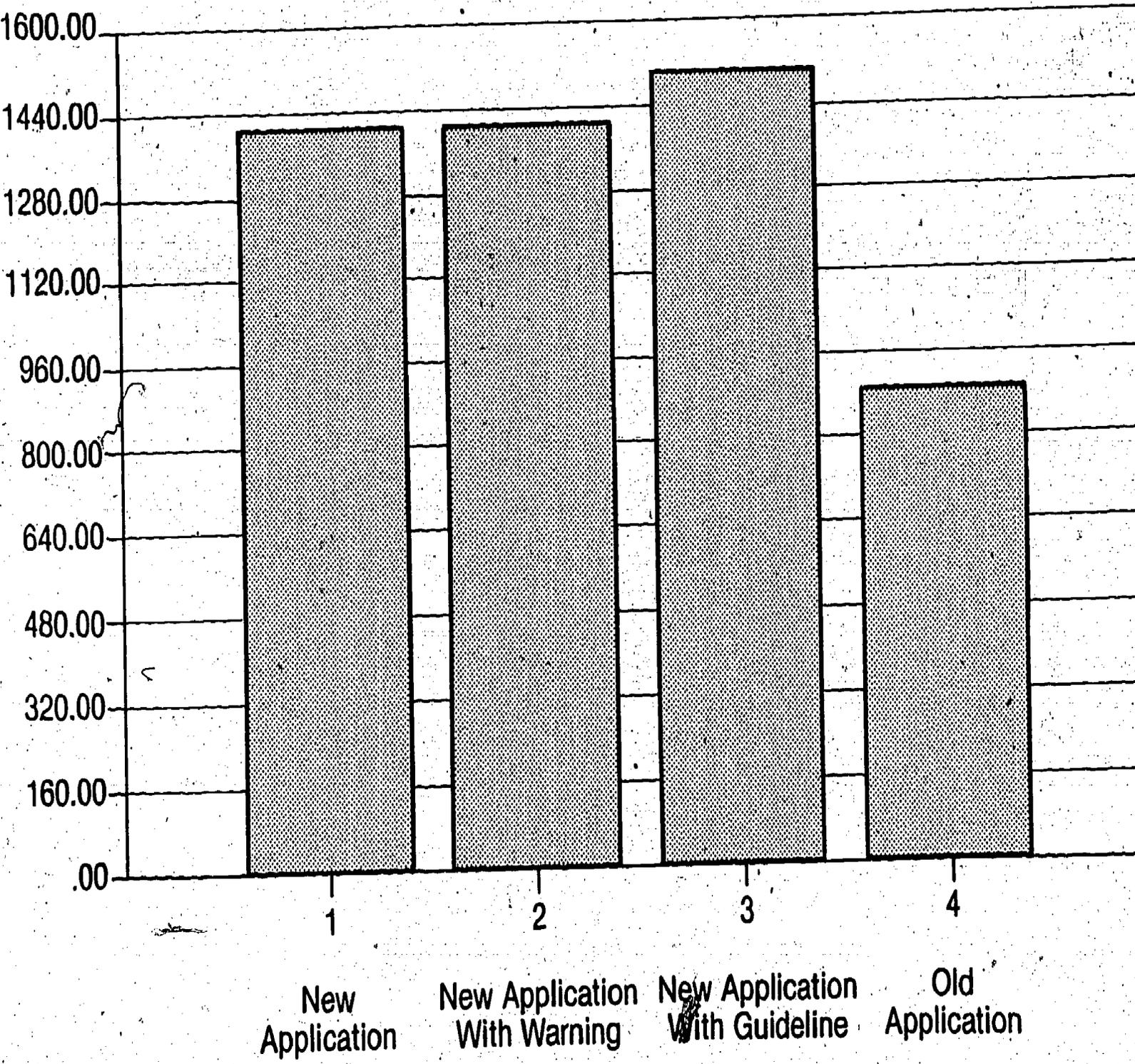
- required the names and Social Security numbers of all adult household members;
- required a reporting of income by sources.

The changes in the application form were motivated, in part, from results of a second study by the Office of the Inspector General in 1981. This study concluded that 28.9 percent of a sample of meal benefit applications contained under-reported income, which resulted in students receiving meal benefits that they were not entitled to receive.

