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REPORT

FINAL REPORT

Evaluation of the Effect of the Older Americans Act Title III-C Nutrition Services Program on Participants' Food Security, Socialization, and Diet Quality

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CONTENTS

TABLES

INTRODUCTION BY THE ADMINISTRATION FOR COMMUNITY LIVING

The 2017 evaluation of the Older Americans Act (OAA) Nutrition Program for the Elderly provides results and information on the impact of the program on the participants' food security, socialization, and diet quality. Comparisons are drawn from the previous evaluation of the program conducted in 1995. This evaluation also serves to provide insight into areas needing further review. This evaluation's results provide much support for the work of the Aging Network as it attempts to fulfill its core mission of reducing hunger and food insecurity, promoting socialization, and promoting the health and well-being of older individuals. For example:

- The majority of program participants had a positive impression of the program. Ninety-two percent of congregate meal participants and 96 percent of home-delivered meal participants rated the nutrition program overall as good, very good, or excellent. Similarly, nearly all participants rated program staff positively overall and would recommend the program to friends or relatives.
- Most participants (81 and 90 percent of congregate and home-delivered meal participants, respectively) reported the program had helped them to eat healthier foods, and 68 to 78 percent indicated the program had improved their health and helped them to achieve or maintain a healthy weight.
- The majority, 71 percent of congregate and 90 percent of home-delivered meal participants, reported the program had helped them to live independently and remain in their own home.

In addition, the evaluation brought to light a few areas that warrant further exploration. For example, the research indicates that 46 percent of home-delivered meal participants felt the deliverer did not engage them. The percentage of those satisfied with the deliverer engagement had significantly increased from the 1995 survey. As the OAA Nutrition Program continues to strive to increase customer satisfaction, additional research may be warranted to evaluate the socialization and the informal safety-check benefits of a daily meal delivery.

Another area that may warrant further research is in response to the findings that suggest many home-delivered meal participants may not be receiving a sufficient number of meals per week to ameliorate their level of food insecurity. The research shows that among home-delivered meal participants who receive fewer than five meals per week (about 30 percent of participants), a significantly greater percentage of participants lived in households that had experienced very low food security, compared to non-participants (25.8 versus 15.9 percent). Part of the research involved assessing participants' food consumption over a 24-hour period. This information was analyzed against current federal nutritional standards to evaluate the adequacy of the participant's diet. The research found that congregate and home-delivered participants had healthier diets compared to nonparticipants, in terms of adequacy of their usual nutrient intakes and the overall quality of their diets.

Finally, when nonparticipants were compared to participants in the congregate meal program, participants were more satisfied with their socialization opportunities. However, when high-income vs low-income congregate participants were questioned regarding their socialization opportunities at the congregate meal site, the low-income participants were less

satisfied. Further investigation may be warranted to ascertain why low-income participants are not as satisfied with the socialization opportunities presented at the meal sites.

Overall, we find this report very informative. We plan to use the results of this evaluation to continue efforts to improve the health and well-being, address food insecurities, and meet the needs of OAA program participants. Further, we plan to use the results to highlight areas where States, Area Agencies on Aging and the local nutrition providers should assess their methods of service provision to ensure optimal benefit and responsiveness to the changing needs of the increasing number and increasingly diverse older population.

EXECUTIVE SUMMARY

In an effort to ensure that the health and social needs of older adults are adequately met and to rebalance long-term care provision away from institutionalization and toward home and community-based services, the Administration on Aging (AoA) within the Administration for Community Living of the U.S. Department of Health and Human Services (DHHS) administers the Title III-C Nutrition Services Program (NSP) as part of the Older Americans Act (OAA). The NSP promotes access to nutritious meals, nutrition education, and nutrition counseling; facilitates social contact; and conducts health promotion activities all which help older adults maintain their independence in their homes and communities.

Two core components of the program are the provision of congregate and home-delivered meals. NSP congregate meal participants can receive a nutritious meal at a senior center or other community location, where they can socialize with peers and may receive other services such as nutrition education, screening, and counseling. Non-nutrition services, including health promotion activities, transportation and case management services, may also be offered.

Participants who are homebound receive nutritious home-delivered meals. Like congregate meal settings, home-delivered meals may offer an opportunity for socializing through interactions with meal delivery drivers and other volunteers. Homebound participants may also receive nutrition education, screening, and counseling. In this way, the NSP provides homebound participants with a primary access point for many home- and community-based services to help meet their health and nutrition needs.

The mission of AoA is to develop a comprehensive, coordinated, and cost-effective system of long-term care that helps older adults maintain their independence in their homes and communities. As part of its ongoing efforts to support program planning, improve program efficiency, and strengthen program effectiveness, AoA contracted with Mathematica Policy Research to conduct the Title III-C NSP Evaluation. The three-part evaluation consists of a process evaluation of program administration and service delivery, a program cost analysis, and an evaluation of the effect of the program on participants' outcomes. This report is the first of two reports about the NSP outcome evaluation. It summarizes findings from the outcomes evaluation using data collected from program participants and nonparticipants.

Background

Organizations in the National Aging Network, an informal network of home- and community-based care providers, administer the NSP. AoA's central and regional offices provide overall federal coordination; however, the State Units on Aging (SUAs) and the Area Agencies on Aging (AAAs) both support key aspects of program operations. In turn, local service providers (LSPs) typically provide the direct nutrition services.

The NSP is authorized under Title III of the OAA.[1] Under Title III, SUAs receive federal grants from AoA for provision of congregate nutrition services (authorized under Part C-1), home-delivered nutrition services (authorized under Part C-2), meals (authorized under Part A) and support services (authorized under Part B).

SUAs support the provision of daily meals and related nutrition services in either group (congregate) or home settings to adults ages 60 and older. The NSP does not have a financial means test, but services target older adults with the greatest economic or social need. Participants are not charged for meals but are encouraged to contribute toward the total cost of the meal voluntarily. However, within site capacity, participants' inability or unwillingness to contribute does not deny them of meals or other services. Congregate meals and support services are provided at LSPs' meal sites (such as senior centers, religious facilities, and public or low-income housing facilities). Home-delivered meals are provided to homebound individuals by the congregate meal sites, affiliated central kitchens, or nonaffiliated food service organizations.

Congregate and home-delivered LSPs must provide meals that comply with the most recent *Dietary Guidelines for Americans* ("*Dietary Guidelines*"; DHSS and USDA 2015a) and provide a minimum of one-third of the Dietary Reference Intakes established by the Food and Nutrition Board of the Institute of Medicine of the National Academy of Science (2006). In addition to meals, LSPs also provide for nutrition education, nutrition screening and assessment, and nutrition counseling if appropriate.[2]

In fiscal year 2014, OAA Title III-C funding was $438 million for congregate nutrition services and $216 million for home-delivered nutrition services (ACL 2014). In that year, 80 million meals were served to 1.6 million people at congregate sites and 138 million home-delivered meals were provided to 836,000 homebound older adults.

Evaluation objectives and research approach

The objectives of the Title III-C NSP evaluation were to:

- Provide information to support program planning, including an analysis of program processes (referred to as the *process study*).
- Develop information about program efficiency and cost issues (referred to as the *cost study*).
- Assess program effectiveness, as measured by the program's effects on a variety of important outcomes, including diet quality, socialization opportunities, health outcomes, and—ultimately—helping older adults avoid institutionalization (referred to as the *outcomes evaluation*).

[1] Similar nutrition and supportive services for elderly American Indians, Alaska Natives, and Native Hawaiians are authorized separately under Title VI. This report focusses on the Title III NSP.

[2] Additional LSP requirements are available in Section 339 of the OAA.

The process study report (Mabli et al. 2015) and cost study report (Ziegler et al. 2015) shed light on the diversity and organizational structure of the National Aging Network and whether the system operates efficiently. However, policymakers and program administrators also need to know whether the NSP succeeds in delivering services of benefit to older adults. Thus, a third major objective of the NSP evaluation is to assess whether the program improves participants' diet quality (and opportunities for socialization and health promotion activities) in the short run and, thereby, improves health outcomes in the longer run—outcomes that would allow participants to remain in their homes and communities aging in place and delaying or avoiding institutionalization.

This report summarizes findings from the NSP outcomes evaluation. The objectives of the evaluation are to:

1. Describe NSP participants' demographic and household characteristics, health status, mobility, eating behaviors, diet quality, food security, socialization, and other characteristics.
2. Describe NSP participants' experiences with and impressions of the NSP and their valuation of meals and supportive services received through the program.
3. Determine the impact of NSP meals and related services on participants' nutrition, food security, and diet quality (with a focus on nutrients linked to health of older adults) by comparing outcomes for NSP participants and nonparticipants.
4. Determine the impact of NSP meals and nutrition services on overall wellness and well-being by comparing outcomes for NSP participants and nonparticipants.

This report addresses the first three objectives and part of the fourth objective that assesses well-being based on loneliness, depression, and socialization opportunities. A separate report will further address the fourth objective which examines overall wellness measured using longer-term outcomes related to health and avoidance of institutionalization.

The NSP outcomes evaluation draws on information obtained from comprehensive surveys of congregate and home-delivered meal participants and a matched comparison group of program-eligible nonparticipants. A comparison group of eligible nonparticipants represents what would happen to participants in the absence of the program. An NSP outcomes survey and a 24-hour dietary recall were administered to random samples of congregate and home-delivered meal participants, based on probability samples of AAAs and LSPs that were surveyed as part of the process study. The nonparticipant comparison group was formed by obtaining administrative lists of Medicare beneficiaries and using statistical matching techniques to identify older adults living in the same geographic area who had similar characteristics to those in the congregate meal and home-delivered meal samples. Descriptive, tabular analysis was used to characterize NSP participants and multivariate analysis and matching methods were used to estimate the effect of congregate and home-delivered meal participation on NSP outcomes.

Study findings

Following are key findings of the evaluation.

A. NSP participant characteristics and circumstances

1. Demographic characteristics and income

Congregate and home-delivered meal participants were similar in terms of gender, veteran status, and whether they live alone, but compared to congregate meal participants, home-delivered meal participants, on average, were older, had less education, and were more likely to be widowed. The average congregate meal participant was 77 years old, whereas the average home-delivered meal participant was 82 years old.[3] More than two-thirds of congregate and home-delivered meal participants were women, and 15 to 17 percent were veterans. The percentage of participants who were married was similar across the two programs, though 52 percent of home-delivered meal participants were widowed compared to 47 percent of congregate meal participants. About 60 percent of participants in both groups lived alone. Participants in each program were largely non-Hispanic white individuals (66 percent for congregate meal participants and 72 percent for home-delivered meal participants), but a sizable percentage of participants were members of racial and ethnic minority groups. Non-Hispanic blacks constituted approximately 14 percent of congregate meal participants and 18 percent of home-delivered meal participants. Hispanics made up another 13 percent and 9 percent of participants, respectively, in the two programs.

Although financial means tests for participation in the NSP are prohibited, most participants were poor or near poor. Thirty-one percent of congregate meal participants and 35 percent of home-delivered meal participants had annual household incomes below 100 percent of the DHHS federal poverty guidelines. Most of the rest had annual household incomes between 100 to 200 percent of the poverty guidelines.

2. Health status, functional ability, and mobility

Compared to congregate meal participants, a greater percentage of home-delivered meal participants reported being in fair or poor health, being underweight, having trouble eating due to dental issues, and taking multiple medications. Nearly half (46 percent) of home-delivered meal participants reported being in fair or poor health, compared to 23 percent of congregate meal participants. Six percent of home-delivered meal participants were underweight, compared to less than 1 percent of congregate meal participants. One-quarter of home-delivered meal participants reported trouble eating due to a condition with their teeth or gums or had other dental issues. Many participants reported taking three or more prescription medications daily (68 percent of congregate meal participants and 82 percent of home-delivered meal participants).

[3] The research team targeted participants who were at least age 67 at the time of the interview to ensure it would have at least one year of Medicare records for each participant for the purposes of identifying potential nonparticipants. This restriction made the average age of congregate and home-delivered meal participants greater than the average age in other surveys. For example, the average congregate meal participant was 76 years old and the average home-delivered meal participant was 79 years old in the 2014 National Survey of Older Americans Act Participants (NSOAAP).

The prevalence of doctor-diagnosed chronic health conditions was substantially higher for home-delivered meal participants than for congregate meal participants. The most common doctor-diagnosed health problems, reported by one-half to almost three-quarters of program participants, were high cholesterol, arthritis or rheumatism, eye conditions, and hypertension. The prevalence of arthritis, cancer, hearing impairments, stroke, and dementia were 8 to 15 percentage points higher for home-delivered meal participants than for congregate meal participants. Forty-one percent of home-delivered meal participants and 35 percent of congregate meal participants also reported a history of heart disease.

The prevalence of recent falls and injuries from falls was much higher for home-delivered meal participants compared to congregate meal participants. Fourteen percent of home-delivered meal participants reported having had two or more falls during the past three months compared to 7 percent of congregate meal participants. Among those individuals who experienced a fall, 45 percent of home-delivered meal participants reported a fall that had resulted in an injury, compared to 28 percent for congregate meal participants.

Finally, a substantial proportion of home-delivered meal participants reported functional impairments and needed help performing one or more activities critical for them to remain in their homes. Twelve percent of home-delivered meal participants were not able to walk and 64 percent had difficulty climbing stairs, compared to 1 and 33 percent, respectively, for congregate meal participants. Home-delivered meal participants were also three to nine times more likely than congregate meal participants to have a condition that could affect independent living, including being unable to shop or having difficulty shopping for groceries or personal items without assistance; having difficulty bathing; and having difficulty dressing.

3. Diet and eating behaviors

Most congregate and home-delivered meal participants reported consuming about three meals a day. Eleven percent of congregate meal participants described their appetite as poor or fair, compared with 29 percent of home-delivered meal participants. More than one-quarter congregate (27 percent) and home-delivered meal participants (34 percent) were on special health-related diets, most commonly diets associated with diabetes or diets to reduce sodium intakes and lower blood cholesterol levels. Although most congregate meal participants could prepare hot meals if necessary, about one-third of home-delivered meal participants were unable to do so themselves.

4. Diet quality

The evaluation used 24-hour dietary recalls to measure contributions of congregate and home-delivered meals to participants' total daily nutrient intakes and found that program meals contribute substantially to both congregate and home-delivered meal participants' diets. On average, congregate meal participants obtained 41 percent of their daily calories from program meals, and home-delivered meal participants obtained 38 percent. In addition, congregate and home-delivered meals contributed more than one-third and up to 47 percent of participants' daily intakes of all nutrients examined (ranging from 39 to 47 percent for congregate meal participants and 35 to 47 percent for home-delivered meal participants).

To assess the adequacy of participants' usual diets, the study examined participants' usual daily intakes—including foods and beverages from congregate and home-delivered meals as well as foods and beverages obtained from other sources—to Dietary Reference Intakes for adults 51 years and older. Findings indicate that the usual diets of more than 92 percent of congregate and home-delivered meal participants included adequate amounts of vitamin B_{12}, niacin, riboflavin, iron, and phosphorus. In addition, the prevalence of adequate usual intakes of thiamin was high for both groups of participants (86 and 89 percent, respectively). The prevalence of adequate usual intakes was lower for both groups of participants for vitamin B_6, folate, and zinc (72 to 78 percent); vitamin A (76 and 65 percent, respectively); vitamin C (55 and 51 percent), magnesium (31 and 22 percent), and calcium (26 and 24 percent).

The study also examined participants' usual intakes of sodium and saturated fat. The 2015-2020 *Dietary Guidelines* recommends that intakes of these nutrients be limited. The findings indicate that a majority of congregate and home-delivered meal participants had usual intakes of sodium that exceeded the *Dietary Guidelines'* recommendation (94 and 69 percent, respectively). The same was true for saturated fat—89 percent of congregate meal participants and 72 percent of home-delivered meal participants had usual intakes of saturated fat that exceeded the recommended limit.

Total Healthy Eating Index (HEI)-2010 scores, which measure overall diet quality relative to the 2010 *Dietary Guidelines'* recommendations, were 66 and 61 of a possible 100 points for congregate and home-delivered meal participants, respectively. Both groups of participants achieved the maximum scores for whole fruit and total protein foods (5 of 5) and came close to achieving the maximum score for total fruit (4.8 and 4.6 of 5 for congregate and home-delivered meal participants, respectively). Congregate meal participants also came close to achieving the maximum score for seafood and plant proteins (4.6 of 5). Scores for total vegetables were slightly lower for both groups of participants but still more than 85 percent of the maximum possible score (4.5 and 4.3 of 5 for congregate and home-delivered meal participants, respectively). For both groups of participants, scores were less than 50 percent of the maximum for fatty acids (4.2 and 4.0 of 10, respectively) and whole grains (3.8 and 3.3 of 10, respectively) and less than 25 percent of the maximum for sodium (2.3 and 2.2 of 10, respectively). Higher scores for the adequacy components (including total fruit, whole fruit, total protein foods, seafood and plant protein, total vegetables, fatty acids, and whole grains) reflect greater consumption and higher diet quality. Higher scores for moderation components (including sodium) reflect lower consumption and higher diet quality.

5. Receipt of nutrition and supportive services

Congregate meal participants attended congregate meal sites frequently, with 43 percent receiving five or more meals per week and 82 percent receiving three or more meals per week. Most congregate meal participants (79 percent) attended a single site for meals. Home-delivered meal participants also received meals frequently. Seventy-one percent received five or more meals per week, and 85 percent received three or more meals per week.

The majority of participants have received meals and program services for more than a year. Eight-four percent of congregate meal participants and 70 percent of home-delivered meal participants first enrolled in the meal program one or more years before taking the survey.

Fifteen percent of congregate meal participants and 27 percent of home-delivered meal participants enrolled within the preceding eight months.

Many participants used nutrition and supportive services outside the scope of NSP. Compared to congregate meal participants, home-delivered meal participants were much more likely to use personal care services (41 versus 6 percent); home visits for physical, occupational, or speech therapy (43 versus 10 percent); case management services (61 versus 13 percent); and light housekeeping services (60 versus 17 percent), but less likely to have received nutrition counseling (12 versus 22 percent).

6. Geographic access to food

Food access limitations are often characterized under the rubric of food deserts, defined in the 2008 Farm Bill as areas with limited access to affordable and nutritious food, particularly those composed of predominantly lower-income neighborhoods and communities. Food deserts are typically identified by having few or no retail food stores such as supermarkets and grocery stores in an area, in combination with other socioeconomic and transportation access criteria. Limited access to these types of stores may make it harder for congregate and home-delivered meal participants to eat a healthy diet. To measure participants' geographic access to food, the research team examined the distance to the nearest retailer and the number of retailers within certain distances from participants' homes for different types of stores.

At least half of congregate meal participants in urban areas lived within 0.6 miles of a supermarket, superstore, or large grocery store and at least half of participants in rural areas lived within 2.3 miles of one. For home-delivered meal participants, these distances were 0.5 and 3.1 miles, respectively.

In urban areas, at least half of congregate and home-delivered meal participants had one supermarket, superstore, or large grocery store within one mile of where they live. Convenience stores were more common, with participants having five to six stores within 1 mile. In rural areas, at least half of congregate and home-delivered meal participants had one supermarket, superstore, or large grocery store within 5 miles of where they live. As in urban areas, convenience stores were more common than supermarkets in rural areas.

7. Food security and food coping strategies

Although the majority of NSP participants were food secure, 16 percent of congregate meal participants and 23 percent of home-delivered meal participants had experienced food access limitations during the past month due to lack of money or other resources—they were food insecure. The rate of very low food security—a severe form of food insecurity—was also higher for home-delivered meal participants than congregate meal participants (7 versus 4 percent). For congregate and home-delivered meal participants, rates of food insecurity were lower for participants with more income: 32 percent of congregate meal participants with income in the lowest income quartile lived in a food insecure household, compared to 6 percent of participants with income in the highest income quartile. For home-delivered meal participants, these percentages were 35 and 13 percent, respectively. (The lowest income quartile consists of congregate meal participants with income below 92 percent of the federal poverty guidelines and the highest income quartile consists of congregate meal participants with income above

188 percent of the poverty guidelines. The corresponding percentages for home-delivered meal participants are 84 and 173 percent, respectively.)

Many participants reported that their income is sufficient to take care of their needs; however, a nontrivial percentage reported challenges in making ends meet and faced trade-offs in purchasing food each month. Specifically, fifteen percent of congregate meal participants and 23 percent of home-delivered meal participants reported that their incomes do not cover their needs and struggle to make ends meet. Some participants faced difficult choices of how to spend scarce household resources, such as whether to buy food or pay for rent, utility bills, or needed medications. About 4 to 9 percent of participants had to make these choices.

NSP participants were asked about coping strategies they would use if their program were unavailable. Sizeable percentages of participants (42 percent of congregate meal participants and 61 percent of home-delivered meal participants) indicated they would skip meals or eat less if the program were unavailable.

B. Participants' experiences with and impressions of the NSP

1. Impressions of the NSP

The majority of program participants had a positive impression of the program. Ninety-two percent of congregate meal participants and 96 percent of home-delivered meal participants rated the nutrition program overall as good, very good, or excellent. Similarly, nearly all participants rated program staff positively overall and would recommend the program to friends or relatives.

Most participants (81 and 90 percent of congregate and home-delivered meal participants, respectively) reported the program had helped them to eat healthier foods, and 68 to 78 percent indicated the program had improved their health and helped them to achieve or maintain a healthy weight. The majority, 71 percent of congregate and 90 percent of home-delivered meal participants, reported the program had helped them to live independently and remain in their own home.

Most home-delivered meal participants reported that meals arrived at the scheduled time (91 percent) and that the delivery person was pleasant (96 percent); however, many participants (46 percent) reported that the delivery person seldom or never spent time talking to them as part of the delivery process. In the 1995 evaluation, 75 percent of home-delivered meal participants reported that the delivery person left immediately after delivering the food and did not spend time to talk with or check on the participant, suggesting that engagement of delivery staff has improved.

More than 95 percent of congregate and home-delivered meal participants liked the meals they received from the nutrition program. Almost 80 percent of participants provided positive ratings on each element that measured their impression of the program meals, with home-delivered meal participants providing slightly lower ratings relative to congregate meal participants. In particular, about 25 percent of home-delivered meal participants reported they only sometimes, seldom, or never liked the taste or variety of food provided.

2. Social interactions and activities

The vast majority (93 percent) of congregate meal participants were satisfied with their opportunities to spend time with other people; 77 percent indicated they had no difficulty getting in touch with others during the past two weeks; and 63 percent belonged to religious, social or special interest groups. Home-delivered meal participants were less satisfied with their opportunities to spend time with other people (81 percent reported they were satisfied), faced more difficulty getting in touch with others (66 percent), and were less likely to belong to religious, social, or special interest groups (48 percent).

Congregate meal participants reported high levels of satisfaction with the opportunities for recreation and social interaction at the meal site. One-third reported spending a lot of time participating in activities or receiving services at the meal site, and 39 percent volunteered at the meal site. Almost all congregate meal program respondents (99 percent) reported being either very satisfied or somewhat satisfied with their opportunities to spend time with other people at the meal site.

C. The effect of congregate and home-delivered meal participation on food security, socialization, and diet quality

The effect of congregate and home-delivered meal participation on food security, socialization, and diet quality was estimated using data from program participants and a matched sample of nonparticipants.

1. Congregate and home-delivered meal participation and household food security

The effect of program participation on household food security was estimated using two measures based on the six-item food security module: whether an individual lives in a food insecure household and whether an individual lives in a household that experiences very low food security. Congregate meal participants had a lower rate of food insecurity than did nonparticipants, but rates of very low food security were similar for the two groups. The percentage of congregate meal participants living in a food insecure household was 4.0 percentage points lower than the percentage of nonparticipants (15.5 versus 19.5 percent). For lower-income individuals, the difference was nearly twice the size—7.8 percentage points (23.2 versus 31.0 percent).

Although home-delivered meal participants and nonparticipants had similar rates of food insecurity, the prevalence of very low food security was 4.2 percentage points higher among participants compared to nonparticipants (6.9 versus 2.7 percent). For the vast majority of participants who receive meals five days per week, however, the prevalence of very low food security among participants was similar to that among nonparticipants. For participants who receive meals fewer than five days per week, home-delivered meal participants experienced greater rates of very low food security than did nonparticipants.

2. Congregate and home-delivered meal participation and socialization

The impact of program participation on socialization outcomes was assessed using three measures. First, individuals' loneliness was measured using an abbreviated version of the Revised UCLA Loneliness Scale. The scale is based on responses to three questions related to

how often individuals feel they lack companionship, feel left out, and feel isolated from others. Higher scores indicate greater perceptions of loneliness.

The second measure came from the Patient Health Questionnaire 2 (PHQ-2) which assesses the frequency of depressed mood over a two-week period. A raw score based on responses to two questions ranges from 0 to 6. Studies have identified thresholds above which respondents screen positively for depression by balancing sensitivity (the ability of the screener to correctly identify those with depression) and specificity (the ability of the screener to correctly identify those without depression). Because there is no agreed-upon threshold that positively identifies individuals with depression, thresholds of 2, 3, and 4 were used to define three measures of screening positively for depression. The raw score itself was also examined.

As a third measure of socialization, two variables were constructed based on a single question measuring individuals' self-reported satisfaction with the opportunities they have had to spend time with other people. One variable indicates whether a respondent was very satisfied compared to somewhat satisfied, not too satisfied, and not at all satisfied; the other variable indicates whether a respondent was either very satisfied or somewhat satisfied, compared to not too satisfied or not at all satisfied.

Congregate meal participants generally had greater socialization outcomes compared to nonparticipants. Although there was no significant difference in loneliness scores between participants and nonparticipants, congregate meal participants were less likely than nonparticipants to screen positively for depression on most of the measures examined. Based on the most conservative measure of depression screening used, the percentage of individuals who screened positively for depression was lower for congregate meal participants than for nonparticipants (2.3 versus 6.5 percent). Participants also had greater satisfaction with their socialization opportunities relative to nonparticipants. The percentage of individuals who were satisfied with their socialization opportunities was 8 percentage points greater for congregate meal participants than for nonparticipants (94.0 versus 85.8 percent), and the percentage of individuals who were very satisfied with their socialization opportunities was 12 percentage points greater for congregate meal participants than for nonparticipants (67.5 versus 55.5 percent).

For home-delivered meal participants, the findings were mixed; for some socialization outcomes there were no significant differences between participants and nonparticipants, yet for other socialization outcomes, participants had less favorable outcomes than nonparticipants. The average loneliness score was higher for home-delivered meal participants compared to nonparticipants (4.5 versus 4.3, respectively), indicating slightly more loneliness among participants, and the percentage of individuals who were very satisfied with their socialization opportunities was 8.9 percentage points lower for home-delivered meal participants than for nonparticipants (44.5 versus 53.4 percent). However, there were no significant effects of home-delivered meal participation on the likelihood of screening positively for depression across any of the measures used and there was no statistical difference between the percentages of home-delivered meal participants and nonparticipants who were satisfied with the socialization opportunities they have had. Furthermore, examining the impact on socialization outcomes separately according to the number of days per week that participants receive meals showed that for the vast majority of participants who receive meals five days per week, there were no

differences in outcomes between participants and nonparticipants, but for participants who receive fewer than five meals per week, home-delivered meal participants experienced greater loneliness and were less likely to be satisfied with their socialization opportunities compared to nonparticipants.

3. Congregate and home-delivered meal participation and diet quality

The effect of program participation on diet quality outcomes was estimated using two measures: (1) the prevalence of adequate and excessive nutrient intakes and (2) the HEI-2010, which assesses overall diet quality. Both of these measures were estimated based on participants' and nonparticipants' usual daily intakes. For participants, this includes foods and beverages from program meals as well as foods and beverages obtained from other sources. The findings indicate that congregate meal participants generally had healthier diets compared to nonparticipants, both in terms of the adequacy of their usual daily nutrient intakes and the overall quality of their diets.

The percentages of congregate meal participants with adequate intakes of niacin, zinc, and vitamin B_6 were 16.6 to 18.5 percentage points higher than nonparticipants; for riboflavin, phosphorus, and vitamin B_{12}, percentages were 8.3 to 13.1 percentage points higher. While these vitamins and minerals are important for people of all ages, some are especially important for older adults. For example, vitamin B_6 is important for numerous metabolic reactions in the body and inadequacies sometimes lead to impaired immune function. Inadequate intakes of vitamin B_6 have also been associated with declines in cognitive functioning and depression, both of which are common among older adults (Institute of Medicine 2010). Vitamin B_{12} is an important nutrient of concern because decreased levels of stomach acid and many commonly prescribed medications can hamper its absorption. Low serum concentrations of vitamin B_{12} can have consequences for mobility and quality of life due to peripheral neuropathy and disturbances in balance and cognitive functioning, and can also increase the risk of heart disease and the loss of bone density (Institute of Medicine 2010).

Although participants were more likely than nonparticipants to have adequate intakes of many nutrients, they were also more likely to have excessive sodium intakes. The percentage of congregate meal participants with excessive sodium intakes was 30.6 percentage points higher compared to nonparticipants.

There was a sizeable difference between congregate meal participants and nonparticipants in total HEI-2010 scores, which provide an overall measure of diet quality. The total score for participants was 6.1 points higher than for nonparticipants (65.5 versus 59.4 points of 100). The statistically significant effect observed for the total HEI-2010 score reflects differences in scores for a number of HEI-2010 components. Relative to nonparticipants, congregate meal participants received higher scores for three adequacy components (total fruit, dairy, and total vegetables) reflecting greater consumption and higher diet quality, and a higher score for one moderation component (refined grains) reflecting lower consumption and higher diet quality. Refined grains are found in products that do not contain all of the components of the grain kernel, which may include white bread, cookies, cakes, pastries, muffins, pasta, and cold cereals made with refined flour.

Overall, home-delivered meal participants were more likely than nonparticipants to have adequate nutrient intakes, but there were few differences in the overall quality of their diets.

Compared to nonparticipants, a greater percentage of home-delivered meal participants had adequate intakes of zinc (18.5 percentage points greater), vitamin B_6 (12.7 percentage points greater), vitamin A (11.8 percentage points greater), and vitamin D (6.6 percentage points greater). There was no significant difference in the proportion of people with excessive sodium intakes. In addition, the percentage of home-delivered meal participants with usual intakes of total fat that were within the acceptable range was 11.5 percentage points higher than the percentage for nonparticipants. Conversely, the percentage of participants with usual intakes of alpha-linolenic acid that were within the acceptable range was 24.0 percentage points lower compared to nonparticipants. Alpha-linolenic acid is a fatty acid found mostly in nuts and seed oils such as walnuts, flaxseeds, canola oil and soybean oil and is essential in the diet because it cannot be produced in the body and must be obtained from food sources.

Few significant differences existed between home-delivered meal participants and nonparticipants in HEI-2010 scores. Although scores for dairy and refined grains were significantly higher for participants than nonparticipants (indicating higher diet quality), there were no significant differences in scores for any of the other components or for the total score.

4. Discussion and implications for future research

The lower food insecurity rate among congregate meal participants, relative to nonparticipants, aligns with expectations about how receipt of nutritious meals can reduce food access limitations. However, although congregate meal participants had lower food insecurity rates than did nonparticipants, a nontrivial percentage of participants were still food insecure. This points to the need to examine the determinants of food insecurity among NSP participants in greater detail, including how food insecurity is related to food coping strategies among lower-income participants. More generally, given that many participants reported that they experience challenges in making ends meet, it is important to learn more about the characteristics and circumstances of the participants who are forced to make difficult trade-offs between food and other goods and services. Exploring the extent to which family networks and food coping strategies complement the meals and services received through the NSP would be a fruitful area for future research.

No difference in the food insecurity rate existed between participants and nonparticipants, and, for participants who received fewer than five meals per week, home-delivered meal participants experienced greater food insecurity than nonparticipants. This suggests that some home-delivered meal participants experiencing food access limitations may not be receiving a sufficient number of meals per week to ameliorate their level of food insecurity. Learning more about why participants receive varying amounts of program meals and how their food needs are assessed is an important step in improving their food security. It is essential to learn more about how the intensity of service receipt for both programs—measured by the number of congregate meals attended or home-delivered meals received per week as well as use of multiple sites—depends on factors such as income, whether participants live alone, and functional impairments and, ultimately, how it affects participants' outcomes.

Congregate meal participants had more positive socialization outcomes compared to nonparticipants. For some outcomes, such as satisfaction with socialization opportunities, differences between participants and nonparticipants were particularly large. Additional research

could examine congregate meal sites' provision of socialization activities to assess whether the number of social activities that sites offer influences the improvement in socialization outcomes.

For home-delivered meal participants, the findings related to socialization were mixed; for some socialization outcomes, there were no significant differences between participants and nonparticipants, whereas for other socialization outcomes, participants had less favorable outcomes than nonparticipants. A possible explanation is that findings from the descriptive analysis showed that nearly half of home-delivered meal participants reported the delivery person seldom or never spent time talking to them as part of the delivery process. This highlights the need to examine the characteristics of the home-delivered meal participants who reported limited engagement from the delivery person, and whether the negative effects observed in the outcomes analysis reflected differences in levels of program staff engagement. Another possible explanation is that the number of days per week that a participant receives meals affects the opportunities for socialization. The negative effects were observed only for participants that received meals fewer than five days per week, and not for the majority of participants that receive meals five or more days per week. Examining how program staff engagement may differ for participants that receive varying amounts of program meals could help to identify ways of improving socialization outcomes among home-delivered meal participants.

Program meals contributed substantially to both congregate and home-delivered meal participants' diets, contributing between 35 and 47 percent of participants' daily intakes of nutrients among participants who consumed a program meal on the interview day. This finding indicates that both congregate and home-delivered meals are important sources of nutrition for participants. Further examination of the meals offered to participants would provide useful information on how modifying meals could improve participants' diet quality. More information is needed about the types of foods that programs frequently offer and the major food sources of nutrients and food groups in program meals.

Finally, congregate and home-delivered meals had a positive effect on diet quality, particularly on the prevalence of adequate nutrient intakes. However, additional research is necessary to assess the effects of participation on participants' food consumption patterns. Participants generally had healthier diets than nonparticipants, but participants' diets still fell short of the *Dietary Guidelines'* recommendations. To understand what is driving the differences in nutrition-related outcomes for participants and nonparticipants, additional analyses that examine differences in the food choices of participants and nonparticipants (outside of program meals) would be useful. Analyses that identify the key contributors to nutrient and food group intakes would also be useful. Both of these analyses would provide information that could be used to identify specific foods and/or consumption patterns to target in nutrition education efforts. It is also important to examine how the overall diets of home-delivered meal participants differ from those of congregate meal participants, given that participation had fewer effects on diet quality among home-delivered meal participants. More research is necessary to identify the differences in nutrient intakes and food choices between home-delivered meal and congregate meal participants, both at lunch (from program meals) and over 24 hours.

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I. INTRODUCTION

In an effort to ensure that the health and social needs of older adults are adequately met and to rebalance the provision of long-term care away from institutionalization and toward home and community-based services, the Administration on Aging (AoA) within the Administration for Community Living (ACL) of the U.S. Department of Health and Human Services (DHHS) administers the Title III-C Nutrition Services Program (NSP) as part of the Older Americans Act (OAA). The NSP promotes access to nutritious meals, facilitates social contact, and helps older adults maintain their independence in their homes and communities.

Two core components of the program are the provision of congregate and home-delivered meals. NSP congregate meal participants can receive a nutritious meal at a senior center or other congregate meal sites. Most sites serve lunch on one or more weekdays; however, in recent years, breakfast and dinner and meals offered on weekends have become more common (Mabli et al. 2015). Congregate meal sites offer an opportunity for participants to socialize with peers and receive other services such as nutrition education, screening, and counseling. These services help older adults identify their general and specific needs related to maintaining their health and managing individual nutrition-related diseases such as heart disease, hypertension, and diabetes. Participants may also receive non-nutrition services, including transportation and case management services.

Participants who are homebound receive nutritious home-delivered meals, typically five days per week. Most deliveries consist of a single meal such as a hot lunch, but meals come in a variety of forms including hot, cold, frozen, dried, canned, or shelf-stable, and some participants receive breakfast and/or dinner as well (Mabli et al. 2015). Like congregate meal settings, home-delivered meals offer an opportunity for socializing. Home-delivered meal volunteers might be older adults as well and, in addition to delivering meals, might offer the opportunity for face-to-face contact or conversation. This allows volunteers to relay important information about participants' well-being and needs to service providers. Homebound participants also receive nutrition education, nutrition screening and assessment, and nutrition counseling. In this way, the NSP provides homebound participants with a primary access point for many home- and community-based services to help meet their health and nutrition needs.

The mission of the AoA is to develop a comprehensive, coordinated, and cost-effective system of long-term care that helps older adults maintain their independence in their homes and communities. As part of its ongoing efforts to support program planning, improve program efficiency, and strengthen program effectiveness, AoA contracted with Mathematica Policy Research to conduct the Title III-C NSP Evaluation. The three-part evaluation consists of a process evaluation of program administration and service delivery, a program cost analysis, and an evaluation of the effect of the program on participants' outcomes. This report summarizes findings from the outcomes evaluation using data collected from program participants and nonparticipants. Another report will be issued to finalize the outcome evaluation using longer-term health outcomes. The findings from the process and cost components of the evaluation are presented separately (see Mabli et al. [2015] and Ziegler et al. [2015], respectively). The remainder of this chapter provides an overview of the NSP, summarizes the research objectives of the evaluation, and describes the organization of the report.

A. Overview of the Title III-C Nutrition Services Program

The NSP is authorized under Title III of the OAA. Through Title III, State Units on Aging (SUAs) implement a system of coordinated, community-based services targeted to older adults. Title III authorized the provision of nutrition and supportive services, such as meals, nutrition education, transportation, personal and homemaker services, and information and referrals.[4] The OAA has been amended frequently since the creation of the NSP in 1972. These amendments have added new responsibilities for agencies in the aging network and clarified responsibilities previously performed under the original legislation.

Under Title III-C of the OAA, AoA provides grants to SUAs to support the provision of daily meals and related nutrition services in either group (congregate) or home settings to adults age 60 and older. In fiscal year (FY) 2014, the most recent year in which counts of meals and individuals served are available, 80 million meals were served to 1.6 million people at congregate sites and 138 million home-delivered meals were provided to 836,000 homebound older adults (ACL 2014). OAA Title III-C funding was $438 million for congregate nutrition services and $216 million for home-delivered nutrition services in FY 2014 (ACL 2015).

1. Funding and administration

Organizations in the National Aging Network, one of the nation's largest provider networks of home- and community-based care for older adults and their caregivers, administer the NSP. AoA's central and regional offices provide overall federal coordination; however, the SUAs and the Area Agencies on Aging (AAAs) both support key aspects of program operations. In turn, local service providers (LSPs) typically provide the direct nutrition services.

Under Title III, SUAs receive federal grants from AoA for provision of congregate nutrition services (authorized under Part C-1), home-delivered nutrition services (authorized under Part C-2), and supportive services (authorized under Part B). Funds are allocated to states and territories according to a formula that is largely based on the state's or territory's share of the population age 60 and older among all states and territories.

SUAs distribute the funds to AAAs, which administer the nutrition services program within their respective planning and service areas. AAAs receive funds from SUAs on the basis of state-determined formulas that reflect the proportion of older adults in their planning and service areas and other factors. AAAs award grants to and contract with LSPs to provide nutrition and supportive services in their planning areas. AAAs, with a waiver from their state, can be direct providers of nutrition services as well. In addition to receiving AoA funds, AAAs and LSPs receive financial support from state and local government, in-kind contributions, private donations, and voluntary contributions from participants. Congregate meals and supportive services are provided at LSPs' meal sites (such as senior centers, religious facilities, and public or low-income housing facilities). Home-delivered meals are provided to homebound individuals through the congregate meal sites, affiliated central kitchens, or nonaffiliated food service organizations.

[4] Similar nutrition and supportive services for elderly American Indians, Alaska Natives, and Native Hawaiians are authorized separately under Title VI.

2. Eligibility requirements

Adults age 60 and older, and their spouses of any age, may participate in the NSP's congregate meal program. In addition, the members of the following groups are eligible to receive congregate meals:

- Disabled people younger than age 60 who reside in housing facilities, occupied primarily by older adults where congregate meals are served.
- Disabled people who reside at home with, and accompany, people age 60 and older to meal sites.
- Nutrition service volunteers.

For home-delivered meals, people who are homebound because of disability, illness, or isolation and are age 60 and older are eligible, as are their spouses of any age. Disabled people younger than age 60 living with older adults are also eligible.

The NSP is not an entitlement program. It also does not have a means test, but the program specifically targets older adults with the greatest economic or social need, with special attention given to low-income older adults, minorities, those living in rural areas, those with limited English proficiency, and those at risk of institutional care. Payment for meals is not mandatory, but participants are encouraged to make a voluntary contribution toward the total cost of the meal. However, within site capacity, participants' inability or unwillingness to contribute does not deny them of meals or other services.

