Compared with estimates from previous research, the recommended approach is likely to yield lower estimates of the prevalence of inadequacy because, as noted, using the RDA as a reference point for assessing adequacy always leads to an overestimation of the problem.[8] Similarly, using observed intakes rather than usual intakes tends to overestimate the percentage of individuals falling below a given cutoff because the distribution of observed intakes is usually wider than the distribution of usual intakes. These improved dietary assessment methods are just beginning to appear in FANP research (Cole and Fox, 2004a; Ponza et al., 2004; and McLaughlin et al., 2002).

Relatively few studies have looked the impact of FANP participation on the quality of dietary intakes, for example, in comparison with recommendations made in the *Dietary Guidelines for Americans* (USDA and the U.S. Department of Health and Human Services (HHS), 2000) and the Food Guide Pyramid (USDA, Center for Nutrition Policy and Promotion (CNPP), 1996) or with the Healthy Eating Index (HEI), a summary measure of overall diet quality developed by CNPP (Kennedy et al., 1995). Many of the studies completed since the mid-1990s have examined dietary quality at some level, but few of the earlier studies did.

Overview of the Findings

The sections that follow summarize key findings from the research available for each FANP. Basic background information on the subject research can be found in detailed tables provided in appendix A. These tables summarize important characteristics of each study, including the year published (or written, for nonpublished reports), data sources, population studied, sample size, research design, measure of program participation, and analysis methods. Tables are provided for all FANPs that had at least one impact study. All identified research that described differences between participants and nonparticipants is included in these tables. Although some of the studies had relatively weak designs or used rudimentary or, in some cases, no statistical analysis, they are included in the interest of completeness.

In interpreting findings from the complete body of research for a given program, greater weight was given to findings from studies that had the strongest research design and analysis methods and that used the most recent data. This report does not comment at length about the strengths and limitations of various studies. These detailed discussions are included in Volume 3 (Fox, Hamilton, and Lin, 2004).

Appendix B includes the reference lists from each program-specific chapter in Volume 3. The lists can be used to obtain full citations for studies cited in the appendix A tables. They can also be used to identify related and background literature used in preparing the comprehensive reviews. Because of space constraints, the tables in appendix A cite only the first author's name for papers or reports that have more than two authors.

Food Stamp Program

The FSP stands at the intersection of two sets of Federal programs: those with the primary goal of improving access to adequate diets and those with the primary goal of maintaining income. The FSP is particularly important because of its universality. It is an entitlement program with eligibility requirements based almost solely on financial need, while the other major FANPs are targeted toward certain types of individuals or households.

FSP benefits can be used only to purchase food for home consumption or seeds and plants used to produce food. Benefits are distributed as electronic transfers, which can be redeemed only at participating retail outlets. The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) mandated that all FSP benefits be distributed via electronic transfers. Nationwide changeover from coupons to electronic transfers was completed in June 2004 (USDA, 2004).

The FSP is the cornerstone of the Nation's nutrition safety net. In FY 2002, the total Federal expenditure for the FSP was $20.7 billion, which accounted for about 54 percent of the $38 billion Federal expenditure for all FANPs. The program served more than 19 million participants per month (table 1). In FY 2003, the maximum monthly food stamp allotment for a family of four was $471 per month.

The FSP has been extensively researched, with much of the research based on secondary analysis of data from large national surveys, such as the Continuing Survey of Food Intakes by Individuals (CSFII). The bulk of the existing research concerns impacts on household food expenditures, household nutrient availability, and individual dietary intakes (app. tables 1-3, pp. 46-56). These three outcomes are logically sequential. The

[8]For some nutrients, the estimated prevalence of inadequate intakes would be lower even if the old approach was replicated using the latest RDAs because the new RDAs for some nutrients differ substantially from previous RDAs. For example, for children ages 1-3, the 1989 RDAs for zinc and vitamin C were, respectively, 10 mg and 40 mg. The new RDAs for these nutrients are substantially lower, at 3 mg (zinc) and 15 mg (vitamin C).

hypothesis is that the FSP benefit leads to increased food spending, which leads to increased household nutrient availability, which, leads to increased intakes by individual household members. However, there are several reasons why these seemingly obvious effects may not occur, particularly for nutrients that are in short supply. For example, participating households may increase expenditures on food in ways that actually reduce the availability of some nutrients—for example, by choosing foods that are convenient or especially palatable but lower in nutrients. Participants may also purchase more expensive forms of the same food, resulting in no net gain in nutrients. In addition, nonparticipants may get more of their food from nonpaid sources, such as friends, relatives, soup kitchens, and food pantries (Gleason et al., 2000).

Similarly, the relationship between nutrient availability at the household level and nutrient intake at the individual level may be weakened by several considerations:

- Household members may unequally consume nutrients from the food supplies, relative to their needs, depending on their tastes and appetites.
- Some household food supplies are consumed by guests or are wasted.
- Some household members may consume food from other sources, including restaurants, school cafeterias, and other nonhome sources.

Moreover, greater nutrient availability is not necessarily a positive outcome. For example, increased expenditures may lead to greater availability of nutrients and food components that Americans consume to excess, including fats, cholesterol, sodium, and added sugars. Increased availability of food energy and selected nutrients at the household level does not necessarily translate into more adequate diets at the individual level or into healthier patterns of food intake (for example, eating more fruits and vegetables or whole grains).

Most studies that examined nutrition-related impacts of the FSP, especially the more recent ones, focused on impacts on the dietary intakes of individuals residing in FSP households. A smaller number of studies examined nutrient availability at the household level.

Food Expenditures

Existing research has consistently shown that the FSP increases household food expenditures, and that the increase is greater than what would occur if the same dollar value of benefits were provided as an unrestricted cash grant. Estimates of the size of the effect vary, depending on the research approach used. The most reliable estimates come from studies that looked at the marginal propensity to spend on food (MPS_F), or the increase in food expenditures per dollar increase in income. These studies indicate that the MPS_F for food stamps is in the range of 0.17-0.47, which translates into additional food expenditures of between $0.17 and $0.47 for every dollar of FSP benefits.

Household Nutrient Availability

The available research suggests that the FSP increases household availability of food energy and protein. It may also increase the availability of a number of vitamins and minerals. The evidence in this area is weaker, however. The strongest study that reported significant effects on household availability of vitamins and minerals used data that were collected in the 1970s, prior to elimination of the purchase requirement.[9]

Individual Dietary Intake

Existing research has provided little evidence that the FSP consistently affects participants' dietary intakes. Several studies found that FSP participation increased vitamin and mineral intakes of young children, but these findings were not replicated in the most recent and well-conducted study (Gleason et al., 2000). Moreover, limitations in measurement techniques and nutrient standards used in existing research make it impossible to adequately address the critical research question of whether the prevalence of inadequate nutrient intakes differs for FSP participants and nonparticipants.

Only a few studies looked at the impact of FSP participation on the intake of carbohydrates, fat, saturated fat, cholesterol, sodium, or fiber or on patterns of food intake. For the most part, these studies found little evidence of an FSP impact. Gleason et al. (2000) found that preschool FSP participants consumed significantly fewer servings of grains and grain products than comparably aged nonparticipants and were significantly less likely to meet the *Dietary Guidelines* recommendation of less than 10 percent of total energy from saturated fat. This study also found that FSP adults consumed significantly fewer servings of vegetables and less dietary fiber than nonparticipating adults.

[9]Before 1979, all households of a given size received the same FSP benefit in the form of coupons, but they had to pay a certain amount of cash to purchase the coupons. Households with more income paid a greater amount.

Other Nutrition and Health Outcomes

A substantially smaller body of research has examined impacts of the FSP on other nutrition- and health-related outcomes (app. table 4, pp. 57-59). More than a dozen identified studies examined the impact of the FSP on food security. Some found that FSP households were more likely than other low-income households to experience food insecurity. Others reported an inverse relationship. These conflicting results underscore the complexity of the relationship between FANP participation and food security. Food insecurity is likely to lead households to seek food assistance, and receiving food assistance benefits may subsequently improve the household's food security. This situation makes estimates of FANP impacts on food security particularly vulnerable to selection bias and reverse causality.

Two recent studies that used sophisticated techniques to control for selection bias help clarify the relationship between FSP participation and food security. Both found that, once one controlled for selection bias, there was no evidence of significantly greater levels of food insecurity (or insufficiency) among FSP participants. The analysis completed by Gundersen and Oliveira (2001) assessed reported levels of food insufficiency using the so-called "USDA food insufficiency question" that preceded the 18-item Federal food security module, the currently accepted standard for measuring household and individual food security (Price et al., 1997; Bickel et al., 2000). Huffman and Jensen (2003) expanded on the work done by Gundersen and Oliveira, incorporating information on labor force participation decisions and using the more severe outcome of food insecurity with hunger based on the 18-item Federal food security module. These authors also simulated the effects of changes in FSP benefits, unemployment rate, and nonlabor income and found that FSP benefits were more effective in reducing levels of food insecurity with hunger than pure cash transfers.

A limited number of studies have considered FSP impacts on other nutrition- and health-related outcomes, including birthweight (two studies), height and/or weight (six studies, but only one or two for any population subgroup—children, adolescents, adults, elderly), nutritional biochemistries (three studies), and general measures of health status (two studies). Because of the limited number of studies available for any given outcome and population subgroup, as well as design limitations of the available research, it is not possible to draw conclusions about FSP impacts in these areas.

WIC Program

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to provide "supplemental nutritious food as an adjunct to good health care during critical times of growth and development in order to prevent the occurrence of health problems and improve health status..." (P.L. 95-627). WIC targets five specific groups: pregnant women, infants, children up their fifth birthday, breastfeeding women (up to 1 year after an infant's birth), and nonbreastfeeding postpartum women (up to 6 months after an infant's birth). In April 2002, 50 percent of all WIC participants were children and 26 percent were infants. The remainder were women—11 percent pregnant women, 8 percent postpartum nonbreastfeeding women, and 6 percent breastfeeding women (Bartlett et al., 2003; Kresge, 2003).

Although WIC is a means-tested program (as of April 2000, all WIC State agencies used an income-eligibility cutoff of 185 percent of poverty (Bartlett et al., 2002)), being low-income is not sufficient to qualify for WIC participation. In addition to being in one of the program's target groups, WIC participants must have one or more documented nutritional risks. Individual States define the specific criteria used to determine nutritional risk, but the criteria must be selected from a standardized list defined by FNS.

WIC is not an entitlement program, so the number of participants served each year depends on available funding and the cost of running the program. To deal with the possibility that local programs may not be able to serve all eligible people, WIC uses a priority system to allocate available caseload slots to eligible applicants. The priority system is designed to ensure that available services go to those most in need. In general, pregnant women, breastfeeding women, and infants are given higher priority than children and nonbreastfeeding postpartum women. In addition, applicants with nutritional risks that are based on hematologic measures, anthropometric measures, or medical conditions are given higher priority than applicants with nutritional risks based on dietary patterns or other characteristics.

The relative importance of the priority system has declined over time as increasing funds have allowed the program to serve many lower priority individuals. Today, the WIC program serves almost half of all infants in the U.S. and about a quarter of the children ages 1-4 (Hirschman, 2004). In FY 2002, the Federal

Government spent approximately $4.3 billion on the WIC program, which served 7.5 million participants each month (table 1).[10]

WIC was designed to counteract the negative effects of poverty on prenatal and pediatric health (Kresge, 2003). To achieve this goal, the program offers a combination of services, including supplemental foods (selected specifically to supply nutrients that may be lacking in the diets of low-income pregnant women and children), nutrition education, and referrals to health care and social services. WIC services do not fluctuate by household income. All participants have access to the same basic benefits. The types and amounts of supplemental food provided to each participant are determined based on participant category, age (for infants), and individual needs and preferences.

An extensive amount of research has investigated the impact of WIC on health- and nutrition-related outcomes. Given the program's integral focus on ameliorating nutritional risks, it is not surprising that, compared with research on other FANPs, research on WIC includes many more studies that have looked at outcomes beyond dietary intake. Coverage of the five different participant groups is very uneven in the existing research. The participant group that has been studied most often is prenatal participants, with a particular focus on program impacts on birthweight and related outcomes, including health care costs. Overall, less research has focused on WIC's impacts on participating children, but much of the most recent research has addressed this information gap. Research on the impact of the program on women (beyond the impact of prenatal participation on birth outcomes) is lacking, particularly for breastfeeding women and nonbreastfeeding postpartum women.