If the new application form achieved its purpose of reducing the under-reporting of income, it is reasonable to expect that school year 1980-81 program eligibles who reapplied for benefits in school year 1981-82 using the new application form would report a higher average increase in income than those who reapplied using the old application form.<sup>3/</sup>

To test this expectation, a comparison was made of the average change in reported income for the three Phase I treatment groups using the new application form with average change in reported income for treatment group 4 that used the prior-year application form.<sup>4/</sup> Exhibit 4.1 displays the results of this analysis and shows that, on the average, in schools where the new application form was used, program reapplicants reported a mean increase in income of approximately \$1,450. This contrasts with a mean increase of only \$900 for schools using the prior-year application form.<sup>5/</sup> Therefore it appears that the new application form has been at least partially successful in preventing the under-reporting of income on meal benefit applications.

# EXHIBIT 4.1: AVERAGE INCREASE IN REPORTED ANNUAL INCOME FOR PROGRAM REAPPLICANTS BY TREATMENT GROUP (NONCOMPUTERIZED PHASE I SFAs)



A comparison was also made of the three treatment groups using the new form with the fourth group that used the prior-year form, in terms of reapplication rate,<sup>6/</sup> percentage of applicants reporting incomes on or near the eligibility cutoff point, change in reported family size, and percentage of total school enrollment certified to receive program benefits.

Average change in reported family size was compared across treatment groups to determine whether the new application prevented or reduced the over-reporting of the number of family members. The percentage of applicants reporting incomes on or near the free and reduced-price eligibility cutoff points was compared to determine whether the new application had deterred applicants from adjusting their reported incomes on the basis of eligibility guidelines. To evaluate the effects of the new application on application and reapplication rates, these two variables were compared across the treatment groups. None of these contrasts revealed any substantively or statistically significant differences between schools using the old application form and schools using the new application form. That is, the new application had no discoverable effects on family size reporting, program reapplication rates, "threshold" income reporting, or total application rate.

A word of caution is necessary here. The lack of findings should not be interpreted as indicating the new application form had no effect on reapplication rate, reported family size, total application rate, or reporting of income near the eligibility threshold. The most that can be reasonably inferred is that if the new application form did affect these variables, the effect was not of a magnitude detectable by the experimental design employed in Phase I. Because of the small number of schools per treatment group (18) and the substantial random variance between schools on all variables of interest, the possibility must remain open that the new application form has generated important although undetected effects on applicant behavior.

#### 4.3 Elimination of Hardship Income Deduction

Another Congressionally-mandated change in the application procedure was the removal of allowable income deductions for special hardships when determining program eligibility. The hardship deduction was removed in mid-school year 1980-81 following requirements of PL 96-499. School year 1980-81 data was composed of applications filed prior to this change. To assess the impact of the removal of the hardship deductions, a two-stage analysis was conducted. First, a measurement was taken of the effect of hardship deductions on program eligibility and participation in

1980 when the deductions were still allowable. Second, an analysis was conducted of the effects of the removal of the deductions on program participation and meal benefit applications in 1981.

The hardship deduction affected the program eligibility of relatively few of meal benefit eligibles in the participating Phase I SFAs in 1980. Only 1.6 percent of all free meal benefit eligibles would have been ineligible for free meals if it were not for the hardship deductions. Similarly, only 1.5 percent of all reduced-price meal benefit eligibles would have been ineligible without the hardship deductions.

Elimination of the hardship deduction appears to have resulted in a small reduction in overall program eligibility in 1981. This reduction was observed by a negative correlation between the percentage of program participants in a school benefiting from the hardship deduction in 1980 and the average daily percentage of students receiving meal benefits in the school in 1981 ( $r = -.35, p < .005$ ).<sup>7/</sup>

There was also a statistically significant and positive relationship between the percentage of applicants in a school who benefited from the hardship deduction in 1980 and the percentage of applicants who in 1981 reported a change in income or family size that positively affected their eligibility status ( $r = .25, p < .05$ ). One possible interpretation of this finding is that the elimination of the hardship deduction may have resulted in a number of individuals under-reporting their income in 1981 to retain program benefits. This interpretation is supported by the discovery of a positive correlation between the percentage of applicants in a school who benefited from the hardship deduction in 1980 and the percentage who, in 1981, reported an annual income on or within \$200 of the yearly reduced-price eligibility guidelines ( $r = .28, p < .02$ ). Therefore it would appear that some of the beneficiaries of the hardship deduction in 1980 lowered their reported income in 1981 to continue receiving program benefits.<sup>8/</sup>

#### 4.4 Experimental Quality Assurance Procedures

The last step in the analysis of the Phase I school application data was an analysis of the effects of the two experimental quality assurance procedures. Group 1 (new application form by itself), Group 2 (new form with income guidelines), and Group 3 (new form with an audit warning notice) were contrasted in terms of:

- average change in reported income for program reapplicants;
- average change in reported family size for program reapplicants;

- percentage of applicants reporting incomes on or near both the reduced-price and free meal eligibility cutoff point;
- application and reapplication rate;
- average number of income sources reported on applications.