3. Meals and services

LSPs must provide congregate and home-delivered meals that comply with the most recent *Dietary Guidelines for Americans* ("*Dietary Guidelines*"; DHHS and USDA 2015a) and provide a minimum of one-third of the Dietary Reference Intakes (DRIs) established by the Food and Nutrition Board of the Institute of Medicine of the National Academy of Sciences (Institute of Medicine 2006). In addition to meals, LSPs also provide for nutrition education, nutrition screening and assessment, and nutrition counseling if appropriate.[5]

B. Nutrition Services Program evaluation objectives and research questions

The objectives of the Title III-C NSP evaluation were to:

- Provide information to support program planning, including an analysis of program processes (referred to as the *process study*).
- Develop information about program efficiency and cost issues (referred to as the *cost study*).
- Assess program effectiveness, as measured by the program's effects on a variety of important outcomes, including diet quality, socialization opportunities, health outcomes, and—ultimately—helping older adults avoid institutionalization (referred to as the *outcomes evaluation*).

[5] Additional LSP requirements are available in Section 339 of the OAA.

Separate reports present findings from the process study (Mabli et al. 2015) and the cost study (Ziegler et al. 2015). The process study report used data collected from SUAs, AAAs, and LSPs to assess the ways in which the program operates to serve older adults. The process study analyzed NSP structure, administration, staffing, coordination, processes, and service delivery. It also described the nutrition and supportive services that agencies offer; differences in participant access to services, prioritization of services, and the use of waiting lists; and program resources.

The cost study report estimated the average costs of a congregate and a home-delivered meal provided under the NSP and assessed whether these average costs vary by meal preparation method or by other program characteristics. The cost study report also examined program efficiency by generating unit cost estimates for individual LSPs and examining cost variation within the program by cost component, meal preparation method, program size, and other program characteristics.

The process and cost studies shed light on the diversity and organizational structure of the National Aging Network and whether the system operates efficiently. However, policymakers and program administrators also need to know whether the NSP succeeds in delivering services of benefit to older adults. Thus, a third major objective of the NSP evaluation is to assess whether the program improves participants' diet quality in the short run and, thereby, improves health outcomes in the longer run—outcomes that would allow participants to stay in their homes and communities and delay or avoid institutionalization.

This report summarizes findings from the outcomes evaluation. Specifically, the objectives of the evaluation are to:

1. Describe NSP participants' demographic and household characteristics, health status, mobility, eating behaviors, diet quality, food security, socialization, and other characteristics.
2. Describe NSP participants' experiences with and impressions of the NSP and their valuation of meals and supportive services received through the program.
3. Determine the impact of NSP meals and related services on participants' nutrition, food security, and diet quality (with a focus on nutrients linked to health of older adults) by comparing outcomes for NSP participants and nonparticipants.
4. Determine the impact of NSP meals and nutrition services on overall wellness and well-being by comparing outcomes for NSP participants and nonparticipants.

This report addresses the first three objectives and part of the fourth objective that assesses well-being based on loneliness, depression, and socialization opportunities. A separate report will address the final portion of the fourth objective that examines overall wellness measured using longer-term outcomes related to health and avoidance of institutionalization based on Medicare claims data. That analysis will determine the impact of receiving program services on patterns of health care behavior and utilization (especially doctor visits, emergency room care, and hospital admission and readmission) by comparing outcomes for NSP participants and nonparticipants. It will also determine the impact of the NSP on older adults' ability to age in place and maintain current quality of life.

C. Organization of the report

The remaining chapters of this report discuss the methodology used in the analysis and present findings. Chapter II provides an overview of the study design and the data and methodology used in the analysis. Chapter III presents detailed tables describing NSP participants' characteristics. Chapter IV presents estimates of the effect of participating in congregate and home-delivered meal programs on food security, socialization, and diet quality outcomes. Chapter V summarizes findings to inform policy and discusses implications for future research.

The appendices of the report provide supporting material and additional tables. Appendix A supplements Chapter II with a more detailed discussion of the data and methodology. Appendix B contains additional tables showing mean usual nutrient intakes and usual intake distributions for participants. Appendix C supplements the Chapter IV tables by presenting estimates of program effects on outcomes for income and family subgroups. Appendix D contains additional tables showing mean usual nutrient intakes and usual intake distributions for nonparticipants.

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II. OVERVIEW OF DATA AND METHODOLOGY

The outcomes evaluation draws primarily on information obtained from comprehensive surveys and 24-hour dietary recalls collected from samples of program participants and a matched comparison group of program-eligible nonparticipants. This chapter presents an overview of the sampling design, discusses the data collection, describes additional data sources used in the analysis, defines the evaluation's outcome measures, and presents the analytic methods used to address the evaluation's research objectives.

A. Sampling design

The evaluation used a multistage clustered sample design. The stages of sampling were:

1. AAAs
2. LSPs within AAAs
3. Congregate meal sites and home-delivered meal distribution locations within LSPs
4. Home-delivered meal routes within home-delivered meal distribution locations
5. Congregate meal participants within each congregate meal site and home-delivered meal participants within each home-delivered meal route

In addition, the research team obtained a matched sample of congregate and home-delivered meal nonparticipants. Details are available in Appendix A.

Data collection spanned one week for each randomly selected congregate meal site and home-delivered meal route. In congregate meals sites, field staff attended the main congregate meal (usually lunch) on the first day meals were provided. They randomly sampled congregate meal participants and conducted interviews. Similarly, on the first day of meal provision for each home-delivered meal distribution location, program staff provided a list of all home-delivered meal participants for the sampled route, participants were randomly sampled, and field staff conducted interviews in homes or another convenient location.

Finally, in the same geographic area as the sampled congregate meal sites and home-delivered meal routes, the research team obtained a list of Medicare beneficiaries from the Centers for Medicare & Medicaid Services (CMS) and used statistical matching techniques to identify older adults with characteristics similar to those in the congregate and home-delivered meal samples to form the study's comparison groups. The research team screened potential program-eligible nonparticipants by phone to exclude anyone who (1) participated in congregate or home-delivered meal programs in the past year; (2) lived in a nursing home, assisted living facility, group home, or rehabilitation facility; or (3) did not live in the same zip code as the participant to whom they were matched. Field staff interviewed nonparticipants in their homes or, for some congregate meal nonparticipants, a public location such as a local library.

B. Data collection

Multiple instruments were used to collect data from NSP participants and nonparticipants. The instruments were pretested and pilot-tested, and interviews were conducted from October 2015 to April 2016.

1. Instruments

The research team collected data from NSP participants and nonparticipants in a computer-assisted personal interview (CAPI) using two main instruments: an outcomes survey and a 24-hour dietary recall. For nonparticipants, a short survey was also administered to screen and recruit individuals into the study.

The outcomes survey collected information on a comprehensive set of topic areas including demographic characteristics, food security, health insurance coverage, health status and depression, and loneliness. In addition, all respondents were asked about their NSP participation history, and congregate and home-delivered meal participants were asked about the types of services they received, their impressions of the program and services, and monetary contributions for program meals.

To describe NSP participants' and nonparticipants' diet quality and to assess the effect of the meal and related services on participant nutrition and diet quality, the research team conducted 24-hour dietary recalls with participants and nonparticipants. The Automated Self-Administered 24-hour dietary recall system (ASA-24 Adult Version 2014) developed by the National Cancer Institute (2014) was used as an in-person interviewer-administered tool to collect the 24-hour dietary recall data. The research team collected a second day of dietary recalls from a subsample of participants and nonparticipants to estimate the distributions of usual intakes of key nutrients. The dietary recall data provide information on the nutrients and food group equivalents (amounts) participants and nonparticipants consumed over 24 hours.

Finally, the research team used a short computer-assisted telephone interview (CATI) survey to screen and recruit meal program nonparticipants to participate in the study. The screener determined whether nonparticipants were eligible for the study using the criteria described in the sampling section.

2. Pretesting

The research team pretested the outcomes survey with nine congregate and home-delivered meal participants (described in Appendix A). A small-scale pilot was also conducted to test the operational aspects of data collection. The pilot included conducting both the outcomes survey and the 24-hour dietary recall with 32 congregate and home-delivered meal participants from five meal program sites. As a result of the pilot test, the research team significantly reduced the length of the survey and incorporated "frail skips" that interviewers could use to bypass noncritical sections of the survey when respondents struggled to complete the survey due to length or fatigue.

3. Conducting interviews

The field data collection began in October 2015 and ended in April 2016. From late October 2015 through early January 2016, field interviewers collected information from program participants. Data collection in each site spanned five days. Field interviewers randomly selected congregate and home-delivered meal participants to participate in the study on one day and, over the next four days, administered the outcomes survey and 24-hour dietary recall to sampled participants who agreed to participate in the study. The research team conducted a second dietary recall with a subsample of participants at least one day after their first dietary recall. From late January 2016 through early April 2016, field interviewers returned to the same geographic areas where they had interviewed program participants to interview a predetermined matched sample of nonparticipants identified through the nonparticipant screener. As with the participant samples, a second dietary recall was conducted with a subsample of nonparticipants at least one day after their first dietary recall.

Response rates. The American Association for Public Opinion Research's (APPOR) *Standard Definitions,* ninth edition, was used to calculate response rates (APPOR 2016). The outcomes survey response rates were 76.1 percent for congregate meal participants and 54.1 percent for home-delivered meal participants (Appendix Table A.1). The outcomes survey completion rates for nonparticipants who were recruited from the telephone screener were 79.1 percent for congregate meal nonparticipants and 76.6 percent for home-delivered meal nonparticipants (Appendix Table A.2).

C. Additional data sources

To address the research objectives, the research team linked the outcomes survey data to several other data sources.

1. Neighborhood contextual data from the American Community Survey

Data from the American Community Survey was used to obtain local-area population characteristics. To obtain characteristics for small census geographies, such as census tracts, the Census Bureau aggregates data over five years. The 2010 to 2014 American Community Survey summary file was used to obtain tract-level measures of population, the percentage of families with income below 200 percent of the federal poverty threshold, the percentage of the total population that is non-white, the percentage of the total population that is Hispanic, and the percentage of housing units without access to a vehicle.

2. Geographic address data for participants and food retailers

To describe NSP participants' geographic access to food, the research team used participant address information for each respondent in the outcomes survey, data from the Census Bureau, and address data for food retailers from the U.S. Department of Agriculture (USDA). The research team geocoded the address information and calculated measures of geographic access to food based on (1) distances from each participant to the nearest store in the area and (2) the number of retailers, by type, within three distances from each participant's residential address. In urban areas, the distances are less than 0.5 miles, 0.5 to less than 1 mile, and 1 to 2 miles. In rural areas, the distances are less than 5 miles, 5 to less than 10 miles, and 10 to 20 miles.

D. Outcome measures

Outcomes in three different domains were analyzed: food security, socialization, and diet quality.

1. Food security

Food security is having access at all times to enough food for an active, healthy life for all household members (Coleman-Jensen et al. 2015). Evaluations of the effectiveness of nutrition assistance programs in improving food security typically measure whether participating in the program reduces food insecurity, defined as whether a household experiences food access limitations due to lack of money or other resources. The research team used the six-item food security module (Bickel et al. 2000) to create a binary variable indicating whether an individual lived in a household that was food insecure in the past 30 days and a second variable indicating whether a household experienced a particularly severe level of food insecurity—referred to as "very low food security."

2. Socialization

The research team assessed socialization using three measures. First, individuals' loneliness was measured using an abbreviated version of the Revised UCLA Loneliness Scale (R-UCLA; Russell et al. 1980; Hughes et al. 2004). The scale is based on responses to three questions related to how often respondents feels they lack companionship, feel left out, and feel isolated from others. Higher scores indicate greater perceptions of loneliness.

The second measure came from the Patient Health Questionnaire 2 (PHQ-2), an abbreviated version of the nine-question PHQ used to diagnose depression. The PHQ-2 assesses the frequency of depressed mood over the past two weeks; however, because it consists of only two of the nine questions, the PHQ-2 can be used for depression screening but not diagnosis. A raw score based on the responses to questions ranges from 0 to 6. Studies have identified thresholds above which respondents screen positively for depression by balancing sensitivity (the ability of the screener to correctly identify those with depression) and specificity (the ability of the screener to correctly identify those without depression). Research comparing the PHQ-2 to patients with depression diagnoses found that a score of 3 or greater was best to achieve this balance (Li et al. 2007; Lowe et al. 2005). However, researchers have recommended that further research evaluate validity and cutoff scores for older adults (Sheeran et al. 2010). Because there is no agreed-upon threshold that positively identifies individuals with depression, the research team used thresholds of 2, 3, and 4 to define three measures of screening positively for depression. The raw score itself was also examined. Thus, when considering this outcome, the research team looked for consistency in findings across these depression screening measures.

As a third measure of socialization, two variables were constructed based on a single question measuring individuals' self-reported satisfaction with the opportunities they have had to spend time with other people. One variable indicates whether a respondent was "very satisfied" compared to "somewhat satisfied," "not too satisfied," and "not at all satisfied"; the other variable indicates whether a respondent was either "very satisfied" or "somewhat satisfied," compared to "not too satisfied" or "not at all satisfied."

3. Diet quality

The research team used several measures to examine the quality of participants' diets and assess the effects of participating in the NSP on diet quality. First, the contribution program meals made to participants' daily intakes of calories and nutrients was examined. The research team also estimated usual nutrient intakes to assess the prevalence of adequate and excessive nutrient intakes among participants and nonparticipants. To assess the overall quality of the diets consumed by participants and nonparticipants, the Healthy Eating Index (HEI)-2010 was used, which assesses conformance to key recommendations of the 2010 *Dietary Guidelines*.

For the first measure of diet quality, the research team estimated the percentage contribution that program meals made to NSP participants' daily calorie and nutrient intakes. To help the research team identify foods obtained from program meals, participants reported the source of each food reported in the 24-hour dietary recall. Because some participants do not receive meals every day, not all participants consumed a program meal on the day referenced in the 24-hour dietary recall (the intake day). The percentage contribution of program meals to participants' daily nutrient intakes was computed as the sum of the nutrients from all foods obtained from program meals divided by total daily nutrient intakes. The mean percentage contribution was estimated two ways: (1) for all participants, including those who did not consume a program meal (where the contribution is zero for non-consumers); and (2) for only participants who consumed a program meal on their intake day. The first measure provides information on the contribution of program meals to participants' intakes on an average day. The second measure provides information on the relative contribution of program meals on days where participants consume meals.

To assess the prevalence of adequate and excessive nutrient intakes among NSP participants and nonparticipants, the research team estimated usual intakes of vitamins, minerals, macronutrients, and other dietary components relative to the DRIs and select recommendations from the 2015-2020 *Dietary Guidelines*. The DRIs are the most up-to-date scientific standards for determining whether diets provide enough nutrients to meet requirements, without being excessive. (The DRIs are defined in Chapter III and Appendix A.) The research team used the method developed by the National Cancer Institute to estimate usual intake distributions, mean usual intakes, and the percentages of participants and nonparticipants with usual intakes that were above, below, or within DRI standards or 2015-2020 *Dietary Guidelines* recommendations. The National Cancer Institute method applies an econometric model to dietary recalls to estimate the distribution of usual intakes for the full population and any subpopulations of interest (Tooze et al. 2010; Freedman et al. 2010). Estimating usual nutrient intakes requires both the first 24-hour recall and, for a subsample of participants and nonparticipants, the second day 24-hour recall.

For the third measure, the research team used the HEI-2010 to assess the overall quality of the diets consumed by NSP participants and nonparticipants. The HEI-2010 is a measure of diet quality that assesses conformance to key recommendations of the 2010 *Dietary Guidelines* (Guenther et al. 2013). The USDA has adopted it as a tool to monitor the quality of foods consumed by the U.S. population overall, as well as progress toward healthier eating habits among food assistance program participants (Guenther et al. 2007). The HEI-2010 is a scoring metric made up of 12 components, each reflecting a key aspect of diet quality, and a total score

that measures overall diet quality. The standards used to assign HEI-2010 component scores are expressed on a density basis (that is, amounts per 1,000 calories or a percentage of calories), rather than absolute amounts of foods consumed. The use of such standards in assessing diet quality reflects the recommendation that individuals should strive to meet food group and nutrient guidelines while maintaining calorie balance, rather than meeting these guidelines simply by consuming large quantities of food.

The HEI-2010 consists of nine adequacy components, which are dietary components individuals are recommended to consume to ensure adequate nutrient intakes, and include the following:

- Total fruit, including juice
- Whole fruit
- Total vegetables
- Greens and beans
- Whole grains
- Dairy
- Total protein foods
- Seafood and plant proteins
- Fatty acids

The remaining three components, referred to as moderation components, measure dietary components that individuals are recommended to limit, and include the following:

- Refined grains
- Sodium
- Empty calories

Maximum component scores for the various components range from 5 to 20. Higher scores for the adequacy components reflect greater consumption and higher diet quality, whereas higher scores for the moderation components reflect lower consumption and higher diet quality. Scores for each of the 12 components are summed to create a total HEI-2010 score, which ranges from 0 to 100. Two HEI-2010–related outcomes were estimated: (1) mean total and component HEI-2010 scores, and (2) percentages of the maximum possible component and total scores. Additional details on scoring are available in Chapter III and Appendix A.

E. Analytic methods

Descriptive, tabular analysis was used to describe the characteristics of older adults who participate in the NSP, participants' impressions of the program, and their valuation of meals and supportive services received through the program. For categorical variables, the percentage of participants who responded in each category was estimated. For continuous variables, the mean and median values of the distribution among participants and the percentages of participants with

values in different ranges of the distribution are presented. (The median, or 50th percentile of the distribution, is the value for which 50 percent of the observations are less than or equal to.) All analyses were conducted separately for congregate and home-delivered meal participants.

To estimate the effect of receiving a congregate meal or home-delivered meal on food security, socialization, and diet quality, the research team compared outcomes for participants and a matched comparison group of program-eligible nonparticipants. The purpose of a comparison group of eligible nonparticipants is to represent what would happen to participants in the absence of the program. The comparison group of nonparticipants should ideally be as similar as possible to the sample of participants, except for program participation and random variation. Despite efforts to use Medicare administrative data to identify a group of nonparticipants who were comparable to participants across several critical individual characteristics related to outcomes (that is, demographics, Medicare eligibility, chronic conditions including depression, and health care service utilization and expenditures [see Appendix A]), the characteristics of the two samples differed. Consequently, the analyses used statistical methods and the outcomes survey data to control for differences in the characteristics of participants and nonparticipants that affect both outcomes and program participation decisions.

The methods used differed depending on the outcome measure examined. For individual-level outcomes in the domains of food security and socialization, the research team estimated multivariate regressions to estimate the effect of NSP participation on the outcomes, controlling for characteristics that could be related to both program participation and the outcomes studied. (These regressions are described in detail in Appendix A.) The research team also used weights for nonparticipants generated using a propensity-score matching algorithm based on machine learning called boosting (Ridgeway and McCaffrey 2007; Lee et al. 2010), that, when used in the analyses, made the characteristics of participants and nonparticipants similar in terms of all of the characteristics the model includes. The research team could not use multivariate regression, however, to estimate the effect of NSP participation on HEI-2010 scores and usual nutrient intakes relative to national standards because they are population-based estimates computed at the group level rather than the individual level. Thus, the analyses of those outcomes solely use the propensity-score weights to make the groups more comparable.

All multivariate analyses were conducted separately for congregate meal participants and nonparticipants and for home-delivered meal participants and nonparticipants. The analyses of the effect of congregate and home-delivered meal participation on outcomes measuring food security, socialization, and HEI-2010 scores were also conducted separately for two important household and economic subgroups. The research team reestimated the analyses by monthly household income relative to poverty, dividing the sample roughly in half into lower-income and higher-income groups. The research team also reestimated the models according to whether individuals lived alone or with other family members.

The multistage sampling design of the outcomes evaluation was accounted for when estimating standard errors. This is described in detail in Appendix A.

F. Analysis weights

Analysis weights allow unbiased estimates to be computed based on sample survey responses from the study population. Weights take into account both the probability of selection into the sample and the differential response patterns that may exist in the respondent sample. Because not all respondents from the outcomes survey completed the 24-hour dietary recalls, the research team constructed one set of weights for analyses using data from the outcomes survey and a second set of weights for analyses using data from both the outcomes survey and the 24-hour dietary recall data. For each set, weights were constructed separately for congregate meal participants and nonparticipants and home-delivered meal participants and nonparticipants.

Based on weighted data, the congregate and home-delivered meal participant findings in Chapter III of this report are nationally representative of the population of congregate and home-delivered meal participants. This is not true for the nonparticipants who completed interviews, however, because, by design, they were not sampled from a frame of nonparticipating older adults. Instead, the estimates of the effects of congregate and home-delivered meal participation on outcomes that use weighted participant and nonparticipant data are representative of the effects for the population of congregate and home-delivered meal participants; that is, the study is meant to assess the effect of the programs on those who choose to participate in the program, not on the entire population.

G. Study limitations

This report represents the most comprehensive assessment in 20 years of the effectiveness of the Title III-C NSP in improving participants' outcomes. When interpreting the report's findings, it is important to consider two limitations.

Item nonresponse. Although interviewers administered the surveys, respondents were able to respond "don't know" or refuse to answer questions. The percentages and estimates presented in Chapter III of this report are based on responses that exclude both types of missing data. As a result, item nonresponse bias is possible for those estimates. Item nonresponse bias occurs when individuals who respond to a question differ in meaningful ways from those who do not respond. This was not a serious problem for most survey questions, however, as all of the estimates presented in the tables either had no item nonresponse or had a particularly low percentage of item nonresponse, which was defined as at least an 80 percent response rate.

Causality. Both the propensity-score matching procedure and regression analysis can adjust for differences only in observable characteristics, whereas program participants might also differ from nonparticipants in unobservable ways that could influence the estimates of program impacts on outcomes. Therefore, the findings based on either approach cannot be definitively interpreted as causal effects of the extent to which program participation affects food security, socialization, and diet quality. Instead, these procedures adjust—to the extent possible—for observable differences likely to be correlated with the outcome measures. This allows similar groups of participants and nonparticipants to be compared, while still acknowledging that unobservable factors might influence differences in outcome measures. The research team attempted to minimize this possibility, however, by using a powerful research design that (1) matched participants and nonparticipants based on a comprehensive set of demographic and health

characteristics in Medicare administrative records and (2) identified matched nonparticipants within small, local geographic areas (zip codes) in which participants lived.

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III. NSP PARTICIPANTS' CHARACTERISTICS AND CIRCUMSTANCES

This chapter describes congregate and home-delivered meal participants' characteristics and circumstances; nutrition and well-being outcomes; and overall impressions of the congregate and home-delivered meal programs. Information is presented separately for each program and describe differences and similarities between congregate and home-delivered meal participants. Section A describes participants' demographic characteristics, including income; health status, functional ability, and mobility; as well as food and dietary behaviors, diet quality, receipt of nutrition and supportive services, geographic access to food, food security, and food coping strategies and participation in food assistance programs. Section B describes participants' impressions of the NSP, their valuation of meals and supportive services received through the program, and opportunities for social interactions.

A. Characteristics of participants

1. Demographic characteristics

Congregate and home-delivered meal participants were similar in terms of gender, veteran status, and whether they live alone, but compared to congregate meal participants, home-delivered meal participants, on average, were older, had less education, and were more likely to be widowed. The average congregate meal participant was 77 years old; the average home-delivered participant was age 82 (Table III.1). Fifty-nine percent of congregate and 79 percent of home-delivered meal participants were 75 and older. More than two-thirds of congregate and home-delivered meal participants were women and 15 to 17 percent were veterans. The percentage of participants who were married was similar across the two programs, although 52 percent of home-delivered meal participants were widowed compared to 47 percent of congregate meal participants. Many participants lived alone (60 percent of congregate meal participants and 59 percent of home-delivered meal participants). Twenty-eight percent of congregate meal participants and 25 percent of home-delivered meal participants resided in rural areas.

Participants in each program were largely non-Hispanic white individuals, but a sizable percentage of participants were members of racial and ethnic minority groups. Non-Hispanic blacks constituted approximately 14 percent of congregate meal participants and 18 percent of home-delivered meal participants (Table III.1). Hispanics accounted for another 13 percent and 9 percent, respectively, of participants in the two programs.

2. Income characteristics

Although the OAA prohibits financial means tests for participation in the NSP, most participants were poor or near poor. Thirty-one percent of congregate meal participants and 35 percent of home-delivered meal participants had annual household incomes below 100 percent of the DHHS federal poverty guidelines (Table III.2). (For a 1-person household, this corresponds to $11,770.) Most of the rest had annual household incomes between 100 and 200 percent of the poverty guidelines. Only about one-quarter of congregate and 20 percent of home-delivered meal participants had annual household incomes above 200 percent of the poverty guidelines.

Sources of income were similar for congregate and home-delivered meal participants. Virtually all participants received income from Social Security (97 percent); and approximately half of both groups (49 percent of congregate meal participants and 47 percent of home-delivered meal participants) received income from pensions or a retirement fund (Table III.2). Reflecting their younger age and better health, nearly 20 percent of congregate meal participants had income from employment (full- or part-time work) compared to just 5 percent of home-delivered meal participants.

Table III.1. Selected demographic and household characteristics of Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Age		
70 and younger	22.2	11.4
71 to 74	19.0	9.6
75 to 84	41.2	36.0
85 and older	17.6	43.1
Average age (years)	77.1	81.8
Gender		
Male	33.1	31.5
Female	66.9	68.5
Military service		
Veteran	16.6	14.7
Nonveteran	83.4	85.3
Highest grade level completed		
8th grade or less	9.5	24.6
9th to 12th grade (no diploma)	14.0	15.7
High school graduate, GED, or equivalent	30.5	27.8
Some college (no degree)	20.3	11.7
Associate's degree, occupational, or technical degree	12.8	7.1
Bachelor's degree	9.8	7.8
Master's degree or higher	3.1	5.3
Race/ethnicity		
Non-Hispanic		
White	66.2	71.8
Black	13.8	17.7
Asian	3.9	0.3
American Indian	4.0	4.6
Other	0.9	0.4
Hispanic		
White	10.0	8.7
Black	0.8	0.0
Asian	1.5	0.0
American Indian	0.2	0.1
Other	0.6	0.3
Marital status		
Married or living with partner	24.9	24.0
Widowed	46.5	52.0
Divorced	16.1	17.3
Separated	4.8	0.6
Never married	7.7	6.0
Number of other people living in household		
Live alone	60.2	59.1
1	29.3	27.3
2	4.8	6.2
3 or more	5.7	7.4
Urbanicity		
Urban	72.3	74.9
Rural	27.7	25.1

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Table III.2. Sources and distribution of income among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Monthly income-to-poverty ratio[a]		
0	2.0	0.0
1 to 50	3.5	6.3
51 to 100	25.7	28.3
101 to 150	28.1	26.7
151 to 200	17.6	19.2
201 to 300	14.3	12.7
301 and above	8.8	6.8
Annual income-to-poverty ratio		
0	1.8	0.0
1 to 50	5.0	7.7
51 to 100	23.5	27.6
101 to 150	28.2	24.6
151 to 200	13.8	18.7
201 to 300	15.8	13.7
301 and above	12.0	7.7
Sources of income		
Full-time or part-time work	16.9	5.0
Social Security	96.9	96.8
Unemployment compensation	0.5	0.3
SSDI or workers' compensation	8.4	5.1
SSI	12.3	12.2
Pension or retirement fund	49.0	46.6
General assistance	2.7	4.8
Money from relatives	3.8	2.6
Other sources	7.9	3.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

[a] Income-to-poverty ratio based on DHHS' poverty guidelines (https://aspe.hhs.gov/2015-poverty-guidelines).

SSDI = Social Security Disability Insurance; SSI = Supplemental Security Income.

3. Health status, functional ability, and mobility

Compared to congregate meal participants, a greater percentage of home-delivered meal participants reported being in fair or poor health, being underweight, having trouble eating due to dental issues, and taking multiple medications. Nearly half (46 percent) of home-delivered meal participants reported being in fair or poor health, compared to 23 percent of congregate meal participants (Table III.3); home-delivered meal participants were about half as likely to report being in excellent health (6 versus 13 percent).

Twenty-seven percent of congregate meal participants and 38 percent of home-delivered meal participants had an estimated body mass index (BMI) in the normal range (Table III.3). Most participants were either over- or underweight, placing them at increased risk for weight-related diseases and other health problems. Six percent of home-delivered meal participants were underweight, compared to 1 percent of congregate meal participants. Seventy-two percent of

congregate meal participants and 57 percent of home-delivered meal participants had a BMI greater than 25, indicating they are overweight or obese and at risk for developing certain diseases such as heart disease, diabetes, high blood pressure, and some types of cancer. Unintentional changes in body weight have been associated with an increased risk of poor nutritional status and adverse health problems (Nutrition Screening Initiative 1991), and 24 percent of congregate meal participants and 30 percent of home-delivered meal participants reported that they had recently lost or gained 10 pounds unintentionally.

Many older adults take multiple medications concurrently, which increases the potential for adverse drug-nutrient interactions, and adverse effects of malnutrition on drug absorption, metabolism, or utilization (Boullata and Armenti 2004). Sixty-eight percent of congregate meal participants and 82 percent of home-delivered meal participants reported taking three or more prescription medications daily (Table III.3).

Table III.3. General health status of Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
General health		
Excellent	12.8	6.4
Very good	27.5	12.5
Good	36.7	35.3
Fair	18.6	30.4
Poor	4.4	15.4
Body mass index		
Below 18.5 (underweight)	0.8	5.6
18.5 to 24.9 (normal)	27.0	37.7
25.0 to 29.9 (overweight)	33.8	27.6
30.0 and above (obese)	38.4	29.1
Unintentional gain or loss of 10 pounds in past six months	23.9	30.3
Trouble eating due to condition of teeth, gums, or other dental issue		
Yes	11.5	25.7
No	88.5	74.3
Number of prescription medications taken every day		
0	11.2	2.5
1 or 2	21.2	15.4
3 to 5	39.1	34.3
6 to 9	20.7	30.7
10 or more	7.8	17.1
Average	4.3	6.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

The prevalence of doctor-diagnosed chronic health conditions were substantially higher for home-delivered meal participants than for congregate meal participants. The most common doctor-diagnosed health problems, reported by one-half to almost three-quarters of program participants, consisted of high cholesterol, arthritis or rheumatism, eye conditions, and

hypertension (Table III.4). The prevalence of arthritis, cancer, hearing impairments, stroke, and dementia were 8 to 15 percentage points higher for home-delivered meal participants than for congregate meal participants. Thirty-five percent of congregate meal participants and 41 percent of home-delivered meal participants also reported a history of heart disease.

Nearly all participants had health insurance coverage; only one percent of congregate meal participants reported not having any medical insurance (Table III.4). Ninety-four percent of congregate and home-delivered meal participants had prescription drug coverage.

Table III.4. Medical status and insurance characteristics of Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Medical doctor has diagnosed		
Anemia	16.6	23.3
Arthritis or rheumatism	60.3	69.2
Breathing or lung problems	39.3	43.9
Cancer (excluding minor skin cancer)	20.2	28.2
Dementia or Alzheimer's disease	3.0	10.9
Diabetes or high blood sugar	32.6	36.3
Hearing impairment	26.3	41.7
Heart disease	34.9	41.0
High blood pressure (hypertension)	70.0	73.8
High cholesterol	57.2	53.0
Kidney disease	10.6	10.5
Medical conditions of the eye	67.7	69.4
Osteoporosis	19.4	23.5
Stroke	9.6	22.3
Type of medical insurance		
Private health insurance	97.6	95.4
Medicare	8.7	9.5
Medi-Gap	48.1	43.1
Medicaid	18.0	18.8
Military health care	5.7	9.1
Indian health service	0.2	0.3
State-sponsored health plan	3.9	5.0
Other government program	1.1	0.9
No coverage	1.1	0.0
Has prescription drug coverage	93.6	94.0
Has dental care coverage	34.9	26.1
Has vision care coverage	53.5	52.2
Has long-term care or nursing home care coverage	21.1	25.6

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

The prevalence of recent falls, injuries from falls, and fear of fall-related injuries was much higher for home-delivered meal participants compared to congregate meal participants. Fourteen percent of home-delivered meal participants reported having had two or more falls during the past three months compared to 7 percent of congregate meal participants. Among those

individuals who experienced a fall, 45 percent of home-delivered meal participants reported a fall that had resulted in an injury, compared to 28 percent for congregate meal participants (Table III.5). Home-delivered meal participants were also more likely to report a fear of falling (76 versus 67 percent).

A substantial proportion of home-delivered meal participants reported functional impairments and needed help performing one or more activities critical for them to remain in their homes. One percent of congregate meal participants were not able to walk and 33 percent had difficulty climbing stairs; this compares to 12 percent of home-delivered meal participants who could not walk and 64 percent who had difficulty climbing stairs (Table III.6). Home-delivered meal participants were also three to nine times more likely than congregate meal participants to have a condition that could affect independent living. For example, 47 percent of home-delivered meal participants were unable to shop or had difficulty shopping for groceries or personal items without assistance, compared with 6 percent of congregate meal participants; 43 percent of home-delivered meal participants had difficulty bathing, compared with 6 percent of congregate meal participants; and 29 percent of home-delivered meal participants had difficulty dressing, compared with 4 percent of congregate meal participants.

Table III.5. Recent falls and fall-related injuries among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Number of falls in the past three months		
0	77.3	66.9
1	15.7	19.2
2	4.2	5.2
3 or more	2.9	8.8
Number of falls in the past three months that caused an injury		
0	72.1	55.4
1	24.4	33.9
2	1.4	7.3
3 or more	2.0	3.4
Fearful of falling		
Not at all	32.9	24.0
A little	35.6	27.7
Somewhat	18.7	22.2
A lot	12.8	26.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Table III.6. Presence of conditions that could affect independent living among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Mobility		
Able to walk	99.0	88.5
Able to walk, but has difficulty walking or climbing stairs	32.9	64.2
Bedbound	0.0	2.2
Chairbound or in a wheelchair	1.0	9.3
Has serious difficulty concentrating, remembering, or making decisions because of a physical, mental, or emotional condition	13.4	30.8
Has difficulty performing the following activities:		
Shopping for groceries or personal items, such as toiletries or medicine	5.9	47.0
Getting to a store to buy groceries or personal items	8.7	49.0
Using the telephone	3.0	20.9
Doing light housework	9.0	45.4
Using public transportation or riding in a private automobile	4.7	31.4
Taking medications	1.6	10.3
Managing money or balancing a checkbook	7.8	20.8
Taking a bath or shower	5.7	43.3
Dressing	4.2	29.1
Getting in or out of a bed or chair	8.1	27.6
Eating	1.0	9.0
Using the toilet	1.4	13.2

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

4. Diet and eating behaviors

Only two thirds of congregate and home-delivered meal participants reported consuming about three meals a day (Table III.7). About half of congregate meal participants and nearly 70 percent of home-delivered meal participants usually ate alone. Eleven percent of congregate meal participants described their appetite as poor or fair, compared with 29 percent of home-delivered meal participants. More than one-quarter of congregate (27 percent) and home-delivered meal participants (34 percent) were on special diets for health, medication, religious, or cultural reasons. The most common were diets associated with diabetes (about 60 percent of those on special diets from each program) and diets to reduce sodium intakes and lower blood cholesterol levels.

Congregate and home-delivered meal participants differed in their ability to prepare meals at home. Relative to congregate meal participants, home-delivered meal participants were twice as likely not to cook (19 and 42 percent, respectively) (Table III.8). The vast majority (95 percent) of congregate meal participants and the majority (68 percent) of home-delivered meal participants were able to prepare hot meals if necessary. Nearly all participants had access to a refrigerator, freezer, stove or toaster oven, or microwave; home-delivered meal participants had slightly greater access to this equipment compared to congregate meal participants.

Table III.7. Diet and eating behavior among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Number of meals per day		
0 to 1	3.6	6.9
2	23.5	27.9
3	68.4	61.8
4 or more	4.6	3.4
Mean	2.8	2.6
Median	3.0	3.0
Currently on a special diet for health, medication, religious, or cultural reasons	27.3	34.1
Type of special diet		
Diabetic	59.6	60.2
Low-sodium	43.8	40.9
Low-cholesterol	21.4	16.0
Low-calorie	9.3	9.5
Low-sugar	27.4	23.5
Low-fat	18.1	15.2
Low-fiber	1.7	0.2
High-fiber	5.6	5.4
Ground or pureed	2.6	0.1
Vegetarian	1.3	1.7
Lactose-free	0.4	5.0
Kosher	0.0	3.8
Halal	0.0	0.0
Other	8.3	9.1
Appetite		
Excellent	38.9	24.9
Good	50.1	46.1
Fair	10.0	23.2
Poor	1.0	5.8
Eats alone most of the time	52.6	69.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Table III.8. Preparation of meals at home among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Meal preparation responsibilities		
Participant prepares own meals	74.1	50.7
Participant helps someone else cook	6.9	7.6
Participant does not cook	19.0	41.7
Participant can prepare hot meals if necessary	95.4	67.6
Access to food preparation equipment		
Refrigerator	97.1	99.5
Freezer	95.4	97.2
Stove or toaster oven	95.7	97.3
Microwave	95.4	97.6

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

5. Diet quality

The congregate and home-delivered meal programs authorized under Title III-C of the OAA strive to reduce hunger and food insecurity, promote health and well-being, and delay adverse health conditions by providing older adults with nutritionally balanced meals (AoA 2016). Title III-C specifies that nutrition programs are to provide at least one meal per day to participants for five or more days per week (however, programs in rural areas may provide meals on fewer days if approved by the SUA). Program meals must comply with the most recent *Dietary Guidelines* and meet standards based on the DRIs developed by the Institute of Medicine. Specifically, if a program offers one meal per day, the program meal must provide a minimum of one-third of the Recommended Daily Allowance for selected nutrients (AoA 2016).

This section provides information on the quality of congregate and home-delivered meal participants' diets. All findings are based on analysis of the 24-hour dietary recall data (see Chapter II and Appendix A). The following measures were used to examine diet quality:

- Proportion of participants' daily nutrient intakes provided by program meals to assess the contribution of meals to participants' diets.
- Usual nutrient intakes to assess the proportions of participants with adequate and excessive nutrient intakes.
- HEI-2010 scores to assess the overall quality of the diets consumed by participants.

a. Contribution of program meals to NSP participants' daily nutrient intakes

This section provides information on the percentage contribution of program meals to NSP participants' daily nutrient intakes. Congregate and home-delivered meal participants reported the source of each food reported in the 24-hour dietary recall so that the research team could identify foods obtained from program meals. Because some participants do not receive meals on every day, not all participants consumed a program meal on the day referenced in the 24-hour dietary recall (the intake day). Overall, 79 percent of congregate meal participants and 86 percent of home-delivered meal participants consumed a program meal on their intake day.

To calculate the percentage contribution of program meals to participants' daily nutrient intakes, the research team computed the sum of the nutrients from all foods obtained from program meals divided by total daily nutrient intakes. If a participant did not consume a program meal on his or her intake day, the percentage contribution was zero. The mean percentage contribution was estimated two ways: (1) for all participants, including those who did not consume a program meal (where the contribution of program meals is zero for non-consumers); and (2) for participants who consumed a program meal on their intake day. The first measure provides information on the contribution of program meals to participants' intakes on an average day. The second measure provides information on the relative contribution of program meals on days when participants consume program meals. The findings in this section focus on estimates for participants who consumed a program meal on their intake day, referred to as "consumers only" in the table below.

Program meals contributed substantially to both congregate and home-delivered meal participants' diets. Among NSP participants who consumed a program meal on their intake day, the average contribution of program meals to participants' daily nutrient intakes ranged, across the nutrients examined, from 39 to 47 percent for congregate meal participants and 35 to 47 percent for home-delivered meal participants (Table III.9). On average, congregate meal participants who consumed a program meal on their intake day obtained 41 percent of their daily calories from program meals, and home-delivered meal participants obtained 38 percent. Among congregate meal participants, program meals made the largest contributions to participants' daily intakes of niacin, vitamin C, alpha-linolenic acid, vitamin A, protein, and sodium. Among home-delivered meal participants, program meals made the largest contributions to participants' daily intakes of alpha-linolenic acid, vitamin A, dietary fiber, vitamin C, sodium, and protein.

b. Prevalence of adequate and excessive nutrient intakes among NSP participants

To assess the prevalence of adequate and excessive nutrient intakes among congregate and home-delivered meal participants, the research team estimated usual nutrient intakes and compared them to the DRIs and 2015-2020 *Dietary Guidelines*. The DRIs, established by the Food and Nutrition Board of the Institute of Medicine, provide standards for the amounts of nutrients healthy individuals should consume, based on age, gender, and life stage (Institute of Medicine 2006). The DRIs are the most up-to-date scientific standards for determining whether diets provide sufficient nutrients to meet requirements without being excessive. The DRIs include four types of standards for various nutrients, as Table III.10 lists. The 2015-2020 *Dietary Guidelines* provide quantitative recommendations for intakes of saturated fat (as a percentage of total calories) and sodium (DHHS and USDA 2015a). The research team used the method developed by the National Cancer Institute to estimate usual intake distributions, mean usual

intakes, and the percentages of participants with usual intakes that were above, below, or within DRI standards or 2015-2020 *Dietary Guidelines'* recommendations.