Birth Outcomes

The impact of prenatal WIC participation has been estimated by comparing birth outcomes of women who participated in WIC during pregnancy and those who did not (app. table 5, pp. 62-70). Because of potential selection bias and other technical limitations, the existing body of research does not provide a definitive conclusion about WIC's impact on birth outcomes. However, the evidence is quite compelling and strongly suggests that WIC increases mean birthweight, reduces the incidence of low birthweight, and decreases birth-related Medicaid costs.

[10]Excludes the estimated cost of the WIC Farmers' Market Nutrition Program.

Because of design characteristics that contribute to inherent underestimation or overestimation of WIC impacts and the wide range of impact estimates reported in the literature, characterizing the relative size of WIC's impact with any confidence is difficult (for example, the estimated reduction in the prevalence of low birthweight infants). Moreover, subgroup analyses completed by some researchers suggest that WIC impacts are likely to be greatest among Blacks and among the lowest income women—groups with the highest prevalence of low birthweight.

In addition, many important changes have taken place since most of the available research was conducted. These changes may influence the extent to which findings from previous research apply to the WIC program as it operates today. Some of the most noteworthy changes include: a substantially higher level of program penetration in most areas of the United States than was present in the mid- to late 1980s when most of the research was completed (most eligible prenatal applicants are able to enroll in the program); more generous Medicaid income-eligibility criteria for pregnant women (including some that exceed the WIC cutoff of 185 percent of poverty), which infers automatic income-eligibility for WIC; and the use of standardized nutritional risk criteria. Furthermore, welfare reform legislation, which did not affect WIC directly, may have affected the circumstances of both WIC participants and nonparticipants. Any of these changes may influence both the presence and size of WIC impacts as well as variations in impacts across subgroups.

Breastfeeding

Relatively little research has examined the impact of WIC on breastfeeding (app. table 6, pp. 71-73). The literature search identified many studies that have assessed the impact of specific breastfeeding promotion programs on breastfeeding behaviors of *WIC participants*. While such studies provide information on the effectiveness of particular breastfeeding interventions (among WIC participants), they provide no information on the impact of WIC per se.

The literature also includes many descriptive studies that examined predictors of breastfeeding behaviors. These studies have demonstrated that women who are African American, less educated, low-income, and younger are less likely to breastfeed than other women. These demographic characteristics are also associated with higher rates of WIC participation, so it is not surprising that studies that included WIC participation among the list of potential breastfeeding predictors have almost

invariably found a negative association or no association between WIC participation and breastfeeding.

These negative statistics have prompted substantial commentary and questions over the years, particularly: Does the formula provided by WIC act as a disincentive to breastfeeding? Does the WIC program devote adequate resources to breastfeeding promotion? Obtaining reliable answers to these questions is complicated by substantial selection bias that makes it more likely that researchers will find a negative association between WIC participation and breastfeeding. As just noted, the demographic characteristics of women who are least likely to breastfeed closely parallel the characteristics of women who are most likely to participate in WIC. In addition, it is reasonable to assume that women who have decided to formula feed may be more likely to participate in WIC than women who have elected to breastfeed in order to obtain the free formula. The incentive to participate may be substantially reduced for women who have decided to breastfeed.

The available research on WIC's impact on the breastfeeding behaviors of WIC participants provides no firm basis for conclusions. Moreover, breastfeeding promotion efforts in the WIC program have expanded substantially since the time most of these studies were conducted.

Nutrition and Health Characteristics of Pregnant Women

Dietary Intakes. With the exception of two recent descriptive studies that compared dietary intakes of WIC participants and nonparticipants without accounting for measured differences between the two groups or for selection bias (Mardis and Anand, 2000; Kramer-LeBlanc et al., 1999), all of the studies that have assessed the impact of WIC participation on the dietary intakes of pregnant women are quite old (app. table 7, pp. 74-76). Indeed, the most recent estimate of WIC impacts in this area comes from the National WIC Evaluation (NWE) (Rush et al., 1988b), which used data collected in 1983-84.

Evidence from the NWE and other contemporaneous studies paints a reasonably consistent picture of potential WIC impacts on women's dietary intakes, suggesting that WIC participation increases intakes of food energy and most of the nutrients examined, including four of the five nutrients traditionally targeted by the program—protein, vitamin C, iron, and calcium. Evidence for vitamin A, the fifth WIC nutrient, is less consistent. Vitamin A intake, however, is especially difficult to estimate because the distribution is so skewed (vitamin A is concentrated in large amounts in relatively few foods). The early evidence also suggests that WIC may increase intakes of vitamin B_6, which the program has targeted in recent years.[11]

NWE authors (Rush et al., 1988b) pointed out that the relative magnitude of the incremental intakes observed among pregnant WIC participants were plausible in that they were comparable to the levels of supplementation achieved in smaller, intensively controlled clinical trials. Moreover, a thorough analysis of the sources of nutrients in women's diets completed for the NWE confirmed that differences in the diets of WIC participants and nonparticipants were attributable to consumption of WIC foods. Other authors also found similar relationships between observed nutrient intakes and the types of food provided in WIC food packages (Endres et al., 1981; Bailey et al., 1983).

In addition to the potential for selection bias, which was not addressed in any of this research, findings from such dated studies are subject to concerns about changes in the program and its participant groups over time, as discussed in the preceding section on birth outcomes. And, as noted previously, a compelling argument can be made that impacts on diet-related outcomes are more sensitive to temporal considerations than impacts on other outcomes. Finally, limitations in the measurement techniques and nutrient standards used in this research make it impossible to determine whether the reported increases in nutrient intake led to a greater prevalence of adequate intakes among WIC participants.

A recent descriptive analysis of the nutrient intakes of pregnant WIC participants and nonparticipants also raises questions about whether previously observed impacts persist today. Kramer-LeBlanc and her colleagues (1999) used data from the third National Health and Nutrition Examination (NHANES-III) to compare nutrient intakes of pregnant WIC participants and income-eligible nonparticipants. In their analysis, the only nutrient for which a significant difference was detected in median intakes was selenium. A comparison of the nutrient intakes of WIC participants and the maximum nutrient contribution of the WIC food package for pregnant women suggested that pregnant WIC participants may

[11]Results from early research do not permit an assessment of the potential impact of WIC on intake of folic acid. All of the available studies were completed before the recent widespread fortification of cereals and grain products with folic acid and before the increased attention to folic acid supplementation during pregnancy. (Inadequate intake of folic acid has been associated with neural tube defects (Centers for Disease Control and Prevention, 1992)).

not have redeemed all of their vouchers or consumed all the food provided. Results of this analysis do not constitute a valid assessment of WIC impacts, and the analysis may have been hampered by small sample sizes (only 71 WIC participants). Nonetheless, the fact that the analysis showed virtually no overlap with findings from earlier studies raises questions about whether positive findings from earlier studies still apply to today's prenatal WIC participants.

To date, only one study (Mardis and Anand, 2000) assessed intakes of prenatal WIC participants and nonparticipants in relation to consumption patterns recommended in the *Dietary Guidelines for Americans*.[12] This analysis, which used bivariate t-tests to assess differences between groups, found no significant differences in intakes of total fat, saturated fat, cholesterol, or sodium. Moreover, with the exception of cholesterol, intakes of both participants and nonparticipants exceeded recommended levels. With regard to food intake, no significant differences were detected between WIC participants and nonparticipants in consumption of grains, vegetables, fruits, milk, or meats and beans.

Given the increasing prevalence of pregnancy-associated obesity (Lederman et al., 2002) and the potential role the WIC program may be able to play in curtailing this problem, it is important to obtain valid estimates of WIC's impact on women's dietary intakes based on more up-to-date information.

Other Nutrition and Health Outcomes. A handful of studies has examined the impact of WIC participation during pregnancy on other measures of nutritional status (app. table 7, pp. 74-76). However, the relative paucity of research on any given measure, as well as design and analytic limitations of existing studies, makes drawing firm conclusions about impacts in this area impossible. Moreover, such impacts may be difficult to elucidate among pregnant women. For example, assessment of hemoglobin concentration, arguably the most straightforward and widely used measure of nutritional status among other population groups, is complicated during pregnancy by numerous physiologic processes that are not completely understood (Rush et al., 1988b). Adequate assessment of iron status during pregnancy requires the collection of several more complex hematologic indices that are not readily available in most WIC or medical records.

[12]Kramer-LeBlanc et al. (1999) also report data for intake of total fat, saturated fat, cholesterol, and sodium, but it is the same data reported in Mardis and Anand (2000).

Nutrition and Health Characteristics of Infants and Children

Although infants and children make up more than three-quarters of the total WIC population, very little research has been done on these participant groups until recently. Of 41 identified studies (app. table 8, pp. 77-86), 10 are based on data collected primarily or exclusively in the early to mid-1990s, 10 are based on data collected in the mid- to late 1990s, and 3 used data that were collected exclusively in 2000 or later or had data collection periods that started late in the 1990s and extended beyond 2000. The relative recency of these studies is particularly important because of the increase in child participation experienced during the early 1990s (Oliveira et al., 2002). Studies based on data collected after this time are more likely to be generalizable to the current population of WIC children and are less subject to bias associated with restricted program access.

Some studies have included both infants (younger than 12 months) and children (1-4 years), but the available research is heavily slanted toward children. Given that children make up 50 percent of the WIC population overall, this emphasis is not inappropriate.

Dietary Intakes of Children. Several studies have suggested that WIC participation increases children's intakes of selected nutrients. The most convincing evidence comes from a study by Oliveira and Gundersen (2000). The authors used data from the 1994-96 CSFII and employed a unique strategy to control for selection bias. They limited their analysis sample to WIC participants and income-eligible nonparticipants who lived in households where at least one other member was on the WIC program. The rationale for this restriction was that it effectively controlled for key sources of selection bias, including lack of awareness of the WIC program and resistance to participation because of stigma or other reasons. The authors acknowledge that two important sources of potential bias remain, both of which are associated with rationing rather than self-selection. The income-eligible nonparticipant group may have included (1) children who were not actually eligible for WIC because they did not have a certified nutritional risk and (2) children who were fully eligible but could not participate because the local WIC program had no available slots. Both of these sources of bias would tend to underestimate program impacts.

Findings from the Oliveira and Gundersen study indicate that WIC participation significantly increases children's intakes of iron, vitamin B_6, and folate. Other studies suggest that WIC participation may lead to

reduced intake of added sugar and, among the lowest income children, to increased intakes of protein, carbohydrate, zinc, vitamin E, thiamin, niacin, riboflavin, and magnesium and reduced intake of fat (Rose, Habicht, and Devaney, 1998; Siega-Riz et al., 2004; Kranz and Siega-Riz, 2002). These suggestive findings would be more convincing if they were replicated in the restricted sample analyzed by Oliveira and Gundersen (Oliveira and Gundersen did not assess intakes of vitamin E, thiamin, niacin, riboflavin, magnesium, carbohydrate, or fat).

As noted in previous discussions of available data on dietary intake, evidence that WIC participants consumed greater amounts of selected nutrients does not necessarily mean that WIC participants were more likely than nonparticipants to have adequate diets. Recent data on the *usual* nutrient intakes of age-eligible children, estimated using state-of-the-art techniques recommended by the IOM (2001), indicate that the vast majority of both WIC and non-WIC children have nutritionally adequate diets. Cole and Fox (2004a) found that virtually all children ages 1-4, regardless of WIC participation status, had adequate usual intakes of iron and zinc. Ponza et al. (2004) reported similar findings for iron for children ages 1 and 2. As discussed in a subsequent section, the adequacy of children's usual iron intakes is consistent with declining levels of anemia in this population and may reflect an indirect effect of the WIC program on the availability and use of iron-fortified breakfast cereals.

Neither Cole and Fox (2004a) nor Ponza et al. (2004) assessed intakes of vitamin B_6 or folate (the other two nutrients found to be significant in Oliveira's and Gundersen's analysis) or vitamin E, niacin, riboflavin, thiamin, or magnesium (the other nutrients for which Rose, Habicht, and Devaney (1998) reported a significant WIC impact). However, in the nationally representative Feeding Infants and Toddlers Study, Devaney and her colleagues (2004b) found that less than 1 percent of all 1 and 2 year olds had inadequate usual intakes of vitamin B_6, riboflavin, thiamin, or magnesium, and only 2 percent had inadequate usual intakes of folate.[13] Three percent had inadequate usual intakes of niacin, and 58 percent had inadequate usual intakes of vitamin E. (The authors urged caution in interpreting the finding for vitamin E, given that clinical data from NHANES-III do not indicate problems with vitamin E status. They suggested that the high prevalence of apparently inadequate vitamin E intakes may be associated with the difficulty of assessing the types and amounts of fats and oils used in cooking and/or with variability in food composition databases.)