The first four contrasts paralleled the analysis of the effects of the new application form. In addition, a fifth contrast was conducted that compared the three groups in terms of average number of income sources reported to determine whether the experimental quality assurance procedures elicited a wider range of reported types of income.

Where it was appropriate to increase the precision of the contrasts, prior-year variables (such as 1980 average income, application rate, and percentage of applicants reporting incomes near the eligibility cutoff points) were held statistically constant across treatment groups.

None of the contrasts revealed any statistically or substantively significant differences between the three groups using the new application form. That is, the application data revealed no effects of the warning and guideline notices on applicant reporting behavior. Again, it should be noted that these findings do not indicate that the experimental quality assurance treatments had no effect on applicant behavior, but rather that if there were any effects they were not of a magnitude detectable by the Phase I experimental design.

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#### NOTES

- 1/ The operationalization of "threshold" income reporting as within \$200 of the annual income of the eligibility cutoff point is based on the results of prior studies including those by USDA's Office of Inspector General. A different operationalization would have produced a different percentage of applicants who report "threshold" incomes.
- 2/ The percentage of reduced-price meal benefit recipients who reported annual incomes within \$200 of the cutoff point in the reduced-price guidelines increased from 2.5 percent in school year 1980-81 to 4.7 percent in school year 1981-82 ( $p < .001$ ).
- 3/ Measuring the effect of the new application form on income reporting in terms of reported income change from prior year is superior to measuring the effect in terms of absolute differences in reported income because program eligibility requirements truncate the recipient income distribution so that the mean income of recipients who under-report their income cannot be assumed to be lower than that of recipients who report their total income.

NOTES (Continued)

- 4/ The statistical procedures used are described in Appendix A.
- 5/ The difference between the groups is statistically significant at the  $p = .2$  level, which means that there is approximately a one-in-five chance the difference is due to random sampling error. To rule out this possibility will require further analysis.
- 6/ Reapplication rate was operationalized as: 
$$R_i = \frac{B_i}{C_i}$$
where  $R$  is the reapplication rate,  $B$  the number of 1980-81 school year program recipients in school  $i$  who applied for benefits in school year 1981-82, and  $C$  is the total number of 1980-81 school year program recipients in school  $i$ .
- 7/ Because the correlation is based on aggregate school level data and not individual applicant level data, its magnitude exceeds the expected individual level correlation (See L. I. Langbein and A. J. Lichtman, Ecological Inference, Sage, Beverly Hills, 1978.).
- 8/ The conclusion presented here must be viewed with caution because it is based on an "ecological inference." That is, conclusions about individual behavior were based on aggregate school level data and not on direct observation of particular individual applicants who lowered their reported income to maintain program benefits. To test for spuriousness at the aggregate level, controls were introduced for school year 1980-81 average income and percentage reporting income near the guideline. The relationship between school year 1980-81 hardship deductions and both school year 1980-81 income change and threshold reporting remained constant when school year 1980-81 average income and average threshold reporting were held statistically constant.

# 5

## SUMMARY OF PHASE I FINDINGS

Analysis of the Phase I data has to this point been directed at providing preliminary indications of the impact of Congressionally mandated changes in the school meal application process and testing two experimental quality assurance procedures.

Three changes in the application procedure made by FNS in response to Congressional requirements were reviewed: removal of the free meal benefit guidelines from application materials, a new application form that requires a listing of all adult household members with Social Security numbers and a listing of income sources, and the elimination of hardship income deductions.

Removal of free meal benefit guidelines from application materials resulted in no discernible change in the percentage of program eligibles reporting incomes on or just under the free meal eligibility cutoff point. In school year 1980-81, when free meal benefit guidelines were distributed to parents, 2.2 percent of free meal benefit eligibles reported annual incomes on or less than \$200 under the free meal eligibility cutoff point. For school year 1981-82, when the free meal guidelines were removed from the application materials, the figure remained constant at 2.2 percent.

The new application form was shown to have a variety of effects on applicant income reporting, program eligibility and participation, and program costs to the Federal government. Eligibles using the new application form reported an average increase in income of more than \$500 greater than program applicants using the prior-year application form. This finding strongly suggests that the new application form has been at least partially successful in preventing under-reporting of income on meal benefit applications.