Table III.9. Mean percentage of daily nutrient intakes obtained from program meals among Nutrition Services Program participants

	Congregate meal participants		Home-delivered meal participants	
	All participants	Consumers only	All participants	Consumers only
	Mean percentage of daily intake			
Calories	32.3	40.6	33.3	38.3
Macronutrients				
Total fat	33.1	41.7	34.0	39.1
Saturated fat	32.9	41.4	33.5	38.5
Linoleic acid	34.0	42.8	34.0	39.1
Alpha-linolenic acid	35.7	44.9	38.2	43.9
Carbohydrate	31.1	39.2	30.7	35.3
Protein	36.7	46.2	41.1	47.3
Vitamins				
Vitamin A	36.2	45.5	38.4	44.2
Vitamin C	35.2	44.3	40.0	46.0
Vitamin D	33.6	42.2	36.2	41.6
Vitamin E	34.3	43.2	36.5	42.0
Vitamin B_6	34.0	42.8	37.7	43.4
Vitamin B_{12}	34.4	43.3	37.6	43.2
Folate	31.2	39.2	30.8	35.4
Niacin	35.2	44.3	37.2	42.7
Riboflavin	31.6	39.8	30.9	35.5
Thiamin	32.2	40.6	31.8	36.6
Minerals				
Calcium	31.1	39.2	31.4	36.2
Iron	31.1	39.1	30.7	35.3
Magnesium	31.2	39.3	32.6	37.5
Phosphorus	33.6	42.3	35.8	41.2
Potassium	34.1	42.9	36.5	42.0
Sodium	36.9	46.5	40.0	46.0
Zinc	34.4	43.3	37.0	42.6
Other dietary components				
Dietary fiber	34.2	43.0	39.4	45.3

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Notes: Not all participants consumed a program meal on the intake day for the 24-hour recall. In this tabulation, consumers are defined as participants who did consume a program meal on their intake day. Tabulations for all participants are based on unweighted sample sizes of 591 congregate meal participants and 502 home-delivered meal participants. Tabulations for consumers only are based on unweighted sample sizes of 468 congregate meal participants and 433 home-delivered meal participants.

Table III.10. Dietary Reference Intakes and 2015-2020 *Dietary Guidelines'* recommendations

Estimated Average Requirement (EAR)	The EAR is the average daily nutrient intake level estimated to meet the requirement of half of the healthy individuals in a particular life stage and gender group. The proportion of a group with usual intakes greater than or equal to the EAR provides an estimate of the prevalence of adequate usual intakes for that group. The prevalence of adequate usual intakes was estimated for the following nutrients with defined EARs: vitamin A, vitamin C, vitamin D, vitamin E, vitamin B_6, vitamin B_{12}, folate, niacin, riboflavin, thiamin, calcium, iron, magnesium, phosphorus, and zinc.
Adequate Intake (AI)	The AI is the recommended average intake level assumed to be adequate for healthy individuals in a life stage and gender group, based on observed or experimentally determined estimates of intake. An AI is defined when the data available for a particular nutrient are insufficient to estimate requirements and establish an EAR. Unlike an EAR, the AI cannot be used to estimate the prevalence of adequate nutrient intakes. Instead, assessment focuses on comparing mean usual intakes to the AI. Populations with mean usual intakes that meet or exceed AI levels can be assumed to have high levels of nutrient adequacy. However, when mean usual intakes fall below the AI, no firm conclusions can be drawn about the adequacy of usual intakes. Mean usual intakes were estimated as a percentage of the AI for potassium, dietary fiber, and sodium.
Tolerable Upper Intake Level (UL)	The UL is the maximum level of daily nutrient intake that is likely to pose no risk of adverse health effects for nearly all individuals in a population group. As intake increases above the UL, the potential risk of adverse effects may increase. The prevalence of excessive usual intakes was estimated relative to the UL for sodium.
Acceptable Macronutrient Distribution Ranges (AMDRs)	The AMDRs define ranges of usual macronutrient intakes that are associated with reduced risk of chronic disease, while providing adequate intakes of other essential nutrients. The DRIs define AMDRs for intakes of macronutrients as percentages of total calorie intake. Usual intakes that fall below or exceed the AMDR may increase risk of chronic diseases. The percentages of individuals with usual intakes of total fat, linoleic acid, alpha-linolenic acid, carbohydrate, and protein that were above, below, and within the AMDRs were estimated.
2015-2020 *Dietary Guidelines'* recommendations	The 2015-2020 *Dietary Guidelines* provide quantitative recommendations for intakes of saturated fat (as a percentage of total calories) and sodium. The *Dietary Guidelines'* recommended limit on sodium is the same as the UL for sodium. The prevalence of excessive nutrient intakes was estimated relative to the *Dietary Guidelines*' recommendations for saturated fat and sodium.

Sources: Institute of Medicine (2006); U.S. Department of Health and Human Services and U.S. Department of Agriculture (2015).

Usual intakes of vitamins and minerals with defined Estimated Average Requirements. The proportion of a group of individuals with usual intakes greater than or equal to the Estimated Average Requirement (EAR) provides an estimate of the prevalence of adequate intakes in that group. The prevalence of adequate usual intakes among congregate and home-delivered meal participants was 86 percent or more for vitamin B_{12}, niacin, riboflavin, thiamin, iron, and phosphorus (Table III.11).[6] The prevalence of adequate usual intakes was lower for vitamin B_6, folate, and zinc for both groups of participants (72 to 78 percent). Three-quarters (76 percent) of congregate meal participants and two-thirds (65 percent) of home-delivered meal participants

[6] Appendix B provides detailed data for each nutrient, including mean usual intakes and usual intake distributions by DRI age and gender groups.

had adequate usual intakes of vitamin A. Just more than half of congregate and home-delivered meal participants had adequate usual intakes of vitamin C (55 percent and 51 percent, respectively).

Less than one-third of congregate and home-delivered meal participants had adequate usual intakes of calcium and magnesium (26 and 24 percent, respectively, for calcium, and 31 and 22 percent, respectively, for magnesium). The prevalence of adequate usual intakes was less than 10 percent in both groups of participants for vitamin D (4 and 7 percent) and vitamin E (5 and 3 percent).[7] The 2015-2020 Dietary Guidelines Advisory Committee has classified calcium and vitamin D as nutrients of public health concern for the U.S. population because underconsumption has been linked in the scientific literature to adverse health outcomes (DHHS and USDA 2015b).

Usual intakes of potassium, dietary fiber, and sodium. Potassium, dietary fiber, and sodium do not have defined EARs, so it is not possible to assess the prevalence of adequate intakes for these nutrients. Instead, mean usual intakes can be compared to the AI. Groups of individuals with usual intakes that meet or exceed the AI can be assumed to have high levels of nutrient adequacy. However, when mean usual intakes fall below the AI, a firm conclusion about nutrient adequacy cannot be made.

Usual intakes of potassium were 53 percent of the AI for congregate meal participants and 48 percent of the AI for home-delivered meal participants (Table III.11). Usual intakes of dietary fiber, relative to the AI, were slightly higher than those observed for potassium—65 and 57 percent of the AI for congregate and home-delivered meal participants, respectively. The 2015-2020 Dietary Guidelines Advisory Committee has also classified potassium and dietary fiber as nutrients of public health concern, given that underconsumption may pose health risks (DHHS and USDA 2015b).

Usual intakes of sodium were more than twice the AI for both congregate and home-delivered meal participants (242 and 223 percent of the AI, respectively). Usual intakes of sodium were also compared to the Tolerable Upper Intake Level (UL) and the 2015-2020 *Dietary Guidelines'* recommended limit on sodium. Most congregate meal participants (94 percent) had usual intakes of sodium that exceeded the UL and 2015-2020 *Dietary Guidelines'* limit. In comparison, 69 percent of home-delivered meal participants had excessive intakes of sodium relative to the UL and 2015 *Dietary Guidelines'* limit. Sodium is overconsumed by the U.S. population in general and may pose a public health concern (DHHS and USDA 2015b).

[7] Findings for vitamins D and E should be interpreted with caution. The data used in this analysis includes only vitamin D consumed in the diet, and most Americans synthesize some additional vitamin D in the skin after inadvertent or intentional sun exposure. Current dietary assessment methods tend to underestimate vitamin E, and many believe the EAR for vitamin E was set too high (Devaney et al. 2007)

Table III.11. Percentage of Nutrition Services Program participants with usual nutrient intakes above, below, or meeting recommendations

	Congregate meal participants	Home-delivered meal participants
Vitamins and minerals with EARs (percentage with usual intakes ≥ EAR)		
Vitamin A	75.5	64.5
Vitamin C[a]	54.9	50.6
Vitamin D	4.1	7.0
Vitamin E	4.7	2.6
Vitamin B_6	77.4	73.1
Vitamin B_{12}	94.4	93.0
Folate	72.1	73.1
Niacin[b]	95.4	95.1
Riboflavin	97.6	95.8
Thiamin	85.5	88.7
Calcium	26.3	24.1
Iron	99.3	98.0
Magnesium	31.3	22.4
Phosphorus	98.8	94.5
Zinc	78.2	77.5
Potassium, dietary fiber, and sodium		
Potassium (mean % of AI)	53.0	47.6
Dietary fiber (mean % of AI)	65.3	56.9
Sodium (mean % of AI)	241.5	223.4
Sodium (% > UL/DG)	93.7	69.2
Macronutrients		
Protein		
% within AMDR	99.9	99.6
% < AMDR	0.1	0.4
% > AMDR	0.0	0.0
Carbohydrate		
% within AMDR	75.6	72.8
% < AMDR	24.2	24.2
% > AMDR	0.2	3.0
Total fat		
% within AMDR	53.9	59.3
% < AMDR	0.0	0.6
% > AMDR	46.1	40.1
Linoleic acid		
% within AMDR	84.8	75.7
% < AMDR	11.3	23.7
% > AMDR	3.9	0.6
Alpha-linolenic acid		
% within AMDR	74.5	50.8
% < AMDR	22.3	48.9
% > AMDR	3.2	0.2
Saturated fat		
% > DG	89.0	71.5

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

Table III.11. *(continued)*

Note: Not all participants consumed a program meal on the intake day for the 24-hour recall. Tabulations are based on unweighted sample sizes of 591 congregate meal participants and 502 home-delivered meal participants.

[a]The EAR for vitamin C is 35 mg greater for smokers than nonsmokers. In this analysis, EARs were used for nonsmokers.

[b]Niacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of adequate niacin intakes may be underestimated.

AI = Adequate Intake; AMDR = Acceptable Macronutrient Distribution Range; DG = 2015-2020 *Dietary Guidelines*; EAR = Estimated Average Requirement; UL = Tolerable Upper Intake Level.

Usual intakes of macronutrients. The DRIs define Acceptable Macronutrient Distribution Ranges (AMDRs) for intakes of macronutrients, as percentages of total calorie intake. Usual intakes that fall below or exceed the AMDR may increase risk of chronic diseases.

Nearly all congregate and home-delivered meal participants had usual intakes of protein that were within with the AMDR (Table III.11). Roughly three-quarters of congregate and home-delivered meal participants (76 and 73 percent, respectively) had usual intakes of carbohydrate that were within with the AMDR. The majority of participants with intakes of carbohydrate that were not consistent with the AMDR were more likely to exceed the recommended range (24 percent for both groups of participants) than fall below it (less than 1 percent of congregate meal participants and 3 percent of home-delivered meal participants).

Just more than half of participants had usual intakes of total fat that were within with the AMDR (54 percent of congregate meal participants and 59 percent of home-delivered meal participants). Among those with intakes of total fat that were not consistent with the AMDR, the majority consumed more calories from total fat than recommended (46 percent of congregate meal participants and 40 percent of home-delivered meal participants).

Nearly 85 percent of congregate meal participants and 76 percent of home-delivered meal participants had usual intakes of linoleic acid that were within the AMDR. Most participants with intakes of linoleic acid that were not consistent with the AMDR had intakes that fell below the recommended range. Smaller percentages of participants had usual intakes of alpha-linolenic acid that were consistent with the AMDR, especially among home-delivered meal participants (75 percent of congregate meal participants and 51 percent of home-delivered meal participants). Usual intakes of alpha-linolenic acid were more likely to fall below the recommended range than to exceed it. Alpha-linolenic acid is a fatty acid found mostly in nuts and seed oils such as walnuts, flaxseeds, canola oil and soybean oil and is essential in the diet because it cannot be produced in the body and must be obtained from food sources.

Among congregate meal participants, 89 percent had usual intakes of saturated fat that exceeded the 2015-2020 *Dietary Guidelines'* recommended limit. Slightly less than three-quarters (72 percent) of home-delivered meal participants had usual saturated fat intakes that exceeded this limit. Saturated fat is also a nutrient of public health concern, given that is it overconsumed by the U.S. population (DHHS and USDA 2015b).

c. Healthy Eating Index-2010 scores of NSP participants

This section presents information on the overall diet quality of congregate and home-delivered meal participants based on HEI-2010 scores. The HEI-2010 is a measure of diet quality that assesses conformance to key recommendations of the 2010 *Dietary Guidelines* (Guenther et al. 2013). It is a scoring metric made up of 12 components, each reflecting a key aspect of diet quality, and a total score that measures overall diet quality. The standards used to assign HEI-2010 component scores are expressed on a density basis (that is, amounts per 1,000 calories or a percentage of calories) rather than absolute amounts of foods consumed. The use of such standards in assessing diet quality reflects the recommendation that individuals should strive to meet food group and nutrient guidelines while maintaining calorie balance, rather than meeting these guidelines simply by consuming large quantities of food.

Table III.12 lists the HEI-2010 components. Nine of the 12 components included in the HEI-2010 are adequacy components, which assess intakes of dietary components individuals are recommended to consume to ensure adequate nutrient intakes. The adequacy components include the following: (1) total fruit, including juice; (2) whole fruit; (3) total vegetables; (4) greens and beans; (5) whole grains; (6) dairy; (7) total protein foods; (8) seafood and plant proteins; and (9) fatty acids. The remaining three components, referred to as moderation components, measure dietary components that individuals are recommended to limit, including refined grains, sodium, and empty calories.

Table III.12 also shows the maximum score for each component, along with the intake criteria corresponding to minimum and maximum scores for each component. Maximum scores for the various components range from 5 to 20. Scores for intakes between the minimum and maximum standards are scored proportionately. For example, an intake that is halfway between the criteria for the maximum and minimum scores yields a score that is half the maximum score. Higher scores for the adequacy components reflect greater consumption and higher diet quality, whereas higher scores for the moderation components reflect lower consumption and higher diet quality. Scores for each of the 12 components are summed to create a total HEI-2010 score, with a range from 0 to 100.

The research team estimated HEI-2010 total and component scores for congregate and home-delivered meal participants at the population level, using the population ratio method (Guenther et al. 2013). This method involves calculating mean intakes of calories, nutrients, and food groups for the population, and then calculating the ratios of the means with calories in the denominator, and comparing ratios with HEI standards for scoring.

Table III.12. Healthy Eating Index-2010 components and standards for scoring

HEI-2010 component[a]	Maximum score	Standard for maximum score	Standard for minimum score of zero
Adequacy components (higher score indicates higher consumption)			
Total fruit[b]	5	≥ 0.8 cup equiv. / 1,000 kcal	No fruit
Whole fruit[c]	5	≥ 0.4 cup equiv. / 1,000 kcal	No whole fruit
Total vegetables[d]	5	≥ 1.1 cup equiv. / 1,000 kcal	No vegetables
Greens and beans[d]	5	≥ 0.2 cup equiv. / 1,000 kcal	No dark green vegetables, beans, or peas
Whole grains	10	≥ 1.5 ounce equiv. / 1,000 kcal	No whole grains
Dairy[e]	10	≥ 1.3 cup equiv. / 1,000 kcal	No dairy
Total protein foods[f]	5	≥ 2.5 ounce equiv. / 1,000 kcal	No protein foods
Seafood and plant proteins[f,g]	5	≥ 0.8 ounce equiv. / 1,000 kcal	No seafood or plant proteins
Fatty acids[h]	10	(PUFAs + MUFAs) / SF > 2.5	(PUFAs + MUFAs) / SF < 1.2
Moderation components (higher score indicates lower consumption)			
Refined grains	10	≤ 1.8 ounce equiv. / 1,000 kcal	≥ 4.3 ounce equiv. / 1,000 kcal
Sodium	10	≤ 1.1 gram / 1,000 kcal	≥ 2.0 grams / 1,000 kcal
Empty calories[i]	20	≤ 19% of energy	≥ 50% of energy
Total score	**100**		

Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion (2013).

[a]Intakes between the minimum and maximum standard are scored proportionately.

[b]Includes 100 percent fruit juice.

[c]Includes all forms except juice.

[d]Includes any beans and peas not counted as total protein foods.

[e]Includes all milk products, such as fluid milk, yogurt, cheese, and fortified soy beverages.

[f]Beans and peas are included here (and not with vegetables) when the total protein foods standard is otherwise not met.

[g]Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted toward total protein foods.

[h]Ratio of PUFAs and MUFAs to SF.

[i]Calories from solid fats, alcohol, and added sugars; threshold for counting alcohol is > 13 grams/1,000 kcal.

Equiv = equivalent; HEI = Healthy Eating Index; kcal = calories; MUFA = monounsaturated fatty acid; PUFA = polyunsaturated fatty acid; SF = saturated fat.

Total HEI-2010 scores. The total HEI-2010 score for congregate meal participants was 65.5 of a possible 100 (Table III.13). The total HEI-2010 score for home-delivered meal participants was lower, at 61.4. This indicates that the diets of both congregate and home-delivered meal participants fell short of the 2010 *Dietary Guidelines'* recommendations but were similar to average scores for the U.S. population of older adults. The total scores for congregate and home-delivered meal participants are consistent with data from the National Health and Nutrition Examination Survey, which found that average total HEI-2010 scores were 61.6 for adults ages 51 to 70 and 65.8 for adults age 71 and older (DHHS and USDA 2015b).

Table III.13. Mean Healthy Eating Index-2010 scores and percentage of maximum scores for Nutrition Services Program participants

HEI-2010 component	Maximum score	Congregate meal participants		Home-delivered meal participants	
		Mean score	Percentage of maximum score	Mean score	Percentage of maximum score
Adequacy (higher score indicates higher consumption)					
Total fruit	5	4.8	96.6	4.6	92.0
Whole fruit	5	5.0	100.0	5.0	100.0
Total vegetables	5	4.5	89.9	4.3	86.7
Greens and beans	5	3.8	75.8	2.6	52.9
Whole grains	10	3.8	37.8	3.3	33.0
Dairy	10	6.9	69.1	7.2	71.8
Total protein foods	5	5.0	100.0	5.0	100.0
Seafood and plant proteins	5	4.6	91.6	3.8	75.0
Fatty acids	10	4.2	42.3	4.0	39.5
Moderation (higher score indicates lower consumption)					
Refined grains	10	7.8	78.0	7.4	74.1
Sodium	10	2.3	23.2	2.2	22.0
Empty calories	20	12.8	64.0	12.0	60.1
Total score	100	65.5	65.5	61.4	61.4

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Not all participants consumed a program meal on the intake day for the 24-hour recall. Tabulations are based on unweighted sample sizes of 591 congregate meal participants and 502 home-delivered meal participants.

HEI = Healthy Eating Index.

HEI-2010 component scores. Both congregate and home-delivered meal participants achieved the maximum scores for whole fruit and total protein foods (5 of 5) and came close to achieving the maximum score for total fruit (4.8 and 4.6 of 5 for congregate and home-delivered meal participants, respectively; Table III.13). Congregate meal participants also came close to achieving the maximum score for seafood and plant proteins (4.6 of 5). For both groups of participants, scores for total vegetables were slightly lower, but still more than 85 percent of the maximum possible score (4.5 and 4.3 of 5 for congregate and home-delivered meal participants, respectively).

Scores for dairy were roughly 70 percent of the maximum possible score for both congregate and home-delivered meal participants (6.9 and 7.2 of 10, respectively). For greens and beans, congregate meal participants achieved a score that was 76 percent of the maximum score (3.8 of 5), whereas the score for home-delivered meal participants was 53 percent of the maximum score (2.6 of 5). For both congregate and home-delivered meal participants, scores were less than 50 percent of the maximum for fatty acids (4.2 and 4.0 of 10, respectively) and whole grains (3.8 and 3.3 of 10, respectively).

For the moderation components (where higher scores indicate lower consumption), scores for refined grains and empty calories ranged from 60 to 78 percent of the maximum possible score for congregate and home-delivered meal participants. For both groups of participants, scores for sodium were less than 25 percent of the maximum score (2.3 and 2.2 of 10, respectively). The lower scores for sodium indicate that consumption of sodium was high for both groups of participants relative to the 2010 *Dietary Guidelines'* recommendation.

6. Receipt of nutrition and supportive services

Congregate meal participants received meals frequently. Forty-three percent received five or more meals per week, and 82 percent received three or more meals per week (Table III.14). Most congregate meal participants (79 percent) attended a single site for meals. Seventeen percent of congregate meal participants indicated that they had used special transportation to and from the meal site in the past 30 days, and 58 percent indicated that if special transposition were not available, they would not visit the site as often.

Table III.14. Frequency of participation in congregate meal program

Characteristic	Congregate meal participants
Number of days in a typical week participant ate a meal at the congregate meal site	
1	6.4
2	12.0
3	18.1
4	20.4
5	42.1
6	0.0
7	1.0
Number of congregate sites the participant usually visits for meals, excluding interview site	
0	79.4
1	11.8
2 or more	8.9
Percentage of participants who used special transportation to and from meal site in the past 30 days	17.3
If special transportation was not available, participants would go to meal site	
About as often as now	41.9
Somewhat less often	17.5
A lot less often	22.6
Wouldn't go at all	18.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on an unweighted sample size of 596 congregate meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Home-delivered meal participants also received meals frequently. Seventy-one percent received five or more meals per week, and 85 percent received three or more meals per week (Table III.15). Most participants (83 percent) had received a delivered meal within the past two days. Nearly all home-delivered meal participants (97 percent) received meals from a single site.

Table III.15. Frequency of participation in home-delivered meal program

Characteristic	Home-delivered meal participants
Number of days in a typical week participant received a delivered meal from the nutrition program	
1	14.3
2	0.7
3	8.4
4	5.7
5	69.2
6	0.0
7	1.4
Number of home-delivered meal sites that deliver meals to the participant excluding the interview site	
0	97.4
1	2.5
2 or more	0.1
Last time participant received a delivered meal from the nutrition program	
0 to 2 days ago	83.1
3 to 4 days ago	5.9
5 to 6 days ago	3.1
7 days ago or more	7.7

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on an unweighted sample size of 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Approximately three-quarters of congregate meal participants had not changed the frequency with which they ate at program sites during the previous six months (Table III.16). Of the 12 percent who visited more often during the past six months, 20 percent indicated they had done so because they had made friends at the meal site, and 11 percent indicated they had done so because they had no one at home with whom to eat. Of the 14 percent of participants who visited the site less often during the past six months, 12 percent indicated they had done so because they did not always like the food.

Table III.16. Changes in congregate meal program participation

Characteristic	Congregate meal participants
In the previous six months, participant ate meals at nutrition program site	
More often	12.2
Less often	14.1
About as often	73.8
Reasons for eating at the nutrition program site more often	
No one at home to eat with	11.1
Made friends at the meal site	20.1
Got involved in activities at the meal site	9.9
Costs less to eat at meal site than elsewhere	6.3
Meal site is warm and inviting	9.2
No longer have a place to prepare meals	0.0
Physically difficult to make own meals	1.1
Like the foods served	11.0
Recently joined program	12.8
Recently moved	11.8
Other	34.6
Reasons for eating at the nutrition program site less often	
Few or no friends at the meal site	5.6
Have other places to eat	7.3
Haven't gotten involved in or not interested in activities at the meal site	6.0
Can't afford to donate at meal site	0.2
Difficult to get to the meal site	3.0
Don't always like the foods served	12.4
Still able to prepare own meals	3.1
Other	70.6

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on an unweighted sample size of 596 congregate meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

The majority of participants have received meals and program services for more than a year. Eight-four percent of congregate meal participants and 70 percent of home-delivered meal participants first enrolled in the meal program more than one year before taking the survey (Table III.17). Fifteen percent of congregate meal participants and 27 percent of home-delivered meal participants enrolled within the preceding eight months.

Congregate and home-delivered meal participants learned about the program in several ways. Fifteen percent of home-delivered meal participants reported they first heard about the program through a social worker, and 16 percent first heard about the program from a hospital or community-based agency or organization (Table III.17). Most of the rest (55 percent) heard about the program through family, friends, or another person. In contrast, 74 percent of congregate meal participants heard about the program from family, friends, or another person, and fewer than 8 percent of congregate meal participants were referred to the program by social workers or from hospitals or community-based organizations.

Table III.17. Initial connections to the Nutrition Services Program

Characteristic	Congregate meal participants	Home-delivered meal participants
How long ago did you first go to a congregate meal site, senior center, or senior lunch program for a meal (or first receive a home-delivered meal)?		
0 to 1 month	3.0	6.2
2 to 4 months	6.2	10.2
5 to 8 months	5.8	10.9
9 to 11 months	0.6	2.9
1 to 5 years	42.9	58.5
6 to 10 years	21.9	10.6
More than 10 years	19.7	0.7
First heard of the nutrition program from		
Another person	23.0	20.3
Medical doctor	1.1	4.8
Medical personnel other than a doctor	0.3	7.3
Social worker	4.2	14.9
Family member	15.3	15.9
Friend	35.4	19.1
Newspaper, TV, radio, Internet	5.6	3.2
Posters, something in the mail	1.6	0.4
Announcement in club or church	1.6	1.3
Referred by a community-based agency (hospital, social services agency, etc.)	3.8	15.6
Other	18.5	8.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Although participants are not charged for meals, they are encouraged to make a voluntary contribution toward the meal costs. However, the program cannot deny participants of meals or other services because of an inability or an unwillingness to contribute. Eighty-one percent of congregate meal participants indicated they had contributed for the meals they consumed; 84 percent indicated the program had a suggested contribution amount and few (3 percent) indicated they felt pressured to contribute (Table III.18). A smaller percentage (58 percent) of home-delivered meal participants indicated they contributed. Seventy percent indicated the program had a suggested contribution amount and very few participants (1 percent) indicated they felt pressured to contribute.

Table III.18. Meal contribution characteristics among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Participant makes a contribution	80.5	58.2
Program has a suggested contribution amount	84.0	70.0
Participant feels pressured to contribute to each meal	3.1	1.4

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Seven percent of congregate meal participants indicated the nutrition program had provided emergency meals at home for them. This compares to 38 percent of home-delivered meal participants (Table III.19).

Table III.19. Receipt of emergency meals among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Percentage of participants for whom the nutrition program has provided any emergency meals at home	7.2	38.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Many participants use nutrition and supportive services outside the scope of NSP, yet there are differences in service uptake between congregate and home-delivered meal participants. Home-delivered meal participants were much more likely than congregate meal participants to use personal care services (41 versus 6 percent); home visits for physical, occupational, or speech therapy (43 versus 10 percent); case management services (61 versus 13 percent); and light housekeeping services (60 versus 17 percent) (Table III.20). Congregate meal participants, however, were more likely to have received nutrition counseling (22 versus 12 percent); 38 percent of congregate meal participants attended a class or lecture on nutrition and healthy eating habits, and 39 percent participated in an exercise or fitness class.

Table III.20. Use of other nutrition and supportive services in the past six months among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Help or services received		
Adult day care services	5.0	1.6
Personal care services for help with dressing or bathing	6.4	41.3
Home visit from nurse or therapist visit to provide physical, occupational, or speech therapy	10.2	43.3
Nutrition counseling	21.8	11.7
Case management services	13.1	61.4
Free or discounted housing	17.0	15.3
Support group	16.4	16.3
Light housekeeping services	17.0	59.9
Chore services for heavier housecleaning or yard work	16.2	23.1
Attended a class or lecture about:		
A specific chronic disease	25.2	NA
Nutrition or healthy eating habits	38.1	NA
Safety issues, such as falls prevention	31.4	NA
Health insurance or Medicare Part D	29.9	NA
How to manage medications	15.0	NA
How to manage finances	11.3	NA
Other activities		
Participated in an exercise or fitness class	38.6	NA
Received assistance in finding employment	2.6	NA
Received legal services	11.9	NA
Received counseling about housing situation	6.6	NA

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

NA = not applicable.

In addition to receiving nutrition and supportive services, home-delivered meal participants were more likely to seek information or referrals for the services they used more often, such as personal care services, home visits, case management services, and light housekeeping services. Congregate meal participants were more likely to seek referrals for support groups (21 versus 7 percent), nutrition counseling (25 versus 19 percent), and housing assistance (12 versus 2 percent) (Table III.21).

Table III.21. Information and referrals in the past year among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Sought information or referral for places that provide information on financial, social, or health services available to participant		
Adult day care program	5.8	3.9
Personal care services	3.8	25.9
Home visiting nurse or therapist	11.0	21.3
Nutrition counseling	25.1	18.9
Case management services	4.7	36.7
Support group	20.6	7.4
Light housekeeping services	14.9	34.2
Heavier housekeeping services or yard work	10.1	28.2
Housing assistance	12.3	2.3
Transportation services	11.1	28.9

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

7. Geographic access to food

At least half of congregate and home-delivered meal participants lived within 0.7 miles of a supermarket, superstore, or large grocery store (Table III.22). Among all store types, participants lived closest to convenience stores, with the nearest store within 0.4 miles from home, on average. Other grocery stores and specialty stores were 1.7 to 2.9 miles from participants, on average. The median distance to retailers differed according to whether a participant lived in an urban or rural area. For congregate meal participants, the median distance to a supermarket, superstore, or large grocery store was 0.6 miles for those in urban areas and about 2.3 miles for those in rural areas. For home-delivered meal participants, these distances were 0.5 and 3.1 miles, respectively.

Table III.22. Median distance (in miles) to nearest retailer, by store type and urbanicity among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
All participants		
All retailers	0.3	0.3
Supermarkets, superstores, and large grocery stores	0.7	0.7
Medium grocery stores	2.2	1.9
Small grocery stores	2.1	1.7
Convenience stores	0.4	0.4
Specialty stores	2.9	1.9
Other outlets	0.5	0.5
Participants living in urban areas		
All retailers	0.3	0.2
Supermarkets, superstores, and large grocery stores	0.6	0.5
Medium grocery stores	1.3	1.4
Small grocery stores	1.3	1.0
Convenience stores	0.3	0.3
Specialty stores	1.6	1.3
Other outlets	0.5	0.5
Participants living in rural areas		
All retailers	0.6	0.5
Supermarkets, superstores, and large grocery stores	2.3	3.1
Medium grocery stores	10.4	8.7
Small grocery stores	14.7	13.0
Convenience stores	1.1	1.6
Specialty stores	16.7	12.9
Other outlets	1.4	1.1

Sources: AoA NSP outcomes survey, 2015-2016, and Store Tracking and Redemption System, 2015, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Specialty food stores comprise stores classified as selling one of the following specialized items: baked goods/bread, fruits/vegetables, meat/poultry products, or seafood products.

Other outlets comprise stores classified as a combination grocery/other store, delivery route, farmers' market, direct marketing farmer, military commissary, nonprofit food buying cooperative, wholesaler, or meal service provider.

Table III.23 presents the distribution of distances to the nearest supermarket, superstore, or large grocery store for all participants, and according to whether the participant lived in an urban or rural area. A quarter of congregate meal participants lived within 0.4 miles of a store, and another quarter lived at least 1.5 miles from a store. These distances are 0.3 and 0.9 miles in urban areas and 0.8 and 9.2 miles in rural areas. The distances for home-delivered meal participants were generally similar to those for congregate meal participants.

Table III.23. Quartiles of distribution of distances (in miles) to nearest supermarket, superstore, or large grocery store, by urbanicity, among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
All participants		
25th percentile	0.4	0.4
50th percentile	0.7	0.7
75th percentile	1.5	1.2
Participants living in urban areas		
25th percentile	0.3	0.3
50th percentile	0.6	0.5
75th percentile	0.9	0.9
Participants living in rural areas		
25th percentile	0.8	0.9
50th percentile	2.3	3.1
75th percentile	9.2	7.3

Sources: AoA NSP outcomes survey, 2015-2016, and Store Tracking and Redemption System, 2015, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Specialty food stores comprise stores classified as selling one of the following specialized items: baked goods/bread, fruits/vegetables, meat/poultry products, or seafood products.

Other outlets comprise stores classified as a combination grocery/other store, delivery route, farmers' market, direct marketing farmer, military commissary, nonprofit food buying cooperative, wholesaler, or meal service provider.

In urban areas, at least half of congregate meal participants had no supermarkets, superstores, or large grocery stores within 0.5 miles of their residence, one store in 0.5 miles to less than 1 mile, and three stores in 1 to 2 miles (Table III.24). Convenience stores were more common, with two stores within 0.5 miles of participants' residence and five stores within 1 mile. The numbers of stores were generally similar for home-delivered meal participants.

Table III.24. Median number of retailers within selected distance from Nutrition Services Program participants living in urban areas, by store type

Characteristic	Congregate meal participants	Home-delivered meal participants
Supermarkets, superstores, and large grocery stores		
Less than 0.5 mile	0	0
0.5 to less than 1 mile	1	1
1 to 2 miles	3	4
Medium grocery stores		
Less than 0.5 mile	0	0
0.5 to less than 1 mile	0	0
1 to 2 miles	0	1
Small grocery stores		
Less than 0.5 mile	0	0
0.5 to less than 1 mile	0	0
1 to 2 miles	1	1
Convenience stores		
Less than 0.5 mile	2	2
0.5 to less than 1 mile	3	4
1 to 2 miles	8	10
Specialty stores		
Less than 0.5 mile	0	0
0.5 to less than 1 mile	0	0
1 to 2 miles	0	0
Other outlets		
Less than 0.5 mile	1	1
0.5 to less than 1 mile	2	2
1 to 2 miles	4	4

Source: AoA NSP outcomes survey, 2015-2016, and Store Tracking and Redemption System, 2015, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Specialty food stores comprise stores classified as selling one of the following specialized items: baked goods/bread, fruits/vegetables, meat/poultry products, or seafood products.

Other outlets comprise stores classified as a combination grocery/other store, delivery route, farmers' market, direct marketing farmer, military commissary, nonprofit food buying cooperative, wholesaler, or meal service provider.

In rural areas, at least half of congregate meal participants had one supermarket, superstore, or large grocery store within 5 miles of their residence, no stores in 5 to less than 10 miles, and five stores in 10 to 20 miles (Table III.25). At least half of home-delivered meal participants had one supermarket, superstore, or large grocery store within 5 miles of their residence, one store in 5 to less than 10 miles, and eight stores in 10 to 20 miles. As in urban areas, convenience stores were more common than supermarkets.

Table III.25. Median number of retailers within selected distance from Nutrition Services Program participants living in rural areas, by store type

Characteristic	Congregate meal participants	Home-delivered meal participants
Supermarkets, superstores, and large grocery stores		
Less than 5 miles	1	1
5 to less than 10 miles	0	1
10 to 20 miles	5	8
Medium grocery stores		
Less than 5 miles	0	0
5 to less than 10 miles	0	0
10 to 20 miles	1	2
Small grocery stores		
Less than 5 miles	0	0
5 to less than 10 miles	0	0
10 to 20 miles	1	2
Convenience stores		
Less than 5 miles	2	2
5 to less than 10 miles	2	4
10 to 20 miles	17	28
Specialty stores		
Less than 5 miles	0	0
5 to less than 10 miles	0	0
10 to 20 miles	1	2
Other outlets		
Less than 5 miles	2	2
5 to less than 10 miles	1	2
10 to 20 miles	9	19

Source: AoA NSP outcomes survey, 2015-2016, and Store Tracking and Redemption System, 2015, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Specialty food stores comprise stores classified as selling one of the following specialized items: baked goods/bread, fruits/vegetables, meat/poultry products, or seafood products.

Other outlets comprise stores classified as a combination grocery/other store, delivery route, farmers' market, direct marketing farmer, military commissary, nonprofit food buying cooperative, wholesaler, or meal service provider.

8. Food security

Although the majority of NSP participants were food secure, 16 percent of congregate meal participants and 23 percent of home-delivered meal participants had experienced food access limitations during the past month due to lack of money or other resources—they were food insecure (Table III.26). The rate of very low food security was also higher for home-delivered meal participants than congregate meal participants (7 percent versus 4 percent).

The patterns of food insecurity by income as a percentage of poverty mostly correspond with conventional wisdom. For congregate and home-delivered meal participants, rates of food insecurity decreased as the household income-to-poverty ratio increased (Table III.27). This was generally true for congregate meal participants' very low food security as well; for home-delivered meal participants, there was no clear pattern.

In general, food insecurity decreased with age for congregate and home-delivered meal participants. For both groups, individuals age 74 and younger experienced the highest rates of food insecurity (24 percent for congregate and 44 percent for home-delivered meal participants) and individuals age 85 and older experienced the lowest rates (5 and 16 percent, respectively) (Table III.28). Food insecurity rates that decline with age, even among older adults, is consistent with findings from studies that use national data such as the Current Population Survey Food Security Supplement (Ziliak and Gundersen 2013).

Table III.26. Food security among Nutrition Services Program participants

Food security	Congregate meal participants	Home-delivered meal participants
Food secure	83.6	77.5
Food insecure	16.4	22.5
Food insecure with low food security	12.1	15.8
Food insecure with very low food security	4.3	6.7

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Table III.27. Food security, by income as a percentage of poverty, among Nutrition Services Program participants[a]

Food security	First income quartile	Second income quartile	Third income quartile	Fourth income quartile
Congregate meal participants				
Food secure	67.6	82.2	90.3	93.9
Food insecure	32.4	17.8	9.7	6.1
Food insecure with low food security	23.8	13.9	8.3	2.7
Food insecure with very low food security	8.5	3.9	1.4	3.4
Home-delivered meal participants				
Food secure	64.7	78.5	79.6	86.9
Food insecure	35.3	21.5	20.4	13.1
Food insecure with low food security	29.4	16.4	10.1	7.8
Food insecure with very low food security	5.9	5.2	10.3	5.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

[a] Income-to-poverty ratio based on the poverty guidelines from DHHS (https://aspe.hhs.gov/2015-poverty-guidelines).

Table III.28. Food security, by age, among Nutrition Services Program participants

Food security	74 and younger	75 to 84	85 and older
Congregate meal participants			
Food secure	75.6	86.5	95.2
Food insecure	24.4	13.5	4.8
Food insecure with low food security	16.4	11.2	4.7
Food insecure with very low food security	8.1	2.4	0.1
Home-delivered meal participants			
Food secure	55.9	81.6	83.8
Food insecure	44.1	18.4	16.2
Food insecure with low food security	29.0	15.9	10.0
Food insecure with very low food security	15.2	2.4	6.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

9. Food coping strategies and participation in food assistance programs

Although many participants reported that their income is sufficient to take care of their needs, a nontrivial percentage reported challenges in making ends meet and faced trade-offs in purchasing food each month. Eighty-five percent of congregate meal participants reported that their incomes take care of their needs very or fairly well; 15 percent reported that their incomes do not cover their needs (Table III.29). A greater percentage of home-delivered meal participants struggle to make ends meet—23 percent reported that their incomes do not cover their needs.

Some participants faced difficult choices of how to spend scarce household resources—whether to buy food or pay for rent, utility bills, or needed medications. Nine percent of home-delivered meal participants said they had to choose between buying food and paying utility bills during the past month; 5 percent also reported having to choose between buying food and paying rent and 4 percent had to choose between buying food and buying medications (Table III.29). The percentages for congregate meal participants were lower when facing the trade-off between buying food and paying rent or utility bills (4 and 7 percent, respectively), but were higher when facing the trade-off between buying food and buying medications (7 percent).

Table III.29. Adequacy of income among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Extent to which income takes care of needs		
Very well	35.7	30.5
Fairly well	48.9	46.9
Poorly	15.3	22.6
Trade-offs in purchasing food in past month		
Buying food and buying medications	7.0	3.9
Buying food and paying utility bills	6.7	8.8
Buying food and paying rent	3.8	4.9

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

A variety of federal, state, and local food assistance programs are available to help older adults meet their food and nutritional needs. Congregate and home-delivered meal participants receive assistance to purchase food through the Supplemental Nutrition Assistance Program (SNAP) and directly receive food through other food and nutrition assistance programs, such as food pantries and soup kitchens; they also receive energy assistance. Twenty-seven percent of congregate meal participants and 30 percent of home-delivered meal participants reported participating in SNAP (Table III.30). Smaller percentages received food from food pantries (17 and 14 percent, respectively) and received meals provided by churches or in soup kitchens in the past 30 days (11 and 3 percent, respectively).

