U.S. DEPARTMENT OF AGRICULTURE

WIC Infant and Toddler Feeding Practices Study-2

Year 9 Final Report

2025

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2025

Contract: GS-00F-009DA

Order: 12319820F0060

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This study was conducted by Westat under Contract No. GS-00F-009DA with the U.S. Department of Agriculture's (USDA) Food and Nutrition Service. The findings and conclusions in this report are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy.

Suggested Citation

Borger, C., Zimmerman, T. P., DeMatteis, J., Gollapudi, B., Thorn, B., Whaley, S. E., & Ritchie, L. (2025). *WIC Infant and Toddler Feeding Practices Study-2: Year 9 report*. Westat. U.S. Department of Agriculture, Food and Nutrition Service. The study was conducted by Westat under Contract No. GS-00F-009DA.

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Acknowledgments

There are many people who deserve acknowledgment for the success of this longitudinal study. Susie McNutt had a vision from which this project developed. She, Gail Harrison, May Wang, Crystal Macallum, and Jacque Wernimont successfully launched the work with the original intention of following study children through age 2 years. Through several study extensions, Nancy Weinfield demonstrated successful leadership, and so did Janice Machado. Laurie May's thought leadership was invaluable during this period. Lauren Au and Hannah Thompson also contributed to important advancements in analyses specific to the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The systems used over the course of the study would not have functioned so well without Beth Mittl's leadership. Brenda Sun's leadership of all coding efforts over all years of the study contributed insightful analysis execution. Quality assurance review by Chris Logan elevated the work further. The importance of the study liaisons for engaging and retaining participants cannot be overstated. We are deeply thankful to Terry Aranda for her leadership in this area.

For this study, the Westat team benefited tremendously from collaboration with the U.S. Department of Agriculture's Food and Nutrition Service. Jay Hirshman's contributions focused the team on issues critical for WIC. Input from Contracting Officer's Representatives, including Renee Arroyo-Lee Sing, Tamika Owens, Allison Magness, Courtney Paolicelli, Danielle Berman, Amanda Reat, and Kavitha Sankavaram, were outstanding collaborators on the project. Additionally, the study benefited from Kelly Scanlon's support and expertise in child nutrition.

Finally, though most active in the early years of the study, the Peer Advisory Panel offered guidance on study design and analysis issues that influenced the trajectory of the entire study. Composed of experts in the fields of child development, infant feeding, and WIC research, the panel included Maureen Black (Department of Pediatrics and Epidemiology, University of Maryland); Sally Findley (Columbia University Population Center); Larry Grummer-Strawn (formerly of the Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention); Suzanne Murphy (Cancer Research Center of Hawaii, University of Hawaii); Zoë Neuberger (Center on Budget and Policy Priorities); Peggy Trouba (State WIC Director, Nebraska Department of Health and Human Services); and Pat Crawford (Nutrition Policy Institute, Division of Agriculture and Natural Resources, University of California).

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Chapter 1

Background and Methodological Overview

This chapter overviews the methodological approach taken for this report, the final one in a series presenting information from the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2.

A. WIC

The Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to safeguard the health of low-income pregnant and postpartum women, infants, and children up to age 5 years who are at nutritional risk. Participants must meet the residency requirements and have a household income at or below 185 percent of the Federal poverty guidelines (FPG)[1] ($51,338 for a family of four in 2022[2]) or be eligible because they participate in other means-tested benefit programs (e.g., Medicaid). The Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) administers WIC, through Federal grant programs, to 89 WIC State agencies, including Indian Tribal Organizations (ITOs) and U.S. territories. The State agencies are responsible for program operations within their jurisdictions and provide services primarily through local agencies (e.g., health departments, community centers, hospitals) that serve WIC participants at local service sites or clinics.

WIC provides a range of benefits to program participants. Benefits include electronic benefit transfer (EBT) cards (or vouchers) to purchase supplemental nutritious foods; nutrition education, including breastfeeding support through access to peer counselors and lactation consultants; and referrals for health screenings, immunizations, and other social services (FNS, 2025).