Data from Devaney et al. (2004b), Cole and Fox (2004a), and Ponza et al. (2004) suggest that the prevalence of inadequate nutrient intakes among very young children is low and that today's WIC children are doing as well nutritionally as their nonparticipating counterparts. However, the fact that the descriptive analyses completed by Cole and Fox (2004a) and Ponza et al. (2004) did not reveal meaningful differences in the prevalence of nutrient inadequacy among WIC and non-WIC children does not necessarily mean that the WIC program has no impact on children's diets. For example, WIC may be responsible for bringing intakes of participating children up to the level of other children. The question of WIC impacts cannot be assessed even at a basic level without multivariate analysis techniques that, at a minimum, control for measured differences between the two groups.

Information about the potential impact of WIC on children's intakes of cholesterol, sodium, and fiber or on food intake relative to recommendations made in the Food Guide Pyramid is very limited. The study by Oliveira and Gundersen did not examine children's diets along these lines, and the majority of studies that did were descriptive studies that assessed differences between groups with bivariate t-tests or did not assess statistical significance.

Dietary Intakes of Infants. Two relatively dated WIC studies (Rush et al., 1988a; Burstein et al., 1991) provided convincing evidence that WIC participation had a significant impact on the dietary intakes of infants. Both studies found that WIC infants had significantly higher intakes of iron than non-WIC infants. More recent data from the Feeding Infants and Toddlers Study (Ponza et al., 2004) showed that WIC infants ages 7-11 months had greater mean *usual* intakes of iron than did nonparticipant infants and, more importantly, that the prevalence of adequate usual iron intakes was greater for WIC infants than for non-WIC infants (99 percent vs. 90 percent). The statistical significance of these differences was not tested.

Rush et al. also found that WIC infants consumed significantly less calcium, magnesium, and phosphorus than non-WIC infants. Burstein and her colleagues reported no impact on calcium intake in their main analysis, which assessed the percentage of infants consuming less

[13]Compared with national distributions, the sample used in this study had slightly higher incomes and had a smaller percentage of Hispanics (Devaney et al., 2004a).

than 77 percent of the RDA. However, supplementary analyses that used mean intakes found, like Rush et al., that WIC infants consumed significantly less calcium than non-WIC infants.

For the NWE, Rush and his colleagues completed a detailed analysis of the sources of nutrients in infants' diets and found that the greater iron intakes and lower calcium, magnesium, and phosphorus intakes noted for WIC infants were related. All of these findings were associated with an increased use of cow's milk among non-WIC infants. Because the American Academy of Pediatrics recommends that cow's milk not be fed to infants less than 12 months of age, the lower intakes of calcium, magnesium, and phosphorus among WIC infants were not interpreted as negative impacts. Burstein and her colleagues (1991) found a similar pattern. Specifically, they found that, among non-breastfed infants, WIC infants were more likely to receive formula and non-WIC infants were more likely to receive cow's milk. Moreover, among formula-fed infants, WIC infants were more likely to receive iron-fortified formula and non-WIC infants were more likely to receive formula that was not fortified with iron.

Recent descriptive studies provide some evidence that differences between WIC infants and non-WIC infants in the use of cow's milk may persist today. For example, Kramer-LeBlanc and her colleagues (1999) found that, among infants ages 4-11 months, WIC participants consumed significantly less protein, calcium, magnesium, riboflavin, vitamin B_{12}, and sodium. All of these nutrients occur in greater concentrations in cow's milk than in iron-fortified infant formula. In addition, Cole and Fox (2004a) analyzed the infant feeding inventory used in NHANES-III and found that WIC participants were significantly less likely than nonparticipants to be fed cow's milk before 12 months of age.

In contrast, in an analysis of 24-hour intakes, Ponza et al. (2004) found no significant difference between WIC infants and non-WIC infants in the percentage consuming cow's milk. In addition, findings from an inventory of feeding practices that assessed whether an infant had ever been fed cow's milk found no difference between WIC and non-WIC infants ages 7-11 months. Reported feeding of cow's milk was rare among younger infants (4-6 months). In this age group, however, significantly more WIC infants than non-WIC infants had been fed cow's milk at some point. These results should be interpreted with caution because the comparison group used in the Ponza et al. analysis included all income levels. This may obscure differences between WIC participants and income-eligible nonparticipants, who constitute a more appropriate comparison group.

Burstein and her colleagues (1991) also found that WIC participation was associated with more appropriate introduction of solid foods. WIC infant feeding guidelines, which are based on recommendations of the American Academy of Pediatrics and other expert groups, recommend that no solids be introduced until infants are at least 4 months of age. Indeed, the WIC food package for infants younger than 4 months is limited to iron-fortified formula. Burstein and her colleagues found that nonparticipant infants were significantly more likely than WIC infants to be fed solid foods before 4 months of age.

It is not clear whether this finding still holds for today's WIC infants. Based on the infant-feeding inventory in NHANES-III, Cole and Fox (2004a) found no difference between WIC participants and nonparticipants in the percentage of infants or children who were fed solid foods before 4 months of age. Similarly, Ponza and his colleagues (2004) found no differences between WIC participants and nonparticipants in the mean ages at which infant cereal and pureed baby foods were introduced. These data may be less reliable than the data from the Burstein et al. study, however, because they are based on a more extended recall period.[14] In addition, as noted previously, the all-income comparison group used by Ponza and his colleagues may obscure differences between WIC participants and income-eligible nonparticipants.

Kramer-LeBlanc et al. (1999) found that carbohydrates and fiber intakes among infants ages 4-11 months were significantly lower for WIC participants than for income-eligible nonparticipants and suggested that this pattern may be associated with earlier introduction and greater consumption of cereal among non-WIC infants. Data from Ponza et al. (2004) suggest that the difference in cereal consumption may be concentrated among older infants and, therefore, not associated with better adherence to infant feeding guidelines per se. Ponza and his colleagues found no difference between WIC participants and nonparticipants in consumption of either infant cereal or ready-to-eat cereal among infants ages 4-6 months. Among infants ages 7-11 months, however, the percentage consuming ready-to-eat cereal was 77 percent lower for WIC participants than for nonparticipants.

[14]The Burstein et al. (1991) study was limited to 6-month-old infants, so caregivers reported on relatively recent feeding practices. The NHANES-III infant feeding histories analyzed by Cole and Fox (2004a) included infants up to 12 months old, and the Ponza et al. (2004) analysis included only toddlers ages 12-24 months.

Growth. Many of the earliest efforts to assess WIC impacts on children's growth were hampered by technical difficulties, such as missing or inaccurate data in medical records or WIC files and problems with equipment calibration. Self-selection issues have also affected this research. In the NWE, Rush and his colleagues (1988a) reported differential recruitment of children with abnormal growth (overweight, underweight, or stunted) into WIC, in keeping with the program's focus on individuals with identifiable nutritional risks. This pattern of self selection is likely the reason for the significantly greater prevalence of underweight and growth retardation among WIC children reported by Cole and Fox (2004a) and Burstein et al. (2000) in their more recent descriptive analyses of NHANES-III data.

Two recent studies that did not suffer from the methodological and technical limitations that affected earlier studies provide evidence to suggest that WIC participation may affect infants' growth (Black et al., 2004) and reduce the prevalence of failure to thrive (Lee et al., 2000). (Failure to thrive is a general diagnosis that can have many causes, but the sentinal finding is a failure to gain weight and to grow as expected.)

In recent years, increasing attention has been paid to problems at the opposite end of the growth spectrum—the problem of overweight among children, including very young children. Research that has examined this issue is sparse. The studies that have been conducted have not found a significant association between WIC participation and the prevalence of overweight.

All of the research in this area is subject to concerns about selection bias. Moreover, it is doubtful that studies like these can provide definitive answers to questions about WIC's impact on the growth of infants and children. Researchers involved in designing and implementing a field test of a study to measure WIC's impact on children concluded that the only way WIC's impacts on child growth can be reliably assessed is through a longitudinal study that includes serial measurements repeated at regular intervals for both WIC participants and nonparticipants (Puma et al., 1991).

Anemia/Iron Status. The majority of studies that examined the relationship between WIC participation and iron status/anemia found that WIC participation was associated with an increase in mean levels of hemoglobin or hematocrit and/or a decrease in the prevalence of anemia. In most cases, these differences were statistically significant. Although each of the studies reviewed had weaknesses, the consistency of findings across studies is compelling.

The most convincing evidence comes from analyses done by Yip and his colleagues at the CDC using data from the Pediatric Nutrition Surveillance System (PedNSS) (Yip et al., 1987). The CDC researchers looked at the prevalence of anemia in infants and children ages 6-60 months between 1975 and 1985, a period of substantial growth in the WIC program. They documented a steady decline in the prevalence of anemia, from 7.8 percent in 1975 to 2.9 percent in 1985. Using detailed data from one State, the authors demonstrated that the socioeconomic status of the population had remained stable over this period. The authors also compared initial and followup measures of hemoglobin or hematocrit (taken roughly 6 months apart) for approximately 73,000 WIC children. The analysis revealed decreased levels of anemia at followup.

Another CDC analysis reported on trends between 1980 and 1991 (Yip et al., 1992). During this period, the prevalence of anemia decreased by more than 5 percent for most age- and race/ethnicity-specific subgroups. Other measures of childhood health monitored in PedNSS, including the prevalence of low birthweight, low height-for-age, low weight-for-height, and high weight-for-height (overweight), generally remained stable.

The CDC analyses suggest that WIC has a direct effect on the prevalence of anemia, as well as a probable indirect effect. WIC requires use of iron-fortified infant formulas and includes iron-fortified breakfast cereals in its food packages. Because more than half of all formula sold in the United States, as well as a large share of breakfast cereals, are purchased with WIC vouchers, manufacturers have consciously focused on bringing to market iron-fortified products that are allowed in WIC food packages (Batten et al., 1990). These foods have assumed a leading position in their respective markets and have, therefore, been increasingly fed to both WIC and non-WIC children. As a result, the WIC program may have contributed to the observed improvement in the prevalence of anemia in the general population of low-income U.S. children.

General Health Status. Although subject to concerns about selection bias, two recent studies suggest that WIC may improve children's general health status (Black et al., 2004; Carlson and Senauer, 2003).

Findings from the Carlson and Senauer study are based on physician ratings assigned after completion of physical exams in NHANES-III. The authors found that children who resided in households where at least one person participated in WIC were significantly more likely than children who resided in non-WIC households to be rated as having excellent health. This association was strongest for the lowest income children.

Immunization Status. Findings from the limited number of studies that have assessed the impacts of WIC on immunization status, including two recent cross-sectional studies that analyzed data from the National Immunization Survey (NIS) for 1999 (Shefer et al., 2001) and 2000 (Luman et al., 2003), generally suggest that WIC participation had a positive impact on the likelihood that children will have up-to-date immunizations. Results from all of these studies are highly vulnerable to selection bias, however. Mothers who are motivated to enroll their child in WIC may be more motivated to keep the child's immunizations up to date.

The positive WIC impact suggested by this research, if real, may be influenced by an ongoing collaboration between USDA and the CDC to use the WIC program as a means to improve immunization rates among the Nation's low-income children. Since the early 1990s, a variety of strategies has been used to promote timely and complete immunizations among WIC participants (Shefer et al., 2001). Randomized trials have demonstrated that some of these strategies can dramatically increase immunization coverage (Birkhead et al., 1995; Hutchins et al., 1999). In addition, Shefer et al. (2001) used data from the 1999 NIS and data from an annual survey of WIC directors and State immunization program directors to model the relationship between WIC immunization activities and immunization rates among WIC children. They found that WIC children in States with high-intensity immunization activities (50 percent or more of WIC children enrolled at sites that implemented an immunization intervention at every WIC visit) had significantly higher rates of up-to-date immunization at 24 months than did WIC children in States with low-intensity immunization activities (less than 50 percent of WIC children enrolled at sites that implemented an immunization intervention and the intervention was implemented at only recertification visits). Finally, Dietz et al. (2000) found that a WIC voucher incentive program was one of eight factors that had a positive, significant effect on immunization rates in Georgia's public health clinics.