Table III.30. Participation in other programs among Nutrition Services Program participants

Program participation	Congregate meal participants	Home-delivered meal participants
Currently receiving SNAP benefits	26.7	29.9
Received food from a food pantry or food bank in the past 30 days	17.3	14.0
Received any meals provided by churches, soup kitchens, or emergency kitchens in the past 30 days	10.7	3.0
Received emergency assistance to help with heating and cooling in the past 30 days	10.2	13.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

SNAP = Supplemental Nutrition Assistance Program.

NSP participants were asked about coping strategies they would use if their program were unavailable. Most congregate meal participants indicated in the absence of the program they would cook for themselves (86 percent), make meals that are easy to fix (88 percent), obtain meals from restaurants more often (71 percent), and eat foods saved from other meals when possible (85 percent) (Table III.31). A sizeable percentage (42 percent) indicated they would skip meals or eat less if the program was unavailable. Coping strategies for home-delivered meal participants were similar; however, relative to congregate meal participants, home-delivered meal participants were more likely to rely on friends and family for meals (73 percent), less likely to cook for themselves (72 percent), less likely to obtain meals from restaurants (48 percent), and more likely to skip meals or eat less (61 percent).

Table III.31. Coping strategies in the absence of NSP among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Participant would cook for self		
Most of the time	56.5	33.5
Sometimes	29.6	38.6
Never	13.9	27.9
Family or friends would provide participant with meals		
Most of the time	14.5	27.5
Sometimes	33.4	45.3
Never	52.1	27.2
Participant would eat at restaurants or have food delivered from restaurants		
Most of the time	6.8	4.5
Sometimes	64.2	43.5
Never	29.0	52.0
Participant would eat meals that were easy to fix		
Most of the time	41.3	47.1
Sometimes	46.9	47.6
Never	11.8	5.3
Participant would eat meals that were ready to eat right out of the package		
Most of the time	6.9	19.0
Sometimes	51.1	58.7
Never	42.0	22.2
Participant would skip meals or eat less		
Most of the time	5.6	12.4
Sometimes	36.3	48.2
Never	58.1	39.4
Participant would eat foods saved from other meals		
Most of the time	23.5	22.6
Sometimes	61.9	66.1
Never	14.6	11.3
Participant would get food in some other way		
Most of the time	6.2	6.7
Sometimes	12.2	9.9
Never	81.6	83.4

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

B. Impressions of the program and social interactions and activities

1. Impression of the program

This section examines congregate and home-delivered meal participants' experiences with the program. It describes their overall impressions of the program, their impressions of the meals, their experience with meal delivery (for home-delivered meal participants), their valuation of supportive services received through the program, and the perceived health benefits of program participation.

The majority of program participants had a positive impression of the program. Ninety-two percent of congregate meal participants and 96 percent of home-delivered meal participants rated the nutrition program overall as good, very good, or excellent (Table III.32). Similarly, 97 percent of congregate meal participants and 98 percent of home-delivered meal participants rated program staff positive overall, and almost all participants would recommend the program to friends or relatives. Most home-delivered meal participants reported that meals arrived at the scheduled time (91 percent) and the delivery person was pleasant (96 percent) (Table III.33). However, a sizeable percentage of home-delivered meal participants (46 percent) reported the delivery person seldom or never spent time talking to them as part of the delivery process.

Table III.32. Impressions of the NSP among participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Overall rating of the nutrition program		
Excellent	42.2	44.3
Very good	36.9	32.5
Good	12.5	19.3
Fair	7.2	2.6
Poor	1.3	1.3
Overall rating of the nutrition program staff		
Excellent	62.4	60.1
Very good	28.1	25.3
Good	6.8	12.8
Fair	2.2	0.6
Poor	0.5	1.1
Recommend nutrition program to friends or relatives		
Yes	95.1	97.0
No	4.9	3.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Table III.33. Impressions of meal delivery among Nutrition Services Program participants

Characteristic	Home-delivered meal participants
Meal arrives at the scheduled time	
Always	58.5
Usually	32.1
Sometimes	6.4
Seldom	0.4
Never	2.6
Delivery person spends time talking	
Always	15.7
Usually	14.0
Sometimes	24.8
Seldom	22.5
Never	23.0
Delivery person is pleasant	
Always	91.8
Usually	4.6
Sometimes	2.3
Seldom	0.0
Never	1.2

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on an unweighted sample size of 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Ninety-seven percent of congregate meal participants and 99 percent of home-delivered meal participants indicated the nutrition program had been helpful, with 68 percent of congregate and 83 percent of home-delivered meal participants indicating that the program had "helped a lot" (Table III.34). Eighty-one percent of congregate meal participants reported the program had helped them to eat healthier foods and 68 percent indicated that the program had improved their health and helped them to achieve or maintain a healthy weight (Table III.34).

Table III.34. Impressions of health benefits of the NSP among participants

Characteristic	Congregate meal participants	Home-delivered meal participants
How helpful has the nutrition program been?		
Helped a lot	67.6	82.7
Helped somewhat	24.0	12.6
Helped a little	5.6	3.3
Did not help	2.3	1.4
Made things worse	0.5	0.0
Has the nutrition program helped participant eat healthier foods?		
Yes	81.1	89.7
No	18.9	10.3
Has the nutrition program improved participant's health?		
Yes	67.9	77.8
No	32.1	22.2
Has the nutrition program helped participant follow special diet prescribed by doctor/dietician?		
Yes	37.3	38.8
No	62.7	61.2
Has the nutrition program helped participant achieve or maintain a healthy weight?		
Yes	67.7	72.0
No	32.3	28.0
Has the nutrition program helped participant live independently and stay in own home?		
Yes	70.6	89.7
No	29.4	10.3

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

Ninety percent of home-delivered meal participants reported the program had helped them to eat healthier foods, and most indicated the program had improved their health (78 percent) and helped them to achieve or maintain a healthy weight (72 percent) (Table III.34). The majority, 71 percent of congregate and 90 percent of home-delivered meal participants, reported the program had helped them to live independently and stay in their own home.

The vast majority of congregate (95 percent) and home-delivered meal participants (96 percent) liked the meals they received from the nutrition program (Table III.35). Almost 80 percent of congregate meal participants provided positive ratings on each element that measured their impression of the program meals; 79 percent liked the foods provided, 81 percent liked the way the food tastes, 84 percent were satisfied with the variety of foods, and 91 percent were satisfied with the amount of food. Home-delivered meal participants were also satisfied with the meals, but fewer people reported that they liked the foods provided (72 percent), liked the way the food tastes (75 percent), and were satisfied with the variety of foods provided (76 percent).

Table III.35. Impressions of meals among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Like meals from nutrition program		
Yes	94.9	95.6
No	5.1	4.4
Like the foods provided		
Always	34.4	36.1
Usually	44.4	35.4
Sometimes	19.2	24.4
Seldom	1.0	2.5
Never	1.1	1.6
Satisfied with the way food tastes		
Always	34.7	33.5
Usually	45.8	41.4
Sometimes	16.3	22.0
Seldom	2.1	1.2
Never	1.1	1.9
Satisfied with the way food smells		
Always	46.0	52.2
Usually	38.8	33.1
Sometimes	12.6	12.2
Seldom	1.5	1.2
Never	1.2	1.3
Satisfied with the way food looks		
Always	46.9	55.0
Usually	38.8	28.7
Sometimes	12.4	14.0
Seldom	0.9	0.7
Never	1.0	1.6
Satisfied with the variety of food		
Always	43.7	47.1
Usually	40.5	28.5
Sometimes	12.6	19.6
Seldom	1.7	3.2
Never	1.4	1.6
Satisfied with the amount of food		
Always	61.8	61.8
Usually	29.3	25.6
Sometimes	5.2	8.4
Seldom	2.7	1.9
Never	1.0	2.3
Satisfied with the attractiveness of the dining area		
Always	68.9	NA
Usually	27.0	NA
Sometimes	3.2	NA
Seldom	0.5	NA
Never	0.4	NA
Satisfied that food meets special dietary needs or restrictions		
Always	50.1	50.5
Usually	22.4	22.1
Sometimes	11.4	12.2
Seldom	2.3	2.4
Never	13.9	12.8
Food is the proper temperature		
Always	59.3	59.2
Usually	31.8	27.2
Sometimes	8.4	8.4
Seldom	0.2	2.0
Never	0.3	3.2

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Table III.35. *(continued)*

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

NA = not applicable.

2. Social interactions and activities

The survey included several questions about the types, frequency, and perceived quality of participants' social interactions and activities. Congregate meal participants were socially active: the vast majority (93 percent) were satisfied with their opportunities to spend time with other people; 77 percent indicated they had no difficulty getting in touch with others during the past two weeks; and 63 percent belonged to religious, social or special interest groups (Table III.36). On a scale of 3 to 9, the average Revised-UCLA loneliness score was a 4.1, indicating that the typical congregate meal participant does not experience loneliness. In addition, only a small percentage of congregate meal participants (7 percent) screened positively for depression. Patterns of responses are similar for home-delivered meal participants, but as a whole the group was less satisfied with their opportunities to spend time with other people (81 percent reported being somewhat satisfied or very satisfied); they were less likely to belong to religious, social, or special interest groups (48 percent); and they were much more likely to screen positively for depression (19 percent).

Table III.36. Socialization outcomes and opportunities among Nutrition Services Program participants

Characteristic	Congregate meal participants	Home-delivered meal participants
Satisfaction with the opportunities to spend time with other people		
Very satisfied	66.9	42.8
Somewhat satisfied	26.5	37.8
Not too satisfied	5.8	11.1
Not at all satisfied	0.8	8.3
Percentage of participants who belong to religious or social groups, book clubs, special interest groups, or other organizations	62.6	47.6
R-UCLA Loneliness Scale mean score[a]	4.1	4.6
Percentage of participants who screen positively for depression based on the Patient Health Questionnaire 2	6.9	19.2
During past two weeks, frequency with which participant found it difficult to get in touch with others		
Almost always	2.9	5.6
Most of the time	2.5	3.8
About half the time	4.6	5.6
Occasionally	13.4	18.9
Not at all	76.7	66.0

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on unweighted sample sizes of 596 congregate meal participants and 504 home-delivered meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

[a] Revised UCLA loneliness scale ranges from 3 to 9.

R-UCLA = Revised UCLA three-item Loneliness Scale.

Congregate meal participants reported high levels of satisfaction with the opportunities for recreation and social interaction at the meal site. One-third reported spending a lot of time participating in activities or receiving services at the nutrition site, and 39 percent volunteered at the nutrition site (Table III.37). Almost all congregate meal participants (99 percent) reported being either very satisfied or somewhat satisfied with their opportunities to spend time with other people at the meal site.

Table III.37. Recreational, volunteer, and social activities among congregate meal participants

Characteristic	Congregate meal participants
Satisfaction with the opportunities to spend time with other people at the nutrition site	
Very satisfied	82.1
Somewhat satisfied	16.6
Not too satisfied	0.4
Not at all satisfied	0.9
Amount of time participating in activities or receiving services at the nutrition site	
A lot of time	32.6
Some time	39.7
Just a little time	13.6
No time	14.2
Volunteer at the nutrition site	
Yes	38.5
No	61.5

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Tabulations are based on an unweighted sample size of 596 congregate meal participants. Individual estimates within the table may have slightly fewer observations due to item nonresponse to individual questions.

IV. CONGREGATE AND HOME-DELIVERED MEAL PARTICIPATION AND PARTICIPANTS' OUTCOMES

This chapter presents estimates of the effects of congregate and home-delivered meal participation on participants' outcomes. The descriptive tabulations of food security, socialization, and diet quality outcomes presented in the previous chapter characterize the population of congregate and home-delivered meal participants. The findings presented in this chapter describe how participation in congregate and home-delivered meal programs affects these outcomes. The findings are based on multivariate analyses that account for observed differences between participants and matched nonparticipants. These findings are referred to as regression-adjusted findings.[8]

Findings are presented about the impact of program participation on food security (Section A), socialization (Section B), and diet quality (Section C). Unless stated otherwise, all differences between participants and nonparticipants are statistically significant at the 0.10, 0.05, or 0.01 levels (specified in the tables).

A. Congregate and home-delivered meal participation and household food security

The impact of program participation on household food security was assessed using two measures: (1) whether an individual lives in a food insecure household and (2) whether an individual lives in a household that experienced very low food security. Overall, congregate meal participants had a lower rate of food insecurity than nonparticipants, but rates of very low food security were similar for the two groups. Home-delivered meal participants had a food insecurity rate similar to nonparticipants and, for the vast majority of participants who receive meals five days per week, a similar rate of very low food security. However, for home-delivered meal participants who receive fewer than five meals per week, the rate of very low food security was significantly greater for participants than nonparticipants.

1. Congregate meal participation

The percentage of congregate meal participants living in a food insecure household was 4.0 percentage points lower than the percentage of nonparticipants (15.5 versus 19.5 percent; Table IV.1). However, there was no statistically significant difference between the percentages of congregate meal participants and nonparticipants living in households that experienced very low food security.

[8] Appendix A describes the regression-adjustment process.

Table IV.1. Regression-adjusted percentages of individuals who live in households that are food insecure or have very low food security, by congregate meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Food insecurity	15.5	(2.1)	19.5	(2.1)	-4.0*	(2.4)
Very low food security	4.2	(0.8)	4.0	(1.0)	0.2	(1.0)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

2. Home-delivered meal participation

There was no statistically significant difference between home-delivered meal participants and nonparticipants in the percentage of individuals living in a food insecure household (Table IV.2). However, the prevalence of very low food security was 4.2 percentage points higher among participants than nonparticipants (6.9 versus 2.7 percent). Because this is a counterintuitive finding, the research team conducted auxiliary analyses to assess whether the effect differed depending on the intensity of participating in the program, measured by the number of days per week participants receive home-delivered meals. Among home-delivered meal participants who receive meals five or more days per week (about 70 percent of participants), there was no difference between participants and nonparticipants in the percentage of individuals who live in households that experienced very low food security (Table IV.3). Among home-delivered meal participants who receive fewer than five meals per week (about 30 percent of participants), a significantly greater percentage of participants lived in households that had experienced very low food security, compared to nonparticipants (25.8 versus 15.9 percent). There were similar findings for food insecurity. This suggests that some home-delivered meal participants experiencing food access limitations may not be receiving a sufficient number of meals per week to ameliorate their severe level of food insecurity. As discussed in the next chapter, learning more about the reasons participants receive varying amounts of program meals and how their food needs are assessed is an important step in improving their food security.

Table IV.2. Regression-adjusted percentages of individuals who live in households that are food insecure or have very low food security, by home-delivered meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Food insecurity	22.0	(2.1)	17.0	(2.1)	5.0	(3.2)
Very low food security	6.9	(1.1)	2.7	(0.7)	4.2***	(1.5)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

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

Table IV.3. Regression-adjusted percentages of individuals who live in households that are food insecure or have very low food security, by home-delivered meal participation status and number of meals received per week

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Food insecurity	22.0	(2.1)	17.0	(2.1)	5.0	(3.2)
Receive fewer than 5 delivered meals per week	13.6	(3.1)	3.5	(1.0)	10.1***	(3.6)
Receive 5 or more delivered meals per week	4.6	(1.3)	2.4	(0.6)	2.2	(1.6)
Very low food security	6.9	(1.1)	2.7	(0.7)	4.2***	(1.5)
Receive fewer than 5 delivered meals per week	25.8	(3.4)	15.9	(1.7)	9.9**	(4.1)
Receive 5 or more delivered meals per week	20.4	(2.4)	17.7	(2.2)	2.7	(3.5)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

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

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

3. Differences by income and whether individuals live alone

As described in Chapter II, the research team assessed whether program impacts varied by household income and whether individuals lived alone. These findings are summarized below.

Congregate meal participants and nonparticipants. Among lower-income individuals, the percentage of congregate meal participants living in a food insecure household was 7.8 percentage points lower than the percentage of nonparticipants (23.2 versus 31.0 percent); Appendix Table C.1). Similar to the full sample, there was no significant difference between participants and nonparticipants in the percentage of individuals living in households that experienced very low food security.

Among higher-income individuals, there were no statistically significant differences between participants and nonparticipants in either of the food security outcomes (Appendix Table C.1). This is expected, given that food insecurity and very low food security are measures of economic access to food—whether a household experiences food access limitations due to lack of money or other resources.

Because food insecurity is a household-level measure, it measures food access limitations for all household members, including those who live with congregate meal participants but do not participate in the program themselves. To assess whether the effect of participation in congregate meal programs on food insecurity partially reflected food access limitations for household members other than the program participant, program impacts were examined for individuals who live with other people and individuals who live alone. There were no significant differences for either group (Appendix Table C.1).[9] This was also true for very low food security.

Home-delivered meal participants and nonparticipants. There were no significant differences in the rates of food insecurity and very low food security for lower-income individuals (Appendix Table C.2). For higher-income individuals, however, the rates of food insecurity and very low food security were each greater for participants than nonparticipants. Because this is a counterintuitive finding, a similar auxiliary analysis was conducted to assess whether the effect differed depending on the number of days per week participants receive home-delivered meals. Participants experienced greater food insecurity and very low food security than nonparticipants regardless of the number of meals per week they received.

B. Congregate and home-delivered meal participation and socialization

The impact of program participation on socialization outcomes was assessed using three measures: (1) a measure of perceived loneliness, (2) a depression screener, and (3) a measure of satisfaction with the opportunities one has to spend time with other people. Congregate meal participants generally had more positive socialization outcomes than nonparticipants. For home-delivered meal participants, the findings were mixed. For some socialization outcomes, there were no significant differences between participants and nonparticipants; for other socialization outcomes, there were no significant differences between participants who receive meals five or more days per week and nonparticipants, but home-delivered meal participants that receive fewer than five meals per week had less favorable outcomes than nonparticipants.

[9] Among individuals living in lower-income households, however, there was a larger and statistically significant reduction in food insecurity for individuals living alone (−11.0 percentage points) and no significant reduction for individuals living with others (−0.9 percentage points) (not shown).

1. Congregate meal participation

There was no statistically significant difference between congregate meal participants and nonparticipants in the average R-UCLA loneliness score (equal to 4.1) (Table IV.4). Based on a scale that ranges from 3 to 9, each group scored an average of 4.1, indicating there was no difference in the extent to which participants and nonparticipants feel a lack companionship, left out, or isolated from others.

Table IV.4. Regression-adjusted socialization outcomes, by congregate meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
R-UCLA loneliness scale						
Loneliness score (mean)[a]	4.1	(0.1)	4.1	(0.1)	0.0	(0.1)
PHQ-2 depression screener						
Percentage of individuals who affirmed at least 2 of 6 questions	18.1	(2.1)	24.3	(2.8)	-6.2*	(3.7)
Percentage of individuals who affirmed at least 3 of 6 questions	6.5	(1.2)	9.3	(1.8)	-2.8	(2.4)
Percentage of individuals who affirmed at least 4 of 6 questions	2.3	(0.7)	6.5	(1.7)	-4.2**	(1.9)
Number of questions individuals affirmed (mean)	0.6	(0.1)	0.8	(0.1)	-0.2**	(0.1)
Satisfaction with socialization opportunities						
Percentage of individuals satisfied with socialization opportunities	94.0	(1.4)	85.8	(2.1)	8.2***	(2.4)
Percentage of individuals very satisfied with socialization opportunities	67.5	(3.3)	55.5	(2.5)	12.0***	(4.3)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

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

[a] R-UCLA loneliness scale ranges from 3 to 9.

PHQ-2 = Patient Health Questionnaire 2; R-UCLA = Revised UCLA Three-Item Loneliness Scale.

As described in Chapter II, the second socialization measure is based on the PHQ-2, which assesses the frequency of depressed mood over the past two weeks to indicate whether an individual screens positively for depression. Because there is no agreed-upon threshold that positively identifies individuals with depression, the research team compared the PHQ-2 raw score to thresholds of 2, 3, and 4 to define three measures of screening positively for depression. The raw score itself was also examined.

Congregate meal participants were less likely to screen positively for depression in three of the four measures examined. The percentage of individuals who screened positively for depression was lower for congregate meal participants than for nonparticipants (18.1 versus 24.3 percent) when using the PHQ-2 screener with a threshold of 2 affirmative answers (Table IV.4). The percentage of individuals who screened positively for depression was also lower for congregate meal participants than for nonparticipants (2.3 versus 6.5 percent) when using the PHQ-2 screener with a threshold of 4 affirmative answers. In addition, the PHQ-2 screener raw score was lower among participants than nonparticipants, indicating a lower average likelihood of participants screening positively for depression. There was no statistically significant difference between participants and nonparticipants in the percentage of individuals who screen positively for depression using the PHQ-2 screener with a threshold of 3 affirmative answers. Because the findings are consistent for three of the four measures, the research team concludes that congregate meal participants were less likely than nonparticipants to screen positively for depression.

The third measure of socialization is based on two variables measuring individuals' self-reported satisfaction with the opportunities they have had to spend time with other people. Compared to nonparticipants, congregate meal participants had greater satisfaction with their socialization opportunities. The percentage of individuals who were satisfied with their socialization opportunities was 8.2 percentage points higher for congregate meal participants than for nonparticipants (94.0 versus 85.8 percent) (Table IV.4). Similarly, the percentage of individuals who were very satisfied with their socialization opportunities was 12.0 percentage points higher for congregate meal participants than for nonparticipants (67.5 versus 55.5 percent).

2. Home-delivered meal participation

The findings were mixed for home-delivered meal participation. The average R-UCLA loneliness score was slightly higher for home-delivered meal participants compared to nonparticipants (4.5 versus 4.3) (Table IV.5), indicating relatively greater levels of loneliness among participants. However, there were no statistically significant differences between participants and nonparticipants in the likelihood of screening positively for depression. The percentage of home-delivered meal participants who screened positively for depression was not statistically different from the percentage of nonparticipants for the PHQ-2 screener with a threshold of 2, 3, and 4. This was also true for the PHQ-2 raw score. Finally, there was no statistical difference between the percentages of home-delivered meal participants and nonparticipants who were satisfied with the socialization opportunities they have had. However, the percentage of individuals who were very satisfied with their socialization opportunities was 8.9 percentage points lower for home-delivered meal participants than for nonparticipants (44.5 versus 53.4 percent).

Table IV.5. Regression-adjusted socialization outcomes, by home-delivered meal participation status

Outcome	Participants		Nonparticipants		Difference	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
R-UCLA loneliness scale						
Loneliness score (mean)[a]	4.5	(0.1)	4.3	(0.1)	0.2*	(0.1)
PHQ-2 depression screener						
Percentage of individuals who affirmed at least 2 of 6 questions	18.0	(2.8)	15.1	(1.7)	2.9	(3.7)
Percentage of individuals who affirmed at least 3 of 6 questions	29.2	(2.6)	27.6	(2.9)	1.6	(4.3)
Percentage of individuals who affirmed at least 4 of 6 questions	11.5	(2.1)	11.6	(1.7)	-0.1	(2.9)
Number of questions individuals affirmed (mean)	1.1	(0.1)	1.1	(0.1)	0.1	(0.2)
Satisfaction with socialization opportunities						
Percentage of individuals satisfied with socialization opportunities	82.3	(1.6)	85.7	(2.1)	-3.3	(2.7)
Percentage of individuals very satisfied with socialization opportunities	44.5	(2.4)	53.4	(2.4)	-8.9**	(3.6)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

[a] Revised UCLA loneliness scale ranges from 3 to 9.

PHQ-2 = Patient Health Questionnaire 2; R-UCLA = Revised UCLA Three-Item Loneliness Scale.

The research team conducted auxiliary analyses to assess whether the effect differed depending on the intensity of participating in the program, measured by the number of days per week participants receive home-delivered meals. Among home-delivered meal participants who receive meals five or more days per week, there were no statistically significant differences between participants and nonparticipants in any of the socialization outcomes (Table IV.6). Among home-delivered meal participants who receive fewer than five meals per week, the average R-UCLA loneliness score was slightly higher for participants than nonparticipants (4.6 versus 4.2), the percentage of individuals who were satisfied with their socialization opportunities was lower for participants than for nonparticipants (79.7 versus 87.2 percent), and the percentage of individuals who were very satisfied with their socialization opportunities was lower for participants than for nonparticipants (34.5 versus 55.0 percent).

Table IV.6. Regression-adjusted socialization outcomes, by home-delivered meal participation status and number of meals received per week

	Participants		Nonparticipants		Difference	
Outcome	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
R-UCLA loneliness scale						
Loneliness score (mean)[a]	4.5	(0.1)	4.3	(0.1)	0.2*	(0.1)
Receive fewer than 5 delivered meals per week	4.6	(0.2)	4.2	(0.1)	0.4*	(0.2)
Receive 5 or more delivered meals per week	4.5	(0.1)	4.3	(0.1)	0.2	(0.1)
PHQ-2 depression screener						
Percentage of individuals who affirmed at least 2 of 6 questions	29.2	(2.6)	27.6	(2.9)	1.6	(4.3)
Receive fewer than 5 delivered meals per week	28.6	(4.9)	27.7	(2.7)	0.8	(5.8)
Receive 5 or more delivered meals per week	28.2	(3.0)	27.4	(2.9)	0.8	(4.4)
Percentage of individuals who affirmed at least 3 of 6 questions	18.0	(2.8)	15.1	(1.7)	2.9	(3.7)
Receive fewer than 5 delivered meals per week	19.4	(4.8)	15.4	(1.7)	4.0	(5.5)
Receive 5 or more delivered meals per week	15.7	(2.8)	14.9	(1.7)	0.8	(3.6)
Percentage of individuals who affirmed at least 4 of 6 questions	11.5	(2.1)	11.6	(1.7)	-0.1	(2.9)
Receive fewer than 5 delivered meals per week	5.3	(2.1)	11.7	(1.5)	-6.4**	(2.7)
Receive 5 or more delivered meals per week	13.2	(2.5)	11.5	(1.7)	1.7	(3.2)
Number of questions individuals affirmed (mean)	1.1	(0.1)	1.1	(0.1)	0.1	(0.2)
Receive fewer than 5 delivered meals per week	1.1	(0.2)	1.0	(0.1)	0.1	(0.3)
Receive 5 or more delivered meals per week	1.1	(0.1)	1.0	(0.1)	0.1	(0.2)
Satisfaction with socialization opportunities						
Percentage of individuals satisfied with socialization opportunities	82.3	(1.6)	85.7	(2.1)	-3.3	(2.7)
Receive fewer than 5 delivered meals per week	79.7	(3.1)	87.2	(1.8)	-7.6**	(3.6)
Receive 5 or more delivered meals per week	84.1	(1.8)	85.2	(2.0)	-1.1	(3.0)
Percentage of individuals very satisfied with socialization opportunities	44.5	(2.4)	53.4	(2.4)	-8.9**	(3.6)
Receive fewer than 5 delivered meals per week	34.5	(4.3)	55.0	(2.2)	-20.5***	(5.2)
Receive 5 or more delivered meals per week	49.7	(2.7)	53.0	(2.4)	-3.4	(3.7)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

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

[a] Revised UCLA loneliness scale ranges from 3 to 9.

PHQ-2 = Patient Health Questionnaire 2; R-UCLA = Revised UCLA Three-Item Loneliness Scale.

3. Differences by income and whether individuals live alone

The research team assessed whether program impacts on socialization outcomes varied by household income and whether individuals lived alone. These findings are summarized below.

Congregate meal participants and nonparticipants. There was no statistically significant difference between congregate meal participants and nonparticipants in the average R-UCLA loneliness score for lower-income individuals, individuals living with others, and individuals living alone. Among higher-income individuals, however, the average loneliness score was lower for congregate meal participants compared to nonparticipants (3.8 versus 4.1 percent) (Appendix Table C.3).

Relative to nonparticipants, congregate meal participants were less likely to screen positively for depression for individuals who lived alone, but not for individuals that lived with other people. Among individuals who lived alone, congregate meal participants were less likely to screen positively for depression in three of the four measures examined; for those who lived with other people, there were no significant differences between participants and nonparticipants (Appendix Table C.4). There also were generally no differences by income group.

Compared to nonparticipants, congregate meal participants had greater satisfaction with the socialization opportunities they have had. This was true for higher-income individuals, however, but not for lower-income individuals. Among higher-income individuals, for example, the percentage of individuals who were very satisfied with the socialization opportunities they have had was 15.1 percentage points greater for congregate meal participants than for nonparticipants (71.2 versus 56.1 percent) (Appendix Table C.5). Congregate meal participants had greater satisfaction with socialization opportunities relative to nonparticipants regardless of whether they lived alone or with other people.

Home-delivered meal participants and nonparticipants. The home-delivered meal program analyses were also reestimated by household income and whether individuals live alone. Among individuals in higher-income households, the average R-UCLA loneliness score was higher for home-delivered meal participants compared to nonparticipants (Appendix Table C.6); however, there were no significant differences for individuals living in lower-income households, individuals living with other people, and individuals living alone (Appendix Table C.7). There were no significant effects of the home-delivered meal program on the likelihood of screening positively for depression across all four outcomes measures regardless of income and whether individuals live alone. Finally, the findings were mixed across subgroups for the percentage of individuals who were satisfied or very satisfied with the socialization opportunities they have had. For example, the percentage of higher-income individuals who were very satisfied with their socialization opportunities was lower for home-delivered meal participants than for nonparticipants (Appendix Table C.8). However, for lower-income individuals, there was no statistical difference between home-delivered participants and nonparticipants. In contrast, for lower-income individuals, there was a significant difference between participants and nonparticipants in the percentage of individuals who were either satisfied or very satisfied with their socialization opportunities and no effect for higher-income individuals.

C. Congregate and home-delivered meal participation and diet quality

The research team estimated the impact of program participation on diet quality outcomes using two measures: (1) the prevalence of adequate and excessive nutrient intakes and (2) the HEI-2010, which assesses overall diet quality. Congregate meal participants generally had healthier diets compared to nonparticipants, both in terms of the adequacy of their usual nutrient intakes and the overall quality of their diets. However, congregate meal participants were more likely than nonparticipants to have excessive intakes of sodium. Overall, home-delivered meal participants were more likely than nonparticipants to have adequate nutrient intakes, but there were few differences in the overall quality of their diets.

1. Prevalence of adequate and excessive nutrient intakes

Congregate meal participation. There were a number of significant differences between congregate meal participants and nonparticipants in the percentage of individuals with adequate intakes for vitamins and minerals (Table IV.7). The percentages of congregate meal participants with adequate intakes for niacin, zinc, and vitamin B_6 were 16.6 to 18.5 percentage points higher than nonparticipants; for riboflavin, phosphorus, and vitamin B_{12}, percentages were 8.3 to 13.1 percentage points higher. While these vitamins and minerals are important for people of all ages, some are especially important for older adults. For example, vitamin B_6 is important for numerous metabolic reactions in the body and inadequacies sometimes lead to impaired immune function. Inadequate intakes of vitamin B_6 have also been associated with declines in cognitive functioning and depression, both of which are common among older adults (Institute of Medicine 2010). Vitamin B_{12} is an important nutrient of concern because decreased levels of stomach acid and many commonly prescribed medications can hamper its absorption. Low serum concentrations of vitamin B_{12} can have consequences for mobility and quality of life due to peripheral neuropathy and disturbances in balance and cognitive functioning and can also increase risk of heart disease and increase loss of bone density (Institute of Medicine 2010).

Congregate meal participants also had higher mean intakes of potassium and dietary fiber, relative to the AI, than nonparticipants (a difference of 8.2 and 6.9 percentage points for potassium and dietary fiber, respectively). The AI is the recommended average intake level assumed to be adequate for healthy individuals in a life stage and gender group, based on observed or experimentally determined estimates of intake. It is important to note that when mean usual intakes fall below the AI, firm conclusions cannot be made about the adequacy of intakes. Thus, given the limitation of the AI standard, the differences observed for potassium and dietary fiber do not necessarily imply that participants were more likely than nonparticipants to have adequate usual intakes of these nutrients.

Although congregate meal participants were more likely than nonparticipants to have adequate intakes of many nutrients, they were also more likely to have excessive sodium intakes. The percentage of congregate meal participants with excessive sodium intakes was 30.6 percentage points higher compared to nonparticipants (93.7 versus 63.1 percent). As reported in Chapter III, congregate meal participants obtained, on average, 47 percent of their daily sodium intakes from program meals.

Home-delivered meal participation. There were a number of statistically significant differences between home-delivered meal participants and nonparticipants in the percentage of

individuals with adequate nutrient intakes. Compared to nonparticipants, a greater percentage of home-delivered meal participants had adequate intakes of zinc (18.5 percentage points greater), vitamin B_6 (12.7 percentage points greater), vitamin A (11.8 percentage points greater), and vitamin D (6.6 percentage points greater) (Table IV.7). There were no statistically significant differences between home-delivered meal participants and nonparticipants in mean usual intakes of potassium or dietary fiber relative to the AI, or in the proportions with excessive sodium intakes. The percentage of home-delivered meal participants with usual intakes of total fat that were within the AMDR was 11.5 percentage points higher compared to nonparticipants. Conversely, the percentage of participants with usual intakes of alpha-linolenic acid that were within the AMDR was 24.0 percentage points lower compared to nonparticipants. Alpha-linolenic acid is a fatty acid found mostly in nuts and seed oils such as walnuts, flaxseeds, canola oil and soybean oil and is essential in the diet because it cannot be produced in the body and must be obtained from food sources.

Table IV.7. Effects of congregate and home-delivered meal program participation on the percentage of people with adequate and excessive usual nutrient intakes, by participation status

	Congregate meal program						Home-delivered meal program					
	Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
Nutrient	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error
Vitamins and minerals with EARs (percentage with usual intakes ≥ EAR)												
Vitamin A	75.5	24.74	47.4	3.98	28.1	25.06	64.5	4.80	52.7	4.25	11.8*	6.41
Vitamin C[a]	54.9	4.07	46.8	3.03	8.1	5.08	50.6	4.58	49.1	3.12	1.5	5.54
Vitamin D	4.1	3.50	2.6	1.27	1.5	3.73	7.0	2.26	0.4	0.83	6.6***	2.41
Vitamin E	4.7	1.70	4.7	1.56	0.0	2.31	2.6	1.70	0.6	1.23	1.9	2.10
Vitamin B_6	77.4	7.39	58.9	3.42	18.5**	8.14	73.1	5.85	60.4	2.78	12.7*	6.47
Vitamin B_{12}	94.4	3.23	81.3	4.80	13.1**	5.78	93.0	8.13	91.1	4.79	1.9	9.44
Folate	72.1	4.97	76.4	6.28	-4.3	8.01	73.1	8.64	63.2	3.38	9.8	9.28
Niacin[b]	95.4	4.18	78.8	3.25	16.6***	5.30	95.1	6.87	83.8	4.41	11.3	8.16
Riboflavin	97.6	1.53	89.3	3.13	8.3**	3.48	95.8	3.30	91.8	1.87	4.0	3.79
Thiamin	85.5	5.45	79.9	4.38	5.6	7.00	88.7	7.28	78.5	4.31	10.2	8.46
Calcium	26.3	4.58	17.6	3.30	8.7	5.64	24.1	3.55	17.1	2.76	7.1	4.50
Iron	99.3	0.59	97.8	2.13	1.5	2.21	98.0	2.20	95.5	1.63	2.5	2.74
Magnesium	31.3	3.15	25.4	3.19	6.0	4.48	22.4	3.54	20.6	3.35	1.8	4.87
Phosphorus	98.8	1.52	88.5	2.70	10.3***	3.10	94.5	2.74	91.4	3.05	3.1	4.10
Zinc	78.2	5.15	60.6	3.90	17.6***	6.46	77.5	7.05	58.9	3.41	18.5**	7.83
Potassium, dietary fiber, and sodium												
Potassium (mean % of AI)	53.0	1.71	44.9	1.50	8.2***	2.28	47.6	1.21	45.9	1.38	1.8	1.84
Dietary fiber (mean % of AI)	65.3	2.15	58.3	2.60	6.9**	3.37	56.9	2.22	58.0	2.41	-1.0	3.27
Sodium (mean % of AI)	241.5	8.75	224.5	6.85	17.1	11.11	223.4	5.08	222.7	6.79	0.7	8.48
Sodium (% > UL/DG)	93.7	18.02	63.1	3.92	30.6*	18.44	69.2	4.29	61.8	3.66	7.4	5.64

Table IV.7. (*continued*)

	Congregate meal program						Home-delivered meal program					
	Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
Nutrient	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error	Percent	Standard error
Macronutrients												
Protein												
% within AMDR	99.9	0.42	99.1	1.35	0.8	1.41	99.6	0.79	99.1	0.75	0.6	1.09
% < AMDR	0.1	0.40	0.9	1.35	-0.8	1.41	0.4	0.79	0.9	0.75	-0.6	1.09
% > AMDR	0.0	0.02	0.0	0.01	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Carbohydrate												
% within AMDR	75.6	5.52	69.0	4.15	6.5	6.90	72.8	4.14	70.4	3.60	2.5	5.49
% < AMDR	24.2	5.27	29.5	3.39	-5.3	6.26	24.2	3.66	27.7	3.10	-3.5	4.80
% > AMDR	0.2	0.30	1.5	1.42	-1.2	1.45	3.0	1.58	2.0	1.27	1.0	2.03
Total fat												
% within AMDR	53.9	5.87	49.5	3.56	4.4	6.87	59.3	5.40	47.8	3.62	11.5*	6.50
% < AMDR	0.0	0.01	0.4	0.47	-0.4	0.47	0.6	0.63	0.5	0.46	0.1	0.78
% > AMDR	46.1	5.87	50.1	3.67	-4.0	6.92	40.1	5.36	51.7	3.71	-11.6*	6.52
Linoleic acid												
% within AMDR	84.8	8.17	79.8	7.40	5.0	11.02	75.7	6.58	86.7	10.84	-11.0	12.68
% < AMDR	11.3	5.66	15.7	5.29	-4.3	7.75	23.7	5.35	10.9	7.91	12.9	9.55
% > AMDR	3.9	3.11	4.5	2.41	-0.6	3.94	0.6	1.53	2.4	3.29	-1.8	3.63
Alpha-linolenic acid												
% within AMDR	74.5	10.66	58.2	5.20	16.3	11.86	50.8	5.67	74.8	13.57	-24.0	14.71
% < AMDR	22.3	8.09	36.5	4.09	-14.1	9.06	48.9	5.65	24.9	12.58	24.1*	13.79
% > AMDR	3.2	3.29	5.3	2.19	-2.1	3.95	0.2	0.53	0.3	1.22	0.0	1.33
Saturated fat												
% > DG	89.0	17.80	72.7	5.81	16.3	18.72	71.5	6.77	70.9	4.29	0.7	8.02

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

Note: Not all participants consumed a program meal on the intake day for the 24-hour recall. Estimates are based on an unweighted sample size of 1,210 congregate meal participants and nonparticipants and 1,016 home-delivered meal participants and nonparticipants.

Table IV.7. (*continued*)

[a]The EAR for vitamin C is 35 mg greater for smokers than nonsmokers. EARs were used for nonsmokers in this analysis.

[b]Niacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of adequate niacin intakes may be underestimated.

* Difference between participants and nonparticipants is significantly different from zero at the .10 level, two-tailed test.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

*** Difference between participants and nonparticipants is significantly different from zero at the .01 level, two-tailed test.

AI = Adequate Intake; AMDR = Acceptable Macronutrient Distribution Range; DG = 2015-2020 *Dietary Guidelines*; EAR = Estimated Average Requirement; UL = Tolerable Upper Intake Level.

2. Healthy Eating Index-2010 scores

Congregate meal participation. There was a sizeable difference between congregate meal participants and nonparticipants in total HEI-2010 scores. The total score for participants was 6.1 points higher than for nonparticipants (65.5 versus 59.4 points of 100) (Table IV.8). The statistically significant effect observed for the total HEI-2010 score reflects differences in scores for a number of HEI-2010 components. Relative to nonparticipants, congregate meal participants received higher scores for refined grains (1.8 points), total fruit (1.2 points), dairy (1.2 points), and total vegetables (0.6 points). Refined grains are found in products that do not contain all of the components of the grain kernel, which may include white bread, cookies, cakes, pastries, muffins, pasta, and cold cereals made with refined flour.

Home-delivered meal participation. There were few statistically significant differences between home-delivered meal participants and nonparticipants in HEI-2010 scores (Table IV.8). Scores for dairy and refined grains were significantly higher (1.3 points and 1.0 point, respectively) for participants than nonparticipants. There were no significant differences between home-delivered meal participants and nonparticipants, however, in scores for any of the other components or for the total score.

Differences by income and whether individuals live alone. The research team examined differences among participants and nonparticipants' HEI-2010 scores by household income and whether individuals live alone.