B. WIC ITFPS-2

WIC Infant and Toddler Feeding Practices Study-2 (ITFPS-2) is a longitudinal study designed to examine changes over time in caregiver feeding practices and the nutrition- and health-related outcomes of children who begin life participating with WIC. The study began collecting data from prenatal WIC enrollees and postnatal WIC enrollees with a newborn less than 3 months old who joined the study from sampled WIC clinics in fall 2013. Once enrolled in WIC ITFPS-2, study participants did not need to stay with WIC to continue with the study. The study followed the same

Purpose of WIC ITFPS-2

- Describe child feeding practices.
- Assess associations between child feeding practices and—
  - WIC services
  - Health-related outcomes, for example:
    - Body mass index
    - Allergies
    - Developmental milestones
  - Nutrition-related outcomes, for example:
    - Macronutrient intake
    - Micronutrient intake
    - Healthy Eating Index-2020 scores
- Assess associations between duration of WIC participation and health- and nutrition-related outcomes.

[1] The historical FPG through 2024 are available at U.S. Department of Health and Human Services (HHS, 2024).
[2] The income-poverty variable used for analysis in this report is based on the 2022 values. Values vary by State. This is the value for a family of 4 in the 48 contiguous states and the District of Columbia. In Alaska, the 2022 value is $64,177. In Hawaii, the 2022 value is $59,052.

cohort of children until they were 9 years old, 4 years after they were no longer age eligible for WIC services.

By capturing data on children over the first 9 years of life, the study addresses a series of research questions about feeding young children who begin life participating with WIC, the association between WIC services and caregiver feeding practices, and the health- and nutrition-related outcomes of children currently or previously participating with WIC. In the early years, the study focused on infant and toddler feeding practices, use of WIC services, and children's nutrition and health-related outcomes. In the later years, the study also examined associations between duration of participation in WIC and children's nutrition- and health-related outcomes.[3]

This is the final report in a series of reports detailing findings from WIC ITFPS-2.[4] This chapter overviews the methodological approach.[5] Chapter 2 presents sociodemographic information about study families and children, including household and child food security status. Chapter 3 overviews select caregiver feeding practices and the study child's eating environment in the home. Chapters 2 and 3 contextualize the nutrition outcomes presented in chapters 4 and 5. Chapter 4 focuses on children's diet quality examining dietary intakes relative to the *Dietary Guidelines for Americans* (USDA & HHS, 2020). Chapter 5 focuses on children's intake of nutrients of public health concern. Finally, chapter 6 summarizes the findings and discusses the study's limitations.

1. Timing of Data Collection

The data used in this report were collected between June 2022 and August 2023.[6] The majority (90%) were collected before the expiration of the COVID-19 health emergency. The COVID-19 health emergency may influence findings throughout this report, as it did with the *WIC ITFPS-2: Sixth Year Report* (Borger et al., 2024).

At the time of data collection for this report, the study children had not been age eligible to participate in WIC for 4 years. However, study families may have participated with WIC for a non-study child and/or for the caregiver or both at any time during these 4 years since the study child turned 5 years old. This report explores nutrition-related outcomes associated with the current WIC participation as well as the study child's past WIC participation.

Though this report focuses on outcomes when the study child was 9 years old, it draws from data collected over the entire decade of the study. Trained interviewers collected study baseline information shortly after study participants enrolled in WIC for the first time for their pregnancy or newborn less than 3 months old, or at the 1- or 3-month interview. Throughout the first year of the study child's life, primary caregivers continued to participate in telephone interviews every 2 months to capture rapidly changing feeding practices as infants develop. In the second year of

[3] Appendix A, table A.1, offers the list of the research questions that the study answers.
[4] Prior reports can be found at Food and Nutrition Services. (2024). *Data & research*. U.S. Department of Agriculture. https://www.fns.usda.gov/data-research?keywords=itfps&sort_bef_combine=created_1_DESC
[5] Detailed information on the study is available in appendix A.
[6] Appendix table A.3 presents the opening and closing dates for each interview.

the study child's life, telephone interviews occurred every 3 months. In the third, fourth, and fifth years, interviews took place every 6 months. There was a 1-year break between the age 5 and age 6 interviews and a 3-year break between the age 6 and age 9 interviews.