The proportion of children receiving free lunches relative to school enrollment was approximately 10 percent lower in schools using the new application form than in schools using the prior-year form. Similarly, the proportion of reduced-price lunch beneficiaries was approximately 15 percent lower in new application schools than in prior-year application schools. The reduction in program participation associated with the new application form translates into lower Federal subsidies. In schools using the new application form, Federal lunch program subsidies averaged 52.5 cents per student enrolled per day. In contrast, the average daily Federal lunch subsidy per student was 56.8 cents for schools using the prior-year application form.

The hardship income deductions were found to affect the eligibility status of less than 2 percent of program eligibles in school year 1980-81 in the Phase I SFAs. Associated with elimination of the hardship deductions was a slight decrease in overall program participation and a slight increase in the percentage of eligibles reporting incomes on or near the reduced-price eligibility guideline.

The two experimental quality assurance procedures had no additional impact on application reporting behavior, program eligibility or participation, or program costs in the Phase I SFAs where they were used in conjunction with the new application form. However, in San Diego, when the quality assurance procedures were used in conjunction with the prior-year form, the procedures were associated with lower rates of program eligibility and lower Federal program costs. One hypothesis that may explain this finding is that the new application form is a stronger treatment than the quality assurance notices and therefore the notices are effective when used with the prior-year application form but have no additive effect when used with the new form.

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## CONCLUSIONS

Phase I analysis has been directed toward analyzing the usefulness of the new Congressionally-mandated application form, warning notices, and income guidelines as quality assurance procedures. The analysis to date has produced useful information. Many questions, however, remain.

- The new application form appears to have been at least partially successful in preventing income under-reporting and preventing ineligible individuals from obtaining program benefits. This success is evidenced by an increase in income reported by applicants and a lower program eligibility and participation rate associated with the new application form. Available data is insufficient for determining how much of the reduction in program eligibility and participation resulted from the new form deterring ineligible individuals from applying or misreporting information on the application and how much of the reduction was the result of the new form acting as a barrier to eligible individuals. Until this issue is effectively addressed, the central question of whether there is still a significant problem of applicant misreporting will be unanswered.
- Audit warning notices, when used with the new application form and without supporting enforcement action, appear ineffective.
- Income guideline notices accompanying the new application form (used in Phase I) appear ineffective. However, the possibility exists that an effective guideline notice could be developed based on an empirical study of reasons for applicant misreporting. The in-home audits to be conducted later in Phase I will provide necessary background data on reasons for applicant misreporting.

## APPENDIX A STATISTICAL PROCEDURES

This appendix presents a summary of the statistical procedures used to estimate treatment group effects. Treatment group effects were modeled through a system of contrast codes defining effects associated with the three a priori hypotheses specified in section 3.2. The General Linear Model (GLM) procedure of the Statistical Analysis System (SAS) computer program was employed to estimate the normal equations.

Models of treatment group effects were estimated through a six-step process. First, in the non-computerized SFAs, values of variables to be included in the models were computed and their distributions examined to identify outliers and distributional irregularities that could violate underlying assumptions of the models. All outliers were examined for potential coding errors, and in several cases school district authorities were contacted to confirm reported values. Second, 1980/81 data for dependent variables to be estimated for 1981/82 were examined by treatment group to identify potential sampling anomalies that could bias treatment group effect estimates. No anomalies were found. Distributions of prior year program participation and eligibility variables are compared across treatment groups to detect any anomalies created by assignment of schools to treatment groups. On the basis of simple chi-square and f-ratio tests, all prior year variables available to the study were unrelated to treatment group. Table A.1 shows the results of these tests. As can be seen, there were no pre-existing statistically significant differences between experimental groups on key variables. Third, ordinary least squares (OLS) models were estimated and the residuals examined to detect technical pathologies and outliers. When significant heterogeneity of variance was found in the residuals of the program participation variables, an angular distribution transform was performed. Fourth, the models were then reestimated, removing covariates and interaction terms that made no discernible

**TABLE A.1: TREATMENT ASSIGNMENT RANDOMNESS TEST**

Analysis of Variance of Prior Year (November 1980) Variables Across Treatment Groups			
Variable	df	F	Significance
Operating days	3/68	.053	.98
Full price breakfasts	3/68	.042	.99
Reduced price breakfasts	3/68	1.058	.37
Free breakfasts	3/68	.515	.67
Full price lunches	3/68	.055	.98
Reduced price lunches	3/68	.384	.77
Free lunches	3/68	.139	.94
Average daily attendance	3/68	.465	.71
Total certified for free meals	3/68	.052	.98
Total certified for reduced price meals	3/68	.009	.99



contribution to the model and were not of substantive interest. Residuals were reexamined and at this point no technical pathologies were found. (If pathologies had persisted, an additional step would have been added to the analysis using jack-knife estimation procedures to minimize bias and increase estimate stability.) Fifth, models were independently estimated using weighted-least-squares (WLS) estimators derived under a finite population sampling model. (The OLS estimators were derived under classical, asymptotic sampling models.) Results of the WLS and OLS estimates were compared and no statistically or substantively significant differences were discovered. Sixth, steps one through five were replicated for the computerized SFAs.