Congregate meal participants and nonparticipants. Relative to nonparticipants, total HEI-2010 scores were significantly higher for congregate meal participants among both lower- and higher-income individuals (7.1 points and 5.6 points, respectively) (Appendix Table C.9). For individuals in both income groups, scores for total fruit and refined grains were significantly higher for congregate meal participants than for nonparticipants (for total fruit, a difference of 1.6 and 0.8 points for lower-income and higher-income participants, respectively; and for refined grains, a difference of 1.8 and 1.9 points, respectively). Among lower-income individuals, the score for total vegetables was 0.9 points higher for congregate meal participants than for nonparticipants, but there was no difference among higher-income individuals for this component. Conversely, among higher-income individuals, the score for dairy was 1.5 points higher for congregate meal participants than nonparticipants, but no effect was observed for this component for lower-income individuals.

The total HEI-2010 score for individuals living with other people was 8.7 points higher for congregate meal participants than nonparticipants, but there was no statistically significant difference in the total HEI-2010 score among individuals living alone (Appendix Table C.10). Among individuals living alone, congregate meal participants had significantly higher scores for refined grains (1.6 points) and total fruit (1.0 points) than nonparticipants. Higher scores for these components were also observed among individuals living with others (2.1 points higher for refined grains and 1.4 points higher for total fruit). Congregate meal participants living with others also had significantly higher scores than nonparticipants for dairy (1.1 points), sodium (1.5 points), and empty calories (1.4 points).

Table IV.8. Effects of congregate and home-delivered meal program participation on mean Healthy Eating Index-2010 scores, by participation status

		Congregate meal program						Home-delivered meal program					
		Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
HEI-2010 component	Maximum score	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error
Adequacy (higher score indicates higher consumption)													
Total fruit	5	4.8	0.19	3.6	0.20	1.2***	0.27	4.6	0.26	4.3	0.26	0.3	0.37
Whole fruit	5	5.0	0.00	4.9	0.14	0.1	0.14	5.0	0.01	5.0	0.02	0.0	0.02
Total vegetables	5	4.5	0.24	3.9	0.17	0.6**	0.29	4.3	0.20	4.4	0.21	0.0	0.29
Greens and beans	5	3.8	0.36	3.5	0.35	0.3	0.50	2.6	0.29	2.8	0.29	-0.2	0.41
Whole grains	10	3.8	0.39	3.7	0.28	0.0	0.48	3.3	0.37	3.5	0.29	-0.2	0.47
Dairy	10	6.9	0.42	5.7	0.27	1.2**	0.50	7.2	0.33	5.8	0.28	1.3***	0.43
Total protein foods	5	5.0	0.00	5.0	0.00	0.0	0.00	5.0	0.00	5.0	0.00	0.0	0.00
Seafood and plant proteins	5	4.6	0.51	4.5	0.37	0.1	0.63	3.8	0.66	4.2	0.43	-0.4	0.78
Fatty acids	10	4.2	0.44	4.3	0.26	-0.1	0.51	4.0	0.31	4.2	0.27	-0.2	0.41
Moderation (higher score indicates lower consumption)													
Refined grains	10	7.8	0.25	6.0	0.41	1.8***	0.48	7.4	0.38	6.4	0.45	1.0*	0.59
Sodium	10	2.3	0.47	2.2	0.37	0.2	0.59	2.2	0.44	1.9	0.29	0.3	0.53
Empty calories	20	12.8	0.52	12.1	0.45	0.7	0.69	12.0	0.41	11.9	0.37	0.1	0.55
Total score	100	65.5	1.41	59.4	1.44	6.1***	2.01	61.4	1.66	59.3	1.34	2.1	2.14

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,210 congregate meal participants and nonparticipants and 1,016 home-delivered meal participants and nonparticipants.

* Difference between participants and nonparticipants is significantly different from zero at the .10 level, two-tailed test.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

*** Difference between participants and nonparticipants is significantly different from zero at the .01 level, two-tailed test.

HEI = Healthy Eating Index.

Home-delivered meal participants and nonparticipants. The research team also examined HEI-2010 scores by household income and whether individuals live alone for home-delivered meal participants and nonparticipants. Among lower-income individuals, the score for dairy was 1.9 points higher for home-delivered meal participants than nonparticipants (Appendix Table C.11). Conversely, the score for greens and beans was 1.2 points lower for participants than nonparticipants. These effects were not observed among higher-income individuals. Among higher-income individuals, the score for refined grains and the total HEI-2010 score were significantly higher for participants compared to nonparticipants (1.3 points for refined grains and 4.1 points for the total HEI-2010 score).

Among individuals living alone, the score for seafood and plant proteins was significantly lower for home-delivered meal participants than nonparticipants (−1.4 points), but there was no effect for this component among individuals living with others (Appendix Table C.12). There were no other significant differences in scores among individuals living alone. Relative to nonparticipants, scores for dairy and refined grains were significantly higher (2.0 points and 1.8 points, respectively) among home-delivered meal participants who live with others. However, the score for greens and beans was lower for participants than nonparticipants (−1.1 points).

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V. CONCLUSION

This chapter compares select findings to those in the last NSP evaluation conducted from 1993 to 1995, here referred to as the 1995 evaluation (Ponza et al. 1996). It also presents recommendations for additional research motivated by the evaluation findings, including analyses that explain some of the counterintuitive findings observed for home-delivered meal participants related to food security and socialization.

A. Comparison to findings from the 1995 NSP evaluation

This is the first national evaluation of the Title III-C NSP in 20 years. Compared to the 1995 evaluation, the overall makeup of NSP participants has remained similar over time, with a few differences highlighted here:

- The demographic composition of congregate and home-delivered meal participants has remained fairly stable over time. A larger percentage of home-delivered meal participants were Hispanic (9 percent in the current evaluation versus 5 percent in 1995); for congregate meal participants, these percentages were roughly the same (13 and 12 percent, respectively). In addition, a larger percentage of congregate meal participants lived alone in the current evaluation compared to in the 1995 evaluation (60 versus 57 percent); the percentage of home-delivered meal participants who lived alone was similar over time (59 versus 60 percent, respectively).
- NSP participants continue to have significant economic needs, though the percentage of poor participants has decreased over time. In the current evaluation, 31 percent of congregate meal participants and 35 percent of home-delivered meal participants had incomes below 100 percent of the DHHS federal poverty guideline, compared to 34 and 48 percent, respectively, in 1995.
- Most NSP participants continue to be satisfied with the services the program provides. The percentages of participants who were satisfied with the way the food tastes and looks, and with the variety of the food, have remained high (above 95 percent) over time. The percentage of home-delivered meal participants who reported the meal arrived at the scheduled time and the delivery person was pleasant also remained high (above 98 percent).
- Participants continue to have a significant number of health problems, though the percentage of participants with doctor-diagnosed chronic health conditions has increased. Compared to the 1995 evaluation, greater percentages of congregate meal participants in the current evaluation had high cholesterol (57 versus 28 percent), heart disease (35 versus 28 percent), diabetes (33 versus 18 percent), and breathing or lung problems (39 versus 13 percent). This was also true for home-delivered meal participants with the exception of heart disease, which was less common in the current evaluation. Compared to the 1995 evaluation, greater percentages of home-delivered meal participants in the current evaluation had high cholesterol (53 versus 20 percent), diabetes (36 versus 25 percent), and breathing or lung problems (44 versus 16 percent). Forty-one percent of home-delivered meal participants reported having heart disease compared to 44 percent in the 1995 evaluation.

- The percentage of home-delivered meal participants who have participated in the program for one or more years has increased, whereas this percentage for congregate meal participants has remained the same over time. Seventy percent of home-delivered meal participants in the current evaluation had participated for one or more years, compared to 65 percent in the 1995 evaluation. Most of the change reflects an increase in the percentage of home-delivered meal participants who have participated in the program for one to five years. Eighty-four percent of congregate meal participants in the current evaluation had participated in the NSP for one or more years, the same as in the 1995 evaluation.

Comparisons of evaluations' findings on key outcomes. Both evaluations also estimated the effects of congregate and home-delivered meal participation on participants' outcomes. The current evaluation was similar to the 1995 evaluation in its study design in terms of using a matched comparison group of nonparticipants based on Medicare administrative records. Both evaluations also examined the domains of socialization and diet quality (the food security domain was assessed only in the current evaluation). Despite similarities across the evaluations in the domains of outcomes used, the evaluations used different outcome measures within the domains. These differences, described below, are important to consider when comparing findings across studies.

Both evaluations measured the effect of NSP participation on socialization outcomes. The 1995 evaluation measured socialization using a single variable counting the number of social contacts older adults had over the previous month, and the current evaluation measured socialization using three outcomes: a measure of loneliness, a depression screener, and a measure of satisfaction with the opportunities one has to spend time with other people.[10] Both evaluations found positive effects of congregate meal participation on socialization. However, whereas in the 1995 evaluation home-delivered meal participants had a greater number of social contacts than nonparticipants, the findings in the current evaluation were mixed, pointing to either no effect or, for participants who receive meals fewer than five days per week, even lower levels of socialization among program participants relative to nonparticipants. Given the differences in the socialization outcome measures used in each study, it is not possible to determine whether differences in the findings for home-delivered meal participants are due to differences in the measurement of outcomes or to changes in the program's effectiveness over time. However, descriptive information on delivery staff engagement suggests that engagement of program staff, namely delivery drivers, has improved over time. In the 1995 evaluation, 75 percent of home-delivered meal participants reported that the delivery person left immediately after delivering the food and did not spend time to talk with or check on the participant, whereas in the current evaluation, 46 percent of participants reported that the delivery person seldom or never spent time talking to them as part of the delivery process. This suggests that although engagement has improved, it may not be translating into improvements in socialization as participants perceive it.

[10] In the 1995 evaluation, "social contacts" included talking on the telephone; visiting friends, relatives, or neighbors; attending religious services; attending clubs; attending congregate meal sites; having contact with providers of personal care, home health, homemaker, and adult day care services; and, for home-delivered meal participants, having contact with the program person who delivers the meal.

Program meals continue to make substantial contributions to both congregate and home-delivered meal participants' diets. Findings on the average contribution program meals made to participants' daily nutrient intakes were comparable across the two studies. Program meals contributed 37 to 50 percent of participants' daily intakes of nutrients in the previous evaluation and, among participants who consumed a program meal on the interview day, between 35 and 47 percent in the current study. Similarly, participants obtained 41 to 44 percent of their daily calories from program meals in the previous evaluation and 38 to 41 percent in the current study. These findings indicate that both congregate and home-delivered meals have remained important sources of nutrition for participants over time.

Because the two evaluations used different measures of diet quality and different nutrient standards, it is difficult to assess how the effects of program participation on diet quality have changed over time. The previous study found that participants had higher mean daily nutrient intakes, as a percentage of the Recommended Dietary Allowance (RDA), than nonparticipants for most nutrients analyzed.[11] In the current study, the research team found that the prevalence of adequate nutrient intakes, relative to Estimated Average Requirements (EARs), was higher for a number of nutrients among participants than nonparticipants. Despite the limitations of this comparison, in general, participation has continued to have positive effects on diet quality over time.

B. Implications for future research and policy

The descriptive study findings suggest several substantive research directions. These include:

- **Examine the reasons why some home-delivered meal participants do not like the taste or variety of food provided.** Overall, nearly all home-delivered meal participants had a positive impression of the program and its staff, and most participants reported that meals arrived on schedule and the delivery person was pleasant. However, with about one-quarter of participants reporting concerns about the taste and variety of the food, more research is needed to understand their food preferences, special diets, and types of meals received (fresh or frozen).
- **Examine nutritional characteristics of the meals offered to participants.** Congregate and home-delivered meals contributed substantially to participants' daily intakes of calories and nutrients. Further examination of the meals offered to participants would provide useful information on how modifying meals could improve participants' diet quality. Analyses could examine the types of foods the program frequently offers and the major food sources of nutrients and food groups in program meals.

[11] The RDA is an estimate of the daily average intake that meets the nutrient needs of nearly all healthy individuals in a life stage and gender group. It has limited use in assessing the adequacy of nutrient intakes. The EAR is the average daily nutrient intake level that is estimated to meet the nutrient needs of half of the healthy individuals in a life stage or gender group and is now the primary reference point for assessing the adequacy of nutrient intakes (IOM 2006).

- **Examine the challenges that congregate and home-delivered meal participants experience in making ends meet.** With 15 percent of congregate meal participants and nearly 25 percent of home-delivered meal participants reporting that they experience challenges making ends meet, it is important to learn more about the characteristics and circumstances of the participants who must make difficult trade-offs between food and other goods and services such as paying utility bills or rent. A related analysis could study the difference between the 42 percent of congregate meal participants and 61 percent of home-delivered meal participants who indicated they would skip meals or eat less if the program were unavailable and those participants who would make other arrangements in the absence of the program. Such an analysis would help to understand the extent to which family networks and food coping strategies complement the meals and services received through the NSP.
- **Describe the types of congregate and home-delivered meal participants who participate in the NSP more intensively.** Analyses could assess the ways in which the 43 percent of participants who attend congregate meal sites five or more times per week differ from those who attend more seldom; describe the characteristics of congregate meal participants who attend multiple sites each week; and describe how frequency of congregate meal participation depends on factors such as income, whether participants live alone, and functional impairments. Similar analyses could assess why 15 percent of home-delivered meal participants receive fewer than three meals per week.
- **Examine the factors associated with receiving other forms of food assistance and using nutrition and supportive services outside the NSP.** This could include analyzing the factors associated with receiving personal care services; home visits for physical, occupational, or speech therapy; and case management services. It could also include analyzing decisions to participate in federal food assistance programs such as SNAP in addition to congregate and home-delivered meal program participation, as well as the factors associated with congregate and home-delivered meal participants receiving food from local emergency pantries.

The study of the effects of congregate and home-delivered meal participation on food security, socialization, and diet quality suggests the following substantive research directions:

- **Examine the determinants of food insecurity and very low food security among congregate meal participants.** The lower food insecurity rate among congregate meal participants, relative to nonparticipants, aligns with expectations about how receipt of nutritious meals can reduce food access limitations. However, although congregate meal participants had lower food insecurity rates than did nonparticipants, a nontrivial percentage of participants were still food insecure. This highlights the need to examine the determinants of food insecurity among NSP participants in greater detail, including how food insecurity is related to food coping strategies among lower-income participants. More generally, given that many participants reported they experience challenges in making ends meet, it is important to learn more about the characteristics and circumstances of the participants who must make difficult trade-offs between food and other goods and services. Exploring the extent to which family networks and food coping strategies complement the meals and services received through the NSP would be a fruitful direction for future research.

- **Examine the determinants of food insecurity and very low food security among home-delivered meal participants.** Unlike for congregate meal participants, the findings for home-delivered meal participants were counterintuitive. There was no difference between participants and nonparticipants in the food insecurity rate and, for participants who received fewer than five meals per week, home-delivered meal participants experienced greater food insecurity than nonparticipants. This suggests that some home-delivered meal participants experiencing food access limitations may not be receiving a sufficient number of meals per week to ameliorate their level of food insecurity. Learning more about why participants receive varying amounts of program meals and how they assess their food needs is an important step in improving their food security. It is essential to learn more about how the intensity of service receipt for both programs—measured by the number of congregate meals attended or home-delivered meals received per week as well as use of multiple sites—depends on factors such as income, whether participants live alone, and functional impairments and, ultimately, how it affects participants' outcomes.
- **Assess how provision of socialization services at congregate meal sites affects the magnitude of the effect of congregate meal participation on socialization outcomes.** Congregate meal participants had more positive socialization outcomes compared to nonparticipants. For some outcomes, such as satisfaction with socialization opportunities, differences between participants and nonparticipants were particularly large. Additional research could examine congregate meal sites' provision of socialization activities to assess whether the number and type of social activities that sites offer influences the improvement in socialization outcomes.
- **Examine in more detail the effects of home-delivered meal participation on socialization outcomes.** For home-delivered meal participants, the findings related to socialization were mixed; for some socialization outcomes there were no significant differences between participants and nonparticipants, whereas for other socialization outcomes, participants had less favorable outcomes than nonparticipants. A possible explanation is that findings from the descriptive analysis showed that nearly half of home-delivered meal participants reported the delivery person seldom or never spent time talking to them as part of the delivery process. This highlights the need to examine the characteristics of nearly half of all home-delivered meal participants who reported limited engagement from the delivery person and whether the negative effects observed in the outcomes analysis reflected differences in levels of program staff engagement. Another possible explanation is that the number of days per week that a participant receives meals affects the opportunities for socialization. The negative effects were observed only for participants that received meals fewer than five days per week, and not for the majority of participants that receive meals five or more days per week. Examining how program staff engagement may differ for participants that receive varying amounts of program meals could help to identify ways of improving socialization outcomes among program participants.
- **Assess the effects of participation on food consumption patterns.** Participants generally had healthier diets relative to nonparticipants, but participants' diets still fell short of the *Dietary Guidelines'* recommendations. Analyses examining differences in food choices and key sources of nutrients and food groups would provide useful information on foods to target through nutrition education.

- **Examine how the diets of home-delivered meal participants differ from those of congregate meal participants, given that participation had fewer effects on diet quality among home-delivered meal participants.** More research could help identify the differences in nutrient intakes and food choices between home-delivered meal and congregate meal participants, both at lunch (from program meals) and over 24 hours.

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APPENDIX A

DATA AND METHODOLOGY

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TABLES

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The Title III-C Nutrition Services Program (NSP) outcomes evaluation draws primarily on information obtained from comprehensive surveys and 24-hour dietary recalls collected from samples of program participants and a matched comparison group of program-eligible nonparticipants. This appendix presents an overview of the sampling design for the data collection and describes topics covered in the survey. It describes additional data sources used in the analysis and defines the evaluation's outcome measures. Next, the chapter presents the analytic methods used to address the evaluation's research objectives, including how sampling weights were constructed to allow findings from the sample to be representative of the population of congregate and home-delivered meal participants (and the group of matched nonparticipants). A final section discusses study limitations.

A. Sampling design

The evaluation used a multistage clustered sample design. The stages of sampling were:

1. Area Agencies on Aging (AAAs)
2. Local service providers (LSPs) within AAAs
3. Congregate meal sites and home-delivered meal distribution locations within LSPs
4. Home-delivered meal routes within home-delivered meal distribution locations
5. Congregate meal participants within each congregate meal site and home-delivered meal participants within each home-delivered meal route

In addition, the research team obtained a matched sample of congregate and home-delivered meal nonparticipants.

In the process study, the research team administered the AAA survey to a probability sample of AAAs. An equal-probability random sample was used to select most of the AAAs, although the six largest AAAs were selected with certainty.[12] For LSPs, the research team administered the survey to a probability sample of LSPs from the sampled and participating AAAs. The sample frame was formed using lists of LSPs obtained from these AAAs. LSPs were selected within AAAs using sequential sampling with probability proportional to size, with the measure of size being a composite measure incorporating both congregate and home-delivered meals. The research team also asked LSPs to provide a list of their congregate and home-delivered meal sites, which were then used as sample frames to select sites for the cost evaluation.

Among those LSPs that participated in the process and cost studies, the research team used the lists of congregate meal sites at each LSP to select the congregate meal sites for the outcomes evaluation. One congregate meal site was randomly selected among all of the LSP's sites using probability proportional to size sampling. On the first day of meal provision in the data collection

[12] Size was defined using a composite measure based on information provided by State Units on Aging (SUAs) and by the National Association of States United for Aging and Disabilities on the total, unduplicated number of people who received NSP congregate nutrition services and home-delivered nutrition services during the most recently completed fiscal year in each of the AAAs. The six AAAs selected with certainty were the Chicago Department of Family and Support Services, New York City Department for the Aging, New Hampshire Bureau of Elderly and Adult Services, Los Angeles County Community and Senior Services, New Mexico Non-metro Area Agency on Aging, and the Greater Wisconsin Agency on Aging Resources, Inc.

week for each selected site, field staff attended the main congregate meal that day (usually lunch) and randomly sampled congregate meal participants and conducted interviews.

The research team selected the home-delivered meal distribution location at the congregate meal site location or in its service area, obtained a list of each distribution location's routes, and randomly sampled one route. On the first day of meal provision in the data collection week for each selected home-delivered meal distribution location, the research team obtained a list of all home-delivered meal participants for the sampled route, randomly sampled participants, and conducted interviews in their homes or in another convenient location.

Finally, in the same geographic area as the sampled congregate meal sites and home-delivered meal routes, the research team obtained a list of Medicare beneficiaries from the Centers for Medicare & Medicaid Services (CMS) and used statistical matching techniques to identify older adults with characteristics similar to those in the congregate and home-delivered meal samples to form the study's comparison groups. Potential program-eligible nonparticipants were screened by phone to exclude anyone who (1) participated in the congregate meal or home-delivered meal programs in the past year; (2) lived in a nursing home, assisted living facility, group home, or rehabilitation facility; or (3) did not live in the same zip code as the participant to whom they were matched. Field staff conducted interviews with nonparticipants in their homes or, for some congregate meal nonparticipants, a public location such as a local library.

B. Data collection

The research team used multiple instruments to collect data from NSP participants and nonparticipants. The instruments were pretested and pilot-tested, and interviews were conducted from October 2015 to April 2016.

1. Instruments

The research team collected data from NSP participants and nonparticipants in a 75-minute computer-assisted personal interview using two main instruments: an outcomes survey and a 24-hour dietary recall. For nonparticipants, a short survey was also administered to screen and recruit individuals into the study.

The outcomes survey collected information on a comprehensive set of topic areas including demographic characteristics, food security, health insurance coverage, health status and depression, and loneliness. In addition, all respondents were asked about their NSP participation history, and congregate and home-delivered meal participants were asked about the types of services they received, their impressions of the program and services, and monetary contributions for program meals.

To describe NSP participants' and nonparticipants' diet quality and assess the effect of the meal and related services on participants' nutrition and diet quality, the research team conducted 24-hour dietary recalls with participants and nonparticipants. The Automated Self-Administered 24-hour dietary recall system (ASA24 Adult Version 2014), developed by the National Cancer Institute (2014), was used as an in-person interviewer-administered tool to collect the 24-hour dietary recall data. The ASA24 is a web-based dietary intake data collection system that is modeled closely on the Automated Multiple Pass Method and uses the same general

methodology as the National Health and Nutrition Examination Survey. ASA24 provides nutrient and MyPyramid ("food group") equivalents values from the Food and Nutrient Database for Dietary Studies, version 4.1, and the MyPyramid Equivalents Database, version 1.0, respectively.[13] The research team created supplemental forms and scripts for field interviewers to use for collecting the 24-hour recalls for this study. A second day of dietary recalls were collected from a subsample of participants and nonparticipants to estimate the distributions of usual intakes of key nutrients.

Finally, a short computer-assisted telephone interview survey was used to screen and recruit meal program nonparticipants to participate in the study. The screener determined whether nonparticipants were eligible for the study using the criteria described in the sampling section.

2. Pretesting

The research team pretested questions from the outcomes survey by phone with nine respondents: two congregate meal participants, three home-delivered meal participants, and four nonparticipants. Most pretest participants thought the questions were easy to understand. As a result of the pretest, minor modifications were made to some of the terminology in the survey, such as referring to home-delivered meals as "meals-on-wheels."

The research team also conducted a small-scale pilot to test the operational aspects of data collection. The pilot included conducting both the outcomes survey and the 24-hour dietary recall with 32 individuals (12 congregate meal participants and 20 home-delivered meal participants) from five meal program sites. The purpose of pilot-testing these instruments was to gauge respondent burden, ASA24 administration and features, and the usefulness of supplemental forms and scripts in collecting the 24-hour recall data.

As a result of the pilot test, the research team significantly reduced the number of items in the outcomes survey. A "frail skip" was also incorporated into the outcomes survey so interviewers could bypass noncritical sections of the survey to significantly reduce its length when respondents struggled to complete the survey due to length or fatigue. Finally, additional procedures were developed to help interviewers identify when a proxy was needed.

3. Conducting interviews

The field data collection began in October 2015 and ended in April 2016. In the first half of the field period, from late October 2015 through early January 2016, field interviewers visited 92 LSPs during a prescheduled one-week period (the target week) to select a random sample of congregate and home-delivered meal participants and collect information from them.

Data collection in each site spanned five days. On the first day of the target week, field interviewers randomly selected congregate and home-delivered meal participants to participate in the study. If necessary, field interviewers attempted to identify a proxy at the time of sampling. The research team targeted participants who were at least age 67 at the time of the interview to ensure it would have at least one year of Medicare records for each participant for the purposes

[13] The food group data were used in estimating the HEI-2010. The food groups included in the MyPyramid database are consistent with the food groups included in the HEI-2010.

of identifying potential nonparticipants. Over the next four days, field interviewers administered the outcomes survey and 24-hour dietary recall to sampled participants who agreed to participate in the study. Interviews with congregate and home-delivered meal participants took place at the meal site, in their homes, or in another convenient location such as a public library. A second dietary recall was conducted with a subsample of participants at least one day after their first dietary recall.

A nonparticipant screener was conducted from December 2015 through March 2016 by trained telephone interviewers. For each congregate and home-delivered meal participant, the research team selected a sample of up to 50 potential nonparticipants from the same geographic area using propensity score matching and a list of Medicare beneficiaries from CMS.

Potential nonparticipants were ranked in numerical order based on the strength of the match to the participant. On the first dialing attempt, interviewers started with the nonparticipant ranked as the best match for each participant and continued down the list of ranked potential nonparticipants in descending order. If the interviewer reached the end of the list and at least one nonparticipant match had not been recruited to participate in the study, the interviewer went back to the top of the list (the best match) and dialed cases that had not received a final status a second time in ranked order. This process continued until the research team recruited up to two nonparticipants for each participant or had exhausted efforts to recruit a nonparticipant match for a participant.[14]

Nonparticipants who were eligible for the study based on the criteria described in the sampling section and agreed to participate were scheduled a time for an in-person interview to complete the 24-hour dietary recall and outcomes survey in person with a field interviewer. These in-person interviewers were typically scheduled about four weeks in advance.

From late January 2016 through early April 2016, field interviewers returned to the same geographic areas where they had interviewed congregate and home-delivered meal participants and for one week interviewed the predetermined matched sample of nonparticipants identified through the nonparticipant screener. Field interviewers administered the 24-hour dietary recall and outcomes survey to nonparticipants in nonparticipants' homes or another convenient location. A second dietary recall took place with a subsample of nonparticipants at least one day after the first dietary recall was completed.

4. Response rates.

The research team used the American Association for Public Opinion Research's *Standard Definitions*, ninth edition (2016), to calculate unweighted response rates for participants.[15] The

[14] For half of the program participants from each LSP (randomly selected), the research team aimed to recruit two nonparticipant matches to participate in the study. For the other half of participants, the research team aimed to recruit one nonparticipant match. This ensured that the number of nonparticipants who completed the 24-hour dietary recall and outcomes survey would be comparable to the sample of meal participants, as it was known that some recruited nonparticipants would not complete the field interview.

[15] American Association of Public Opinion Research, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys,* revised April 2015. https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions2015_8theditionwithchanges_April2015_logo.pdf.

response rate (RR3) was defined as response rate = $I / (I + P + R + NC + O + e(UH + UO))$ where I = complete interviews, P = partial interviews, R = refusal and break off, NC = non-contact, O = other, UH = unknown if housing unit was occupied, UO = unknown other, and e = proportion of cases with unknown eligibility estimated to be eligible. The eligibility rate for unknown cases was estimated based on the observed eligibility rate. The outcomes survey response rates were 76.1 percent for congregate meal participants and 54.1 percent for home-delivered meal participants (Table A.1). The outcomes survey completion rates for nonparticipants who were recruited from the telephone screener were 79.1 percent for congregate meal nonparticipants and 76.6 percent for home-delivered meal nonparticipants (Table A.2).

Table A.1. Final disposition and response rates for participants

	Initial sample	Study-ineligible	Study-eligible noncomplete	Study eligibility undetermined	Complete	Response rate
Outcomes survey						
Congregate meal participant	980	151	29	198	602	76.1%
Home-delivered meal participant	1,306	216	43	539	508	54.1%
24-hour dietary recall						
Congregate meal participant	980	151	31	198	600	75.9%
Home-delivered meal participant	1,306	216	39	539	512	54.6%

Table A.2. Completion rates for screened nonparticipants[a]

	Screened and eligible	Study-eligible noncomplete	Complete	Completion rate
Outcomes survey				
Congregate meal nonparticipant	808	169	639	79.1%
Home-delivered meal nonparticipant	691	162	529	76.6%
24-hour dietary recall				
Congregate meal nonparticipant	808	179	629	77.8%
Home-delivered meal nonparticipant	691	172	519	75.1%

[a] Because each potential nonparticipant sample member was likely attempted only once before going to the next person on the list, rather than making a full attempt to reach each one (as was done for the probability sample of program participants), neither a screener completion rate nor an actual response rate that accounts for all potential sample members ever attempted is presented for them. Instead, the completion rates among those nonparticipants who were recruited from the telephone screener are presented.

C. Additional data sources

To address the research objectives the research team linked the outcomes survey data to several other data sources.

1. Neighborhood contextual data from the American Community Survey

The research team used data from the American Community Survey to obtain local-area population characteristics. To obtain characteristics for small census geographies, such as census tracts, the Census Bureau aggregates data over five years. The 2010 to 2014 American Community Survey summary file was used to obtain tract-level measures of population, the percentage of families with income below 200 percent of the federal poverty threshold, the percentage of the total population that is non-white, the percentage of the total population that is Hispanic, and the percentage of housing units without access to a vehicle.

2. Geographic address data for participants and food retailers

To describe NSP participants' geographic access to food, the research team used residential address information for each respondent in the outcomes survey, data from the Census Bureau, and address data for food retailers from the U.S. Department of Agriculture (USDA). Using this information, the research team calculated measures of geographic access to food and determined whether a respondent lives in an urban or rural area.

The outcomes survey collected street address information for each respondent. The addresses were located using the geocoding tool in Google Maps API software. This process converted the address information to latitude and longitude coordinates and stored them in a newly created file. Next, data were obtained from the Store Tracking and Redemption System (STARS), which contains the name, street address, and type of store for all of the retailers in the country authorized to accept Supplemental Nutrition Assistance Program (SNAP) benefits. This set of stores make up most of the food retailers in the country, especially among supermarkets, superstores, and large grocery stores (Economic Research Service [ERS] 2009). The STARS' data contained any store SNAP-authorized from October 2015 to April 2016, which aligns with the NSP evaluation data collection period. Using these data, the research team overlaid the map of individuals' residential locations with the map of SNAP retailers and calculated distances from each individual to each store in the area. For each individual, the minimum distance to each store type was calculated and then recorded on the individual-level data file. As a second measure of geographic access to food, the number of retailers was calculated, by type, within three distances from each individual's residential address. In urban areas, the distances are less than 0.5 miles, 0.5 to less than 1 mile, and 1 to 2 miles. In rural areas, the distances are less than 5 miles, 5 to less than 10 miles, and 10 to 20 miles.

The research team determined whether an individual lived in an urban or rural area by overlaying the map of respondents' residential locations with a U.S. Census Bureau geographic boundaries file and identifying the census tract in which each respondent was located.[16] A binary indicator of urban/rural status was created using the census tract identification number. Using the ERS food environment atlas (ERS 2016), the research team obtained a variable that indicates whether the population-weighted centroid of a census tract is in an urban or rural area. According to ERS (2016): "urban and rural are defined in the Census Bureau's urbanized area definitions, where rural areas are sparsely populated areas with fewer than 2,500 people, and urban areas are areas with more than 2,500 people. A census tract is urban if the geographic centroid of the tract is in an area with more than 2,500 people; all other tracts are rural." Urban/rural status in ERS (2016) is based on the 2010 census.

D. Outcome measures

The research team analyzed outcomes in three domains— food security, socialization, and diet quality (Table A.3).

1. Food security

Food security is having access at all times to enough food for an active, healthy life for all household members (Coleman-Jensen et al. 2015). Evaluations of the effectiveness of nutrition assistance programs in improving food security typically measure whether participating in the program reduces food insecurity, defined as whether a household experiences food access limitations due to lack of money or other resources. A binary variable was created indicating whether an individual lived in a household that was food insecure in the past 30 days using responses to six questions related to food access and available income (Bickel et al. 2000). Households that affirmed two or more items of the six were classified as "food insecure." A second binary variable was created indicating whether a household experienced a particularly severe level of food insecurity—referred to as "very low food security." Households that affirmed five or more items were classified as having very low food security.

2. Socialization

The research team assessed socialization using three measures. First, individuals' loneliness was measured using an abbreviated version of the Revised UCLA Loneliness Scale (R-UCLA; Russell et al. 1980; Hughes et al. 2004). The scale is based on responses to three questions related to how often respondents feel they lack companionship, feel left out, and feel isolated from others. Response options of hardly ever, some of the time, and often were coded to values of 1, 2, and 3, respectively, and the values were summed for each respondent across the three questions. Higher scores indicate greater perceptions of loneliness.

[16] Census tracts are geographic boundaries developed by the U.S. Census Bureau. They are drawn to encompass similar population sizes and, thus, vary in spatial size depending on whether they are in a metropolitan or nonmetropolitan area. Census tracts are the largest subcounty geographies defined by the Census Bureau and generally contain 1,500 to 8,000 people and have a target size of 4,000. In 2010, the United States was divided into more than 73,000 census tracts.

Table A.3. Outcome measures and data sources

Domain of outcome measure	Data source	Outcome measures	Description
Food security	Outcomes survey	Whether an individual lives in a household that was food insecure in the past 30 days	Based on responses to six questions about the food eaten in the past 30 days and whether the respondent's household was able to afford enough food
Food security	Outcomes survey	Whether an individual lives in a household that experienced very low food security in the past 30 days	Based on responses to six questions about the food eaten in the past 30 days and whether the respondent's household was able to afford enough food
Socialization	Outcomes survey	Revised UCLA Loneliness Scale	Based on responses to an abbreviated version of the Revised UCLA Loneliness Scale to measure individuals' loneliness
Socialization	Outcomes survey	PHQ-2 depression screener	Based on responses to a two-question Patient Health Questionnaire (PHQ) screener for depression
Socialization	Outcomes survey	Whether an individual is very satisfied with the opportunities he or she has had to spend time with other people Whether an individual is satisfied with the opportunities he or she has had to spend time with other people	Based on responses to a question asking how satisfied respondents are with the opportunities they have had to spend time with other people
Diet quality	24-hour dietary recall	Percentage contribution of program meals to participants' total daily nutrient intakes	Estimate the proportion of participants' daily nutrient intakes provided by program meals to assess the contribution of meals to participants' diets
Diet quality	24-hour dietary recall	Usual nutrient intakes relative to national standards	Usual nutrient intakes relative to Dietary Reference Intake (DRI) standards and select recommendations of the 2015-2020 *Dietary Guidelines* to assess the proportion of participants and nonparticipants with adequate or excessive nutrient intakes
Diet quality	24-hour dietary recall	Healthy Eating Index (HEI)-2010 scores	HEI-2010 scores estimated to provide an overall measure of diet quality relative to the 2010 *Dietary Guidelines'* recommendations

The second measure came from the Patient Health Questionnaire 2 (PHQ-2), an abbreviated version of the nine-question PHQ used to diagnose depression. The PHQ-2 assesses the frequency of depressed mood over the past two weeks; however, because it consists of only two of the nine questions, the PHQ-2 can be used for depression screening, but not diagnosis. People who screen positive for depression should receive further evaluation with the PHQ-9 to determine whether they meet criteria for a depressive disorder (Kroenke et al. 2003). The

outcomes survey contained the two questions in the PHQ-2, not the full set of nine PHQ-9 questions. The two questions asked how often the respondent had little interest or pleasure in doing things and how often he or she felt down, depressed, or hopeless. The response options of not at all, several days, more than half of the days, and nearly every day were coded as 0, 1, 2, and 3, respectively. The values were summed for each respondent across the two questions, resulting in a raw score ranging from 0 to 6.

Studies have identified thresholds above which respondents screen positively for depression by balancing sensitivity (the ability of the screener to correctly identify those with depression) and specificity (the ability of the screener to correctly identify those without depression). Research comparing the PHQ-2 to patients with depression diagnoses found that a score of 3 or greater was best to achieve this balance (Li et al., 2007; Lowe et al., 2005). However, researchers have recommended that further research evaluate validity and cutoff scores for older adults (Sheeran et al. 2010). Because there is no agreed-upon threshold that positively identifies individuals with depression, thresholds of 2, 3, and 4 were used to define three measures of screening positively for depression. The raw score itself was also examined. Thus, when considering this outcome, the research team looked for consistency in findings across these depression-screening measures.

As a third measure of socialization, two variables were constructed from a single question measuring respondents' self-reported satisfaction with the opportunities they have had to spend time with other people. Response options consisted of very satisfied, somewhat satisfied, not too satisfied, and not at all satisfied. A binary variable was created equal to 1 if an individual reported being very satisfied and equal to 0 otherwise. A second binary variable was created equal to 1 if an individual reported being satisfied (either very satisfied or somewhat satisfied) and equal to 0 otherwise.

3. Diet quality

The research team used the 24-hour dietary recall data to analyze diet quality outcomes. Three measures were used to examine the quality of participants' diets and assess the effects of participating in the NSP on diet quality. First, the contribution program meals made to participants' daily intakes of calories and nutrients was examined. The research team also estimated usual nutrient intakes to assess the prevalence of adequate and excessive nutrient intakes among participants and nonparticipants. To assess the overall quality of participants' and nonparticipants' diets, the Healthy Eating Index (HEI)-2010 was used, which assesses conformance to key recommendations of the 2010 *Dietary Guidelines* (DHHS and USDA 2015a).

Contributions of program meals to daily nutrient intakes. The research team estimated the percentage contribution program meals made to participants' daily intakes of calories and nutrients. To identify foods obtained from program meals, participants reported the source of each food reported in the 24-hour dietary recall. Because some participants do not receive program meals every day, not all participants consumed a program meal on the day referenced in the 24-hour dietary recall (the intake day). The percentage contribution of program meals to participants' daily nutrient intakes was computed as the sum of the nutrients from all foods obtained from program meals divided by total daily nutrient intakes. If a participant did not

consume a program meal on his or her intake day, the percentage contribution was zero. The mean percentage contribution was estimated two ways: (1) for all participants, including those who did not consume a program meal (where the contribution is zero for non-consumers); and (2) for only participants who consumed a program meal on their intake day. The first measure provides information on the contribution of program meals to participants' intakes on an average day. The second measure provides information on the relative contribution of program meals on days where participants consume meals.

Usual nutrient intakes. To assess the prevalence of adequate and excessive nutrient intakes among participants and nonparticipants, the research team estimated usual intakes of vitamins, minerals, macronutrients, and other dietary components relative to the Dietary Reference Intakes (DRIs) and select recommendations from the 2015-2020 *Dietary Guidelines*. The DRIs are the most up-to-date scientific standards for determining whether diets provide enough nutrients to meet requirements, without being excessive. The DRIs are intended to be applied to measures of long-run or usual intakes. Therefore, both the mean and the distribution of usual daily intakes were estimated.

Experts in diet assessment have found that data from single 24-hour recalls will lead to biased estimates of the distribution of usual intakes, as well as the proportion of a group with usual intakes above or below a standard (Beaton et al. 1983). This is due to individuals' dietary intakes varying from day to day. Statistical modeling has mitigated some of the limitations of 24-hour recalls by estimating and removing the within-person variation in dietary intake (Dodd et al. 2006). The research team used the method developed by the National Cancer Institute to generate estimates of usual nutrient intakes. The National Cancer Institute method applies an econometric model to dietary recalls to estimate the distribution of usual intakes for the full population and any subpopulations of interest (Tooze et al. 2010; Freedman et al. 2010). Estimating usual nutrient intakes requires both the first 24-hour recall and, for a subsample of participants and nonparticipants, the second 24-hour recall.

The research team used the SAS macros developed by the National Cancer Institute to estimate usual intake distributions, mean usual intakes, and the percentage of people with usual intakes that were above, below, or within DRI standards or select recommendations from the 2015-2020 *Dietary Guidelines*. The DRIs include four types of standards for various nutrients (Table A.4). Estimated Average Requirements (EARs) were used as the cutpoint to assess adequacy for most vitamins and minerals. For potassium, dietary fiber, and sodium, which do not have established EARs, usual intakes were compared to the Adequate Intake (AI) level. Usual intakes of macronutrients (for example, total fat and carbohydrate) were compared to the Acceptable Macronutrient Distribution Ranges (AMDRs), which are expressed as percentages of total calorie intake. Usual intakes of sodium were also compared to the Tolerable Upper Intake Level (UL) (Institute of Medicine 2006). The 2015-2020 *Dietary Guidelines* include quantitative recommendations for intakes of saturated fat (as a percentage of total calories) and sodium that encourage reduced intakes of these nutrients (DHHS and USDA 2015a). Usual daily intakes of saturated fat and sodium were compared to these recommendations. Table A.5 shows the DRI standards and *Dietary Guidelines'* recommendations for the nutrients included in the analysis, by DRI age and gender groups.