Use and Costs of Health Care Services. Three recent studies have examined the relationship between children's WIC participation and the use of health care services (Lee et al, 2000; Buescher et al., 2003) and dental care services (Lee et al., 2004a). All three studies reported that WIC participation had a significant, positive effect on the use of health care/dental care services, and the two studies that examined health care/dental care costs (Buescher et al., 2003; Lee et al., 2004b) reported an associated increase in costs for WIC participants. Only the study that looked at the use of dental care services controlled for selection bias (Lee et al., 2004a).[15] Thus, findings from the other two studies are vulnerable to potential selection bias—it is possible that children who have health problems or who use more health care services may be more likely to be referred to WIC.

Cognitive Development and Behavior. There is little evidence that WIC affects children's cognitive development or behavior. Few studies have examined outcomes in this area, however, and most suffer from selection bias, as well as small sample sizes and/or noncomparability of WIC and non-WIC groups. The strongest and most recent study in this area was completed by Kowaleski-Jones and Duncan (2000). The authors examined the impact of prenatal WIC participation on temperament and the development of motor and social skills using a fixed-effects model (based on sibling pairs) to control for selection bias. The authors reported that WIC participation decreased the likelihood that a child would have a difficult temperament; however, the result was significant only at the $p < 0.10$ level.

Food Security. Only one identified study examined the impact of WIC participation on household food security (Black et al., 2004). The study found that WIC infants had significantly higher rates of food insecurity than low-income infants in households that did not participate in WIC because caregivers did not perceive a need for WIC services. The difference between WIC infants and low-income infants who did not participate in WIC because of access problems was not significant. As noted previously, assessment of the impact of FANP participation on food security is particularly vulnerable to problems of selection bias and reverse causality.

[15]Lee and her colleagues completed separate analyses of dental care use (Lee et al., 2004a) and costs (Lee et al., 2004b). The former analysis controlled for selection bias, but the latter did not.

Nutrition and Health Characteristics of Nonbreastfeeding Postpartum Women and Breastfeeding Women

Very little is known about the impact of WIC on either group of postpartum WIC participants. Other than the previously described study by Kramer-LeBlanc et al. (1999), which assessed nutrient intakes of WIC participants and nonparticipants, the literature search identified only two studies that assessed WIC impacts on nonbreastfeeding postpartum WIC participants and only one study that looked at the impact of WIC participation on breastfeeding participants (app. table 9, pp. 87-88). The latter study provides little insight because it is a dated local study that used a very small sample of breastfeeding WIC participants and an even smaller comparison sample of middle-class women who were nonbreastfeeding (Argeanas and Harrill, 1979).

The two studies that focused on nonbreastfeeding postpartum women provide evidence to suggest that WIC participation during the postpartum period may have positive impacts on the women themselves, as well as on the outcomes of subsequent pregnancies. Caan et al. (1987) assessed women's weight status at the start of a subsequent pregnancy and the birth outcomes of that pregnancy. The authors found that extended postpartum WIC participation (5-7 months) increased both weight and length of the second infant at birth. The odds ratio of having a low birthweight infant approached significance, but, because low birthweight is rare, small sample sizes hampered the analysis. In addition, women who had been obese at the start of the previous pregnancy and had 5-7 months of postpartum WIC participation were 50 percent less likely than comparable women with 0-2 months of postpartum participation to be obese at the start of the subsequent pregnancy.

Pehrsson et al. (2001) found that nonbreastfeeding postpartum WIC participants who experienced 6 uninterrupted months of participation were significantly less likely to become anemic than comparable women who did not participate in WIC during the postpartum period.

Neither of these studies provides definitive information about the impact of WIC participation during the postpartum period. Exploration of impacts on this lowest priority participant group is needed. If postpartum WIC participation is associated with improved birth outcomes in the subsequent pregnancy and with improved nutrition, health, and/or weight status for the women, there may be reason to rethink the lower priority assigned to this group. In view of the ongoing obesity epidemic, the potential for WIC to play a role in addressing pregnancy-related weight retention, which is especially prevalent among minority women (Gore et al., 2003; Abrams et al., 2000), seems particularly important.

National School Lunch Program

The NSLP, established in 1946, is the oldest and second largest FANP. The NSLP is the cornerstone of the largely school-based child nutrition programs. Schools that participate in the NSLP receive Federal reimbursement for each program meal served to students, with higher reimbursements for lunches served free of charge or at a reduced price to children certified to receive NSLP meal benefits.[16] Since 1998, the program has also covered snacks served to children in after-school programs (USDA/FNS, 2003b). Any child in a participating school is eligible to participate in the NSLP.

In FY 2002, more than 28 million children participated in the NSLP on an average school day. The program served more than 4.7 billion lunches and 123 million after-school snacks. The total cost for the NSLP was $6.9 billion, about 18 percent of the total Federal expenditure for FANPs (table 1). Almost 99 percent of public schools and 83 percent of all public and private schools combined participate in the NSLP.

On an average school day, about 60 percent of children in schools that offer the NSLP participate in the program (Fox et al., 2001). Participation varies with household income, age, and gender. For example, studies have shown that students certified to receive free or reduced-price lunches are more likely to participate than students who are not certified for meal benefits, elementary school students are more likely to participate than secondary school students, and males are more likely to participate than females (Fox et al., 2001; Gleason, 1996; Maurer, 1984; Akin et al., 1983).

The literature on the impacts of the NSLP is anchored by two national evaluations: the National Evaluation of School Nutrition Programs (NESNP), conducted in 1980-81 (Wellisch et al., 1983), and the first School Nutrition Dietary Assessment Study (SNDA-I), conducted in 1991-92 (Burghardt et al., 1993; Devaney et al., 1993). A third national evaluation, the second School Nutrition Dietary Assessment Study (SNDA-II), was conducted in 1998-99 (Fox et al., 2001), but this study did not assess student-level impacts. In addition to these national evaluations, a few studies have used

[16]USDA does not reimburse schools for adult meals, second meals, or a la carte items, including extra servings of components of program meals.

national survey data to assess NSLP impacts, and a number of studies have examined program impacts in smaller, local samples.

The existing literature on NSLP impacts needs to be considered cautiously because program operations changed substantially after most of the available research was completed. In 1995, USDA launched the School Meals Initiative for Healthy Children (SMI). The SMI was designed specifically to address nutritional shortcomings identified in SNDA-I. SNDA-I found that, compared with the *Dietary Guidelines* (USDA/HHS, 1990) and NRC *Diet and Health* recommendations (NRC, 1989b), NSLP meals were high in fat, saturated fat, and sodium and low in carbohydrates (Burghardt et al., 1993). At the time, schools were not required to offer meals that were consistent with these guidelines.

The SMI provides schools with educational and technical resources that can be used to assist foodservice personnel in preparing nutritious and appealing meals and to encourage children to eat more healthful meals. Key components of the SMI include revised nutrition standards, such as goals for fat and saturated fat content that are consistent with *Dietary Guidelines* recommendations, a major restructuring of menu planning requirements, and a broad-based nutrition education program known as the Team Nutrition Initiative.[17]

The Healthy Meals for Healthy Americans Act (P.L. 103-448) formally required that school meals be consistent with the *Dietary Guidelines* and that schools begin complying with SMI nutrition standards in the 1996-97 school year unless a waiver was granted by the cognizant State agency. The regulatory requirement that school meals be consistent with the *Dietary Guidelines* has been incorporated into the FNS strategic plan. The current goal is for all schools to satisfy these standards by 2005 (USDA/FNS, 2000a).

The SMI has been supported by several parallel initiatives. For example, considerable efforts have been devoted to improving the nutrient profile of commodity foods provided to NSLP schools (Buzby and Guthrie, 2002). In addition, under the Nutrition Title of the 2002 Farm Act, USDA received $6 million for a pilot program to provide fresh and dried fruits and fresh vegetables to children in elementary and secondary schools. The pilot program, which was implemented in the 2002-03 school year, was very well received (Buzby et al., 2003) and was expanded under the Child Nutrition and WIC Reauthorization Act of 2004 (P.L. 108-265).

Most recently, policymakers have begun to focus on the "school nutrition environment" (Ralston et al., 2003; American School Food Service Association (ASFSA), 2003; USDA/FNS, 2000b). A school's nutrition environment includes the nutritional quality of reimbursable school meals, the availability and nutritional quality of competitive (non-NSLP) foods, meal scheduling, physical characteristics of the cafeteria, nutrition education and marketing activities, and the school's commitment to nutrition and physical activity.

The SNDA-II study, completed in the early stages of SMI implementation (the 1998-99 school year), provides some evidence that the nutritional profile of school meals is improving. Although, on average, lunches offered to students in 1998-99 continued to exceed *Dietary Guidelines* and NRC recommendations, they were significantly lower in total fat, saturated fat, and sodium than lunches offered in 1991-92 (as reported in SNDA-I) (Fox et al., 2001). Moreover, schools were able to reduce fat and saturated fat content without diminishing the relative contribution of school meals to children's daily nutrient needs. Since the SNDA-II data were collected, efforts to implement the SMI nutrition standards have continued at the Federal, State, and local levels. Consequently, even this relatively recent data may not provide an accurate picture of the nutrient content of meals currently offered in the NSLP.

Given the nature and extent of the changes associated with the SMI—changes that specifically targeted the nutrient content of school lunches and students' consumption of healthful lunches—the available research on program impacts is significantly limited. Although the existing research provides information on past and potential impacts of the NSLP, one cannot assume that findings from this research apply to today's NSLP. New research is essential to understanding the impact of the NSLP as it operates today (Guthrie, 2003).

Students' Dietary Intakes

Existing NSLP research has focused mainly on impacts on students' dietary intakes at lunch and/or over 24 hours (app. table 10, pp. 90-93). The strongest evidence comes from the SNDA-I study (Devaney et al., 1993) and from a recent analysis of data from the 1994-96 CSFII completed by Gleason and Suitor (2003). SNDA-I researchers controlled for selection bias using an instrumental variables approach and confirmed the

[17]Goals for sodium and cholesterol content are not included in SMI nutrition standards; however, schools are encouraged to monitor levels of these dietary components.

robustness of their results using a variety of specifications. Gleason and Suitor improved upon the techniques used in SNDA-I to control for selection bias by using a fixed-effects model. SNDA-I completed subgroup analyses that suggest that some program impacts may vary by students' age and household income. The findings summarized here apply to students overall.

The evidence is strong that, before the SMI, the NSLP increased children's lunchtime intakes of selected vitamins and minerals (riboflavin, vitamin B_{12}, calcium, phosphorus, magnesium, and zinc). Evidence for riboflavin, calcium, and phosphorus is particularly strong. Every study that examined intakes of these nutrients found that NSLP participants had significantly higher intakes at lunch than nonparticipants. It is generally accepted that this pattern is caused by increased consumption of milk, which is a concentrated source of all of these nutrients, among NSLP participants (Lin and Ralston, 2003; Devaney et al., 1993; Radzikowski and Gale, 1984).

Analyses completed by both SNDA-I (Devaney et al., 1993) and NESNP (Wellisch et al., 1983) researchers suggest that differences in the vitamin and mineral intakes of NSLP participants and nonparticipants at lunch are due to the *types* of food eaten rather than to the *quantities*. Both SNDA-I and NESNP examined the nutrient density of lunches and found that lunches eaten by NSLP participants were higher in nutrient density than lunches eaten by nonparticipants. Although only the NESNP results were tested for statistical significance, both groups of investigators concluded that the NSLP increased intakes of selected nutrients by providing lunches that were more dense in those nutrients, rather than by simply providing more food.

The strongest available study (Gleason and Suitor, 2003) suggests that NSLP effects on students' intakes of vitamins and minerals persisted over 24 hours. Because of limitations in the dietary assessment methodologies used, however, it is not possible to determine whether NSLP participants were more likely than nonparticipants to have adequate intakes of these vitamins and minerals.

The evidence is also strong that, before the SMI, NSLP participants consumed less carbohydrate and more fat and saturated fat (as percentages of total food energy) than nonparticipants, both at lunch and over 24 hours. Available evidence suggests that the difference in carbohydrate intake was due to decreased consumption of added sugars among NSLP participants (Gleason and Suitor, 2003).

Finally, the available evidence indicates that, before the SMI, NSLP participation had no significant effect on students' energy intakes or on sodium or cholesterol intakes. NSLP participation was associated, however, with a significantly greater intake of dietary fiber, both at lunch and over 24 hours.