#### A.1. The General Model

The four treatment groups in Phase I SFAs were compared through a system of orthogonal linear contrasts as defined by the equation

$$C = \sum a_j y_j \quad (1)$$

subject to the condition

$$\sum a_j = 0 \quad (2)$$

where:

$a_j$  is a value code for experimental group  $j$ ;

$\bar{y}_j$  is the mean value of dependent variable  $y$  for experimental group  $j$ ;

The magnitude and direction of  $C$ 's deviation from 0 is a measure of the hypothesized effect. For a nondirectional hypothesis, statistical significance is a function of  $P(C \neq 0)$ . For a directional hypothesis, statistical significance is a function of either  $P(C < 0)$  or  $P(C > 0)$ , depending on the expected direction of the effect. Three linear contrasts were conducted corresponding to the three hypotheses specified in Section 3.2. Table A.2 defines the coding structure used. As can be seen, the sum of all the columns in Table A.2 is zero and the covariance of the columns is zero.

Contrast coding has several important advantages over classical ANOVA procedures in the present case. Contrast coding handles problems of unbalanced designs (as occurs in estimates involving breakfast program participation) more easily than does ANOVA. Contrast coding produces greater estimate precision in disaggregating effects of the new application form from the quality assurance procedure effects. Finally, contrast coding allows use of a priori hypotheses and directional significance tests that are often difficult with ANOVA.

TABLE A.2: CONTRAST CODES

Treatment Group	Hypothesis Contrast		
	H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>
1 1981/82 Application	1/3	-1	0
2 1981/82 Application with Warning	1/3	1/2	-1
3 1981/82 Application with Guideline	1/3	1/2	1
4 1980/81 Application	-1	0	0

Effect parameters associated with the hypothesized contrasts were estimated by the normal least squares equation:

$$\hat{\beta} = (X'X)^{-1} X'Y \quad (3)$$

where

$\hat{\beta}$  is a vector of coefficients associated with an intercept term and a set of independent variables, including the three contrasts codes;

X is a data matrix having all 1's as its first column and individual values of the independent variables as its remaining columns; and

Y is a data vector of values of  $y_i$ .

The normal equations were estimated using the GLM procedure of SAS.

As an exploratory measure, an alternative finite population sampling model was estimated. Under a finite population model, variables describing the population under study (in this case program applicants in Phase I schools) are seen as random realizations of a process operating in a larger super population. Therefore even if a complete census of program applications were studied in all participating schools, the total school value for any given variable is regarded as a random rather than a fixed value. As a random variable, the sum of a given variable, 'Y', in a school is subject to an error variance inversely proportional to the size of the finite population from which it was drawn. For some of the variables estimated, the population base was total school enrollment; for others, total applicants. To account for this error variance and thereby increase parameter estimate precision, a

weighted least squares approach was used in which  $\sum w (y - \hat{y})^2$  is minimized and  $w$  is proportional to the population base. The resulting normal equation is:

$$\hat{\beta} = (X'WX)^{-1} X'WY \quad (4)$$

where  $W$  is a diagonal matrix of population base values. Comparisons of parameter estimates for weighted and unweighted models showed only marginal variations and no clear superiority of either model. For simplicity, the results of the unweighted models are presented.

## A.2 Program Participation

Rates of program participation for an individual school 'i' and program category 'j' were defined by the equation

$$P_{ij} = (K_{ij}) / (E_i \times D_i) \quad (5)$$

where  $K_{ij}$  is the number of meals served in program category 'j' in school 'i' in November 1981.

$E_i$  is enrollment in school i in November 1981; and

$D_i$  is the number of days meals were served in school i in November 1981

Program participation was defined in this way to standardize for variations in school size and number of operating days. Problems of bias commonly associated with sample-based ratio estimators do not occur in this case because by definition the expected value of the number of meals served is zero if either enrollment or operating days is zero and the ratios are calculated on the basis of a census of the total relevant population and not a sample.