Sample Analyzed

While participants in WIC ITFPS-2 are caregiver-child dyads, the study follows the child. Therefore, caregivers may change over time, but the child remains focal. Throughout this report, the discussion refers to the "study" child to distinguish this child from other family members.

To be eligible to participate in WIC ITFPS-2, caregivers of study children met the following criteria:

- Were at least 16 years old at the time of WIC enrollment
- Spoke either English or Spanish
- Were enrolling in WIC for the first time for their current pregnancy or for their child less than 3 months old[7] between July and November 2013 at a sampled WIC site expected to enroll at least 30 new pregnant women or infants per month

The sample used for analysis is the group of study participants who responded to every postnatal interview. The first interview was at 1 or 3 months of age, depending on when the child entered the study, and then at ages 5, 7, 9, 11, 13, 15, 18, 24, 30, 36, 42, 48, 54, 60, and 72 months and at 9 years (unweighted n = 682).[8] This group represents about half of the total number of respondents to the Year 9 interview (unweighted n = 1,382). For convenience, the text refers to the sample used as "the longitudinal sample." Additionally, after the 15-month interview, the text references the study child's age in years, not months. For example, the 36-month interview is the interview at age 3 years, and the 42-month interview is the interview at age 3.5 years. This reframing aligns the discussion with reference to the Year 9 interview, which took place around the study child's ninth birthday. Study participants completed 17 or 18 postnatal interviews depending on the age of the child at study enrollment.

Study findings represent the characteristics, views, behaviors, and experiences of the study-eligible population (i.e., study-eligible pregnant and early postpartum women and their infants who enrolled at eligible WIC clinics in July through November 2013). The statistical weights inflate this sample to represent the study-eligible population and compensate for both the unequal sampling rates of different groups[9] and nonresponse of study-eligible participants. Because the recruitment period for WIC ITFPS-2 spanned 20 weeks, the weighted number of cases shown in the report tables is a national estimate of study-eligible 9-year-old children who enrolled in WIC around the time of birth during that 20-week period (July through November 2013). It is not an

[7] For sampling, the age cutoff for the child was 3 months. To provide time to respond to the interview, this age was operationalized during recruitment as eligible for enrollment if the child was less than 2.5 months old, assuming other eligibility criteria were met.

[8] One case was missing the pattern of WIC participation. If this case is added to the analysis, unweighted n = 683 and weighted n = 440,188. Appendix A details different samples available for analyses.

[9] Unequal sampling rates (i.e., variations in probabilities of selection) in both the core and combined samples were due to (1) variations in the probabilities of selection of sites; (2) differential subsampling of new WIC enrollees into the core and supplemental samples based on demographics; and (3) changes in sampling rates that were made partway through the study recruitment period affected by extending the recruitment windows for remaining sites and eliminating the subsampling of participants.

estimate of the monthly or annualized total number of WIC participants nationally and should not be interpreted as such. The weighted sample size of the longitudinal sample at age 9 is 439,117. Unless otherwise noted, all analyses represent weighted estimates.

2. Pattern of WIC Participation

This report presents findings on the nutrition-related outcomes of study children who previously participated in WIC. Caregiver report, not administrative data, determined WIC participation. In the *WIC ITFPS-2: Fifth Year Report* (Borger, Zimmerman, et al., 2022, chapter 7), the study team introduced a variable categorizing study children's patterns of WIC participation over the period of age eligibility, birth through age 5. Table 1.1 presents the percentages of study participants by their pattern of WIC participation over the first 5 years of the study child's life. Categories of participation were collapsed from the original specification to increase cell sizes for analysis. One case from the longitudinal sample reported that she did not participate with WIC postnatally.

The first two categories in table 1.1 indicate the duration of WIC participation based on caregiver responses to the surveys. The first category, "No longer receiving WIC benefits after age 3," includes study children who participated with WIC up to age 3. The second category, "Still receiving WIC benefits after age 3," includes study children who participated with WIC beyond age 3. The third category, "Received WIC benefits intermittently during the first 5 years of life," captures families that cycled in and out of the program. It does not reflect the duration of WIC participation.