Table A.4. Definitions of Dietary Reference Intakes and 2015-2020 *Dietary Guidelines'* recommendations

Estimated Average Requirement (EAR)	The EAR is the average daily nutrient intake level estimated to meet the requirement of half of the healthy individuals in a particular life stage and gender group. The proportion of a group with usual intakes greater than or equal to the EAR provides an estimate of the prevalence of adequate usual intakes for that group. The prevalence of adequate usual intakes was estimated for the following nutrients with defined EARs: vitamin A, vitamin C, vitamin D, vitamin E, vitamin B_6, vitamin B_{12}, folate, niacin, riboflavin, thiamin, calcium, iron, magnesium, phosphorus, and zinc.
Adequate Intake (AI)	The AI is the recommended average intake level assumed to be adequate for healthy individuals in a life stage and gender group, based on observed or experimentally determined estimates of intake. An AI is defined when the data available for a particular nutrient are insufficient to estimate requirements and establish an EAR. Unlike an EAR, the AI cannot be used to estimate the prevalence of adequate nutrient intakes. Instead, assessment focuses on comparing mean usual intakes to the AI. Populations with mean usual intakes that meet or exceed AI levels can be assumed to have high levels of nutrient adequacy. However, when mean usual intakes fall below the AI, no firm conclusions can be drawn about the adequacy of usual intakes. Mean usual intakes were estimated as a percentage of the AI for potassium, dietary fiber, and sodium.
Tolerable Upper Intake Level (UL)	The UL is the maximum level of daily nutrient intake that is likely to pose no risk of adverse health effects for nearly all individuals in a population group. As intake increases above the UL, the potential risk of adverse effects may increase. The prevalence of excessive usual intakes was estimated relative to the UL for sodium.
Acceptable Macronutrient Distribution Ranges (AMDRs)	The AMDRs define ranges of usual macronutrient intakes that are associated with reduced risk of chronic disease, while providing adequate intakes of other essential nutrients. The DRIs define AMDRs for intakes of macronutrients as percentages of total calorie intake. Usual intakes that fall below or exceed the AMDR may increase risk of chronic diseases. The percentages of individuals with usual intakes of total fat, linoleic acid, alpha-linolenic acid, carbohydrate, and protein that were above, below, and within the AMDRs were estimated.
2015-2020 *Dietary Guidelines'* recommendations	The 2015-2020 *Dietary Guidelines* provide quantitative recommendations for intakes of saturated fat (as a percentage of total calories) and sodium. The *Dietary Guidelines'* recommended limit on sodium is the same as the UL for sodium. The prevalence of excessive nutrient intakes was estimated relative to the *Dietary Guidelines'* recommendations for saturated fat and sodium.

Sources: Institute of Medicine (2006); U.S. Department of Health and Human Services and U.S. Department of Agriculture (2015a).

Table A.5. Dietary Reference Intakes and select 2015-2020 *Dietary Guidelines'* recommendations, by age and gender groups

	Estimated Average Requirement (EAR)								
	Vitamin A (mcg RAE)	Vitamin C (mg)	Vitamin D (mcg)	Vitamin B_6 (mg)	Vitamin B_{12} (mcg)	Vitamin E (mcg)	Folate (mcg DFE)	Niacin (mg)	Phosphorus (mg)
Males									
51–71+ years	625	75	10	1.4	2.0	12	320	12	580
Females									
51–71+ years	500	60	10	1.3	2.0	12	320	12	580

	Estimated Average Requirement (EAR)					
	Riboflavin (mg)	Thiamin (mg)	Calcium (mg)	Iron (mg)	Magnesium (mg)	Zinc (mg)
Males						
51–70 years	1.1	1.0	800	6.0	350	9.4
71+ years	1.1	1.0	1,000	6.0	350	9.4
Females						
51–70 years	0.9	0.9	1,000	5.0	265	6.8
71+ years	0.9	0.9	1,000	5.0	265	6.8

	Adequate Intake (AI)		
	Potassium (mg)	Sodium (mg)	Dietary Fiber (g)
Males			
51–70 years	4,700	1,300	30
71+ years	4,700	1,200	30
Females			
51–70 years	4,700	1,300	21
71+ years	4,700	1,200	21

	Upper Tolerable Intake Level (UL)[a]
	Sodium (mg)
Adults 51+ years	2,300

	Acceptable Macronutrient Distribution Range (AMDR)				
	Total fat	Linoleic acid	Alpha-linolenic acid	Carbohydrate	Protein
	Percentage of total calories				
Adults 51+ years	20–35	5–10	0.6–1.2	45–65	10–35

	2015 Dietary Guidelines' recommendations[a]
	Saturated fat (percentage of total calories)
Adults 51+ years	< 10

Sources: Institute of Medicine (2006); U.S. Department of Health and Human Services and U.S. Department of Agriculture (2015a).

[a] The UL and the 2015-2020 *Dietary Guidelines'* recommendation for sodium are the same.

DFE = dietary folate equivalent; RAE = retinol activity equivalent.

HEI-2010 scores. The HEI-2010 is a measure of diet quality that assesses conformance to key recommendations of the 2010 *Dietary Guidelines* (Guenther et al. 2013). The USDA has adopted it as a tool to monitor the quality of foods consumed by the U.S. population overall, as well as progress toward healthier eating habits among food assistance program participants (Guenther et al. 2007). The HEI-2010 is a scoring metric made up of 12 components, each reflecting a key aspect of diet quality, and a total score that measures overall diet quality. The standards used to assign HEI-2010 component scores are expressed on a density basis (that is, amounts per 1,000 calories or a percentage of calories), rather than absolute amounts of foods consumed. The use of such standards in assessing diet quality reflects the recommendation that individuals should strive to meet food group and nutrient guidelines while maintaining calorie balance, rather than meeting these guidelines simply by consuming large quantities of food.

Table A.6 lists the HEI-2010 components and standards for scoring. The HEI-2010 consists of nine adequacy components, which are dietary components individuals are recommended to consume to ensure adequate nutrient intakes, and include (1) total fruit, including juice; (2) whole fruit; (3) total vegetables; (4) greens and beans; (5) whole grains; (6) dairy; (7) total protein foods; (8) seafood and plant proteins; and (9) fatty acids. The remaining three components, referred to as moderation components, measure dietary components that individuals are recommended to limit and include refined grains, sodium, and empty calories.

Table A.6 also shows the maximum score for each component, along with the intake criteria corresponding to minimum and maximum scores for each component. Maximum component scores for the various components range from 5 to 20. Scores for intakes between the minimum and the maximum standards are scored proportionately. For example, an intake that is halfway between the criteria for the maximum and minimum scores yields a score half the maximum score. Higher scores for each of the adequacy components reflect greater consumption and higher diet quality, whereas higher scores for each of the moderation components reflect lower consumption and higher diet quality. Scores for each of the 12 components are summed to create a total HEI-2010 score, with a range from 0 to 100.

SAS macros developed by the National Cancer Institute were used to estimate mean HEI-2010 scores using data from the single 24-hour recall available for all participants and nonparticipants. The National Cancer Institute programs produce estimates at the population level, using the population ratio method (Guenther et al. 2013). This method involves calculating mean intakes of calories, nutrients, and food groups for the population, and then calculating the ratios of the means with calories in the denominator, and comparing ratios with HEI standards for scoring. Two HEI-2010 related outcomes were estimated: (1) mean total and component HEI-2010 scores, and (2) percentages of the maximum possible component and total scores.

Table A.6. Healthy Eating Index-2010 components and standards for scoring

HEI-2010 component[a]	Maximum score	Standard for maximum score	Standard for minimum score of zero
Adequacy components (higher score indicates higher consumption)			
Total fruit[b]	5	≥ 0.8 cup equiv. / 1,000 kcal	No fruit
Whole fruit[c]	5	≥ 0.4 cup equiv. / 1,000 kcal	No whole fruit
Total vegetables[d]	5	≥ 1.1 cup equiv. / 1,000 kcal	No vegetables
Greens and beans[d]	5	≥ 0.2 cup equiv. / 1,000 kcal	No dark green vegetables, beans, or peas
Whole grains	10	≥ 1.5 ounce equiv. / 1,000 kcal	No whole grains
Dairy[e]	10	≥ 1.3 cup equiv. / 1,000 kcal	No dairy
Total protein foods[f]	5	≥ 2.5 ounce equiv. / 1,000 kcal	No protein foods
Seafood and plant proteins[f,g]	5	≥ 0.8 ounce equiv. / 1,000 kcal	No seafood or plant proteins
Fatty acids[h]	10	(PUFAs + MUFAs) / SF > 2.5	(PUFAs + MUFAs) / SF < 1.2
Moderation components (higher score indicates lower consumption)			
Refined grains	10	≤ 1.8 ounce equiv. / 1,000 kcal	≥ 4.3 ounce equiv. / 1,000 kcal
Sodium	10	≤ 1.1 gram / 1,000 kcal	≥ 2.0 grams / 1,000 kcal
Empty calories[i]	20	≤ 19% of energy	≥ 50% of energy
Total score	**100**		

Source: U.S. Department of Agriculture, Center for Nutrition Policy and Promotion (2013).

[a]Intakes between the minimum and maximum standard are scored proportionately.

[b]Includes 100 percent fruit juice.

[c]Includes all forms except juice.

[d]Includes any beans and peas not counted as total protein foods.

[e]Includes all milk products, such as fluid milk, yogurt, cheese, and fortified soy beverages.

[f]Beans and peas are included here (and not with vegetables) when the total protein foods standard is otherwise not met.

[g]Includes seafood, nuts, seeds, soy products (other than beverages) as well as beans and peas counted toward total protein foods.

[h]Ratio of PUFAs and MUFAs to SF.

[i]Calories from solid fats, alcohol, and added sugars; threshold for counting alcohol is > 13 grams/1,000 kcal.

Equiv = equivalent; HEI = Healthy Eating Index; kcal = calories; MUFA = monounsaturated fatty acid; PUFA = polyunsaturated fatty acid; SF = saturated fat.

E. Analytic methods

The research team used both descriptive and multivariate analysis methods to address the research objectives in the evaluation.

1. Descriptive analysis

Descriptive, tabular analysis was used to describe the characteristics of older adults who participate in the NSP, participants' impressions of the program, and their valuation of meals and supportive services received through the program. For categorical variables, the percentage of individuals who responded in each category was estimated. For example, the responses to a

question that asks participants for their overall impression of the nutrition program were tabulated, with the options of excellent, very good, good, fair, and poor. For continuous variables, the mean and median values of the distribution among individuals and the percentages of individuals with values in different ranges of the distribution are presented. (The median, or 50th percentile of the distribution, is the value for which 50 percent of the observations are less than or equal to.) For example, the mean and median number of meals participants report eating per day and the percentages of participants who report eating 0 to 1, 2 to 3, or 4 to 5 meals per day are presented. All analyses were conducted separately for congregate and home-delivered meal participants. In several cases, cross-tabulations were performed using variables other than program type. For example, the prevalence of food insecurity by income and age is presented.

2. Multivariate analysis

To estimate the effect of receiving a congregate meal or home-delivered meal on food security, socialization, and diet quality, the research team compared outcomes for participants and a matched comparison group of program-eligible nonparticipants. The purpose of a comparison group of eligible nonparticipants is to represent what would happen to participants in the absence of the program. The comparison group of nonparticipants should ideally be as similar as possible to the sample of participants, except for program participation and random variation. After NSP participants completed the survey and provided their Social Security number, the research team selected a group of potential nonparticipants from the Medicare Beneficiary Summary File of nonparticipants who lived in the same geographic area as participants and who were similar to participants on a set of demographic, economic, and health-related variables. For each NSP participant, propensity score matching was used to identify the best potential nonparticipant matches based on observable characteristics,[17] contacted them and confirmed they met the eligibility criteria described in the sampling section (including that they were not participating in the congregate meal or home-delivered meal programs), and administered the outcomes survey and dietary recall. Despite efforts to use Medicare administrative data to identify a group of nonparticipants who were comparable to participants across several critical individual characteristics related to outcomes, the characteristics of the two samples differed. Consequently, the research team used statistical methods and the outcomes survey data in the analyses to control for differences in the characteristics of participants and nonparticipants that affect both outcomes and program participation decisions.

The methods used differed depending on the outcome measure examined. For individual-level outcomes in the domains of food security and socialization, multivariate regressions were used to estimate the effect of NSP participation on the outcomes, controlling for characteristics that could be related to both program participation and the outcomes studied. The regressions are described in greater detail below. The research team also used weights for nonparticipants that

[17] The research team estimated a logistic regression model of NSP participation as a function of age; gender; race and ethnicity; Medicare eligibility; whether the beneficiary was dually eligible for both Medicare and Medicaid (which served as a proxy for socioeconomic status); indicators for cancer conditions (breast, colon, prostate, lung, endometrial); indicators for and counts of chronic conditions for some of the 27 chronic conditions on the file including cataract, chronic kidney, glaucoma, hip fracture, depression, stroke, diabetes, and asthma; Medicare service utilization indicators including inpatient and emergency department visits and skilled nursing facility and home health visits; and total Part A and Part B Medicare expenditures.

were generated using a propensity-score matching algorithm based on machine learning called boosting (Ridgeway and McCaffrey, 2007 and Lee et al. 2010), that when used in the analyses make the characteristics of participants and nonparticipants similar in terms of all of the characteristics the model includes. (The weight construction procedure is described in greater detail in the weighting section below.) Multivariate regression analysis could not be used, however, to estimate the effect of NSP participation on HEI-2010 scores and usual nutrient intakes relative to national standards because they are population-based estimates computed at the group level rather than the individual level. Thus, the analyses of those outcomes solely use the propensity score weights to make the groups more comparable.

Regression analysis. For individual-level outcomes in the domains of food security and socialization, the research team estimated multivariate regressions to estimate the effect of NSP participation on the outcomes, controlling for characteristics that could be related to both program participation and the outcomes studied. Ordinary least squares (OLS) regression analysis was used for outcome measures that are continuous variables: the R-UCLA raw score and the PHQ-2 depression screener raw score. Logistic regression analysis was used for binary variables: food insecurity, very low food security, PHQ-2 depression screener indicators, and respondents' report of being very satisfied or satisfied with their socialization opportunities. The full sample findings were robust to whether OLS or logistic regression models were used for binary outcomes in that the program effects were similar in magnitude and statistical significance.[18]

All multivariate analyses were conducted separately for congregate meal participants and nonparticipants and for home-delivered meal participants and nonparticipants. The regression models differed across the congregate and home-delivered meal samples only in terms of the set of independent variables. The independent variables used in the congregate meal regressions consisted of:

- Individual-level demographic and economic variables (gender; age; veteran status; educational attainment; whether the individual was white, non-Hispanic; whether the individual was Hispanic; whether the individual was married or had a partner; whether the individual lived with other people in the household; monthly household income relative to the federal poverty DHHS guidelines;[19] and whether anyone in the household received Social Security benefits or Supplemental Security Income [SSI])
- Health variables (whether the individual had ever been diagnosed with high blood pressure or hypertension, whether the individual had ever been diagnosed with diabetes or high blood sugar, and the number of falls in the past three months)

[18] For several subgroup analyses for the binary outcome of very low food security, the research team used OLS in place of logistic regression analyses due to lack of convergence of the nonlinear model likely attributed to the smaller sample sizes and limited variation in the dependent variable.

[19] https://aspe.hhs.gov/2015-poverty-guidelines.

- Local-area population characteristics of the census tract in which the individual lived (total population, percentage of families with income below 200 percent of the federal poverty threshold, percentage of the total population that is non-white, percentage of the total population that is Hispanic, percentage of housing units without access to a vehicle, and urbanicity).

The independent variables used in the home-delivered meal regressions consisted of this same set of variables plus indicators of (1) whether the individual was able to walk, was bed bound, or was chair bound or in a wheelchair and (2) whether the individual had serious difficulty concentrating, remembering, or making decisions because of a physical, mental, or emotional condition. To determine the set of variables to include in each model, the research team started with the variables included in similar models from the 1995 NSP outcomes evaluation (Ponza et al. 1996) and both dropped variables and added new variables to maximize the fit of the model to the data.

The results of regression analyses are presented using regression-adjusted tables of estimates of program effects that resemble descriptive tables (see Chapter IV). For example, a regression-adjusted table compares the rates of food insecurity for congregate meal participants and nonparticipants after accounting or adjusting for compositional differences across groups. To examine binary outcome measures using logistic regression analysis, the regression-adjusted estimates were obtained by estimating the regression, using the regression coefficients and variable values for each person in the sample to obtain a predicted probability of being food insecure, and averaging the predicted probabilities to obtain the adjusted (predicted) rate of food insecurity in the sample. By performing these steps assuming all sample members are participants, then repeating the procedure assuming all sample members are nonparticipants, two averaged values were obtained. The difference between these values is the regression-adjusted estimate of the effect of program participation on food insecurity. The procedure is identical for continuous outcome measures, except that the tables contain regression-adjusted mean values of the R-UCLA raw score and the PHQ-2 raw score.

The research team analyzed the effect of congregate and home-delivered meal participation on outcomes measuring food security, socialization, and diet quality (HEI-2010 scores) separately for two important household and economic subgroups. The models were reestimated by monthly household income relative to poverty by dividing the sample into those individuals with income-to-poverty ratios less than the median value in the sample and those with ratios greater than or equal to the median value. Median income as a percentage of poverty was equal to 128 percent for congregate meal participants and nonparticipants and 122 percent for home-delivered meal participants and nonparticipants. These groups are referred to as lower-income and higher-income groups. The models were also reestimated according to whether individuals lived alone or with other family members.

F. Accounting for item nonresponse

Missing data are a potential source of bias in the regression analysis of the effects of program participation on food security and socialization outcomes. The research team used three sequential methods to impute missing data for specific survey items to help reduce this bias. First, imputations of demographic and household information were used based on the empirical

distributions of variables to correct for incomplete responses to survey items that were included as covariates in the regression model. Next, a simple imputation method was used to fill in specific numeric values for categorical data for monthly and annual income variables in which individuals were asked to provide a range of values when they believed they could not provide a specific number. Finally, predictive mean matching was used to fill in any remaining missing income information.

Imputation of demographic and household variables. Item nonresponse was low for the demographic and household variables included in the regression models. Nonresponse ranged from 2 individuals for veteran status to 31 individuals for whether anyone in the household receives SSI (of a total sample size of 2,255 individuals). Simple random imputation was used to impute missing values of the following variables (the number of imputed cases for each variable is in parentheses): educational attainment (24); veteran status (2); whether the individual was white, non-Hispanic (10); whether the individual was Hispanic (5); whether the individual was married or had a partner (7); whether the individual had ever been diagnosed with high hypertension (14); the number of falls in the past three months (8); whether the individual had serious difficulty concentrating, remembering, or making decisions because of a physical, mental, or emotional condition (14); whether anyone in the household received Social Security benefits (19); and whether anyone in the household received SSI (31).

Imputation of categorical income data. For the monthly and annual household income variables in the outcomes survey, the research team asked respondents who were not able or refused to provide a specific dollar value to provide a categorical response. A simple imputation method was used to fill in values for these variables while maintaining the patterns observed for the group of individuals who provided numerical responses. For each individual providing a categorical response to a survey item, the research team randomly selected an individual in the same participation status group (congregate meal participant, congregate meal nonparticipant, home-delivered meal participant, or home-delivered meal nonparticipant) and the same educational attainment group (less than high school, high school, some college, or college) with income in the same category who provided an exact dollar response; this was called the donor observation. The individual with missing monthly income data inherited the donor's exact monthly income. This was repeated for annual income for individuals with missing annual income data.

To define monthly income in the regression analysis, reported monthly income was used for those individuals with a nonmissing value. There were 607 individuals missing a numerical value of monthly income. The research team imputed 325 cases using the categorical monthly income data imputation procedure described previously. Annual income (both reported and imputed based on categorical annual income data) divided by 12 was used to impute monthly income for another 24 cases. Predictive mean matching (described below) was used to impute monthly income values for the remaining 258 cases with missing monthly and annual income.

Predictive mean matching. The imputation process was conducted based on predictive mean matching using five steps. First, an imputation model was estimated in which the reported monthly income was modeled as a linear function of program participation status, age, and educational attainment. The imputation model was estimated using only individuals who reported a nonmissing monthly income amount. Second, the estimated coefficients and standard

errors from the imputation model were used to form a posterior distribution for the true coefficients of the imputation model. A random draw was obtained from this posterior distribution, producing a specific set of coefficients. Third, the specific set of coefficients drawn in the previous step was used to generate predicted values of monthly income for individuals who responded to the question about monthly income and those who did not respond. Fourth, for each person who did not respond to the monthly income question, the five respondents who had the closest predicted values to that of the nonrespondent were identified. Finally, one of these five respondents was randomly selected, and the reported monthly income of the selected respondent served as the imputed value for the nonrespondent.

G. Standard errors

For all regression-based analyses, standard errors were estimated using a variance estimator based on a first-order Taylor series approximation. The research team accounted for the multistage sampling design of the outcomes survey when estimating standard errors by using the Stata 14.1 software's "svy" commands and identifying the strata and primary sampling unit identifiers. For the estimation of HEI-2010 total and component scores, standard errors were estimated using the National Cancer Institute's SAS macros that account for the complex survey design in a similar way. Finally, for the usual nutrient intake analyses, the National Cancer Institute's SAS macros only allow standard error estimation using replicate weights. Sixty-nine replicate weights were constructed using a jackknife method and included them in the estimation procedure.

H. Analysis weights

Analysis weights allow unbiased estimates to be computed based on sample survey responses from the study population. Weights take into account both the probability of selection into the sample and the differential response patterns that may exist in the respondent sample.

Because not all respondents from the outcomes survey completed the 24-hour dietary recalls, one set of weights was constructed for analyses using data from the outcomes survey and a second set of weights was constructed for analyses using data from both the outcomes survey and the 24-hour dietary recall data. For each set, weights were constructed separately for congregate meal participants and nonparticipants and home-delivered meal participants and nonparticipants.

Because the sample design incorporated multiple stages of selection (AAA, LSP, congregate meal site, home-delivered meal route, congregate meal participant, and home-delivered meal participant), the weights had to account for selection and response at each stage. The analysis weights were the product of sampling weights and nonresponse adjustments to those weights across all stages of sampling. The first step of weighting in each stage consisted of calculating the sampling weight (the inverse of its selection probability) for each unit sampled and released. These sampling weights were by-products of the sampling procedures and had already been constructed for AAAs and LSPs for the process and cost studies (Mabli et al. 2015; Ziegler et al. 2015).

For congregate meal participants, the sampling weight was calculated for the selection of:

- Each AAA
- Each LSP selected within the AAA
- The congregate meal site selected within each LSP, and its associated home-delivered meal site
- Each congregate meal participant selected within each congregate meal site

For home-delivered meal participants, the sampling weight was calculated for the selection of:

- Each AAA
- Each LSP selected within the AAA
- The congregate meal site selected within each LSP that is associated with the home-delivered meal site
- The home-delivered meal route selected within the associated home-delivered meal site[20]
- Each home-delivered meal participant selected within each home-delivered meal route

Because of the way they were selected, home-delivered meal sites were assigned the sampling weight of their associated congregate meal site. The only exceptions to this were in the four LSPs containing only one home-delivered meal site and no congregate meal sites—these home-delivered meal sites received a sampling weight equal to one.

The sampling weights were adjusted to compensate for nonresponse and to help ensure accurate representation of the population at each stage of selection and data collection in the evaluation results. This included:

- Adjusting the AAA weight for process study nonresponse with respect to provision of its LSP list
- Adjusting the LSP weight for process study and cost study nonresponse
- Adjusting the LSP weight for outcomes evaluation nonparticipation
- Adjusting the home-delivered meal site–level sampling weights for one site that did not participate (no congregate meal sites within participating LSPs declined to participate)

The research team made the remaining nonresponse adjustments to the weights at the participant level, separately, for congregate and home-delivered meal participants. This was done in two stages: (1) adjusting for whether the screener obtained sufficient information so that the participant's study eligibility status was determined, and (2) adjusting for nonresponse among participants determined to be eligible. Due to the lack of any specific information about sampled

[20] The research team did not randomly select a home-delivered meal site within each LSP. Instead, the home-delivered meal site associated with each sampled congregate meal site was included in the study.

participants who did not respond to the survey, participant sampling weights were adjusted for participant-level nonresponse within weighting cells defined by the AAA in which the LSP and its sites were operating.[21] The inverse of the weighted response rate within the weighting cell was used as the nonresponse adjustment factor to the prevailing cumulative weight.

After applying the adjustments to the sampling weights for the responding sample members, the research team examined the weight distribution for outliers. Weight trimming and redistribution were then used to address outliers that were unduly increasing the design effect or could potentially give any one participant too much influence on an estimate.[22]

This entire process was carried out for response to the outcomes survey and for response to both the outcomes survey and the dietary recall instrument.

Weights for congregate and home-delivered meal nonparticipants. Despite efforts to identify a group of nonparticipants from Medicare beneficiaries within the same geographic areas who were comparable to participants across several critical individual characteristics related to outcomes, the characteristics of the two samples differed, both for the congregate and home-delivered meal samples. Consequently, the research team did not assign the matched comparison cases the sampling weight of their associated program participant. Instead, a propensity score matching algorithm was estimated based on a machine learning process called boosting, using the R package TWANG (Ridgeway et al. 2016), described below. Recent studies have concluded that propensity score estimation using boosting has consistently superior performance (Ridgeway and McCaffrey 2007; Lee et al. 2010).

The model used data from participants and nonparticipants and defined the dependent variable to measure whether the respondent was a participant. The matching algorithm, which was separately run for congregate and home-delivered meal participants, used the following information from the outcomes survey that was not available in the Medicare administrative records used in the initial matching performed to identify a comparison group of nonparticipants age, gender, race, ethnicity, veteran status, education, monthly household income, monthly household income-to-poverty ratio, employment status, marital status, and household size. Among this set of potential candidate variables, the matching algorithm identified monthly household income, monthly household income-to-poverty ratio, race, ethnicity, and age as the variables that would achieve the best balance between participants of both types and their

[21] In cases where the use of the AAA as the weighting cell was thought to be problematic (either due to a small number of respondents per cell or a large nonresponse adjustment per cell), the research team instead used census region crossed with a four-category LSP size variable (quartile for number of congregate or home-delivered meals) as the weighting cell.

[22] The congregate and home-delivered meal participants in one LSP ended up with extremely high weights due to a combination of factors, including expected size measures at the time of sampling that did not match actual size measures, and high nonresponse adjustment factors. These extremely high weights significantly increased the design effect, meaning that the participants in that LSP would have represented a substantial proportion of the estimated population, as well as imposed a risk that participants in that LSP would have an undue influence on the study findings. The research team tried various ways of trimming their weights but found no way to do so without risking the introduction of bias. Because the research team believed it did not have sufficient information about the LSP and its components to adequately describe the population it represented, the research team ultimately excluded the participants from this LSP from the analysis.

corresponding nonparticipants. The algorithm produced propensity score weights for nonparticipants that, when used in the analyses, make the characteristics of participants and nonparticipants similar in terms of all of the characteristics included in the model. This process was carried out for response to the outcomes survey and then again for response to both the outcomes survey and the dietary recall.

Representativeness of weights. Based on weighted data, the congregate and home-delivered meal participant findings in Chapter III of this report are nationally representative of the population of congregate and home-delivered meal participants. However, this is not true for the nonparticipants who completed interviews because, by design, they were not sampled from a frame of nonparticipating older adults. Instead, the estimates of the effects of congregate and home-delivered meal participation on outcomes that use weighted participant and nonparticipant data are representative of the effects for the population of congregate and home-delivered meal participants. In other words, the study intends to assess the effect of the programs on those who choose to participate in the program, not on the entire population.

Replicate weights. To estimate the effect of program participation on usual nutrient intakes, the research team could not estimate standard errors using a Taylor series approach based on the full sample weights along with design variables. Instead, eight sets of replicate weights were created, with each set having 69 replicates. These were constructed separately for congregate meal participants and nonparticipants and home-delivered meal participants and nonparticipants, and separately for analyses using data from the outcomes survey and analyses using data from both the outcomes survey and the 24-hour dietary recall data. To construct these weights, the research team used a jackknife approach in which one primary sampling unit (usually the AAA) was removed at a time and, using the final full-sample weights described above, re-weighted within the impacted stratum to account for the individuals in the dropped unit.

Nonresponse bias analysis. Because the response rates for both the outcomes survey and dietary recall were less than 80 percent for both congregate and home-delivered meal participants, the research team analyzed the potential for nonresponse bias—bias that results when respondents differ in meaningful ways from nonrespondents. As response rates decrease, the risk for nonresponse bias increases if nonrespondents respond differently from respondents. The goal was to assess the potential risk for nonresponse bias and whether nonresponse could be properly accounted for using the nonresponse-adjusted analysis weights, thereby mitigating any significant differences between the respondents and the sample as a whole. Nonresponse bias cannot usually be directly measured. However, the research team can look for indications of the risk for nonresponse bias on key outcomes and examine whether the nonresponse-adjusted weights mitigate this risk.

Because the research team had little to no information about the sampled but nonresponding individuals, information was used on the census region for each participant and the size (number of meals served) of the LSP from which the research team sampled the participant's site. Because census region and LSP size could be related to key study outcomes, whether differences existed in response patterns with respect to these variables was examined. Table A.7 presents the findings. Because the findings were nearly identical for the analysis of nonresponse to the dietary recall, only the findings for the analysis of nonresponse to the outcomes survey are presented here.

The second column of Table A.7 contains the weighted response rates for each census region and LSP size. The next column contains the weighted distribution of census region and LSP size for all sample members.[23] This column is the standard for comparison and is a best guess as to what the distribution of individuals looks like across regions and size. The next column shows what the distribution would be like among respondents and ineligible sample members had the research team not adjusted for nonresponse, and the last column shows the distribution after nonresponse adjustments and weight trimming.

The weighted response rates differed by census region. Congregate meal participants were more likely to respond if they lived in the Northeast (83.9 percent) and less likely to respond if they lived in the Midwest (74.6 percent). This is evident by comparing the census region distribution for the entire sample and for the responding (plus ineligible) sample. For the entire sample, the Midwest represents 21.5 percent, but among the respondents, the Midwest represents 20.2 percent. After nonresponse adjustments to the weights, the Midwest represents 21.6 percent of the population. For the home-delivered meal participants, the South had the highest weighted response rate (57.6 percent) and the West had the lowest (48.7 percent). The census region distribution before weighting adjustments overrepresented participants in the South by less than 2 percentage points, but this discrepancy narrowed after weighting. The corresponding discrepancy for the West did not resolve after weighting, but all discrepancies, both before and after nonresponse adjustments, were minor.

The weighted response rates differed slightly by the size of LSP (as measured by either number of congregate meals served or number of home-delivered meals served). Congregate meal participants were more likely to respond if they attended a site in a small LSP (84.3 percent) and less likely to respond if they attended a medium LSP (76.3 percent). This is evident by comparing the size distribution for the entire sample and for the responding (plus ineligible) sample. For the entire sample, participants in medium LSPs represent 43.4 percent, but among the respondents, they represent 41.9 percent. After nonresponse adjustments to the weights, they represent 43.0 percent of the population. For the home-delivered meal participants, small LSPs once again had the highest weighted response rate (55.9 percent) and large LSPs had the lowest (48.1 percent). The size distribution before weighting adjustments overrepresented participants in small LSPs by less than 2 percentage points, but this discrepancy narrowed after weighting. The corresponding discrepancies for medium and large LSPs did not resolve after weighting, but again, all discrepancies, both before and after nonresponse adjustments, were minor.

[23] The weighted response rate accounts for each participant's sampling weight, which incorporates prior sample selection stages.

Table A.7. Nonresponse bias analysis for outcomes survey

Characteristic	Weighted response rate (percentage)	Selected sample (weighted by sampling weight) (percentage)	Respondents plus ineligible sample (weighted by sampling weight) (percentage)	Respondents plus ineligible sample (weighted by nonresponse-adjusted weight) (percentage)
Congregate meal program				
Census region				
Midwest	74.6	21.5	20.2	21.6
Northeast	83.9	24.6	26.0	24.7
South	80.5	19.1	19.4	19.2
West	77.6	34.8	34.3	34.4
LSP size[a]				
Small	84.3	23.4	24.8	23.6
Medium	76.3	43.4	41.9	43.0
Large	79.0	33.2	33.3	33.5
Home-delivered meal program				
Census region				
Midwest	51.6	23.9	23.7	25.1
Northeast	54.5	15.7	16.1	16.6
South	57.6	17.4	18.8	18.3
West	48.7	43.0	41.3	40.0
LSP size[a]				
Small	55.9	20.3	21.3	20.7
Medium	52.5	48.4	50.2	46.8
Large	48.1	31.3	28.5	32.5

Source: AoA NSP outcomes survey, 2015-2016.

[a]For congregate meals, the categories were 1 to 168 meals, 169 to 532 meals, and more than 532 meals. For home-delivered meals, the categories were 1 to 135 meals, 136 to 406 meals, and more than 406 meals. These were based on LSP size distributions (tertiles among non-zero values).

Although there is no rule of thumb for how large of a relative bias is acceptable, the larger it is, the more caution it merits in analysis. In this study, for the two high-level variables that were available for analysis, respondent distributions differed from those of the full sample by less than 2 or 3 percentage points even before nonresponse weighting adjustments. In most cases, those small differences narrowed after adjustments. This is a good indication that the nonresponse adjustment reduces the potential bias that results from interview nonresponse.

I. Study limitations

This report represents the most comprehensive assessment in 20 years of the effectiveness of the Title III-C NSP in improving participant outcomes. When interpreting the report's findings, it is important to consider two limitations.

Item nonresponse. Although interviewers administered the surveys, respondents were able to respond "don't know" or refuse to answer questions. The percentages and estimates presented in Chapter III of this report are based on responses that exclude both types of missing data. As a result, item nonresponse bias is possible for those estimates. Item nonresponse bias occurs when individuals who respond to a question differ in meaningful ways from those who do not respond.

This was not a serious problem for most survey questions, however, as all of the estimates presented in the tables either had no item nonresponse or very little item nonresponse, which the research team defined as at least an 80 percent response rate.

Causality. Both the propensity score matching procedure and regression analysis can adjust for differences only in observable characteristics, whereas program participants might also differ from nonparticipants in unobservable ways that could influence the estimates of program impacts on outcomes. Therefore, the findings based on either approach cannot be definitively interpreted as causal effects of the extent to which program participation affects food security, socialization, and diet quality. Instead, these procedures adjust—to the extent possible—for observable differences likely to be correlated with the outcome measures. This allows similar groups of participants and nonparticipants to be compared, while still acknowledging that unobservable factors might influence differences in outcome measures. The research team attempted to minimize this possibility, however, by using a powerful research design that (1) matched participants and nonparticipants based on a comprehensive set of demographic and health characteristics in Medicare administrative records and (2) identified matched nonparticipants within small, local geographic areas (zip codes) in which participants lived.

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APPENDIX B

USUAL NUTRIENT INTAKE DISTRIBUTIONS FOR NSP PARTICIPANTS

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TABLES

Table B.1. Vitamin A (mcg RAE): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	774	44.5	368	427	548	719	933	1,186	1,371
Males	183	870	109.1	359	427	574	791	1,076	1,408	1,676
51–70 years	40	722	195.8	414	470	574	702	853	1,000	1,100
71+ years	143	917	100.6	362	433	581	813	1,127	1,533	1,839
Females	408	724	44.7	383	438	543	687	864	1,056	1,192
51–70 years	77	750	99.5	374	430	542	701	904	1,135	1,280
71+ years	331	714	56.1	387	440	539	679	846	1,038	1,169
All home-delivered meal program participants	502	773	70.8	227	295	444	673	988	1,375	1,660
Males	156	910	148.9	228	295	448	719	1,138	1,719	2,244
51–70 years	22	693	157.5	312	376	489	667	863	1,037	1,181
71+ years	134	939	179.5	248	317	481	750	1,158	1,767	2,249
Females	346	690	29.0	299	361	485	652	851	1,070	1,217
51–70 years	35	722	99.3	224	304	468	670	924	1,209	1,382
71+ years	311	685	34.4	321	383	498	653	837	1,037	1,161

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

RAE = retinol activity equivalent; SE = standard error.

Table B.2. Vitamin C[a] (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	78	4.1	22	29	46	70	101	138	164
Males	183	92	14.1	15	23	42	76	124	182	229
51–70 years	40	91	22.0	15	24	45	78	123	174	211
71+ years	143	94	13.4	16	24	44	78	125	187	232
Females	408	71	4.4	35	42	53	68	86	104	117
51–70 years	77	71	4.6	35	41	53	68	86	103	116
71+ years	331	69	4.6	28	35	48	65	86	109	124
All home-delivered meal program participants	502	72	3.7	21	28	43	65	92	124	146
Males	156	69	5.0	18	24	39	61	89	122	148
51–70 years	22	60	6.9	–	–	–	–	–	–	–
71+ years	134	70	6.1	16	22	37	60	91	131	158
Females	346	73	4.2	23	30	45	66	94	126	148
51–70 years	35	111	17.8	24	36	61	97	146	206	245
71+ years	311	69	4.2	22	29	42	63	88	117	136

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

[a]The EAR for vitamin C is 35 mg greater for smokers than nonsmokers. In this analysis, EARs were used for nonsmokers.

– The usual intake distribution could not be reliably estimated for this subgroup.

Table B.3. Vitamin D (mcg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	5.2	0.27	2.1	2.6	3.5	4.8	6.4	8.3	9.6
Males	183	6.5	0.66	2.0	2.5	3.8	5.7	8.3	11.4	13.9
51–70 years	40	6.7	2.25	0.9	1.3	2.4	4.4	8.3	14.3	20.0
71+ years	143	6.6	0.61	2.6	3.2	4.4	6.1	8.3	10.7	12.5
Females	408	4.6	0.26	2.5	2.9	3.6	4.4	5.4	6.5	7.1
51–70 years	77	4.6	0.26	2.5	2.9	3.5	4.4	5.4	6.4	7.1
71+ years	331	4.3	0.26	1.7	2.1	2.9	4.0	5.3	6.9	7.9
All home-delivered meal program participants	502	5.1	0.36	1.3	1.8	2.9	4.5	6.7	9.1	10.8
Males	156	6.4	0.71	1.6	2.2	3.5	5.6	8.4	11.7	14.4
51–70 years	22	6.0	1.94	0.7	1.1	2.1	4.4	8.1	12.4	16.7
71+ years	134	6.6	0.77	1.8	2.3	3.7	5.7	8.4	12.0	14.4
Females	346	4.5	0.38	1.3	1.8	2.7	4.1	5.8	7.7	8.9
51–70 years	35	4.7	0.55	3.0	3.3	3.9	4.6	5.4	6.2	6.7
71+ years	311	4.4	0.43	1.1	1.6	2.5	4.0	5.8	7.9	9.2

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.4. Vitamin E (mg AT): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	6.4	0.24	2.9	3.4	4.4	5.9	7.8	10.1	11.8
Males	183	7.3	0.38	2.5	3.1	4.3	6.3	9.1	12.6	15.7
51–70 years	40	9.3	1.34	2.5	3.2	4.8	7.5	11.8	17.5	22.3
71+ years	143	6.6	0.51	2.7	3.2	4.3	6.0	8.2	10.9	13.0
Females	408	6.0	0.36	3.1	3.5	4.4	5.7	7.2	8.8	9.9
51–70 years	77	6.5	0.81	4.2	4.6	5.3	6.3	7.4	8.7	9.4
71+ years	331	5.8	0.35	2.8	3.3	4.2	5.5	7.0	8.8	10.0
All home-delivered meal program participants	502	6.0	0.30	2.5	3.1	4.2	5.6	7.4	9.4	10.7
Males	156	6.3	0.36	2.7	3.3	4.4	6.0	7.8	9.8	11.3
51–70 years	22	6.3	0.38	2.6	3.2	4.4	6.0	7.8	9.7	11.2
71+ years	134	6.3	0.38	2.5	3.1	4.3	5.9	7.8	10.1	11.5
Females	346	5.8	0.38	2.5	3.0	4.0	5.4	7.2	9.2	10.6
51–70 years	35	7.0	1.75	2.1	2.6	4.0	5.8	8.7	12.8	15.6
71+ years	311	5.7	0.38	2.5	3.0	4.0	5.3	7.0	9.0	10.2

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

AT = alpha-tocopherol; SE = standard error.