Because initial analysis revealed heterogeneity in model residuals, an angular (arc sin) transform was performed on participation rate variables. That is, in the analysis, rather than using  $P_{ij}$  as defined above, the following variant was used:

$$\rho_{ij} = \arcsin (\sqrt{P_{ij}}) \quad (6)$$

$\rho_{ij}$  has the advantages of an asymptotic normal distribution, greater stability than  $P_{ij}$  and a variance that is independent of  $P_{ij}$ .<sup>2/</sup> Subsequent residual analysis revealed no technical pathologies.

### A.3 Variable Definitions

Table A.3 presents the variable mnemonics and titles used in the preliminary analysis.

### Final Models

Table A.4 presents results of the final models in terms of the statistical significance of parameter estimates. Without elaborate manipulations, the raw parameter estimates and decomposed sums of square are uninterpretable, therefore they have been excluded from the table. Contrast 1 and Contrast 2 correspond to hypotheses that predict direction treatment effects, thus except where indicated, one-tailed t-tests were used to determine statistical significance. Contrast 3 corresponds to a non-directional hypothesis and as a result two-tailed t-tests were used.

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### NOTES

- 1/ S. Cohen and P. Cohen. Applied Multiple Regression/Correlations Analysis for the Behavioral Sciences. Wiley & Sons, New York, 1975, pages 195-206 present the basic rationale and derivations for contrast coding of experimental data.
- 2/ For an introductory discussion of angular transforms, see Y.M. Bishop, S.E. Fienberg, and P.W. Holland. Discrete Multivariate Analysis, MIT Press, Cambridge, 1975, pages 366-368.

TABLE A.3: VARIABLE MNEMONICS

Mnemonic	Variable Title
FL1180	Rate of free lunch participation 11/1980
FL1181	Rate of free lunch participation 11/1981
RL1180	Rate of reduced-price lunch participation 11/1980
RL1181	Rate of reduced-price lunch participation 11/1981
PL1180	Rate of full price lunch participation 11/1980
PL1181	Rate of full price lunch participation 11/1981
FB1180	Rate of free breakfast participation 11/1980
FB1181	Rate of free breakfast participation 11/1981
RB1180	Rate of reduced-price breakfast participation 11/1980
RB1181	Rate of reduced-price breakfast participation 11/1981
PB1180	Rate of full price breakfast participation 11/1980
PB1181	Rate of full price breakfast participation 11/1981
SFA	School Food Authority
CSTL80	Average daily per student Federal subsidy of the lunch program 11/1980
CSTL81	Average daily per student Federal subsidy of the lunch program 11/1981
CSTB80	Average daily per student Federal subsidy of the breakfast program 11/1980
CSTB81	Average daily per student Federal subsidy of the breakfast program 11/1981
INC80	Average annual reported income for 1980 applicants
INC81	Average annual reported income for 1981 applicants
INCHG	Average annual change in reported income for 1980 applicants who reapplied in 1981
SOURCE	Number of income sources reported on 1981 application
REAPPLY	Proportion of 1980 program applicants who are also 1981 applicants in the same school
THR80F	Proportion of 1980 free meal recipients reporting an annual income on or less than \$200 under the free meal eligibility cutoff point
THR81F	Proportion of 1981 free meal recipients reporting an annual income on or less than \$200 under the free meal eligibility cutoff point
THR80R	Proportion of 1980 reduced-price meal recipients reporting an annual income on or less than \$200 under the free meal eligibility cutoff point
THR81R	Proportion of 1981 reduced-price meal recipients reporting an annual income on or less than \$200 under the free meal eligibility cutoff point
APR80	Proportion of students enrolled approved for meal benefits in 1980
APR81	Proportion of students enrolled approved for meal benefits in 1981
CONTRAST1	Treatment Group Coding corresponding to Hypothesis 1 in Section 3.2
CONTRAST2	Treatment Group Coding corresponding to Hypothesis 2 in Section 3.2
CONTRAST3	Treatment Group Coding corresponding to Hypothesis 3 in Section 3.2

TABLE A.3: STATISTICAL SIGNIFICANCE OF ESTIMATED EFFECT PARAMETERS FOR FINAL MODELS (NONCOMPUTERIZED SFAs)