A few researchers have looked at food consumption patterns of NSLP participants and nonparticipants. The quality of measures used in these studies varied and none of these analyses controlled for potential selection bias. Thus, conclusions about impacts on food consumption patterns are more tentative than conclusions about impacts on intake of energy and nutrients. Results of the available studies are largely consistent, however, and fit reasonably well with the conclusions about pre-SMI impacts on energy and nutrient intake.

The available data suggest that NSLP participants consumed *more* milk and vegetables at lunch and *fewer* sweets and snack foods than nonparticipants. Findings for other food groups are equivocal. SNDA-I found that a significantly greater proportion of NSLP participants than nonparticipants consumed grain products at lunch.

In contrast, Gleason and Suitor (2001) found that, on average, NSLP participants consumed significantly fewer servings of grains at lunch than nonparticipants. In both cases, between-group differences were relatively small.

The Gleason and Suitor (2001) finding deserves more weight than the SNDA-I finding because the former analysis looked at the actual number of servings consumed (rather than the percentage of children eating at least one item within the food group) and adjusted for differences in observed characteristics of students. Rainville (2001) reported results similar to Gleason and Suitor (2001) and found that the increase in the number of grain items consumed by nonparticipants was attributable to a high prevalence of sandwiches in lunches from home.

Gleason and Suitor (2001) found no difference between NSLP participants and nonparticipants in consumption of fruits and juices at lunch. However, all of the other studies reported that NSLP participants consumed more fruit and juices than nonparticipants.

Data on food consumption patterns of NSLP participants and nonparticipants over 24 hours are more limited. The available data suggest that some NSLP impacts on food consumption at lunch were maintained over 24 hours, while others faded.

Other Nutrition and Health Outcomes

A small number of studies have examined NSLP impacts on other nutrition- and health-related outcomes, such as height and/or weight (six studies), iron status (three studies), cholesterol levels (two studies), and cognitive functioning (one study) (app. table 11, pp. 94-95). None of these studies support firm conclusions about NSLP effects.

School Breakfast Program

The School Breakfast Program (SBP) began as a pilot program in 1966 and was permanently authorized in 1975. The intent of the program was to provide breakfast at school to children from poor areas who may not have eaten breakfast at home and to children in rural areas who ate an early breakfast, did chores, and then arrived at school hungry after traveling long distances (Devaney and Stuart, 1998). The program was modeled after the NSLP, which had been in existence for some 20 years when the SBP was established. The combination of the NSLP and SBP was intended to provide "a coordinated and comprehensive child food service [program] in schools" (P.L. 89-842).

The SBP operates in essentially the same manner as the NSLP. Schools that participate in the SBP provide breakfasts to children, regardless of household income. Federal reimbursement is provided for each breakfast served, with higher reimbursements for breakfasts served free of charge or at a reduced price to children certified to receive NSLP and SBP meal benefits. Any child in a participating school is eligible to participate in the SBP. In FY 2002, more than 8 million children participated in the SBP on an average school day. Approximately 1.4 billion meals were served, at a total Federal cost of $1.6 billion (table 1).

Compared with the NSLP, the SBP is available to fewer children and student participation rates are lower. The SBP is offered in about 78 percent of the schools and institutions that offer the NSLP (USDA/FNS, 2003c; USDA/FNS, 2003d). Using data from SNDA-I, Rossi (1998) found that, in schools where the SBP was available, only 78 percent of children who were eligible for free or reduced-price breakfasts were certified to receive meal subsidies. And of those certified, only 37 percent participated in the breakfast program. The combined effect was that, at the time the SNDA-I data were collected (the 1991-92 school year), only 29 percent of children eligible for free and reduced-price meals were eating school breakfasts. More recent studies have reported similar findings (Fox et al., 2001).

A major factor affecting application and participation decisions related to the NSLP and SBP is the perceived stigma of receiving free or reduced-price meals (Glantz et al., 1994). Stigma appears to be more of an issue for the SBP and for secondary school students than for the NSLP and elementary school students. Although program regulations require school districts to ensure that children approved for free and reduced-price meals are not overtly identified, many students and parents believe that simply eating a school breakfast carries a stigma. Other factors that have been identified as potential barriers to SBP participation include scheduling (when breakfast is served relative to the official start of the school day), meal prices, competing a la carte offerings, bus/transportation issues, lack of time to eat, lack of space, and student preferences for other foods (Reddan et al., 2002; Rosales and Jankowski, 2002; and Project Bread, 2000).

Some States require that all schools, or schools with a specific proportion of low-income students, participate in the SBP. Offering a free breakfast to all children regardless of family income—or a "universal-free" breakfast program—has become a popular vehicle for increasing participation in the SBP. In the 1990s, several States and school districts implemented demonstrations to test the feasibility and impact of such programs. Early results indicated that universal-free breakfasts substantially increased participation. Program evaluators also reported positive effects on tardiness, absentee rates, academic achievement, and related outcomes. However, most of the demonstrations were small in size, used nonexperimental designs, and had other design and/or data limitations (McLaughlin et al., 2002).

To obtain a more scientifically sound assessment of the potential impacts of universal-free school breakfast, Congress established the School Breakfast Program Pilot Project (SBPP) in 1998 (P.L. 105-336). The project, which began in the 2000-01 school year and ended at the end of the 2002-03 school year, included a comprehensive evaluation of both the implementation and impact of universal-free school breakfast. Results from the first year of implementation, including information on impacts on a variety of student outcomes, were published in late 2002 (McLaughlin et al., 2002). A final report covering all 3 years of the pilot is expected in 2004.

The existing literature on SBP impacts needs to be considered cautiously because program operations

changed substantially after most of the available research was completed. The SMI and related initiatives (see discussion in preceding section on the NSLP) may have affected the meals offered to students and students' consumption of those meals. In addition, concerted efforts have been made in recent years to increase participation in the SBP. Increased participation may lead to changes in the characteristics of the children being served by the program, which, in turn, may lead to changes in program impacts. For these reasons, new research is essential to understanding the nutrition- and health-related impacts of the SBP as it operates today (Guthrie, 2003).

SBP research has studied the impacts of the program on two categories of student outcomes: (1) dietary intake and (2) academic performance and related outcomes such as attendance, tardiness, and behavior. The evaluation of the SBPP is the only study to look at all of these outcomes concurrently.

Students' Dietary Intakes

A total of 14 of the identified studies tried to estimate SBP impacts on children's dietary intakes (app. table 12, pp. 98-100). The best data in this area come from the SNDA-I study (Gordon et al., 1995; Devaney and Stuart, 1998) and the first-year report of the evaluation of the SBPP (McLaughlin, 2002). Both of these studies have limitations, however. SNDA-I provides the most recent nationally representative data and includes statistical controls for selection bias, but the study was completed prior to both the SMI and recent initiatives to increase SBP participation. Data from the SBPP evaluation are more recent—collected in spring 2001—but are not nationally representative and are based on data from six school districts that volunteered to participate in a universal-free breakfast demonstration. The SBPP evaluation used a randomized experimental design; however, the evaluation was designed to assess the impact of universal-free breakfast rather than the impact of the SBP per se.

The main analyses completed for the first-year SBPP report compared the *entire* treatment group (students in schools where universal-free breakfast was available) with the *entire* control group (students in schools where the standard SBP was available). Results of these analyses provide no information on the question that is central to understanding the impact of the SBP: Do the dietary intakes (or other outcomes) of students who participate in the SBP differ from those of students who do not participate in the program?

However, SBPP researchers completed a separate analysis that does provide some insight on this issue. A statistical procedure (based on Bloom, 1984) was used to estimate impacts on students who actually participated in the universal-free breakfast program. Results of this adjustment provide unbiased estimates of the impact of participating in universal-free school breakfast.[18] These findings are *suggestive* of the impact of participating in the regular SBP some 6 years after the SMI was launched.[19]

The overarching goal of the SBP is to provide breakfast to children who might otherwise not eat before starting the school day. The extent to which the SBP influences the likelihood that a child will eat breakfast has been addressed most thoroughly in a reanalysis of the SNDA-I data (Devaney and Stuart, 1998).[20] The analysis considered three different definitions of "breakfast." Each definition was based on foods consumed between waking and 45 minutes after the start of school and included foods consumed at home and at school. The three definitions were as follows:

(1) Consumption of any food or beverage (except water).

(2) Consumption of food or beverages that contributed more than 10 percent of the Recommended Energy Allowance (REA).

(3) Consumption of food or beverages from at least two of five major food groups PLUS more than 10 percent of the REA.

Overall, the availability of the SBP had no significant impact on the likelihood of breakfast consumption, regardless of the definition used. For students from low-income households, however, availability of the SBP significantly increased the likelihood that students would eat a more substantial breakfast (a breakfast that satisfied either definition 2 or 3). At the same time, availability of the SBP significantly reduced the likelihood of

[18]For more information, see McLaughlin et al. (2002), chapter 4 and appendixes C and F.

[19]The characteristics of meals provided in universal-free breakfast programs are likely to be comparable to those provided in the regular SBP (see McLaughlin et al., 2002). However, the characteristics and consumption behaviors of students who choose to participate in universal-free school breakfast and students who choose to participate in the regular SBP may not be comparable.

[20]The Evaluation of the SBPP (McLaughlin et al., 2002) assessed the impact of a universal-free breakfast program on the likelihood that students would eat breakfast. These data are not included in this review because they have limited applicability to the regular SBP, where free breakfasts are available only to students who are certified to receive that benefit.

low-income students eating a nominal breakfast (a breakfast that provided 10 percent or less of the REA).[21]

SBP impact studies completed before implementation of the SMI are virtually unanimous that the program increased students' intakes of three minerals—calcium, phosphorous, and magnesium—both at breakfast, and, when examined, over 24 hours. There is also a consistent finding that the SBP increased riboflavin intake at breakfast but this effect generally did not persist over the full day. All of these nutrients (calcium, phosphorus, magnesium, and riboflavin) occur in concentrated amounts in milk.

Findings from pre-SMI studies are less consistent for food energy and other nutrients and dietary components. SNDA-I, which provides the strongest evidence, found that SBP participants consumed significantly more food energy and protein and less carbohydrate (as a percentage of food energy) at breakfast than nonparticipants (Gordon et al., 1995). In addition, although differences were not statistically significant, mean intakes of fat and saturated fat, as a percentage of total energy intake, and intakes of cholesterol and sodium were greater for SBP participants than nonparticipants. All of these differences persisted over 24 hours.

The evaluation of the SBPP, the only post-SMI study identified, found few significant differences between energy and nutrient intakes of universal-free breakfast participants, either at breakfast or over 24 hours. Universal-free breakfast participants consumed significantly more calcium and phosphorus at breakfast than nonparticipants, but neither of these differences persisted over 24 hours. Differences for magnesium and riboflavin were not statistically significant for either time point. In addition, the SBPP evaluation estimated *usual* daily (24-hour) intakes and assessed the impact of universal-free breakfast on the likelihood that students had adequate intakes, using the approach recently recommended by the IOM (2001). No significant differences were found in the prevalence of inadequate nutrient intakes among students who participated in universal-free breakfast and those who did not.

The evaluation of the SBPP found no significant differences in energy and macronutrient intakes of universal-free breakfast participants and nonparticipants, either at breakfast or over 24 hours. Moreover, the general trend was the reverse of the trend observed in SNDA-I. That is, on average, point estimates for the percentage of calories from fat and saturated fat were lower for universal-free breakfast participants than nonparticipants. And the SBPP evaluation found that universal-free breakfast participants consumed significantly less cholesterol than nonparticipants, both at breakfast and over 24 hours. No significant between-group differences were noted for sodium intake.

While results of the SNDA-I and SBPP studies cannot be compared directly, the SBPP data suggest a shift in SBP impacts over time that is largely consistent with changes observed in the nutrient profiles of SBP meals. For example, the SNDA-II study found that breakfasts offered in 1998-99 provided 5-6 percent less calcium than breakfasts offered at the time SNDA-I data were collected (1991-92 school year) (Fox et al., 2001).[22] Likewise, breakfasts offered in 1998-99 were significantly lower in energy, protein, total fat, saturated fat, cholesterol, and sodium than breakfasts offered in 1991-92.

A few studies have examined SBP impacts on students' food consumption patterns. Findings from McLaughlin et al. (2002) provide the strongest suggestive evidence of current SBP impacts. These data indicate that universal-free breakfast participants consumed significantly more servings of fruit and dairy products at breakfast than nonparticipants, and significantly fewer servings of meats and meat substitutes. However, data on 24-hour intakes indicate that all of these effects dissipated over the course of the day.