Table 1.1. The percentage of study participants by pattern of participation in WIC (longitudinal cohort)

Patterns of WIC participation[a]	Study child and/or caregiver	
	% (Standard error)	Unweighted n
No longer receiving WIC benefits after age 3[b]	25.0 (2.8)	173
Still receiving WIC benefits after age 3[c]	62.7 (2.9)	423
Received WIC benefits intermittently during the first 5 years of life	12.3 (1.6)	86
Unweighted *n*[d]	N/A	682
Weighted *n*	N/A	439,117

N/A = not applicable

[a] Categories of WIC participation are mutually exclusive.

[b] Study children may have stopped participating with WIC after their first, their second, or their third year of life.

[c] Study children may have stopped participating with WIC after their fourth year, participated into their fifth year, or participated consistently over the first 5 years of life. "Consistently" means the respondent indicated that either the study child or the caregiver was receiving WIC in Years 1 and 2 and in all subsequent survey months through the 54-month interview.

[d] One of the prenatal WIC enrollees who enrolled in the study indicated at every postnatal interview that she was not participating with WIC. This study participant is excluded from this table.

Because the study follows a study child, the pattern of participation variable is often referred to as the child's pattern of WIC participation; however, given the survey item used to assess participation, caregiver participation may be included.[10] The study child's pattern of WIC participation is a focal analytical variable in this report. It is not known how study participation influenced WIC participation.

3. Analysis Approach

Analyses in this report focus on associations between study children's past participation with WIC using the patterns variable described previously and their dietary outcomes at age 9. In addition to focusing on past participation with WIC, this report also highlights associations between current WIC participation (for the caregiver or a non-study child) and dietary outcomes when the study child was age 9. Current participation with WIC may affect household food resources through the supplemental food package, while continuing exposure to nutrition education may affect diet-related choices. Consequently, 9-year-old children in families that continue with WIC for a non-study child or caregiver may have different outcomes than peers who no longer have any exposure to WIC.

The analysis primarily relied on chi-square tests of association and *t* tests to assess bivariate associations between categorical variables. Multivariable regression analysis was used to assess independent associations. Results from multivariable logistic regression are described using the odds ratio (OR). Simply put, the OR describes the likelihood of an event occurring after exposure. Tenny and Hoffman (2017) provide more information on ORs.

Statistical significance was determined at $p \leq 0.05$. Associations were tested for all outcomes of interest except in cases where the standard error for an estimate from external sources was not available.

[10] The survey item (SD31) reads, "Are you currently getting WIC food or checks for yourself or {CHILD}?" Appendix E contains the survey instruments for WIC ITFPS-2.

Chapter 2

Sociodemographic Characteristics

This chapter describes the following findings from the Year 9 interview for the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2:

- *Most study children (84%) lived in households with at least one sibling.*
- *About two of three (64%) caregivers were employed for pay, and many were employed full time (47%).*
- *About four of five (79%) families reported annual household income at or below 185 percent of the Federal poverty guidelines, the income eligibility threshold for WIC.*
- *About one of five (19%) households continued to participate with WIC either for the caregiver or a non-study child.*
- *Slightly more than two of five (43%) households received Supplemental Nutrition Assistance Program benefits.*
- *About four of five (79%) households reported participation in school or summer meal programs.*
- *Slightly more than one of four (26%) households reported being food insecure, compared with about one of six (17%) households with children nationally.*
- *About 10 percent of households receiving WIC reported child food insecurity, compared with 9 percent nationally.*

A. Introduction

This chapter focuses on participant and household characteristics of study families. Topics covered contextualize information presented in subsequent chapters. In addition to presenting findings from the Year 9 interview, the discussion highlights change over time using data from all years of the study.

B. Number of Children, Income, and Employment

Between enrollment in the study and the study child turning age 9, study families changed in ways that may influence the study child's eating environment and nutritional outcomes. This section highlights changes in household size, income, and employment over the course of the study. Findings at study baseline were collected when the caregiver was enrolling in Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) for the first time for the pregnancy or newborn, or when the study child was 1 or 3 months old. The Year 9 data were collected between June 2022 and August 2023. Information on the timing of data collections between these two points is in appendix A, table A.3.

1. Number of Children

At age 9, the study child was the only child in one of every six (16%) study families. About one of three (34%) study families had two children, slightly fewer (31%) had three children, and about one of five (20%) had four or more children. The mean number of children in study families was 2.6, and the median number was 2.0. Two of every five (42%) study children were the first-born child in their household.