MODEL NUMBER	DEPENDENT VARIABLE	MAIN EFFECTS				COVARIATES (3)	NUMBER OF CASES	MULTIPLE R SQUARE OF MODEL	
		SFA (1)	Contrast 1 (2)	Contrast 2 (2)	Contrast 3 (3)				
1.	FL1181	.2962	.0010	.9914 (4)	.6652	FL1180 PL1180	.0001 .1846	72	.9866
2.	RL1181	.2296	.0459	.0690	.7900	RL1180 FL1180 PL1180	.0001 .3082 .5544	72	.7319
3.	PL1181	.0001	.7187 (5)	.3376 (5)	.9298	PL1180 FL1180	.0001 .3483	72	.9699
4.	FB1181	.6457	.1434 (4)	.1224	.5537	FB1180	.0001	35 (6)	.9593
5.	RB1181	.0064	.7529 (4)	.0434 (4)	.9241	RB1180 FB1180	.0001 .3826	35 (6)	.9741
6.	PB1181	.2114	.4318 (5)	.3231 (5)	.4695	PB1180 FB1180	.0005 .5590	35 (6)	.7362
7.	CSTL81	.0001	.0004	.1749	.6791	CSTL80	.0001	72	.9811
8.	CSTB81	.7084	.3885 (4)	.0737	.4064	CSTB80	.0001	35 (6)	.9550
9.	SOURCE	.0001	(7)	.4506	.6451	INC80 (9)	.3733	54 (7)	.5997
10.	INCHG(9)	.2800	.1629	.9815 (4)	.8895	INC80 (9)	.8333	69 (8)	.1738
11.	REAPPLY	.0506	.2026	.4703 (4)	.9264	APR80	.3386	69 (8)	.3127
12.	THR81F(9)	.2017	.3989 (4)	.1843	.3686	THR80F (9) THR80R (9)	.1232 .1739	72	.2615
13.	THR81R(9)	.0080	.7503 (4)	.0625	.5071	THR80R (9) THR80F (9)	.0598 .3060	72	.3538

NOTES

- (1) Test based on F Ratio for type IV sums-of-squares breakdown.
- (2) Unless otherwise indicated, probability based on one-tailed t-test.
- (3) Probability based on two-tailed t-test.
- (4) Estimated effect in opposite direction predicted by hypothesis, two-tailed t-test used.
- (5) Hypothesis does not predict directional effect, two-tailed t-test used.
- (6) Three Phase I SFAs do not have breakfast programs and 13 schools in the remaining 6 SFAs do not have breakfast programs.
- (7) Treatment Group 1 not included in the model
- (8) 1980 and 1981 applications could not be matched in three schools
- (9) Teacher child applicants' income not used in making estimates.

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MAIN EFFECTS

DEPENDENT VARIABLE	SFA <sup>(1)</sup>	Contrast 1 <sup>(2)</sup>	Contrast 2 <sup>(2)</sup>	Contrast 3 <sup>(3)</sup>	COVARIATES <sup>(3)</sup>	NUMBER OF CASES	MULTIPLE R SQUARE OF MODEL	
FL1181	.2962	.0010	.9914 (4)	.6652	FL1180 PL1180	.0001 .1846	72	.9866
RL1181	.2296	.0459	.0690	.7900	RL1180 FL1180 PL1180	.0001 .3082 .5544	72	.7319
PL1181	.0001	.7187 (5)	.3376 (5)	.9298	PL1180 FL1180	.0001 .3483	72	.9699
FB1181	.6457	.1434 (4)	.1224	.5537	FB1180	.0001	35 (6)	.9593
RB1181	.0064	.7529 (4)	.0434 (4)	.9241	RB1180 FB1180	.0001 .3826	35 (6)	.9741
PB1181	.2114	.4318 (5)	.3231 (5)	.4695	PB1180 FB1180	.0005 .5590	38 (6)	.7362
CSTL81	.0001	.0004	.1749	.6791	CSTL80	.0001	72	.9811
CSTB81	.7084	.3885 (4)	.0737	.4064	CSTB80	.0001	35 (6)	.9550
SOURCE	.0001	(7)	.4506	.6451	INC80 (9)	.3733	54 (7)	.5997
INCHG(9)	.2800	.1629	.9815 (4)	.8895	INC80 (9)	.8333	69 (8)	.1738
REAPPLY	.0506	.2026	.4703 (4)	.9264	APR80	.3386	69 (8)	.3127
THR81F(9)	.2017	.3989 (4)	.1843	.3686	THR80F (9) THR80R (9)	.1232 .1739	72	.2615
THR81R(9)	.0080	.7503 (4)	.0625	.5071	THR80R (9) THR80F (9)	.0598 .3060	72	.3538

est based on F Ratio for type IV sums-of-squares breakdown.

less otherwise indicated, probability based on one-tailed t-test.

robability based on two-tailed t-test.

estimated effect in opposite direction predicted by hypothesis, two-tailed t-test used.

hypothesis does not predict directional effect, two-tailed t-test used.

three Phase I SFAs do not have breakfast programs and 13 schools in the remaining 6 SFAs do not have breakfast programs.

treatment Group 1 not included in the model

980 and 1981 applications could not be matched in three schools

oster child applicants' income not used in making estimates.