School Performance and Cognitive/Behavioral Outcomes

Eight of the identified studies attempted to measure the impact of eating a school breakfast on an array of school performance, cognitive, and behavioral outcomes (app. table 13, pp. 101-102). With one exception (Meyers, 1989), these studies evaluated universal-free breakfast programs rather than the actual SBP. Consequently, findings from these studies provide, at best, suggestive evidence of potential SBP impacts. Because the SBP does not offer breakfasts free of charge to all students, impacts observed in demonstrations of universal-free breakfast cannot be assumed to apply to the regular SBP.

[21]The results differed slightly for elementary and secondary school students. Among secondary school students, a significantly greater likelihood of breakfast consumption was observed only for the most stringent definition (two food groups and more than 10 percent of the REA).

[22]The average calcium content of breakfasts offered at both points in time more than satisfied the program standard of providing one-fourth of children's daily calcium needs. SNDA-II did not assess magnesium, phosphorus, or riboflavin content.

In this research, impacts on school performance and related outcomes were often measured based on group membership rather than on individual behavior. That is, analyses generally compared the *entire* treatment group (students in schools where universal-free breakfast was available) with the *entire* comparison/control group (students in schools where the standard SBP was available). This is a fairly imprecise definition of program participation because it does not take into consideration the actual behavior of students in the two groups of schools—students in either type of school may or may not have eaten the breakfasts that were offered to them.

The previously described supplementary analysis completed for the evaluation of the SBPP compared universal-free breakfast participants with nonparticipants based on actual participation in the universal-free breakfast program. Participation was defined based on same-day participation for short-term outcomes and on cumulative participation over the implementation year for longer term outcomes. This more precise definition of universal-free breakfast participation, combined with the randomized design, dictates that considerably more credence be given to results of the SBPP study than to the other studies. Other factors that minimize the credibility of findings from other studies are limitation to one geographic area (one city or State), small sample sizes, and inadequate statistical control for clustering (Ponza et al., 1999).

The SBPP evaluation found that universal-free breakfast participation had no significant effect on a broad array of measures, including attendance, tardiness, academic achievement, cognitive functioning, behavior, health status, food security, and Body Mass Index. The study found a small but significant and negative effect on teacher-rated behavioral opposition among long-term participants in universal-free breakfast.[23]

Child and Adult Care Food Program

The CACFP began in 1968 as a pilot program known as the Special Food Service Program for Children (SFSPFC). Participation was initially limited to center-based child care in areas with poor economic conditions. Beginning in 1976, family child care homes were also eligible to participate, provided that they met State licensing requirements, where these were imposed, or obtained approval from a State or local agency. Homes had to be sponsored by a nonprofit organization that assumed responsibility for ensuring compliance with Federal and State regulations and that acted as a conduit for meal reimbursements.

The CACFP was authorized as a permanent program in 1978. At the time, the program was focused exclusively on children and was called the Child Care Food Program (CCFP). In 1987, as a means of increasing support for elderly feeding programs, P.L. 100-175 amended the Older Americans Act to mandate that the CCFP be expanded to allow eligible adult day care centers to participate. The program was renamed the Child and *Adult* Care Food Program and institutional participation was expanded to include centers that provide day care services to people age 60 and older or to functionally impaired people age 18 and older. Eligible adult care centers have the option of participating in the CACFP or in the HHS-sponsored Elderly Nutrition Program (discussed later in this report) but cannot receive reimbursement under both programs for the same meal. The child and adult care components of the program are governed by the same rules and regulations. However, at the State level, the two components may be administered by separate agencies, at the discretion of the governor.

In 1998, the Child Nutrition Reauthorization Act (P.L. 105-336) expanded institutional eligibility for the child care component of the CACFP to include after-school care programs not participating in the NSLP and homeless shelters that serve children. Participation of after-school programs is limited to those in geographic areas where 50 percent or more of the children enrolled in school are eligible for free or reduced-price meals in the NSLP. Programs must provide regular, structured activities for children, including educational and enrichment activities (USDA/FNS, 2003e).

Although the adult component of the CACFP has increased steadily over time, the child care component of the program is substantially larger. In September 2002, the program served an average of 2.9 million children and 86,000 adults per day (USDA/FNS, 2003e). The $1.9 billion Federal expenditure for FY 2002 supported the provision of 1.7 billion meals and snacks to children and 44.6 million meals and snacks to adults (table 1).

Child and adult care providers who participate in the CACFP are reimbursed at fixed rates for each meal and snack served. Under current program regulations, child and adult care centers and child care homes may be

[23]This result is based on the first year of a 3-year demonstration and may not hold across all 3 years.

reimbursed for a maximum of two meals and one snack or two snacks and one meal per eligible participant per day. Homeless shelters may be reimbursed for up to three meals per child per day and after-school programs may be reimbursed for one snack per child per day. After-school programs in some States are also eligible to receive reimbursement for suppers.

To date, no research has examined the impact of the CACFP on participants' dietary intakes or other nutrition- and health-related outcomes. The limited amount of research on the CACFP is almost entirely descriptive, focusing on the characteristics of participating institutions, providers, and the children or adults they serve. An early study of the child care component of the program compared the nutrient content of meals offered in child care centers that did and did not participate in the program (then known as the CCFP) (Glantz and O'Neill-Fox, 1982). The study found that meals offered in CCFP centers were higher in calories and provided greater quantities of a number of different nutrients. The study design is potentially vulnerable to selection bias. Moreover, the study's results are of questionable importance today because over time so much has changed in the CACFP program and in the child care industry in general. Other available research on the child care component of the program is less outdated but provides no information on program impacts because the research did not include non-CACFP institutions.

The one study that has been completed on the adult component of the program (Ponza et al., 1993) was also descriptive and did not compare outcomes for program participants and nonparticipants.

The most recent study of the CACFP was a congressionally mandated study that examined the effects of a new reimbursement structure designed to increase the number of low-income children served in family child care homes. Under the new reimbursement structure, family child care homes that are (1) located in low-income areas or (2) operated by low-income providers have reimbursement rates similar to the rates that existed before the change. (A low-income area is defined as either an area where at least half of the children live in families with incomes below 185 percent of the poverty level or an area served by an elementary school in which at least half of the enrolled children are eligible for free or reduced-price school meals.) All other homes are reimbursed at substantially lower rates than those that were in existence before the change.

The change in reimbursement structure has been referred to as "tiering." Tier I homes are those that receive the greater reimbursement associated with operating in a low-income area or being run by a low-income provider. Homes that receive the lower reimbursement are referred to as Tier II homes.

The mandated evaluation of the effects of tiering found that the legislative change achieved the desired objectives: The number of low-income children served in family child care homes grew by 80 percent between 1995 and 1999, and the number of meal reimbursements going to low-income children doubled (Hamilton et al., 2001). Moreover, tiering had no adverse effect on either the number or nutritional characteristics of meals offered by Tier II providers (Crepinsek et al., 2002).

Summer Food Service Program

The SFSP was created to ensure that low-income children would have access to nutritionally balanced meals when school is not in session. The program was created in 1968 as a 3-year pilot project and was permanently authorized as an entitlement program in FY 1975.

The SFSP provides funds to eligible organizations to serve nutritious meals and snacks, free of charge, to children at approved feeding sites. Organizations eligible to sponsor feeding sites include public or private nonprofit schools; local government agencies; nonprofit community organizations, such as YMCAs and Boys and Girls Clubs; churches; National Youth Sports Programs (NYSP);[24] and residential camps. In FY 2002, the SFSP cost $263 million and served about 122 million meals and snacks (table 1). In July 2002, during peak participation, the program served about 1.9 million children per day.[25]

In recent years, concerns have escalated about the number of low-income children who go without Federal meal benefits during the summer. In describing the problem, Under Secretary of Agriculture Eric M. Bost pointed out that the 2 million SFSP meals served per day in FY 2000 represented only about 12 percent of the free and reduced-price meals served each day during the regular school year through the

[24]NYSPs are federally funded sports camps for low-income children. Programs are administered by colleges and universities.

[25]An additional 1.6 million children per day received summer meals through the NSLP as part of summer school programs or year-round schools (based on reported NSLP participation for July 2002 (USDA/FNS, 2003f)).

NSLP (Bost, 2000). Bost deemed this level of SFSP participation, which reached "only a fraction of eligible children," to be "unreasonably low."[26]

Several initiatives have been implemented to increase penetration of the SFSP by attracting more program sponsors, particularly school districts. In late 2000, P.L. 106-554 (the Consolidated Appropriations Act), authorized a special pilot project to increase the number of children participating in the SFSP in Puerto Rico and 13 States with low SFSP participation rates (Garnett, 2001; Food Research and Action Center (FRAC), 2001).[27] The pilot project was initially authorized to operate from FY 2001 through FY 2003 and was extended by Congress through March 2004. It simplified recordkeeping and reporting requirements and provided sites with the maximum per meal reimbursement for both operating (foodservice) cost reimbursements and administrative cost reimbursements. Moreover, pilot sites were allowed greater flexibility in using funds from two different reimbursement streams. Analyses completed by FRAC (FRAC, 2003) and FNS (Singh and Endahl, 2004) indicate that States participating in the pilot successfully increased SFSP participation. FNS found that, in all 14 States combined (considering Puerto Rico a State), the number of SFSP sponsors increased by 18 percent between July 2000 and July 2003, and average daily participation increased by 43 percent. Impacts varied substantially across States, however, and based on July 2003 data, many pilot States continued to have low SFSP participation relative to other States. Assessment of the pilot's impacts was complicated by other SFSP initiatives that were implemented during the same period.

For example, before the start of SFSP activities for summer 2002, USDA implemented "seamless summer waivers" for school districts that operate the NSLP (USDA/FNS, 2002a). The waivers, which ran through FY 2004, allowed school districts to offer the SFSP without having to deal with paperwork and other administrative tasks that were previously required. Tasse and Ohls (2003) studied early reaction to and effects of seamless waivers. Although school district response to the waivers was generally positive, early evidence indicated that the waivers had a limited impact on the number of children receiving summer meals. On a typical day in summer 2002, an estimated 50,000 children received meals who would not have done so without seamless waivers. Determining the ultimate success of seamless waivers will require information about impacts during summer 2003 and 2004.

Other actions taken by USDA to increase SFSP sponsorship include providing State agencies with the flexibility to approve deviations in the length of time between meal services and/or the duration of meal service, when existing requirements pose a barrier to participation, and to consider closed, enrolled sites that provide services exclusively to the "Upward Bound" program as categorically eligible for the SFSP. (Income-eligibility thresholds used for "Upward Bound" are identical to those used in the SFSP.) Finally, USDA developed a Web-based geographic information tool to help State agencies and other interested organizations identify areas that are underserved by the SFSP (Gordon and Briefel, 2003).[28]

To date, no research has examined the impact of the SFSP on nutrition or health outcomes of participating children. The research that does exist has been descriptive, much of it focusing on program operations and the characteristics of sponsoring organizations. The most recent such study was completed in March 2003 (Gordon and Briefel, 2003). In addition to looking at program operations and characteristics, the study looked at factors that affect participation, the nutritional quality of the meals served, and the extent of plate waste. FNS is currently undertaking a qualitative study to examine what low-income children not participating in the SFSP do during the summer.

The Emergency Food Assistance Program

The Emergency Food Assistance Program (TEFAP) provides commodity foods to emergency kitchens (often referred to as soup kitchens), homeless shelters, and similar organizations that serve meals to homeless and other needy individuals. Through food banks and food pantries, the program also provides basic commodities to low-income households for preparation and consumption at home. USDA purchases commodity foods and processes, packages, and distributes them to designated State agencies, which, in turn, distribute the foods to approved local charitable organizations.

TEFAP evolved from the Federal Surplus Relief Corporation, which was established under the Agricultural

[26]There are several reasons that SFSP participation is lower than NSLP participation. One is that open SFSP sites must be located in low-income neighborhoods, whereas the NSLP is available everywhere; another is that attendance at SFSP sites is voluntary, while children must attend school during the year (Gordon and Briefel, 2003). In addition, systems that transport students to schools during the normal school year are generally not operational during the summer months.

[27]The 13 States are Alaska, Arkansas, Idaho, Indiana, Iowa, Kansas, Kentucky, Nebraska, New Hampshire, North Dakota, Oklahoma, Texas, and Wyoming.

[28]Available at www.ers.usda.gov/data/SFSP/.