2. Household Income

Household income plays a significant role in food resources and feeding opportunities available to children and is an eligibility criterion for participation in many Federal nutrition assistance programs. This study uses the Federal poverty guidelines (FPG) to assess income. The FPG represents income thresholds to establish income eligibility for many Federal programs.

At baseline, nearly three of four (73%) caregivers reported annual household incomes at or below 100 percent of the FPG—$23,550 per year for a family of 4 in the 48 contiguous States in 2013.[11] One hundred percent of FPG is the minimum income a family needs to cover basic needs. When the study child was age 9, just under half (45%) of caregivers reported household income at or below 100 percent of the FPG—$27,750 per year for a family of 4 in the 48 contiguous States in 2022.[12] The decline over the course of the study in the percentage of households with income at

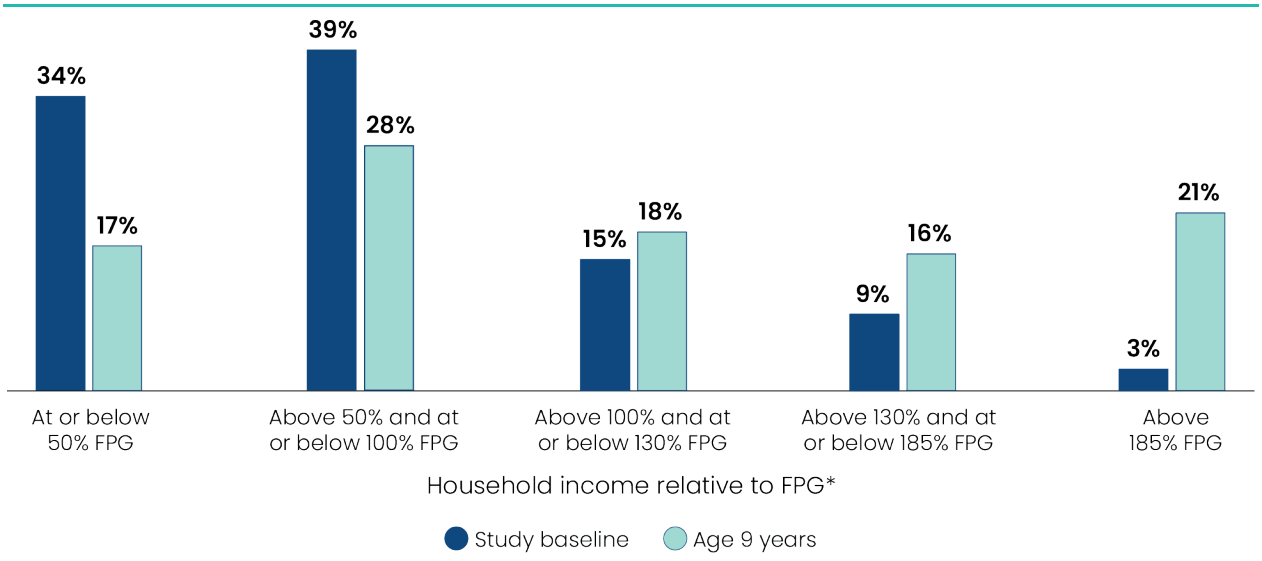
[11] A common income eligibility limit for WIC participation is 185 percent of the FPG. The 2013 FPG used in this report can be found at https://aspe.hhs.gov/2013-poverty-guidelines#guidelines.

[12] A common income eligibility limit for WIC participation is 185 percent of the FPG. The 2022 FPG used in this report can be found at https://aspe.hhs.gov/sites/default/files/documents/4b515876c4674466423975826ac57583/Guidelines-2022.pdf.

or below 100 percent of FPG indicates that many households had more income when the study child was older.