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APPLICATION

PARENTS: To apply for free and reduced price meals for your children, fill out this form and return it to the school office.

CHILDREN: Names and Grades of Children for Whom Application is Made

NAME	SCHOOL	GRADE

ALL OTHER HOUSEHOLD MEMBERS:

HOUSEHOLD MEMBERS: List all related or unrelated persons who live in your household and share living expenses or meals. (Don't include children listed above)

SOCIAL SECURITY NUMBER: List the Social Security number of all adults. Adults are family members 18 years or older.

HOUSEHOLD MEMBERS	SOCIAL SECURITY NUMBER

TOTAL: Total number of Household Members: \_\_\_\_\_

HOUSEHOLD INCOME: Enter amount of current income before deductions, such as taxes and Social Security, in appropriate category. If you receive more than one check from any one of these sources, please indicate the total monthly amount received.

TOTAL PER MONTH

Wages, Salary _____	Child Support (Alimony) _____
Social Security _____	Pension or Retirement _____
Public Assistance (Welfare) _____	Other _____
Unemployment _____	

TOTAL MONTHLY INCOME \_\_\_\_\_

FOSTER CHILDREN: In certain cases foster children are eligible for free or reduced price meals regardless of their family's income. If you have foster children living with you and wish to apply for such meals for them, please check here.

SIGNATURE/ADDRESS: I hereby certify that all the above information is true and correct. I understand that this information is being given in connection with the receipt of Federal funds; that school officials may verify information; and that deliberate misrepresentation may be subject to prosecution under applicable State and Federal criminal statutes.

SIGNATURE OF ADULT FAMILY MEMBER \_\_\_\_\_ DATE \_\_\_\_\_ TELEPHONE \_\_\_\_\_

PRINT NAME \_\_\_\_\_ ADDRESS \_\_\_\_\_

FOR SCHOOL USE ONLY

Approved Free

Approved Reduced

Denied Reason for Denial \_\_\_\_\_

Parents Notified Date \_\_\_\_\_

Determining Official \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_



Dear Parent:

The school which your child attends participates in the National School Lunch Program. All students are encouraged to enjoy this nutritious lunch each school day. Students may purchase lunch for: \_\_\_\_\_

Elementary, 85¢; Secondary \$1.00

Extra milk may be purchased for: 15¢

If your school participates in the School Breakfast Program, students may purchase breakfast for: \_\_\_\_\_

Students from families whose income is at or below the level shown on the income guidelines scale may be eligible for either free meals or meals at a reduced price of 40 cents for lunch and 30 cents for breakfast.

To apply for free or reduced price meals for your children at any time during the year, complete the attached application and return it to the school. If, during the school year, there are changes in your family size or substantial changes in your income, please report these changes to the school's determining official in order for appropriate eligibility adjustments to be made.

- **Verification of Current Family Income** - The application now requires the name and Social Security number of all adult family members and specific income information. Adults without Social Security numbers must indicate that they do not have one. School officials may verify the source and amount of income as well as household composition.
- **Foster Children** - In certain cases foster children are also eligible for these benefits. If you have foster children living with you and you wish to apply for such meals for them, please notify us or indicate it on the application.
- **Nondiscrimination** - All students are treated the same regardless of ability to pay. In the operation of child feeding programs, no child will be discriminated against because of race, sex, creed, color or national origin.
- **Fair Hearing** - Within 10 days of receiving your application, the school will notify you whether or not your children are eligible. If you do not agree with the school's decision on your application, you may wish to discuss it with the school official. If you wish to review the decision further, you have a right to a fair hearing. This can be done by calling or writing.

\_\_\_\_\_  
(NAME OF HEARING OFFICIAL)

\_\_\_\_\_  
(ADDRESS)

\_\_\_\_\_  
(PHONE NO.)

INCOME ELIGIBILITY GUIDELINES, School Year 1981-82

FAMILY SIZE

1	-----	\$ 7,970
2	-----	10,530
3	-----	13,080
4	-----	15,630
5	-----	18,190
6	-----	20,740
7	-----	23,290
8	-----	25,840

Each additional family member 2,550

If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

\_\_\_\_\_  
NAME  
Food Service Director

\_\_\_\_\_  
TITLE

(Rev. 8-81)

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