Adjustment Act of 1933 to encourage consumption of surplus domestic farm commodities, while providing nutritious foods to needy individuals. The current program was first authorized as the Temporary Emergency Food Assistance Program in 1981. The name associated with the acronym TEFAP was changed to The Emergency Food Assistance Program under the 1990 Farm Act. In 1996, PRWORA combined TEFAP with the previously separate Commodity Distribution Programs for Charitable Institutions, Soup Kitchens, and Food Banks.

TEFAP foods are distributed free of charge, but individuals who receive TEFAP foods for home use must meet eligibility criteria defined by each State. The types of commodities available through TEFAP vary from year to year, depending on agricultural conditions as well as State preferences. In FY 2001, more than 40 products were available, including canned and dried fruits; canned vegetables; fruit juice; meat, poultry, and fish; dried egg mix; peanut butter; nonfat dry milk; rice; pasta; and cereal (USDA/FNS, 2003g).

A recently completed study of providers in the U.S. Emergency Food Assistance System (EFAS) found that TEFAP commodities account for about 14 percent of all food distributed through the EFAS (Ohls and Saleem-Ismail, 2002). Nationally, 55 percent of emergency kitchens, 52 percent of food pantries, and 84 percent of food banks distribute TEFAP foods. In FY 2002, 611 million pounds of food were distributed through TEFAP at a Federal cost of $435 million (table 1).

The literature search identified no direct evaluations of TEFAP's effects on nutrition or health outcomes. A small number of studies have examined nutrition and health characteristics of people who use programs that commonly receive and distribute TEFAP foods, but TEFAP provides only part of the food that these programs distribute and the studies do not specifically measure TEFAP's role.

The recent survey of providers in the EFAS (Ohls and Saleem-Ismail, 2002) offers a detailed and up-to-date picture of the organizational system and programs that distribute TEFAP foods. An associated survey of EFAS clients in food pantries and emergency kitchens describes the characteristics and experiences of likely recipients of TEFAP food (Briefel et al., 2003).

Nutrition Services Incentive Program

The Nutrition Services Incentive Program (NSIP), formerly known as the Nutrition Program for the Elderly (NPE), provides cash and/or commodities to agencies or organizations that sponsor Elderly Nutrition Program (ENP) sites. The ENP, which is administered by HHS's Administration on Aging (AoA), is the primary vehicle for the organization and delivery of nutrition and support services to the Nation's elderly. The ENP provides meals in both group (congregate feeding sites) and home settings (the "Meals on Wheels" program). People ages 60 and older, their spouses, and certain others are eligible to participate in the ENP. The ENP has no income eligibility requirement, although the administering programs typically target lower income persons. Recipients are encouraged, not required, to contribute toward the cost of the meals they receive.

USDA's involvement in the ENP began in 1975 when Congress authorized USDA to donate commodities to the program. The USDA program, known as the Nutrition Program for the Elderly (NPE), provided commodities to States and Indian Tribal Organizations (ITOs) which, in turn, distributed them to local ENP sites. In 1977, P.L. 95-65 allowed States and ITOs to elect to receive their NPE entitlement in the form of cash or commodities. Over time, the predominant type of support provided by the NPE shifted from commodities to cash. In FY 1999, only 2 percent of the $140 million NPE appropriation was distributed to ENP meal providers as commodities (HHS/AoA, 2002).

When the ENP was reauthorized in FY 2000, the name for the USDA program was changed to the NSIP. In addition, the model for administering the program was changed from a simple reimbursement model to an allocation model. Rather than reimbursing States and ITOs per meal based on the number of meals served the previous fiscal year, NSIP funds are now distributed to States and ITOs based on the number of meals served *relative to the total number of meals served by all States and ITOs*. The reason for this change was a desire to reward States and ITOs for efficient use of cash and/or commodities in providing meals to older adults (USDA/FNS, 2002b).

In FY 2003, responsibility for the administration of the NSIP was transferred from USDA to HHS, although USDA continues to provide financial support and donated commodities. In FY 2002, USDA's contribution to the ENP was $152 million (table 1).

No studies have examined the effectiveness of the NSIP (or the former NPE) per se. To understand the impact of the NSIP, one has to look to research on the larger program, the ENP. Since the inception of the

ENP, two national evaluations and a number of smaller local studies have assessed the program's effectiveness. All of these studies used quasi-experimental designs, with nonparticipants identified in a variety of ways. Selection bias is an issue in all of this research, but only the most recent national study addressed the problem systematically (although inconclusively) (Ponza et al., 1996).

Most of the studies that have looked at the health and nutrition impacts of the ENP have focused on dietary intake or nutritional status, although food security has also received some attention (app. table 14, pp. 104-107). Some research has also examined the impact of the ENP on socialization. While many of the available studies are dated—approaching or exceeding 20 years old—a comprehensive national evaluation published in 1996 provides a reasonably up-to-date perspective on the nutrition- and health-related impacts of the ENP (Ponza et al., 1996).

Dietary Intakes

The strongest available evidence on the ENP's impact on dietary intake comes from the National Evaluation of the Elderly Nutrition Program, 1993-95 (Ponza et al., 1996). This study found that both congregate and home-delivered meal participants had significantly greater intakes of energy and protein than nonparticipants. In addition, ENP participants who received congregate meals had significantly greater intakes of a wide variety of vitamins and minerals than nonparticipants. ENP participants who received home-delivered meals also had higher mean intakes than did nonparticipants, but some of these differences did not reach statistical significance. Because of limitations in the dietary assessment methodologies used, determining whether ENP participants were more likely than nonparticipants to have adequate intakes of these vitamins and minerals is not possible.

No significant differences between ENP participants and nonparticipants were detected in intakes of total fat, saturated fat, cholesterol, or sodium. Mean cholesterol intakes of both groups were well within the recommended range. However, excessive intake of total fat, saturated fat, and sodium, relative to accepted recommendations, was a problem for some ENP participants.

Other Outcomes

While all studies of the impact of the ENP are subject to selection bias, studies that looked at measures other than dietary intake are especially prone to this problem because the program specifically targets individuals who are at nutritional or social risk. The impact of the ENP on more direct measures of nutritional status—including nutritional biochemistries, weight status, and a comprehensive measure of nutritional risk—has been examined only in small, local studies. The limited information available suggests that ENP participation is not associated with obesity and that, in fact, thinner, more frail elderly may self-select into the program. With the possible exception of serum vitamin A, which was positively associated with participation in the ENP, drawing firm conclusions about the impact of the ENP on nutritional biochemistries is not possible.

Evidence is mixed about the impact of the ENP on reducing social isolation and promoting quality of life among the elderly. While the perceived benefit of social and support services is high, two national evaluations that attempted to systematically measure social outcomes of ENP participants, relative to a group of eligible nonparticipants, employed different measures of socialization and reported divergent results.

The issue of food security among ENP participants has not been well researched, and the relationship is a complicated one. The 1993-95 evaluation assessed food security among ENP participants but did not collect comparable data for nonparticipants (Ponza et al., 1996). Instead, the authors compared data for ENP participants with data for the U.S. elderly population overall. Results indicated that, although most ENP participants reported having enough food to eat, they were much more likely to experience food insecurity than elderly people overall. This pattern presumably does not reflect an impact of ENP participation but indicates that individuals who choose to participate in the ENP are more food insecure than the general elderly population.

Only one of the identified studies estimated the impact of ENP participation on food security by comparing ENP participants with comparable nonparticipants (Edwards et al., 1993). The study included a sample of elderly diabetics who were either receiving home-delivered meals or on a waiting list for home-delivered meals. The ENP was found to have a positive effect on food security. Elderly diabetics who were receiving home-delivered meals were less likely than their counterparts on the waiting list to be food insecure or to go 1 or more days per month without food.

Nutrition Assistance Program in Puerto Rico, American Samoa, and the Northern Marianas

The NAP provides food and nutrition assistance to low-income individuals in Puerto Rico, American Samoa, and the Northern Marianas through block grants to territory administrative agencies. The territories provide cash or checks to eligible participants. The NAP replaced the FSP, which operated in the territories from 1975 through 1982. The 1981 Omnibus Budget Reconciliation Act (OBRA) abolished the FSP in the territories and replaced it with a block grant. Puerto Rican authorities designed the NAP to administer the block grant beginning in July 1982. The switch from the coupon-based FSP to the cash-based NAP was permanently authorized in September 1985.

The objectives of the NAP and the FSP are identical: to provide low-income households with access to a nutritious diet through increased food purchasing power. Both programs have monthly benefits that vary by household size and net income, and both programs are available to all applicants who meet specified eligibility criteria. Major differences between the programs include the following:

- ***Form of benefit.*** Electronic benefits for the FSP; cash or check for the NAP.[29]
- ***Benefit restrictions.*** FSP benefits are restricted to purchase of food for home consumption. NAP benefits are not restricted.
- ***Size of benefit.*** NAP benefits are constrained by the size of the block grant so eligibility requirements are stricter and benefits are generally smaller.

In FY 2002, the NAP block grants were $1.35 billion for Puerto Rico, $5.3 million for American Samoa, and $6.1 million for the Northern Marianas (table 1).

Very little research has been done on the impacts of the NAP (app. table 15, p. 110). The three studies identified in the literature search all focused on Puerto Rico. All three studies are considerably dated, having used data from the 1977 Puerto Rico Supplement to the Nationwide Food Consumption Survey (NFCS) and/or the 1984 Puerto Rico Household Food Consumption Survey (HFCS). The former survey was conducted while the FSP was still in place. The latter survey was conducted during the second full year of NAP operations.

The strongest analysis of food expenditures found a positive impact, as would be expected from a program that supplements the household's purchasing power (Beebout et al., 1985). Contradictory findings from the only other analysis of this outcome probably stem from weaknesses in the analytic approach (Hama, 1993).

Available evidence on the impact of the NAP on household nutrient availability is limited but suggests small, positive effects. All three of the identified studies looked at this outcome, using the same database but different analytic approaches. All found small increases in household availability of food energy as well as several vitamins and minerals considered to be potentially problematic in the Puerto Rican diet. However, only one study reported on the statistical significance of observed differences (Bishop et al., 1996). This study found that some nutrient intake distributions improved significantly after the NAP (iron, vitamin A, and niacin), some worsened significantly (calcium and riboflavin), and some remained the same (magnesium and vitamin B_6). In examining impacts by income quintiles, the authors noted that the improvements reached the lowest income quintile while the negative changes did not.

Bishop and his colleagues also compared energy and nutrient availability among NAP participants and nonparticipants, using only the 1984 HFCS data. In these analyses, the sample was restricted to households in the lowest quintile of the nutrient distribution under consideration. Among these high-risk households, NAP participation was associated with greater availability of food energy and six of the seven nutrients examined (all but calcium). Differences were statistically significant for iron, magnesium, and vitamin B_6.

Commodity Supplemental Food Program

The CSFP was established in 1968, largely in response to concerns about hunger and malnutrition among vulnerable low-income populations. The Supplemental Food Program, as it was initially known, was developed as a joint effort between USDA and the U.S. Department of Health, Education, and Welfare (the forerunner of the current HHS). The program provided food packages, including evaporated milk, corn syrup, and "reinforced" cereals, to low-income women, infants, and preschool children. Food packages were distributed to participants—upon "determination [of need] by a competent medical authority"—through health clinics, visiting nurses,

[29]PRWORA mandated that all FSP benefits be distributed as electronic transfers rather than as coupons. Nationwide changeover from coupons to electronic transfers was completed in June 2004 (USDA, 2004).

and health centers that served low-income populations (Mahoney Monrad et al., 1982).

Over time, other types of social service organizations have come to serve as local CSFP agencies. In the current configuration, not all local agencies that provide commodity foods also provide direct health services, but all are encouraged to provide health information and linkages. In addition, with the inception and growth of the WIC program and growing interest in issues related to aging, the CSFP has shifted emphasis toward the low-income elderly. Elderly participation in the CSFP began with a pilot project in FY 1982. The program continues to serve pregnant and breastfeeding women, new mothers up to 1 year postpartum, infants, and children under age 6. The nonelderly population is similar to the population served by WIC, but eligible individuals cannot participate in both programs at the same time.

The CSFP does not operate in all 50 States. In FY 2003, 32 States, the District of Columbia, and 2 Indian reservations were authorized to operate the program (USDA/FNS, 2003h). In FY 2002, 427,000 individuals, the majority of whom were elderly, participated in the CSFP each month. The total Federal expenditure for the program was $110 million (table 1).