Table B.5. Vitamin B_6 (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	1.8	0.06	1.0	1.1	1.4	1.7	2.1	2.6	2.9
Males	183	2.0	0.22	0.9	1.0	1.4	1.9	2.5	3.3	3.9
51–70 years	40	2.2	0.73	0.6	0.8	1.2	1.8	2.8	4.1	5.2
71+ years	143	2.0	0.13	1.1	1.3	1.5	1.9	2.4	2.8	3.1
Females	408	1.7	0.07	1.1	1.2	1.4	1.6	1.9	2.2	2.4
51–70 years	77	1.8	0.12	0.9	1.0	1.3	1.7	2.2	2.7	3.0
71+ years	331	1.7	0.07	1.1	1.2	1.4	1.6	1.9	2.1	2.3
All home-delivered meal program participants	502	1.7	0.06	0.9	1.1	1.3	1.6	2.0	2.4	2.7
Males	156	1.9	0.09	1.2	1.3	1.5	1.8	2.1	2.5	2.7
51–70 years	22	1.9	0.29	1.0	1.1	1.4	1.8	2.3	2.6	2.9
71+ years	134	1.9	0.12	1.2	1.3	1.6	1.8	2.1	2.5	2.7
Females	346	1.6	0.08	0.9	1.0	1.2	1.5	1.9	2.4	2.6
51–70 years	35	1.8	0.27	0.9	1.0	1.3	1.7	2.1	2.6	3.0
71+ years	311	1.6	0.07	0.8	1.0	1.2	1.5	1.9	2.3	2.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.6. Vitamin B_{12} (mcg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5ths	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	5.2	0.31	1.9	2.3	3.2	4.6	6.4	8.8	10.6
Males	183	6.4	0.80	1.9	2.4	3.5	5.3	8.0	11.5	14.7
51–70 years	40	6.4	2.45	1.0	1.3	2.4	4.3	8.0	13.5	18.6
71+ years	143	6.5	0.75	2.5	3.0	4.0	5.7	8.0	11.0	13.3
Females	408	4.6	0.26	2.0	2.4	3.2	4.2	5.7	7.3	8.5
51–70 years	77	5.0	0.70	1.9	2.3	3.1	4.4	6.2	8.4	9.8
71+ years	331	4.5	0.29	2.0	2.4	3.1	4.1	5.5	7.1	8.3
All home-delivered meal program participants	502	5.5	0.45	1.8	2.3	3.3	4.8	6.9	9.4	11.2
Males	156	7.3	1.15	2.3	2.9	4.1	6.2	9.1	12.9	16.1
51–70 years	22	5.7	1.51	1.9	2.4	3.4	5.2	7.4	9.5	11.4
71+ years	134	7.5	1.40	2.5	3.0	4.4	6.4	9.3	13.4	16.5
Females	346	4.5	0.22	2.3	2.7	3.4	4.3	5.3	6.4	7.1
51–70 years	35	4.6	0.69	3.4	3.6	4.1	4.6	5.1	5.7	6.1
71+ years	311	4.4	0.22	2.1	2.5	3.2	4.2	5.4	6.6	7.4

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.7. Folate (mcg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	442	14.8	207	239	308	407	532	685	798
Males	183	539	39.8	192	236	332	479	678	916	1,111
51–70 years	40	661	165.3	149	198	313	511	840	1,286	1,674
71+ years	143	503	28.1	260	299	374	478	603	744	841
Females	408	395	16.0	224	252	305	377	465	560	627
51–70 years	77	457	49.7	264	294	354	435	537	649	718
71+ years	331	379	14.0	215	242	292	362	445	540	605
All home-delivered meal program participants	502	406	15.6	226	256	314	390	479	576	641
Males	156	448	26.2	274	303	358	432	519	612	681
51–70 years	22	446	26.2	268	300	355	433	517	607	681
71+ years	134	458	32.3	264	295	357	437	534	649	725
Females	346	386	14.9	216	245	300	371	455	546	606
51–70 years	35	435	72.4	244	276	339	414	510	622	693
71+ years	311	378	16.1	197	229	286	363	453	550	611

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.8. Niacin[a] (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	20	0.5	12	13	16	19	23	27	30
Males	183	24	1.8	14	16	19	23	28	33	37
51–70 years	40	27	6.4	10	13	18	25	34	43	50
71+ years	143	23	1.2	17	18	20	23	25	28	30
Females	408	18	0.6	12	13	15	18	21	24	25
51–70 years	77	20	0.9	13	14	17	20	23	26	28
71+ years	331	18	0.7	11	13	15	17	20	23	25
All home-delivered meal program participants	502	19	0.5	12	13	16	18	21	24	26
Males	156	20	0.9	14	15	17	20	23	26	28
51–70 years	22	23	2.4	13	16	19	23	27	29	31
71+ years	134	20	1.1	14	15	17	20	23	26	28
Females	346	18	0.7	12	13	15	18	20	23	24
51–70 years	35	19	2.3	11	12	15	18	22	26	29
71+ years	311	18	0.7	11	13	15	17	20	23	24

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

[a]Niacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of adequate niacin intakes may be underestimated.

Table B.9. Riboflavin (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	2.0	0.06	1.1	1.2	1.5	1.9	2.3	2.8	3.2
Males	183	2.4	0.22	1.3	1.4	1.8	2.2	2.8	3.4	3.9
51–70 years	40	2.4	0.62	1.2	1.4	1.8	2.2	2.9	3.5	4.0
71+ years	143	2.4	0.14	1.3	1.5	1.8	2.3	2.8	3.4	3.9
Females	408	1.8	0.06	1.1	1.2	1.4	1.7	2.1	2.4	2.7
51–70 years	77	1.8	0.10	1.3	1.4	1.6	1.8	2.0	2.2	2.3
71+ years	331	1.7	0.06	1.0	1.2	1.4	1.7	2.0	2.4	2.7
All home-delivered meal program participants	502	1.9	0.05	1.0	1.2	1.4	1.8	2.3	2.8	3.1
Males	156	2.2	0.10	1.3	1.4	1.7	2.1	2.6	3.1	3.5
51–70 years	22	2.1	0.29	1.2	1.3	1.6	2.0	2.5	3.0	3.4
71+ years	134	2.2	0.13	1.3	1.4	1.7	2.1	2.6	3.2	3.6
Females	346	1.8	0.06	1.0	1.1	1.4	1.7	2.1	2.4	2.7
51–70 years	35	2.0	0.22	1.2	1.3	1.6	1.9	2.3	2.7	2.9
71+ years	311	1.7	0.06	0.9	1.1	1.3	1.7	2.1	2.5	2.7

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.10. Thiamin (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	1.4	0.04	0.8	0.9	1.1	1.3	1.7	2.0	2.3
Males	183	1.7	0.16	0.7	0.8	1.1	1.5	2.1	2.8	3.4
51–70 years	40	1.9	0.58	0.6	0.7	1.1	1.6	2.4	3.4	4.3
71+ years	143	1.6	0.10	0.8	0.9	1.2	1.6	2.0	2.5	2.8
Females	408	1.3	0.04	0.8	0.9	1.1	1.2	1.4	1.6	1.8
51–70 years	77	1.5	0.08	1.1	1.2	1.3	1.5	1.7	1.8	1.9
71+ years	331	1.2	0.04	0.8	0.9	1.0	1.2	1.4	1.6	1.7
All home-delivered meal program participants	502	1.3	0.05	0.8	0.9	1.1	1.3	1.5	1.8	1.9
Males	156	1.5	0.06	1.0	1.1	1.3	1.4	1.7	1.9	2.0
51–70 years	22	1.5	0.27	0.9	1.0	1.2	1.5	1.8	2.1	2.4
71+ years	134	1.5	0.07	1.0	1.1	1.3	1.4	1.6	1.9	2.0
Females	346	1.3	0.05	0.8	0.9	1.0	1.2	1.5	1.7	1.9
51–70 years	35	1.3	0.17	0.9	0.9	1.1	1.3	1.5	1.8	1.9
71+ years	311	1.3	0.05	0.7	0.8	1.0	1.2	1.5	1.7	1.9

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.11. Calcium (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	826	34.6	428	489	614	782	984	1,215	1,378
Males	183	975	90.1	455	537	702	926	1,193	1,474	1,683
51–70 years	40	946	237.1	397	478	643	872	1,175	1,505	1,749
71+ years	143	997	65.1	516	598	752	959	1,196	1,452	1,621
Females	408	751	39.0	421	476	580	719	887	1,065	1,188
51–70 years	77	696	35.3	511	547	611	689	774	856	902
71+ years	331	756	44.5	403	460	567	718	898	1,105	1,247
All home-delivered meal program participants	502	784	35.7	307	382	532	734	980	1,249	1,430
Males	156	869	70.6	371	440	579	789	1,064	1,391	1,654
51–70 years	22	772	152.0	312	375	493	704	970	1,239	1,487
71+ years	134	891	76.8	376	445	592	804	1,082	1,442	1,699
Females	346	746	31.6	295	367	512	705	933	1,180	1,344
51–70 years	35	945	125.5	284	371	565	828	1,200	1,671	1,985
71+ years	311	721	31.1	302	376	512	691	898	1,113	1,244

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.12. Iron (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	12.6	0.37	7.1	8.0	9.7	12.0	14.8	18.0	20.3
Males	183	15.2	1.39	7.7	8.8	11.0	14.2	18.2	22.8	26.3
51–70 years	40	18.3	5.06	6.1	7.6	10.8	15.7	23.0	31.9	39.1
71+ years	143	14.2	0.84	9.3	10.1	11.8	13.9	16.2	18.8	20.5
Females	408	11.4	0.36	7.0	7.8	9.3	11.1	13.2	15.4	16.9
51–70 years	77	12.4	0.80	6.8	7.7	9.4	11.7	14.7	18.1	20.2
71+ years	331	11.2	0.35	7.1	7.8	9.1	10.9	12.8	14.9	16.3
All home-delivered meal program participants	502	12.6	0.38	6.4	7.5	9.5	12.1	15.1	18.3	20.3
Males	156	13.5	0.73	8.5	9.4	11.0	13.1	15.6	18.3	20.2
51–70 years	22	12.2	2.51	5.2	6.2	7.9	11.1	15.1	19.2	23.1
71+ years	134	13.8	0.78	8.9	9.7	11.3	13.4	15.7	18.4	20.2
Females	346	12.1	0.45	5.9	7.0	9.0	11.6	14.7	18.0	20.2
51–70 years	35	12.8	2.09	6.5	7.5	9.5	12.0	15.2	19.1	21.6
71+ years	311	12.0	0.51	5.2	6.4	8.6	11.5	14.9	18.4	20.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.13. Magnesium (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	257.1	6.02	146.7	164.6	200.0	246.8	301.4	362.2	404.3
Males	183	293.8	23.04	154.5	175.4	217.8	277.1	350.6	432.4	496.3
51–70 years	40	329.2	70.25	129.9	156.2	211.8	293.3	408.9	544.4	650.5
71+ years	143	284.1	17.43	169.6	188.5	224.4	273.3	330.7	395.1	438.8
Females	408	237.9	7.27	145.7	164.2	196.4	234.9	276.2	315.2	340.0
51–70 years	77	247.2	13.69	150.3	168.8	202.2	243.1	288.0	332.0	356.6
71+ years	331	234.7	6.92	144.9	162.8	193.8	231.8	271.4	311.3	335.8
All home-delivered meal program participants	502	232.0	8.42	123.9	142.3	177.6	222.9	276.1	332.8	370.6
Males	156	252.2	10.88	146.5	163.8	196.5	241.5	295.2	353.6	397.5
51–70 years	22	251.7	34.50	153.6	169.8	197.9	243.0	294.6	342.6	384.6
71+ years	134	253.0	11.60	143.5	160.9	195.5	241.0	295.6	360.7	404.2
Females	346	222.4	11.04	119.9	137.3	170.7	214.0	264.4	318.8	355.0
51–70 years	35	221.9	17.68	101.3	122.3	163.1	211.2	270.4	336.1	376.0
71+ years	311	221.9	12.00	122.4	140.1	171.8	213.7	263.2	316.3	349.5

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.14. Phosphorus (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	1,169	35.0	695	773	926	1,127	1,359	1,616	1,793
Males	183	1,373	101.1	824	913	1,088	1,321	1,599	1,894	2,117
51–70 years	40	1,426	308.1	704	813	1,031	1,329	1,723	2,155	2,477
71+ years	143	1,361	65.6	868	958	1,122	1,332	1,565	1,809	1,966
Females	408	1,068	45.1	668	739	870	1,038	1,233	1,432	1,567
51–70 years	77	1,072	44.7	689	760	891	1,053	1,234	1,413	1,515
71+ years	331	1,061	52.0	657	727	856	1,028	1,225	1,441	1,584
All home-delivered meal program participants	502	1,068	32.3	568	661	832	1,041	1,274	1,509	1,660
Males	156	1,217	49.9	722	804	959	1,169	1,419	1,689	1,890
51–70 years	22	1,213	51.8	706	796	951	1,173	1,413	1,673	1,890
71+ years	134	1,214	53.0	715	797	956	1,163	1,409	1,698	1,889
Females	346	1,000	35.6	540	627	786	980	1,190	1,402	1,535
51–70 years	35	1,086	99.7	541	644	837	1,053	1,306	1,574	1,731
71+ years	311	987	38.2	532	622	777	968	1,177	1,385	1,508

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.15. Zinc (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	10.2	0.31	6.1	6.7	8.1	9.8	11.9	14.1	15.7
Males	183	12.0	1.07	6.3	7.2	8.9	11.3	14.3	17.6	20.1
51–70 years	40	12.7	3.49	4.5	5.5	7.7	11.0	15.9	21.8	26.5
71+ years	143	11.8	0.61	7.1	8.0	9.5	11.5	13.8	16.3	17.9
Females	408	9.3	0.23	6.3	6.9	7.9	9.2	10.6	12.0	12.9
51–70 years	77	9.9	0.62	5.5	6.2	7.6	9.4	11.7	14.0	15.5
71+ years	331	9.2	0.26	6.5	7.0	7.9	9.1	10.3	11.6	12.4
All home-delivered meal program participants	502	10.1	0.35	5.8	6.5	8.0	9.8	11.8	14.0	15.3
Males	156	11.5	0.64	5.9	6.8	8.4	10.8	13.7	17.1	19.6
51–70 years	22	11.5	0.68	5.8	6.7	8.4	10.8	13.7	16.9	19.6
71+ years	134	11.2	0.57	5.5	6.3	8.1	10.5	13.5	17.0	19.3
Females	346	9.4	0.37	6.1	6.7	7.8	9.2	10.8	12.4	13.5
51–70 years	35	9.3	0.39	6.1	6.7	7.7	9.2	10.7	12.2	13.2
71+ years	311	9.3	0.43	5.1	5.9	7.2	9.0	11.1	13.3	14.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.16. Potassium (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	2,493	80.5	1,344	1,537	1,915	2,404	2,959	3,559	3,965
Males	183	2,826	295.7	1,416	1,640	2,087	2,692	3,413	4,175	4,746
51–70 years	40	2,755	711.7	1,171	1,395	1,858	2,512	3,405	4,409	5,171
71+ years	143	2,885	191.6	1,610	1,832	2,246	2,793	3,412	4,078	4,513
Females	408	2,326	77.4	1,349	1,536	1,871	2,282	2,733	3,169	3,451
51–70 years	77	2,377	110.4	1,325	1,515	1,868	2,314	2,822	3,333	3,625
71+ years	331	2,303	82.5	1,357	1,539	1,859	2,262	2,691	3,133	3,408
All home-delivered meal program participants	502	2,238	56.5	1,281	1,458	1,785	2,185	2,631	3,082	3,372
Males	156	2,471	89.5	1,427	1,597	1,920	2,363	2,894	3,473	3,909
51–70 years	22	2,508	356.4	1,596	1,751	2,015	2,435	2,908	3,342	3,718
71+ years	134	2,471	85.5	1,402	1,572	1,909	2,353	2,885	3,521	3,945
Females	346	2,127	64.2	1,308	1,461	1,741	2,086	2,464	2,852	3,100
51–70 years	35	2,271	263.4	980	1,195	1,623	2,139	2,788	3,525	3,978
71+ years	311	2,110	68.6	1,366	1,515	1,769	2,079	2,418	2,756	2,956

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.17. Dietary fiber (g): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	15	0.4	7	8	11	15	19	23	26
Males	183	17	1.5	6	7	11	16	22	28	32
51–70 years	40	18	3.6	7	8	11	16	22	30	36
71+ years	143	16	1.3	6	8	11	16	21	26	30
Females	408	15	0.6	8	9	12	14	17	20	22
51–70 years	77	14	1.0	6	7	10	14	18	22	24
71+ years	331	15	0.6	9	10	12	14	17	20	21
All home-delivered meal program participants	502	13	0.5	7	8	10	13	16	19	21
Males	156	14	0.6	8	9	11	13	17	20	22
51–70 years	22	14	1.8	11	12	13	14	15	17	17
71+ years	134	14	0.6	8	9	11	13	17	20	23
Females	346	13	0.6	7	8	10	12	15	18	20
51–70 years	35	14	1.3	6	7	10	13	17	22	25
71+ years	311	13	0.7	7	8	10	12	15	18	20

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.18. Sodium (mg): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	2,948	104.3	2,261	2,392	2,632	2,920	3,226	3,538	3,741
Males	183	3,309	237.2	2,474	2,630	2,919	3,273	3,657	4,032	4,297
51–70 years	40	3,203	617.8	1,635	1,881	2,364	3,014	3,854	4,756	5,417
71+ years	143	3,310	236.1	2,469	2,626	2,913	3,276	3,658	4,036	4,304
Females	408	2,767	129.4	2,280	2,380	2,551	2,753	2,967	3,169	3,298
51–70 years	77	2,843	134.0	1,774	1,974	2,340	2,792	3,294	3,791	4,072
71+ years	331	2,768	128.5	2,280	2,382	2,553	2,755	2,968	3,172	3,299
All home-delivered meal program participants	502	2,708	62.4	1,508	1,748	2,174	2,672	3,199	3,709	4,025
Males	156	3,027	111.1	2,152	2,319	2,614	2,985	3,388	3,789	4,069
51–70 years	22	3,019	120.7	2,118	2,302	2,601	2,991	3,379	3,767	4,069
71+ years	134	3,022	103.2	2,162	2,318	2,611	2,968	3,363	3,800	4,074
Females	346	2,568	71.3	1,313	1,560	2,004	2,530	3,084	3,628	3,966
51–70 years	35	2,945	254.1	1,406	1,664	2,172	2,784	3,557	4,442	4,991
71+ years	311	2,519	81.2	1,297	1,554	1,980	2,489	3,026	3,543	3,841

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.19. Protein (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	17.5	0.38	13.2	14.0	15.5	17.4	19.3	21.3	22.6
Males	183	18.5	0.70	15.8	16.3	17.3	18.4	19.6	20.7	21.5
51–70 years	40	19.0	1.04	12.6	13.8	15.9	18.5	21.7	24.8	27.0
71+ years	143	18.5	0.71	15.8	16.3	17.3	18.4	19.6	20.7	21.5
Females	408	17.0	0.34	12.2	13.2	14.8	16.8	19.0	21.1	22.5
51–70 years	77	18.0	1.04	11.5	12.7	14.9	17.6	20.7	23.8	25.5
71+ years	331	16.7	0.39	12.3	13.2	14.7	16.6	18.6	20.6	21.9
All home-delivered meal program participants	502	17.4	0.35	12.5	13.5	15.3	17.3	19.4	21.4	22.6
Males	156	17.6	0.51	–	–	–	–	–	–	–
51–70 years	22	21.4	2.02	13.1	15.1	18.1	21.7	24.9	27.3	29.1
71+ years	134	17.6	0.51	–	–	–	–	–	–	–
Females	346	17.3	0.45	11.9	13.0	14.9	17.1	19.5	21.8	23.2
51–70 years	35	16.7	1.13	13.9	14.5	15.5	16.6	17.8	19.0	19.7
71+ years	311	17.3	0.47	11.6	12.8	14.7	17.1	19.7	22.2	23.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

– The usual intake distribution could not be reliably estimated for this subgroup.

Table B.20. Carbohydrate (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	49.0	0.50	39.2	41.4	45.1	49.1	52.9	56.3	58.4
Males	183	47.2	1.20	35.6	38.5	43.0	47.6	51.9	55.5	57.7
51–70 years	40	47.1	1.87	36.2	38.8	42.9	47.2	51.5	55.1	57.4
71+ years	143	47.5	1.66	36.0	39.0	43.4	47.9	52.1	55.7	57.8
Females	408	49.8	0.78	40.6	42.7	46.1	49.9	53.5	56.7	58.7
51–70 years	77	49.0	1.98	35.8	38.6	43.3	48.8	54.5	59.7	62.6
71+ years	331	49.9	0.83	42.3	44.1	46.8	50.0	53.0	55.8	57.4
All home-delivered meal program participants	502	50.3	0.77	38.9	41.2	45.2	49.9	54.9	59.8	62.9
Males	156	48.3	0.88	39.5	41.3	44.5	48.2	52.0	55.5	57.8
51–70 years	22	48.2	0.88	39.1	41.2	44.4	48.3	51.9	55.3	57.8
71+ years	134	49.1	1.16	39.1	41.2	44.9	49.0	53.1	57.3	59.7
Females	346	51.2	0.87	39.2	41.5	45.6	50.7	56.1	61.7	65.3
51–70 years	35	50.8	3.04	38.1	40.9	45.7	50.6	55.8	61.0	63.9
71+ years	311	51.2	0.90	39.0	41.4	45.5	50.6	56.2	61.9	65.4

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.21. Total fat (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	34.7	0.44	29.1	30.3	32.4	34.7	36.9	39.0	40.3
Males	183	34.6	0.43	29.1	30.3	32.4	34.6	36.8	38.9	40.2
51–70 years	40	34.6	0.43	29.2	30.4	32.5	34.7	36.6	38.6	40.0
71+ years	143	34.6	0.43	29.1	30.2	32.3	34.6	37.0	39.1	40.4
Females	408	34.6	0.66	27.1	28.8	31.6	34.6	37.7	40.4	42.1
51–70 years	77	34.7	1.83	23.8	26.1	30.0	34.6	39.3	43.8	46.2
71+ years	331	34.5	0.66	28.2	29.6	31.9	34.5	37.1	39.5	41.0
All home-delivered meal program participants	502	33.6	0.66	24.7	26.8	30.1	33.7	37.2	40.3	42.1
Males	156	34.4	0.83	29.3	30.4	32.2	34.4	36.5	38.4	39.7
51–70 years	22	34.3	0.84	29.1	30.3	32.2	34.4	36.4	38.3	39.7
71+ years	134	34.2	0.92	28.0	29.4	31.7	34.2	36.6	39.0	40.3
Females	346	33.2	0.73	23.3	25.6	29.4	33.4	37.2	40.6	42.7
51–70 years	35	34.2	2.44	24.4	26.9	30.8	34.4	38.0	41.2	43.0
71+ years	311	33.0	0.78	23.1	25.5	29.2	33.2	37.1	40.6	42.5

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.22. Linoleic acid (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	6.8	0.22	4.5	4.9	5.7	6.7	7.8	8.9	9.7
Males	183	6.8	0.37	4.8	5.2	5.8	6.7	7.6	8.4	9.1
51–70 years	40	7.7	0.30	6.7	6.9	7.3	7.7	8.1	8.4	8.7
71+ years	143	6.4	0.38	4.3	4.6	5.3	6.2	7.3	8.4	9.1
Females	408	6.9	0.28	4.4	4.8	5.6	6.7	7.9	9.1	10.0
51–70 years	77	7.0	0.78	5.1	5.5	6.1	6.9	7.9	8.8	9.4
71+ years	331	6.8	0.31	4.3	4.7	5.5	6.6	7.8	9.1	9.9
All home-delivered meal program participants	502	6.0	0.17	3.9	4.3	5.1	5.9	6.9	7.8	8.4
Males	156	6.2	0.26	4.7	5.0	5.5	6.1	6.8	7.4	7.8
51–70 years	22	6.2	0.26	4.6	5.0	5.5	6.1	6.8	7.4	7.8
71+ years	134	6.3	0.26	4.4	4.8	5.4	6.2	7.0	7.8	8.3
Females	346	5.9	0.21	3.6	4.0	4.8	5.8	6.9	8.1	8.8
51–70 years	35	6.5	0.58	3.9	4.4	5.3	6.4	7.6	8.8	9.5
71+ years	311	5.9	0.20	3.6	4.0	4.8	5.7	6.8	7.9	8.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.23. Alpha-linolenic acid (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	0.8	0.03	0.5	0.5	0.6	0.7	0.9	1.0	1.1
Males	183	0.7	0.04	0.5	0.6	0.6	0.7	0.8	0.9	0.9
51–70 years	40	0.7	0.05	0.5	0.5	0.6	0.7	0.8	0.9	1.0
71+ years	143	0.7	0.05	0.5	0.6	0.6	0.7	0.8	0.8	0.9
Females	408	0.8	0.05	0.5	0.5	0.6	0.8	0.9	1.1	1.2
51–70 years	77	0.7	0.09	0.3	0.4	0.5	0.7	0.9	1.1	1.3
71+ years	331	0.8	0.05	0.5	0.5	0.6	0.8	0.9	1.1	1.2
All home-delivered meal program participants	502	0.6	0.02	0.4	0.4	0.5	0.6	0.7	0.8	0.9
Males	156	0.6	0.04	0.5	0.5	0.6	0.6	0.7	0.8	0.9
51–70 years	22	0.6	0.13	0.4	0.5	0.5	0.6	0.7	0.8	0.9
71+ years	134	0.6	0.04	0.5	0.5	0.6	0.6	0.7	0.8	0.8
Females	346	0.6	0.02	0.4	0.4	0.5	0.6	0.7	0.8	0.9
51–70 years	35	0.7	0.09	0.3	0.4	0.5	0.7	0.8	1.0	1.0
71+ years	311	0.6	0.02	0.4	0.4	0.5	0.6	0.7	0.8	0.9

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

Table B.24. Saturated fat (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program participants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program participants	591	11.4	0.30	9.6	9.9	10.6	11.4	12.2	12.9	13.4
Males	183	11.4	0.36	9.1	9.6	10.4	11.4	12.4	13.4	14.1
51–70 years	40	11.4	0.38	9.1	9.6	10.4	11.4	12.4	13.3	14.0
71+ years	143	12.0	0.42	8.2	9.0	10.3	11.8	13.5	15.2	16.2
Females	408	11.4	0.38	9.9	10.2	10.7	11.4	12.0	12.6	13.0
51–70 years	77	11.2	0.66	7.3	8.0	9.4	11.0	12.8	14.6	15.6
71+ years	331	11.5	0.43	–	–	–	–	–	–	–
All home-delivered meal program participants	502	11.3	0.28	7.8	8.5	9.8	11.2	12.7	14.0	14.9
Males	156	11.4	0.23	10.3	10.6	11.0	11.4	11.9	12.3	12.6
51–70 years	22	11.4	0.24	10.3	10.5	10.9	11.4	11.9	12.3	12.6
71+ years	134	11.3	0.25	9.9	10.2	10.7	11.3	11.9	12.5	12.8
Females	346	11.2	0.36	7.1	7.9	9.4	11.1	12.8	14.5	15.5
51–70 years	35	11.3	0.66	9.1	9.7	10.5	11.4	12.2	13.0	13.5
71+ years	311	11.1	0.41	6.8	7.7	9.2	11.0	12.9	14.7	15.8

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015, weighted data.

SE = standard error.

– The usual intake distribution could not be reliably estimated for this subgroup.

APPENDIX C

SUPPLEMENTARY TABLES OF NSP PROGRAM EFFECTS FOR INCOME AND FAMILY SUBGROUPS

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TABLES

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Table C.1. Regression-adjusted percentages of individuals who live in households that are food insecure or have very low food security, by congregate meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Food insecurity						
Full sample	15.5	(2.1)	19.5	(2.1)	-4.0*	(2.4)
Individuals in lower-income households	23.2	(3.1)	31.0	(3.5)	-7.8**	(3.9)
Individuals in higher-income households	8.0	(1.8)	7.8	(1.7)	0.2	(2.0)
Individuals who live with other family members	14.7	(2.5)	17.7	(2.4)	-3.0	(3.0)
Individuals who live alone	16.6	(2.6)	20.0	(3.1)	-3.4	(3.9)
Very low food security						
Full sample	4.2	(0.8)	4.0	(1.0)	0.2	(1.0)
Individuals in lower-income households	5.8	(1.2)	5.9	(1.5)	-0.1	(1.9)
Individuals in higher-income households[a]	2.1	(1.1)	2.5	(1.3)	-0.4	(1.7)
Individuals who live with other family members	2.7	(0.7)	3.3	(1.3)	-0.6	(1.2)
Individuals who live alone	5.3	(1.2)	4.5	(1.4)	0.8	(1.9)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants and nonparticipants.

[a] Estimated using ordinary linear squares regression model.

*Significantly different from zero at the .10 level, two-tailed test.

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

Table C.2. Regression-adjusted percentages of individuals who live in households that are food insecure or have very low food security, by home-delivered meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
Food insecurity						
Full sample	22.0	(2.1)	17.0	(2.1)	5.0	(3.2)
Individuals in lower-income households	28.3	(3.6)	29.2	(4.1)	-0.8	(6.1)
Individuals in higher-income households	16.7	(3.1)	4.0	(1.7)	12.7***	(4.1)
Individuals who live with other family members	24.0	(3.1)	20.1	(3.0)	3.8	(4.5)
Individuals who live alone	19.8	(2.1)	15.6	(2.8)	4.2	(3.5)
Very low food security						
Full sample	6.9	(1.1)	2.7	(0.7)	4.2***	(1.5)
Individuals in lower-income households	7.1	(1.7)	4.8	(1.3)	2.4	(2.4)
Individuals in higher-income households	8.6	(1.7)	0.2	(0.2)	8.4***	(1.8)
Individuals who live with other family members	7.8	(2.5)	2.4	(1.3)	5.4	(3.3)
Individuals who live alone	8.1	(1.7)	3.1	(1.1)	5.0***	(1.9)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

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

Table C.3. Regression-adjusted percentages of individuals who experience social isolation, by congregate meal participation status

Outcome	Participants		Nonparticipants		Difference	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
R-UCLA loneliness score[a]						
Full sample	4.1	(0.1)	4.1	(0.1)	0.0	(0.1)
Individuals in lower-income households	4.4	(0.1)	4.2	(0.1)	0.2	(0.2)
Individuals in higher-income households	3.8	(0.1)	4.1	(0.1)	-0.3**	(0.1)
Individuals who live with other family members	3.8	(0.1)	3.8	(0.1)	0.0	(0.1)
Individuals who live alone	4.3	(0.1)	4.3	(0.1)	-0.1	(0.2)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants and nonparticipants.

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

[a] Revised UCLA loneliness scale ranges from 3 to 9.

R-UCLA = Revised UCLA Loneliness Scale.

Table C.4. Regression-adjusted percentages of individuals who screen positively for depression, by congregate meal participation status

Outcome	Participants		Nonparticipants		Difference	
	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
PHQ-2 screener (affirm at least 2 of 6 questions)						
Full sample	18.1	(2.1)	24.3	(2.8)	-6.2*	(3.7)
Individuals in lower-income households	23.6	(3.9)	31.0	(5.0)	-7.4	(6.8)
Individuals in higher-income households	13.0	(2.9)	16.1	(2.5)	-3.1	(3.4)
Individuals who live with other family members	18.4	(3.3)	19.7	(2.9)	-1.3	(4.2)
Individuals who live alone	18.4	(2.5)	27.8	(3.7)	-9.5*	(5.2)
PHQ-2 screener (affirm at least 3 of 6 questions)						
Full sample	6.5	(1.2)	9.3	(1.8)	-2.8	(2.4)
Individuals in lower-income households	10.1	(2.4)	15.1	(3.4)	-5.0	(4.8)
Individuals in higher-income households	3.9	(1.1)	4.6	(1.2)	-0.6	(1.7)
Individuals who live with other family members	6.5	(1.8)	6.2	(1.5)	0.3	(2.5)
Individuals who live alone	6.8	(1.7)	12.0	(3.2)	-5.2	(4.1)
PHQ-2 screener (affirm at least 4 of 6 questions)						
Full sample	2.3	(0.7)	6.5	(1.7)	-4.2**	(1.9)
Individuals in lower-income households	4.1	(1.4)	10.6	(2.9)	-6.5*	(3.6)
Individuals in higher-income households	0.9	(0.6)	3.8	(1.0)	-2.9**	(1.3)
Individuals who live with other family members	3.3	(1.0)	5.4	(1.7)	-2.1	(2.2)
Individuals who live alone	2.3	(0.8)	8.5	(2.4)	-6.2**	(2.6)
PHQ-2 screener (raw score)						
Full sample	0.6	(0.1)	0.8	(0.1)	-0.2**	(0.1)
Individuals in lower-income households	0.7	(0.1)	1.0	(0.2)	-0.3	(0.2)
Individuals in higher-income households	0.5	(0.1)	0.6	(0.1)	-0.1	(0.1)
Individuals who live with other family members	0.6	(0.1)	0.6	(0.1)	-0.1	(0.1)
Individuals who live alone	0.6	(0.1)	0.9	(0.1)	-0.3**	(0.2)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

PHQ-2 = Patient Health Questionnaire 2.

Table C.5. Regression-adjusted percentages of individuals who are satisfied with socialization opportunities, by congregate meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Percentage of individuals who are very satisfied with socialization opportunities						
Full sample	67.5	3.3	55.5	2.5	12.0***	4.3
Individuals in lower-income households	64.1	4.1	54.5	3.6	9.6	6.1
Individuals in higher-income households	71.2	3.5	56.1	3.6	15.1***	5.1
Individuals who live alone	75.2	3.2	65.4	2.5	9.8**	4.3
Individuals who live with other family members	61.5	4.6	48.4	3.9	13.1**	6.4
Percentage of individuals who are satisfied with socialization opportunities						
Full sample	94.0	1.4	85.8	2.1	8.2***	2.4
Individuals in lower-income households	92.4	1.9	87.2	2.5	5.2	3.3
Individuals in higher-income households	95.5	1.9	84.0	3.1	11.5***	3.4
Individuals who live alone	96.7	1.5	90.3	1.6	6.4***	2.0
Individuals who live with other family members	92.1	2.1	82.1	3.4	10.0***	3.7

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,226 congregate meal participants.

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

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

Table C.6. Regression-adjusted percentages of individuals who experience social isolation, by home-delivered meal participation status

Outcome	Participants		Nonparticipants		Difference	
	Estimate	Standard error	Estimate	Standard error	Estimate	Standard error
R-UCLA three-item loneliness score[a]						
Full sample	4.5	(0.1)	4.3	(0.1)	0.2*	(0.1)
Individuals in lower-income households	4.5	(0.1)	4.4	(0.1)	0.0	(0.2)
Individuals in higher-income households	4.6	(0.1)	4.2	(0.1)	0.4**	(0.2)
Individuals who live with other family members	4.3	(0.1)	4.1	(0.1)	0.2	(0.2)
Individuals who live alone	4.7	(0.1)	4.4	(0.1)	0.3	(0.2)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

[a] Revised UCLA loneliness scale ranges from 3 to 9.

R-UCLA = Revised UCLA Loneliness Scale.

Table C.7. Regression-adjusted percentages of individuals who screen positively for depression, by home-delivered meal participation status

Outcome	Participants		Nonparticipants		Difference	
	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
PHQ-2 screener (affirm at least 2 of 6 questions)						
Full sample	18.0	(2.8)	15.1	(1.7)	2.9	(3.7)
Individuals in lower-income households	20.1	(3.1)	14.4	(2.6)	5.7	(4.4)
Individuals in higher-income households	17.6	(3.6)	14.7	(2.9)	2.9	(5.0)
Individuals who live with other family members	19.8	(2.9)	16.4	(2.6)	3.4	(4.4)
Individuals who live alone	19.2	(3.8)	12.6	(2.6)	6.6	(5.3)
PHQ-2 screener (affirm at least 3 of 6 questions)						
Full sample	29.2	(2.6)	27.6	(2.9)	1.6	(4.3)
Individuals in lower-income households	29.4	(3.2)	29.1	(4.2)	0.3	(5.7)
Individuals in higher-income households	29.4	(3.6)	26.4	(3.5)	3.1	(5.3)
Individuals who live with other family members	30.2	(3.4)	30.0	(3.5)	0.2	(5.3)
Individuals who live alone	28.7	(3.3)	25.3	(4.3)	3.3	(6.2)
PHQ-2 screener (affirm at least 4 of 6 questions)						
Full sample	11.5	(2.1)	11.6	(1.7)	-0.1	(2.9)
Individuals in lower-income households	15.4	(2.7)	12.5	(2.7)	3.0	(4.1)
Individuals in higher-income households	9.8	(2.2)	9.5	(2.2)	0.3	(3.1)
Individuals who live with other family members	12.1	(2.5)	13.4	(2.5)	-1.2	(4.0)
Individuals who live alone	13.0	(3.0)	9.4	(2.3)	3.6	(3.9)
PHQ-2 screener (raw score)						
Full sample	1.1	(0.1)	1.1	(0.1)	0.1	(0.2)
Individuals in lower-income households	1.2	(0.1)	1.2	(0.1)	0.0	(0.2)
Individuals in higher-income households	1.1	(0.1)	0.9	(0.1)	0.2	(0.2)
Individuals who live with other family members	1.1	(0.1)	1.1	(0.1)	0.0	(0.2)
Individuals who live alone	1.2	(0.1)	1.0	(0.1)	0.2	(0.2)

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,024 home-delivered meal participants and nonparticipants.

There were no statistically significant differences in any outcome measure between participants and nonparticipants at the 0.10 level, two-tailed test.

Table C.8. Regression-adjusted percentages of individuals who are satisfied with socialization opportunities, by home-delivered meal participation status

	Participants		Nonparticipants		Difference	
Outcome	Percentage	Standard error	Percentage	Standard error	Percentage	Standard error
Percentage of individuals who are very satisfied with socialization opportunities						
Full sample	44.5	2.4	53.4	2.4	-8.9**	3.6
Individuals in lower-income households	50.3	3.7	52.0	4.0	-1.8	6.4
Individuals in higher-income households	39.9	3.4	53.3	3.0	-13.3***	4.4
Individuals who live alone	46.6	3.8	58.1	3.7	-11.5**	5.8
Individuals who live with other family members	42.2	3.4	50.8	3.3	-8.6*	4.6
Percentage of individuals who are satisfied with socialization opportunities						
Full sample	82.3	1.6	85.7	2.1	-3.3	2.7
Individuals in lower-income households	83.5	2.0	90.7	2.0	-7.2**	3.1
Individuals in higher-income households	80.9	2.9	80.7	3.2	0.2	4.4
Individuals who live alone	80.9	2.8	86.4	2.6	-5.6	4.4
Individuals who live with other family members	82.8	2.4	85.7	2.8	-2.9	3.9

Source: AoA NSP outcomes survey, 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,029 home-delivered meal participants and nonparticipants.

*Significantly different from zero at the .10 level, two-tailed test.

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

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

Table C.9. Effects of congregate meal program participation on mean Healthy Eating Index-2010 scores, by participation status and household income

HEI-2010 component	Maximum score	Lower income						Higher income					
		Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
		Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error
Adequacy (higher score indicates higher consumption)													
Total fruit	5	4.8	0.20	3.2	0.28	1.6***	0.35	4.8	0.26	4.0	0.24	0.8**	0.36
Whole fruit	5	5.0	0.00	4.5	0.40	0.5	0.40	5.0	0.00	5.0	0.04	0.0	0.04
Total vegetables	5	4.6	0.24	3.7	0.25	0.9***	0.34	4.4	0.35	4.1	0.21	0.3	0.41
Greens and beans	5	3.9	0.58	3.2	0.48	0.7	0.75	3.7	0.36	3.7	0.44	0.0	0.57
Whole grains	10	3.7	0.69	3.8	0.40	-0.1	0.80	3.9	0.32	3.7	0.32	0.2	0.45
Dairy	10	6.6	0.80	5.8	0.50	0.8	0.94	7.1	0.43	5.6	0.27	1.5***	0.51
Total protein foods	5	5.0	0.00	5.0	0.00	0.0	0.00	5.0	0.00	5.0	0.00	0.0	0.00
Seafood and plant proteins	5	4.2	0.76	4.1	0.57	0.1	0.95	4.7	0.48	4.7	0.38	0.0	0.61
Fatty acids	10	4.6	0.85	4.4	0.44	0.3	0.96	3.9	0.41	4.2	0.37	-0.3	0.55
Moderation (higher score indicates lower consumption)													
Refined grains	10	7.1	0.28	5.3	0.66	1.8**	0.72	8.4	0.31	6.5	0.48	1.9***	0.57
Sodium	10	1.2	0.62	1.8	0.57	-0.6	0.84	3.3	0.49	2.4	0.47	0.9	0.68
Empty calories	20	13.3	0.97	12.2	0.69	1.1	1.19	12.4	0.34	12.1	0.51	0.3	0.62
Total score	100	64.1	2.74	57.0	2.24	7.1**	3.54	66.7	1.27	61.0	1.57	5.6***	2.02

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,210 congregate meal participants and nonparticipants.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

*** Difference between participants and nonparticipants is significantly different from zero at the .01 level, two-tailed test.