The only identified study to examine CSFP impacts dates back to 1982 (app. table 16, p. 112). The study included only pregnant women and preschool children. For pregnant women, the study found favorable impacts on birth outcomes such as gestational age, birthweight, and length of hospital stay after birth (Mahony Monrad et al., 1982). The study found some evidence of positive effects for children but generally had inconclusive results. Study authors provided little information on the procedures used to identify nonparticipants; however, the study likely suffers from selection bias. The relevance of the study to today's CSFP is also limited by the fact that it is more than 20 years old and provides no information on the current majority participant group (the elderly).

Food Distribution Program on Indian Reservations and the Trust Territories

The FDPIR was authorized under the Food Stamp Act of 1977.[30] In establishing the FDPIR, Congress cited concerns that the FSP might not adequately meet the food assistance needs of low-income American Indian households living on or near reservations (Usher et al., 1990). The primary concern was that the remote location of many reservations made it difficult for American Indian households to participate in the FSP. In many instances, the distance between the reservation and the local FSP offices was substantial and/or food stores where FSP coupons could be redeemed were scarce or far away. Thus, the FDPIR was designed to provide an alternative to the FSP for low-income American Indian households living on or near reservations.

The FDPIR provides monthly supplemental food packages to low-income households living on Indian reservations and to eligible American Indian households living in approved areas near reservations. Income eligibility for the FDPIR is based on federally defined income eligibility requirements used in the FSP. However, the FDPIR does not impose FSP requirements related to employment and training or time limits for able-bodied adults without dependents (ABAWDs). All households residing on Indian reservations are eligible to participate in the program if they meet income and resource standards. Households living in approved areas near reservations or in Oklahoma are eligible to participate if at least one member of the household is a member of a federally recognized tribe (USDA/FNS, 2003j).

Eligible households may choose to participate in either the FDPIR or the FSP but not both. Participating households receive a monthly food package weighing between 50 and 75 pounds. In FY 2003, more than 70 different food items were offered, including canned meats, poultry, and fish; canned fruits, vegetables, and juices; dried fruits; dehydrated potatoes; canned soups; canned spaghetti sauce; packaged macaroni and cheese and other types of pasta; cereals; rice and other grains; cheese; egg mix; peanuts; peanut butter; low-fat refried beans; and nonfat dry and evaporated milks (USDA/FNS, 2003j). Staples, such as flour, cornmeal, bakery mix, corn syrup, vegetable oil, and shortening, are also offered. Frozen ground beef and chicken and/or fresh produce are also available to most programs that have facilities to store and handle these foods.[31]

In addition to providing food, the FDPIR makes available to participants printed materials, including guidance on how to use FDPIR foods as part of a healthy diet, commodity fact sheets that provide storage and preparation tips, nutrition information and recipes, and

[30]The FDPIR was actually the precursor to today's FSP. After FY 1975, when the FSP was available nationwide, the program served U.S. territories in the Pacific Islands as well as Indian reservations. Most of the Pacific Island sites were phased out during the 1980s and 1990s, as the islands converted from U.S. territories to commonwealths (USDA/FNS, 2003i).

[31]Even when offered, some families are not able to use fresh or frozen foods because they do not have refrigerators (Ballew et al., 1997).

a "Nutrition Facts" booklet that lists the ingredients and nutrient composition of available commodities (USDA/FNS, 2003j). Sponsoring agencies can also apply for additional Federal funding to be used specifically for nutrition education.

In FY 2003, the FDPIR was administered by 98 Indian Tribal Organizations and five States and provided benefits to approximately 243 American Indian tribes (USDA/FNS, 2003j). In FY 2002, the program served approximately 110,000 individuals each month at an annual cost of $69 million (table 1).

Very little research has been done on the FDPIR. The only program-specific study identified was a nationally representative study completed by Usher et al. (1990). The study was descriptive in nature, with the primary objectives of describing program operations, sociodemographic characteristics of FDPIR households, the dietary needs and preferences of low-income American Indians, and how the FDPIR addresses those needs. The study also compared availability and acceptability of the FDPIR vs. the FSP in providing food assistance. The only other potentially relevant literature documents nutrition and health concerns among American Indians, suggesting a need for the program's benefits. However, no scientific research has assessed the extent to which the FDPIR meets these needs.

WIC and Senior Farmers' Market Nutrition Programs

The Farmers' Market Nutrition Programs provide low-income individuals with coupons that can be used to buy fresh fruits, vegetables, and herbs from authorized farmers and farmers' markets. The WIC Farmers' Market Nutrition Program (FMNP) is affiliated with the WIC program and serves certified WIC participants and eligible nonparticipants who are on waiting lists. FMNP participants can receive farmers' market coupons totaling $10-$20 per year, usually at the beginning of the fruit- and vegetable-growing season. Not all WIC programs participate in the FMNP. In FY 2003, the FMNP operated in 36 States, the District of Columbia, Guam, Puerto Rico, and 5 Indian Tribal Organizations (USDA/FNS, 2003k). The Federal appropriation for the FMNP was $25 million for FY 2003, and the program served more than 2 million participants in FY 2002 (table 1).

The Senior Farmers' Market Nutrition Program (SFMNP) is a new FANP, just started in 2002. The SFMNP is essentially the same as the WIC version of the program but is targeted toward low-income elderly. Total costs for the program were about $13 million in its first year of operation (table 1). In FY 2003, the SFMNP operated in 35 States, the District of Columbia, Puerto Rico, and 3 Indian Tribal Organizations (USDA/FNS, 2003l). A total of $17 million in funding was available, including the FY 2003 appropriation ($15 million) and unspent funds from FY 2002 (approximately $2 million) (USDA, FNS, 2003l).

The literature search identified two studies that assessed nutrition-related impacts of the FMNP by comparing participants and nonparticipants (app. table 17, p. 114).[32] Both studies used research designs that were quite vulnerable to selection bias, reported on a very early period in the program's operation, and based impact assessments on self-reported consumption of fresh fruits and vegetables. One study found that participants ate more fresh fruits and vegetables (Galfond et al., 1991), while the other found no effect (Anliker et al., 1992).

The limited and scientifically flawed research that is available on the FMNP does not support a firm conclusion about the program's impact. The small dollar value of the FMNP benefit—no more than $20 per year—suggests that the program's impact, if any, is likely to be so small that it would be extremely costly to measure.

Special Milk Program

The Special Milk Program (SMP) operates in schools and child care institutions that do not participate in other federally sponsored child nutrition programs (the NSLP, the SBP, or the CACFP). Schools that do participate in these other programs may also participate in the SMP to provide milk to children enrolled in preschool or kindergarten programs that do not provide meals.

Institutions participating in the SMP provide milk to children and receive a Federal subsidy for each half pint served. Children from households with incomes at or below 130 percent of the Federal poverty level may receive milk free of charge. In FY 2002, the program provided approximately 113 million half pints of milk to low-income children at a Federal cost of $16 million (table 1).

Research on the SMP is extremely limited. Only two studies that assessed program impact were identified (app. table 18, p. 116). Both of these studies are based

[32]The SFMNP was not considered in the literature review because it was not established until 2002.

on data that are more than 20 years old, reflecting a time when the program was 10-15 times as large as it is today.

The strongest available evidence on the potential impact of the SMP, although subject to selection bias, comes from the National Evaluation of School Nutrition Programs (NESNP), which collected data in the 1980-82 school year (Wellisch et al., 1983). Results of this study indicated that SMP participants consumed significantly more food energy and protein than nonparticipants, as well as more calcium, riboflavin, magnesium, and vitamin B_6. These results are consistent with the nutrient content of milk.

Team Nutrition Initiative and Nutrition Education and Training Program

The Team Nutrition (TN) Initiative and the Nutrition Education and Training (NET) Program differ from other FANPs in three important ways.[33] First, the primary focus of each program is educational in nature—to promote healthful eating patterns. Neither program provides food or enhances food purchasing power. Second, neither program targets benefits based on household income. That is, both programs, which are implemented primarily in schools, are intended to serve all children rather than offering greater benefits to low-income children (as the NSLP and SBP do) or being limited to children with specific nutritional risks (as WIC is).[34] Finally, target audiences for both TN and NET services extend beyond children to include teachers, school foodservice workers, parents, and community members, all of whom may influence children's food choices.

After the Senior Farmers' Market Nutrition Program, which began in 2002, TN is the youngest FANP. It was created in 1995 as part of the comprehensive School Meals Initiative (see preceding discussion on the NSLP). The FY 2002 appropriation for TN was $10 million (table 1). NET has been authorized for more than 25 years but has not received funding since FY 1998. Relatively little research has been done on either TN or NET (app. table 19, p. 118).

Team Nutrition Initiative

The best available information about potential impacts of TN comes from an evaluation of a pilot project that was implemented shortly after the program was established (USDA/FNS, 1998). The evaluation assessed the impact of TN in three key areas: skill-based nutrition knowledge, nutrition-related motivation and attitude, and food consumption behaviors. The TN pilot was designed to test optimal implementation of the initiative. School districts selected to participate in the pilot demonstrated capacity to meet the requirements of TN implementation, as well as the associated evaluation. Four districts were selected to participate in an indepth outcome evaluation. Three other districts participated in a limited process study.

Results of the pilot evaluation, although preliminary and certainly not generalizable, were promising. For skill-based knowledge, significant and positive impacts were noted for students' ability to (1) identify healthier choices and (2) apply knowledge of the Food Guide Pyramid. Students' ability to apply a "balanced diet" concept also increased, relative to pretest scores, but differences were not statistically significant. Small but positive and significant effects were noted for three different attitude measures. Followup data showed that significant TN effects were maintained over time, although the size of the impact decreased for three of the five measures that were significant initially. Estimated impacts at followup were equivalent to or greater than initial impacts only for the general attitudes measure and for perceived consequences of increased consumption of fruits, vegetables, and grains. The fact that the relative size of the impacts was small (generally one more correct answer) did not seem to be attributable to a ceiling effect. The authors suggested that the results reflected the short implementation period used for the evaluation and speculated that impacts could be larger with a more protracted period of intervention.

Effects on observed food selection and consumption behaviors in the cafeteria were modest. The only effects that were noted in an analysis that combined results for all pilot districts were a slight increase in the number of grain foods selected, an associated increase in the amount of grain foods eaten, and a small increase in the diversity of foods eaten (the number of different food groups tasted per day and total number of items). No significant differences were noted for selection or consumption of fruits, vegetables, or low-fat milk.

Analysis of three different measures of self-reported eating behaviors showed that TN had small but statistically significant effects on self-reported behaviors. The specific behaviors examined were use of low-fat foods, consumption of fruits and vegetables, and dietary variety (the number of food groups included in meals and

[33]FNS considers the TN to be part of the NSLP and SBP rather than a separate FANP.

[34]The TN also provides nutrition education materials to other FANP programs, such as WIC and the FSP.

snacks eaten the previous day). TN was found to have a small but positive and statistically significant impact on all three measures, but none of the impacts persisted over time.

Nutrition Education and Training Program

The only national study of NET was completed during the very early stages of the program, between 1979 and 1980 (St. Pierre and Rezmovic, 1982). At that point, it was plausible to expect program impacts in only a few States that had been able to begin implementation almost immediately after funds became available. Moreover, because of the diversity of States' goals, only State-specific impact evaluations were deemed appropriate.

Consequently, impact assessment was limited to two States in which NET was firmly established: Georgia and Nebraska (St. Pierre and Rezmovic, 1982). In Nebraska, a pre-/post-test design showed significant, positive impacts on children's nutrition-related knowledge (St. Pierre et al., 1981). In addition, some groups of students were more willing to try new or previously rejected foods in the school cafeteria or more likely to have improved their food preferences (based on self-report). Effects on nutrition-related attitudes, self-reported eating behaviors, or plate waste were not consistent. In the Georgia study, NET had strong positive effects on nutrition knowledge but limited effects on attitudes and self-reported eating behaviors (St. Pierre and Glotzer, 1981).

The literature search identified three small local studies that examined the impact of NET interventions on children's nutrition-related knowledge, attitudes, and/or eating behaviors.[35] Some of these studies, like the national evaluation, yielded convincing evidence that NET nutrition education activities produced at least short-term improvements in children's nutrition knowledge and attitudes, but little evidence that they affected children's eating habits.

[35]The literature search included only studies where NET was specifically identified and did not include studies that examined impacts on teachers or foodservice workers. The latter research is sumarized elsewhere (Olson, 1994).