HEI = Healthy Eating Index.

Table C.10. Effects of congregate meal program participation on mean Healthy Eating Index-2010 scores, by participation status and whether participant lives alone

		Lives alone						Lives with others					
		Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
HEI-2010 component	Maximum score	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error
Adequacy (higher score indicates higher consumption)													
Total fruit	5	4.7	0.22	3.7	0.29	1.0***	0.36	4.9	0.25	3.5	0.27	1.4***	0.36
Whole fruit	5	5.0	0.01	4.9	0.17	0.1	0.17	5.0	0.00	4.8	0.24	0.2	0.24
Total vegetables	5	4.4	0.35	3.7	0.22	0.6	0.42	4.6	0.30	4.1	0.24	0.5	0.39
Greens and beans	5	3.6	0.36	3.5	0.46	0.1	0.58	4.0	0.55	3.4	0.54	0.6	0.77
Whole grains	10	4.0	0.46	3.8	0.40	0.2	0.61	3.5	0.38	3.7	0.33	-0.2	0.50
Dairy	10	7.2	0.68	6.0	0.37	1.2	0.78	6.5	0.40	5.4	0.32	1.1**	0.52
Total protein foods	5	5.0	0.00	5.0	0.00	0.0	0.00	5.0	0.00	5.0	0.00	0.0	0.00
Seafood and plant proteins	5	4.3	0.60	4.1	0.54	0.2	0.81	4.6	0.71	4.8	0.33	-0.1	0.78
Fatty acids	10	4.0	0.70	4.2	0.34	-0.2	0.78	4.6	0.51	4.4	0.41	0.2	0.65
Moderation (higher score indicates lower consumption)													
Refined grains	10	7.7	0.30	6.1	0.50	1.6***	0.59	7.9	0.34	5.8	0.64	2.1***	0.72
Sodium	10	1.8	0.59	2.6	0.53	-0.8	0.79	3.1	0.70	1.6	0.51	1.5*	0.86
Empty calories	20	12.4	0.71	12.2	0.67	0.1	0.98	13.5	0.51	12.1	0.58	1.4*	0.77
Total score	100	64.0	1.52	59.9	2.18	4.1	2.66	67.3	2.13	58.6	1.51	8.7***	2.61

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,210 congregate meal participants and nonparticipants.

* Difference between participants and nonparticipants is significantly different from zero at the .10 level, two-tailed test.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

*** Difference between participants and nonparticipants is significantly different from zero at the .01 level, two-tailed test.

HEI = Healthy Eating Index.

Table C.11. Effects of home-delivered meal program participation on mean Healthy Eating Index-2010 scores, by participation status and household income

		Lower income						Higher income					
		Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
HEI-2010 component	Maximum score	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error
Adequacy (higher score indicates higher consumption)													
Total fruit	5	4.6	0.33	4.2	0.36	0.4	0.48	4.6	0.36	4.4	0.33	0.2	0.49
Whole fruit	5	5.0	0.04	5.0	0.14	0.0	0.14	5.0	0.03	5.0	0.03	0.0	0.04
Total vegetables	5	4.1	0.30	3.9	0.25	0.2	0.39	4.5	0.25	4.7	0.23	-0.2	0.34
Greens and beans	5	1.9	0.37	3.0	0.53	-1.2*	0.64	3.4	0.52	2.6	0.35	0.8	0.63
Whole grains	10	3.6	0.65	4.2	0.54	-0.6	0.84	3.0	0.30	2.9	0.33	0.2	0.45
Dairy	10	7.6	0.77	5.6	0.41	1.9**	0.87	6.8	0.51	6.0	0.42	0.8	0.66
Total protein foods	5	5.0	0.00	5.0	0.00	0.0	0.00	5.0	0.00	5.0	0.00	0.0	0.00
Seafood and plant proteins	5	3.1	0.87	3.9	0.62	-0.8	1.07	4.3	0.63	4.3	0.45	0.0	0.77
Fatty acids	10	3.5	0.45	4.1	0.32	-0.6	0.55	4.4	0.66	4.2	0.37	0.2	0.76
Moderation (higher score indicates lower consumption)													
Refined grains	10	7.1	0.48	6.3	0.70	0.8	0.85	7.8	0.49	6.5	0.52	1.3*	0.71
Sodium	10	2.5	0.48	2.2	0.44	0.3	0.65	1.8	0.67	1.5	0.43	0.4	0.80
Empty calories	20	11.4	0.68	11.9	0.60	-0.5	0.90	12.6	0.35	12.0	0.59	0.6	0.69
Total score	100	59.4	2.40	59.4	1.89	0.0	3.06	63.2	1.55	59.1	1.59	4.1*	2.22

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,016 home-delivered meal participants and nonparticipants.

* Difference between participants and nonparticipants is significantly different from zero at the .10 level, two-tailed test.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

HEI = Healthy Eating Index.

Table C.12. Effects of home-delivered meal program participation on mean Healthy Eating Index-2010 scores, by participation status and whether participant lives alone

		Lives alone						Lives with others					
		Participants		Nonparticipants		Difference		Participants		Nonparticipants		Difference	
HEI-2010 component	Maximum score	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error	Mean score	Standard error
Adequacy (higher score indicates higher consumption)													
Total fruit	5	4.8	0.24	4.2	0.37	0.6	0.44	4.2	0.38	4.3	0.37	-0.1	0.53
Whole fruit	5	5.0	0.01	5.0	0.04	0.0	0.04	4.9	0.22	5.0	0.10	-0.1	0.24
Total vegetables	5	4.2	0.25	4.5	0.30	-0.3	0.39	4.5	0.30	4.2	0.23	0.3	0.37
Greens and beans	5	3.3	0.44	2.8	0.41	0.5	0.60	1.8	0.34	2.8	0.42	-1.1**	0.54
Whole grains	10	3.1	0.35	3.5	0.32	-0.3	0.48	3.6	0.70	3.6	0.50	0.0	0.86
Dairy	10	7.2	0.42	6.4	0.40	0.8	0.58	7.2	0.48	5.2	0.37	2.0***	0.61
Total protein foods	5	5.0	0.00	5.0	0.00	0.0	0.00	5.0	0.00	5.0	0.00	0.0	0.00
Seafood and plant proteins	5	3.3	0.52	4.8	0.37	-1.4**	0.63	4.2	0.85	3.1	0.51	1.0	0.99
Fatty acids	10	3.8	0.40	4.0	0.46	-0.2	0.61	4.1	0.42	4.3	0.38	-0.2	0.57
Moderation (higher score indicates lower consumption)													
Refined grains	10	7.1	0.42	6.6	0.51	0.4	0.66	7.9	0.57	6.1	0.61	1.8**	0.83
Sodium	10	2.8	0.61	1.6	0.40	1.2	0.73	1.4	0.54	2.2	0.44	-0.8	0.70
Empty calories	20	11.7	0.63	12.1	0.52	-0.4	0.82	12.5	0.57	11.8	0.62	0.7	0.85
Total score	100	61.2	1.31	60.4	1.71	0.8	2.15	61.2	2.48	57.7	1.50	3.6	2.90

Source: AoA NSP 24-hour dietary recall (Day 1), 2015-2016, weighted data.

Note: Estimates are based on an unweighted sample size of 1,016 home-delivered meal participants and nonparticipants.

** Difference between participants and nonparticipants is significantly different from zero at the .05 level, two-tailed test.

*** Difference between participants and nonparticipants is significantly different from zero at the .01 level, two-tailed test.

HEI = Healthy Eating Index.

APPENDIX D

USUAL NUTRIENT INTAKE DISTRIBUTIONS FOR NSP NONPARTICIPANTS

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TABLES

Table D.1. Vitamin A (mcg RAE): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	600	32.1	151	203	321	513	779	1,113	1,355
Males	220	642	61.1	148	198	317	513	820	1,225	1,569
51–70 years	106	642	73.9	225	272	381	552	799	1,116	1,361
71+ years	114	644	75.1	122	171	285	491	824	1,306	1,695
Females	399	583	36.3	163	217	332	512	754	1,038	1,251
51–70 years	194	642	48.2	218	283	407	585	816	1,080	1,248
71+ years	205	571	41.0	152	203	315	493	740	1,034	1,258
All home-delivered meal program nonparticipants	514	633	43.9	176	233	357	551	815	1,139	1,379
Males	175	687	95.8	158	211	329	545	870	1,336	1,713
51–70 years	68	555	69.8	–	–	–	–	–	–	–
71+ years	107	707	106.5	138	187	306	526	887	1,444	1,885
Females	339	608	47.3	184	238	357	539	780	1,068	1,277
51–70 years	108	418	59.6	56	94	185	337	564	850	1,046
71+ years	231	632	49.6	203	262	382	566	807	1,086	1,293

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

RAE = retinol activity equivalent; SE = standard error.

– The usual intake distribution could not be reliably estimated for this subgroup.

Table D.2. Vitamin C[a] (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	72	3.9	15	22	36	61	95	137	167
Males	220	71	6.8	9	15	30	56	96	145	183
51–70 years	106	80	12.9	6	12	28	60	110	175	223
71+ years	114	68	7.5	13	19	33	56	90	134	165
Females	399	72	4.6	19	26	40	63	94	131	158
51–70 years	194	84	11.3	16	24	41	69	111	164	200
71+ years	205	70	5.0	20	27	41	62	90	122	146
All home-delivered meal program nonparticipants	514	76	3.9	12	18	35	62	102	151	187
Males	175	84	9.0	13	21	38	69	113	169	210
51–70 years	68	63	11.6	4	10	25	53	88	134	160
71+ years	107	88	10.1	16	24	42	73	117	171	208
Females	339	72	4.1	11	17	33	59	96	143	177
51–70 years	108	56	12.6	2	4	11	28	65	134	197
71+ years	231	74	4.1	13	20	36	63	99	142	174

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

[a]The EAR for vitamin C is 35 mg greater for smokers than nonsmokers. In this analysis, EARs were used for nonsmokers.

Table D.3. Vitamin D (mcg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	3.8	0.19	0.9	1.2	2.0	3.3	5.0	7.1	8.6
Males	220	4.3	0.35	1.0	1.4	2.3	3.7	5.6	7.7	9.4
51–70 years	106	5.0	0.46	1.4	1.9	2.9	4.4	6.4	8.8	10.5
71+ years	114	4.0	0.43	1.0	1.4	2.2	3.5	5.3	7.4	8.9
Females	399	3.7	0.20	0.9	1.2	1.9	3.2	4.8	6.7	8.2
51–70 years	194	3.6	0.20	0.9	1.2	1.9	3.1	4.7	6.7	8.1
71+ years	205	3.5	0.23	0.7	1.0	1.7	3.0	4.7	6.8	8.3
All home-delivered meal program nonparticipants	514	3.9	0.20	1.5	1.9	2.6	3.6	4.8	6.2	7.1
Males	175	3.7	0.40	1.2	1.5	2.2	3.3	4.7	6.4	7.7
51–70 years	68	3.7	0.38	1.2	1.6	2.2	3.2	4.6	6.3	7.6
71+ years	107	3.6	0.46	0.6	0.8	1.5	2.7	4.7	7.5	9.6
Females	339	3.9	0.21	1.6	2.0	2.7	3.7	4.8	6.1	7.0
51–70 years	108	2.6	0.42	0.5	0.7	1.2	2.1	3.4	5.1	6.2
71+ years	231	4.1	0.23	1.8	2.2	2.9	3.9	5.0	6.2	7.0

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.4. Vitamin E (mg AT): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	5.9	0.28	2.0	2.5	3.6	5.3	7.4	10.0	11.9
Males	220	6.8	0.49	2.7	3.3	4.4	6.1	8.4	11.1	13.2
51–70 years	106	6.5	0.57	2.5	3.0	4.1	5.8	8.1	10.9	12.9
71+ years	114	6.9	0.62	2.9	3.5	4.6	6.2	8.5	11.2	13.3
Females	399	5.5	0.29	1.8	2.3	3.3	4.9	7.0	9.4	11.2
51–70 years	194	6.5	0.78	2.5	3.1	4.3	6.0	8.2	10.7	12.2
71+ years	205	5.3	0.34	1.5	2.0	3.1	4.6	6.8	9.3	11.2
All home-delivered meal program nonparticipants	514	5.6	0.25	2.7	3.2	4.1	5.3	6.7	8.3	9.3
Males	175	6.9	0.59	2.8	3.4	4.5	6.2	8.5	11.4	13.6
51–70 years	68	6.2	0.92	2.1	2.6	3.9	5.7	7.8	10.5	12.0
71+ years	107	7.0	0.67	2.9	3.5	4.7	6.4	8.7	11.5	13.5
Females	339	5.1	0.25	3.1	3.5	4.2	5.0	5.9	6.8	7.4
51–70 years	108	4.2	0.38	1.7	2.2	2.9	3.9	5.2	6.4	7.2
71+ years	231	5.2	0.25	3.3	3.7	4.3	5.1	6.0	6.8	7.4

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

AT = alpha-tocopherol; SE = standard error.

Table D.5. Vitamin B_6 (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	1.6	0.06	0.7	0.8	1.1	1.5	2.0	2.6	2.9
Males	220	1.9	0.12	0.8	0.9	1.3	1.7	2.3	3.0	3.5
51–70 years	106	2.1	0.20	0.7	0.9	1.3	1.8	2.6	3.6	4.4
71+ years	114	1.8	0.14	0.9	1.0	1.3	1.7	2.2	2.8	3.2
Females	399	1.5	0.07	0.6	0.8	1.0	1.4	1.8	2.3	2.7
51–70 years	194	1.6	0.10	1.2	1.3	1.4	1.6	1.8	2.0	2.1
71+ years	205	1.5	0.09	0.6	0.7	0.9	1.3	1.8	2.4	2.8
All home-delivered meal program nonparticipants	514	1.6	0.06	0.7	0.8	1.1	1.5	1.9	2.4	2.8
Males	175	1.9	0.11	0.8	1.0	1.3	1.8	2.3	3.0	3.4
51–70 years	68	2.2	0.41	1.3	1.4	1.7	2.1	2.6	3.2	3.6
71+ years	107	1.8	0.11	0.8	0.9	1.2	1.7	2.3	2.9	3.3
Females	339	1.5	0.06	0.7	0.8	1.1	1.4	1.8	2.2	2.5
51–70 years	108	1.1	0.08	0.4	0.5	0.8	1.0	1.4	1.7	1.9
71+ years	231	1.5	0.06	0.7	0.9	1.1	1.4	1.8	2.2	2.5

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.6. Vitamin B_{12} (mcg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	4.2	0.23	1.2	1.5	2.3	3.6	5.4	7.8	9.4
Males	220	5.7	0.53	1.3	1.8	2.8	4.6	7.3	10.8	13.7
51–70 years	106	6.1	0.82	1.6	2.1	3.1	4.9	7.6	11.4	14.4
71+ years	114	5.6	0.69	1.4	1.8	2.8	4.5	7.1	10.7	13.5
Females	399	3.6	0.19	1.3	1.6	2.3	3.3	4.6	6.1	7.1
51–70 years	194	3.6	0.19	1.3	1.6	2.3	3.3	4.5	6.1	7.1
71+ years	205	3.5	0.21	1.0	1.3	2.0	3.0	4.5	6.3	7.6
All home-delivered meal program nonparticipants	514	4.2	0.23	1.7	2.1	2.8	3.9	5.2	6.7	7.8
Males	175	5.1	0.48	1.6	2.0	2.9	4.3	6.4	9.0	11.1
51–70 years	68	5.0	0.47	1.6	2.0	2.9	4.3	6.3	8.8	10.8
71+ years	107	5.0	0.52	1.2	1.6	2.5	4.0	6.3	9.6	11.9
Females	339	3.9	0.25	1.8	2.1	2.7	3.6	4.7	5.9	6.8
51–70 years	108	3.0	0.33	1.4	1.7	2.2	2.8	3.6	4.5	5.0
71+ years	231	4.0	0.28	1.9	2.2	2.8	3.7	4.8	6.1	6.9

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.7. Folate (mcg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	450	20.1	215	253	326	427	547	680	769
Males	220	521	36.6	197	239	328	460	645	870	1,050
51–70 years	106	501	47.5	179	219	311	447	630	849	1,006
71+ years	114	527	43.8	212	255	339	468	648	878	1,049
Females	399	421	22.6	257	287	341	411	489	568	622
51–70 years	194	446	25.6	267	303	363	437	520	605	655
71+ years	205	415	28.2	286	311	354	408	468	528	567
All home-delivered meal program nonparticipants	514	413	15.1	158	195	271	379	517	674	786
Males	175	524	32.7	208	252	339	475	649	864	1,020
51–70 years	68	484	75.5	220	256	332	444	584	772	889
71+ years	107	529	35.1	211	256	349	485	657	864	1,001
Females	339	372	15.8	156	188	256	349	462	587	674
51–70 years	108	298	26.4	96	129	193	278	383	495	565
71+ years	231	383	17.4	172	204	264	353	467	599	697

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.8. Niacin[a] (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	18	0.6	8	9	13	17	23	28	32
Males	220	21	1.3	10	12	15	20	26	33	38
51–70 years	106	24	1.9	13	15	19	23	29	35	40
71+ years	114	21	1.6	10	11	15	19	25	32	36
Females	399	17	0.6	7	9	12	16	21	26	29
51–70 years	194	18	1.1	9	11	15	18	22	26	28
71+ years	205	17	0.8	7	8	11	16	21	26	29
All home-delivered meal program nonparticipants	514	18	0.6	9	11	13	17	21	25	28
Males	175	22	1.1	14	16	18	21	25	29	32
51–70 years	68	27	4.0	13	15	19	25	32	41	46
71+ years	107	21	1.1	15	16	18	21	24	28	30
Females	339	16	0.5	9	10	13	16	19	22	24
51–70 years	108	13	0.8	10	10	12	13	15	16	17
71+ years	231	16	0.6	9	11	13	16	19	23	25

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

[a]Niacin intakes include preformed niacin only. EARs for niacin are expressed as niacin equivalents, including contributions from tryptophan. Therefore, prevalence of adequate niacin intakes may be underestimated.

Table D.9. Riboflavin (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	1.8	0.07	0.8	1.0	1.3	1.7	2.2	2.8	3.2
Males	220	2.2	0.13	0.9	1.1	1.5	2.0	2.7	3.5	4.1
51–70 years	106	2.3	0.16	1.0	1.2	1.6	2.1	2.8	3.5	4.1
71+ years	114	2.2	0.16	0.9	1.1	1.4	2.0	2.7	3.5	4.1
Females	399	1.6	0.07	0.8	1.0	1.2	1.6	2.0	2.4	2.7
51–70 years	194	1.8	0.11	0.9	1.1	1.4	1.7	2.1	2.6	2.8
71+ years	205	1.6	0.08	0.8	1.0	1.2	1.5	1.9	2.3	2.6
All home-delivered meal program nonparticipants	514	1.8	0.05	0.9	1.0	1.3	1.7	2.1	2.6	2.9
Males	175	2.0	0.11	1.1	1.3	1.5	1.9	2.4	2.9	3.3
51–70 years	68	2.0	0.17	1.4	1.5	1.7	2.0	2.3	2.6	2.8
71+ years	107	2.0	0.12	1.1	1.2	1.5	1.9	2.4	3.0	3.4
Females	339	1.7	0.06	0.8	0.9	1.2	1.6	2.0	2.4	2.7
51–70 years	108	1.4	0.10	0.6	0.8	1.0	1.4	1.8	2.2	2.4
71+ years	231	1.7	0.06	0.9	1.0	1.3	1.6	2.0	2.4	2.7

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.10. Thiamin (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	1.3	0.04	0.7	0.8	1.0	1.3	1.6	2.0	2.2
Males	220	1.6	0.08	0.7	0.8	1.0	1.4	1.9	2.5	3.0
51–70 years	106	1.8	0.18	0.7	0.8	1.1	1.6	2.2	3.1	3.7
71+ years	114	1.5	0.09	0.7	0.8	1.1	1.4	1.8	2.3	2.7
Females	399	1.2	0.05	0.8	0.9	1.0	1.2	1.4	1.7	1.8
51–70 years	194	1.3	0.07	0.9	1.0	1.1	1.3	1.5	1.6	1.8
71+ years	205	1.2	0.06	0.7	0.8	1.0	1.2	1.5	1.7	1.9
All home-delivered meal program nonparticipants	514	1.3	0.04	0.6	0.8	1.0	1.2	1.6	1.9	2.2
Males	175	1.6	0.06	1.0	1.1	1.3	1.6	1.9	2.2	2.4
51–70 years	68	1.7	0.15	0.9	1.0	1.3	1.6	2.1	2.6	2.9
71+ years	107	1.6	0.07	1.1	1.2	1.4	1.6	1.9	2.1	2.3
Females	339	1.2	0.05	0.6	0.7	0.9	1.1	1.4	1.8	2.0
51–70 years	108	1.0	0.06	0.4	0.5	0.7	1.0	1.3	1.6	1.7
71+ years	231	1.2	0.06	0.6	0.7	0.9	1.2	1.5	1.8	2.0

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.11. Calcium (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	719	24.4	314	375	499	674	886	1,126	1,287
Males	220	767	43.8	366	430	558	725	932	1,152	1,311
51–70 years	106	823	62.1	426	490	618	787	989	1,203	1,345
71+ years	114	752	49.9	358	422	539	704	911	1,150	1,314
Females	399	700	27.3	294	357	479	652	867	1,102	1,272
51–70 years	194	775	51.5	368	441	570	741	944	1,162	1,295
71+ years	205	681	31.9	280	340	459	630	847	1,087	1,261
All home-delivered meal program nonparticipants	514	714	27.3	296	361	488	666	885	1,131	1,303
Males	175	760	74.6	285	345	469	669	940	1,294	1,563
51–70 years	68	778	70.3	–	–	–	–	–	–	–
71+ years	107	752	82.0	249	308	437	643	938	1,338	1,629
Females	339	691	26.2	303	365	490	657	852	1,061	1,202
51–70 years	108	621	60.9	224	288	414	580	787	1,011	1,151
71+ years	231	701	27.3	314	380	501	668	862	1,067	1,209

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

– The usual intake distribution could not be reliably estimated for this subgroup.

Table D.12. Iron (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	12.8	0.50	6.3	7.3	9.3	12.1	15.5	19.3	21.8
Males	220	14.1	0.90	6.4	7.5	9.8	13.0	17.2	21.9	25.6
51–70 years	106	14.4	1.28	7.0	8.0	10.2	13.3	17.3	22.0	25.4
71+ years	114	14.1	1.11	6.3	7.4	9.6	12.9	17.2	22.3	26.0
Females	399	12.3	0.54	6.7	7.6	9.4	11.8	14.6	17.5	19.6
51–70 years	194	12.8	0.79	6.9	8.1	10.1	12.5	15.2	17.9	19.5
71+ years	205	12.2	0.67	6.4	7.3	9.0	11.5	14.6	18.0	20.4
All home-delivered meal program nonparticipants	514	12.2	0.33	5.5	6.5	8.6	11.5	15.0	19.0	21.8
Males	175	15.0	0.76	6.6	7.9	10.4	14.1	18.5	23.5	27.0
51–70 years	68	16.4	1.98	7.2	8.6	11.4	15.4	20.0	25.8	29.1
71+ years	107	14.8	0.81	6.5	7.8	10.4	13.9	18.3	23.2	26.3
Females	339	11.2	0.38	5.4	6.3	8.2	10.7	13.6	16.8	18.9
51–70 years	108	11.3	0.39	5.4	6.4	8.3	10.7	13.6	16.7	19.1
71+ years	231	11.4	0.43	5.5	6.5	8.3	10.9	13.9	17.1	19.4

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.13. Magnesium (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	232.7	8.36	106.7	126.0	164.8	219.0	284.5	358.4	408.3
Males	220	254.1	12.72	123.8	143.9	184.0	237.9	306.7	382.7	439.3
51–70 years	106	273.6	18.71	137.5	157.4	198.9	256.5	329.2	411.3	468.4
71+ years	114	248.6	14.39	122.7	142.8	179.9	232.4	299.1	377.3	431.8
Females	399	224.1	8.94	100.2	120.1	158.0	210.9	275.3	344.6	394.1
51–70 years	194	254.4	17.22	114.7	140.9	186.2	244.7	312.4	383.0	425.1
71+ years	205	216.6	10.48	99.3	117.2	152.2	201.9	264.8	334.2	384.7
All home-delivered meal program nonparticipants	514	224.0	6.69	122.2	139.7	172.3	215.3	265.6	319.6	356.3
Males	175	254.8	14.28	127.1	146.9	184.5	239.4	306.0	384.4	439.3
51–70 years	68	312.3	46.95	122.4	149.1	205.1	287.1	386.6	515.1	591.7
71+ years	107	245.9	14.05	129.2	147.7	183.7	233.1	293.2	362.6	407.3
Females	339	212.1	6.62	123.3	139.1	169.1	206.9	248.9	292.3	320.6
51–70 years	108	189.9	12.23	91.7	110.0	143.3	183.8	230.7	278.6	307.4
71+ years	231	215.2	6.53	128.1	144.4	172.9	210.0	251.1	292.9	321.0

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.14. Phosphorus (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	1,016	31.4	469	559	736	972	1,244	1,535	1,724
Males	220	1,116	52.7	586	677	850	1,070	1,333	1,606	1,798
51–70 years	106	1,187	68.6	647	734	909	1,139	1,412	1,703	1,897
71+ years	114	1,095	61.4	587	677	837	1,050	1,304	1,582	1,765
Females	399	976	32.3	422	517	693	930	1,207	1,492	1,688
51–70 years	194	1,094	69.6	508	627	825	1,068	1,336	1,603	1,757
71+ years	205	947	39.5	400	489	659	893	1,176	1,473	1,681
All home-delivered meal program nonparticipants	514	991	29.4	516	600	754	955	1,187	1,431	1,594
Males	175	1,172	74.1	594	681	848	1,096	1,401	1,769	2,031
51–70 years	68	1,429	151.1	796	896	1,095	1,367	1,679	2,063	2,286
71+ years	107	1,131	72.2	576	660	826	1,060	1,353	1,701	1,931
Females	339	923	26.8	521	597	738	908	1,089	1,269	1,383
51–70 years	108	873	64.8	379	476	648	851	1,078	1,303	1,435
71+ years	231	931	27.9	537	615	748	916	1,094	1,268	1,382

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.15. Zinc (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	9.2	0.39	3.9	4.7	6.3	8.5	11.3	14.6	16.9
Males	220	10.6	0.70	4.0	5.0	6.9	9.6	13.3	17.4	20.6
51–70 years	106	12.2	1.12	5.3	6.2	8.2	11.0	14.9	19.6	23.0
71+ years	114	10.1	0.80	3.9	4.8	6.6	9.3	12.7	16.6	19.4
Females	399	8.6	0.38	4.1	4.8	6.2	8.1	10.4	13.0	14.9
51–70 years	194	9.5	0.70	6.1	6.8	8.0	9.4	10.9	12.5	13.4
71+ years	205	8.4	0.51	3.7	4.4	5.7	7.7	10.3	13.3	15.6
All home-delivered meal program nonparticipants	514	8.9	0.35	3.8	4.5	6.0	8.2	10.9	14.1	16.4
Males	175	11.3	0.63	4.9	5.8	7.6	10.4	13.8	18.0	21.0
51–70 years	68	13.0	1.88	5.8	6.8	8.8	11.9	15.7	20.9	24.0
71+ years	107	11.0	0.58	4.8	5.7	7.5	10.2	13.5	17.5	20.1
Females	339	8.0	0.36	3.7	4.3	5.7	7.5	9.8	12.3	14.1
51–70 years	108	7.7	0.54	4.7	5.3	6.3	7.6	9.0	10.4	11.3
71+ years	231	8.1	0.39	3.7	4.4	5.7	7.5	9.8	12.4	14.3

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.16. Potassium (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	2,110	70.6	954	1,145	1,519	2,018	2,592	3,206	3,603
Males	220	2,354	126.7	1,113	1,320	1,723	2,241	2,866	3,518	3,980
51–70 years	106	2,535	193.1	1,294	1,492	1,893	2,423	3,054	3,724	4,168
71+ years	114	2,303	143.9	1,074	1,286	1,668	2,187	2,810	3,496	3,949
Females	399	2,010	70.7	908	1,102	1,458	1,930	2,470	3,020	3,394
51–70 years	194	2,263	117.1	1,069	1,298	1,689	2,188	2,757	3,344	3,692
71+ years	205	1,947	84.7	877	1,063	1,411	1,869	2,398	2,932	3,294
All home-delivered meal program nonparticipants	514	2,156	65.2	1,076	1,265	1,616	2,074	2,600	3,154	3,524
Males	175	2,424	115.7	1,320	1,516	1,868	2,346	2,878	3,454	3,830
51–70 years	68	2,557	254.7	1,496	1,697	2,067	2,521	2,984	3,492	3,760
71+ years	107	2,402	131.3	1,260	1,453	1,820	2,305	2,871	3,496	3,884
Females	339	2,051	66.6	1,015	1,195	1,542	1,986	2,483	2,999	3,336
51–70 years	108	1,700	120.4	700	863	1,178	1,593	2,113	2,684	3,044
71+ years	231	2,098	70.2	1,070	1,261	1,597	2,037	2,525	3,019	3,349

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.17. Dietary fiber (g): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	13	0.6	5	7	9	13	17	21	25
Males	220	14	0.8	6	7	9	13	17	22	25
51–70 years	106	14	1.2	5	7	9	12	17	23	27
71+ years	114	14	0.9	6	7	10	13	17	22	25
Females	399	13	0.7	5	7	9	13	17	21	24
51–70 years	194	15	1.2	7	8	11	14	18	22	24
71+ years	205	13	0.8	5	6	8	12	16	21	25
All home-delivered meal program nonparticipants	514	13	0.5	5	6	9	12	17	21	25
Males	175	15	0.8	6	7	10	14	18	24	27
51–70 years	68	15	2.3	6	7	10	14	19	26	30
71+ years	107	15	0.9	6	7	10	14	18	23	27
Females	339	13	0.6	5	6	8	12	16	20	23
51–70 years	108	11	0.9	3	4	7	10	14	18	20
71+ years	231	13	0.6	5	6	9	12	16	21	24

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.18. Sodium (mg): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	2,747	84.0	1,323	1,554	2,009	2,622	3,337	4,117	4,628
Males	220	3,012	144.3	1,471	1,723	2,216	2,857	3,644	4,478	5,077
51–70 years	106	3,286	187.8	1,844	2,072	2,535	3,148	3,885	4,678	5,212
71+ years	114	2,932	169.3	1,427	1,683	2,146	2,780	3,549	4,407	4,979
Females	399	2,639	87.0	1,274	1,509	1,941	2,524	3,206	3,915	4,408
51–70 years	194	2,928	189.1	1,273	1,587	2,128	2,821	3,616	4,435	4,921
71+ years	205	2,569	99.5	1,276	1,486	1,887	2,437	3,106	3,818	4,323
All home-delivered meal program nonparticipants	514	2,696	81.7	1,351	1,576	2,001	2,571	3,246	3,982	4,486
Males	175	3,440	161.4	1,999	2,236	2,672	3,291	4,020	4,860	5,440
51–70 years	68	3,777	477.9	1,927	2,198	2,750	3,540	4,489	5,724	6,470
71+ years	107	3,391	168.8	2,056	2,282	2,711	3,275	3,935	4,671	5,133
Females	339	2,431	84.2	1,317	1,514	1,888	2,364	2,894	3,442	3,800
51–70 years	108	2,313	154.3	1,696	1,823	2,040	2,290	2,566	2,838	2,996
71+ years	231	2,453	96.9	1,306	1,517	1,888	2,379	2,929	3,489	3,868

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.19. Protein (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	16.6	0.26	11.7	12.7	14.4	16.4	18.6	20.8	22.2
Males	220	16.3	0.42	12.6	13.3	14.6	16.1	17.8	19.5	20.6
51–70 years	106	17.4	0.66	11.5	12.5	14.4	16.9	19.9	23.1	25.2
71+ years	114	16.3	0.43	12.6	13.3	14.6	16.2	17.8	19.5	20.6
Females	399	16.7	0.33	11.6	12.6	14.4	16.6	18.9	21.0	22.4
51–70 years	194	17.2	0.47	11.2	12.5	14.7	17.1	19.7	22.1	23.4
71+ years	205	16.6	0.41	11.8	12.7	14.3	16.4	18.6	20.8	22.3
All home-delivered meal program nonparticipants	514	16.5	0.33	11.6	12.6	14.2	16.3	18.5	20.8	22.3
Males	175	17.2	0.48	12.3	13.2	14.8	16.9	19.2	21.6	23.2
51–70 years	68	18.8	1.76	13.5	14.5	16.3	18.5	20.9	23.7	25.2
71+ years	107	17.0	0.46	11.7	12.7	14.4	16.6	19.1	21.8	23.4
Females	339	16.2	0.42	11.4	12.4	14.0	16.0	18.2	20.3	21.7
51–70 years	108	16.4	0.75	10.1	11.3	13.5	16.0	19.0	22.0	23.8
71+ years	231	16.2	0.47	11.6	12.5	14.1	16.1	18.1	20.1	21.4

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.20. Carbohydrate (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	49.0	0.63	36.9	39.5	44.0	49.0	53.9	58.4	61.1
Males	220	46.9	1.13	30.7	34.5	40.8	47.1	53.3	58.7	62.1
51–70 years	106	47.3	1.91	28.9	32.9	39.9	47.5	55.0	61.7	65.6
71+ years	114	46.9	1.18	32.8	36.3	41.5	47.1	52.5	57.3	60.1
Females	399	49.9	0.77	40.0	42.2	45.8	49.9	53.9	57.6	59.9
51–70 years	194	48.7	1.14	39.8	41.8	44.9	48.5	52.3	55.9	57.9
71+ years	205	50.3	0.93	39.1	41.7	45.8	50.4	54.9	58.9	61.3
All home-delivered meal program nonparticipants	514	49.4	0.60	37.7	40.2	44.4	49.3	54.2	58.9	61.8
Males	175	46.6	0.95	33.7	36.7	41.3	46.7	51.8	56.6	59.4
51–70 years	68	43.7	2.66	30.8	34.1	39.2	44.3	48.7	52.9	55.0
71+ years	107	47.1	1.06	34.1	37.0	41.7	47.1	52.4	57.5	60.3
Females	339	50.2	0.74	40.0	42.0	45.7	50.0	54.4	58.6	61.2
51–70 years	108	49.2	1.96	37.8	40.0	43.9	48.5	53.8	59.3	62.6
71+ years	231	50.3	0.85	40.2	42.4	45.9	50.2	54.5	58.6	61.1

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.21. Total fat (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	34.9	0.48	25.8	27.8	31.2	35.0	38.6	42.0	43.9
Males	220	36.1	0.88	25.9	28.1	31.8	35.9	40.2	44.1	46.7
51–70 years	106	36.1	1.72	22.6	25.2	30.1	35.7	41.8	47.5	51.1
71+ years	114	36.1	1.03	28.8	30.4	33.0	36.0	39.1	42.2	44.0
Females	399	34.5	0.55	25.9	27.9	31.1	34.6	37.9	40.9	42.7
51–70 years	194	34.4	0.56	25.9	27.7	31.1	34.5	37.8	40.9	42.6
71+ years	205	34.3	0.70	22.8	25.6	29.9	34.5	39.0	42.9	45.3
All home-delivered meal program nonparticipants	514	35.2	0.52	25.4	27.6	31.2	35.2	39.1	42.7	44.9
Males	175	36.7	0.80	27.1	29.2	32.5	36.6	40.6	44.5	46.9
51–70 years	68	36.5	2.10	28.6	30.1	32.8	36.1	39.6	43.5	45.6
71+ years	107	36.8	0.90	26.6	28.9	32.6	36.8	40.9	44.8	47.0
Females	339	34.5	0.62	25.2	27.3	30.8	34.6	38.4	41.8	43.8
51–70 years	108	35.6	1.54	24.4	27.1	31.8	36.0	40.0	43.4	45.2
71+ years	231	34.5	0.69	25.2	27.3	30.7	34.5	38.3	41.6	43.7

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.22. Linoleic acid (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	6.8	0.13	4.1	4.6	5.5	6.7	7.9	9.1	9.9
Males	220	6.9	0.28	4.1	4.7	5.7	6.8	8.0	9.2	10.0
51–70 years	106	6.3	0.57	2.2	2.8	4.1	5.9	8.1	10.5	12.1
71+ years	114	7.1	0.34	5.3	5.7	6.3	7.0	7.8	8.6	9.0
Females	399	6.8	0.17	4.0	4.6	5.5	6.6	7.9	9.1	9.9
51–70 years	194	7.3	0.44	5.1	5.6	6.3	7.2	8.2	9.1	9.7
71+ years	205	6.6	0.21	3.8	4.3	5.3	6.5	7.8	9.1	9.9
All home-delivered meal program nonparticipants	514	6.8	0.22	4.5	4.9	5.7	6.7	7.7	8.7	9.4
Males	175	6.9	0.37	4.0	4.5	5.4	6.6	8.0	9.7	10.8
51–70 years	68	6.8	0.75	4.4	4.8	5.6	6.6	7.8	9.2	10.0
71+ years	107	6.9	0.41	3.9	4.4	5.4	6.6	8.1	9.7	10.7
Females	339	6.7	0.28	4.8	5.2	5.8	6.6	7.5	8.3	8.8
51–70 years	108	6.0	0.47	3.6	4.1	4.9	5.9	7.0	8.1	8.8
71+ years	231	6.8	0.30	5.1	5.4	6.0	6.7	7.5	8.2	8.6

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.23. Alpha-linolenic acid (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	0.7	0.02	0.4	0.4	0.5	0.7	0.9	1.1	1.2
Males	220	0.7	0.04	0.4	0.4	0.5	0.7	0.8	1.0	1.2
51–70 years	106	0.7	0.06	0.3	0.4	0.5	0.6	0.8	1.1	1.2
71+ years	114	0.7	0.05	0.4	0.5	0.6	0.7	0.8	1.0	1.1
Females	399	0.7	0.03	0.4	0.4	0.5	0.7	0.9	1.1	1.2
51–70 years	194	0.8	0.06	0.5	0.5	0.6	0.7	0.9	1.1	1.2
71+ years	205	0.7	0.03	0.3	0.4	0.5	0.7	0.9	1.1	1.3
All home-delivered meal program nonparticipants	514	0.7	0.03	0.5	0.5	0.6	0.7	0.8	0.9	1.0
Males	175	0.7	0.03	0.4	0.4	0.5	0.7	0.8	1.1	1.2
51–70 years	68	0.7	0.08	0.4	0.4	0.5	0.6	0.8	1.0	1.1
71+ years	107	0.7	0.04	0.4	0.4	0.5	0.7	0.9	1.1	1.2
Females	339	0.7	0.03	0.5	0.5	0.6	0.7	0.8	0.9	1.0
51–70 years	108	0.6	0.05	0.4	0.4	0.5	0.6	0.6	0.7	0.8
71+ years	231	0.7	0.03	0.5	0.5	0.6	0.7	0.8	0.9	1.0

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

Table D.24. Saturated fat (as a percentage of calories): Usual nutrient intakes of congregate and home-delivered meal program nonparticipants

				Percentiles						
	N	Mean	SE	5th	10th	25th	50th	75th	90th	95th
All congregate meal program nonparticipants	619	11.5	0.24	7.8	8.5	9.8	11.4	13.0	14.6	15.6
Males	220	11.8	0.35	7.8	8.6	10.0	11.7	13.5	15.3	16.4
51–70 years	106	12.2	0.57	7.7	8.5	10.0	11.9	14.1	16.3	17.7
71+ years	114	11.8	0.45	8.2	9.0	10.2	11.7	13.2	14.8	15.7
Females	399	11.4	0.28	7.8	8.6	9.8	11.3	12.8	14.2	15.1
51–70 years	194	11.2	0.44	9.3	9.7	10.4	11.2	12.0	12.8	13.2
71+ years	205	11.4	0.35	7.2	8.1	9.5	11.3	13.2	14.9	16.1
All home-delivered meal program nonparticipants	514	11.7	0.19	7.5	8.3	9.7	11.5	13.5	15.5	16.9
Males	175	12.3	0.49	7.3	8.2	9.7	11.8	14.2	17.0	19.0
51–70 years	68	12.6	1.31	8.2	8.9	10.4	12.3	14.4	16.9	18.4
71+ years	107	12.2	0.51	7.0	7.9	9.7	11.9	14.4	17.0	18.5
Females	339	11.5	0.24	7.7	8.4	9.7	11.3	13.0	14.8	15.9
51–70 years	108	12.3	0.64	8.0	9.0	10.5	12.2	14.0	15.7	16.7
71+ years	231	11.4	0.29	7.6	8.4	9.6	11.2	13.0	14.7	15.8

Source: AoA NSP 24-hour dietary recall (Day 1 and Day 2), 2015-2016, weighted data.

SE = standard error.

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