At study baseline, about one of three (34%) study households had income at or below 50 percent of FPG (figure 2.1), an extreme level of poverty.[13] By age 9, the percentage had declined to around one of six households (17%). The finding for households with annual incomes between 50 and 100 percent of FPG is similar: Nearly 4 of 10 (39%) had income between 50 and 100 percent of FPG at the study baseline, and 3 of 10 (28%) at age 9. When assessing incomes exceeding 100 percent of FPG, the changes between baseline and Year 9 show increases in the percentage of households in each range: above 100 percent and at or below 130 percent of FPG, above 130 percent and at or below 185 percent of FPG, and above 185 percent of FPG. Increasing rates of caregiver full-time employment discussed subsequently in this report and emergency benefits received during the COVID-19 health emergency may have contributed to this shift toward higher incomes in study households.

Figure 2.1. Percentage of study households by income relative to the Federal poverty guidelines at study baseline and Year 9



Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. Numbers reflect rounding. More information on the data presented is available in appendix D1.
FPG = Federal poverty guidelines
* Household income relative to FPG was based on self-report and did not include a review of documentation as is done to determine WIC eligibility. Adjunctive eligibility with Medicaid can result in some families having household income exceeding 185 percent of the FPG. Moreover, income may have changed between WIC enrollment and the first interview.

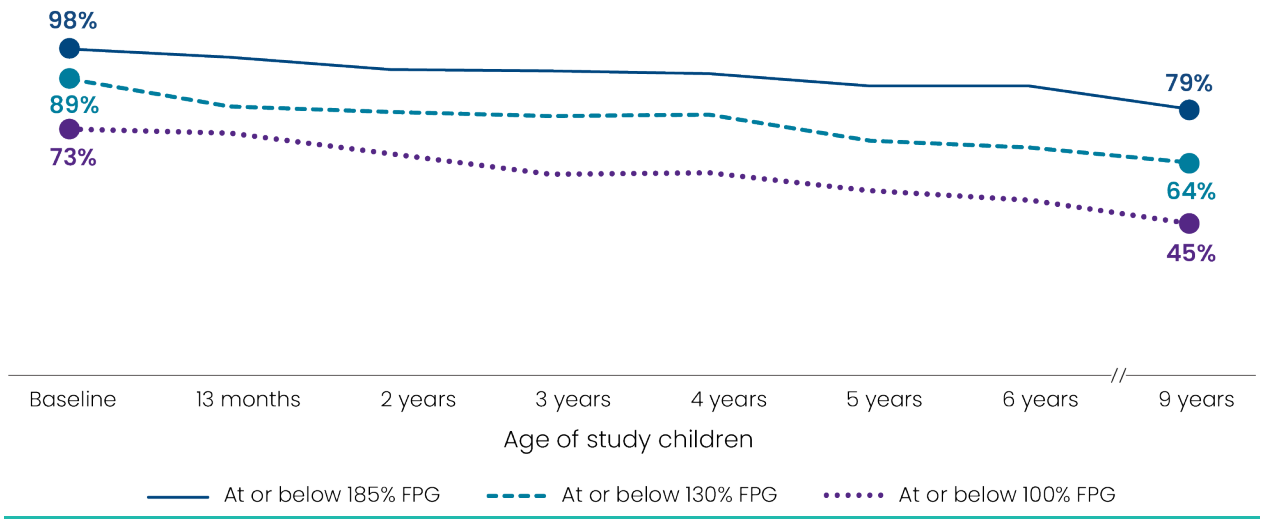
Despite household income rising for many, most study households had low incomes when the study child was age 9. More than three of four (79%) caregivers reported annual household income at or below 185 percent of the FPG, the income eligibility threshold for WIC. About two of

[13] Fifty percent of FPG is $13,875 per year for a family of 4 in the 48 contiguous States in 2022.

three (64%) caregivers reported household income at or below 130 percent of the FPG, a typical income cutoff for participation in the Supplemental Nutrition Assistance Program (SNAP).

Figure 2.2 presents the trend over time of households with income below 185 percent, 130 percent, and 100 percent of the FPG. Households may be eligible for WIC by participating in Medicaid, which in some States has income eligibility thresholds higher than 185 percent of the FPG. A very small percentage of households (2.5%) reported household income above 185 percent of FPG at the study baseline. As study children grew older, the percentage of households with income at or below 185 percent of FPG declined, from 98 to 79 percent. The same downward trend is evident for incomes at or below 130 percent of FPG and incomes at or below 100 percent of FPG. The 28-percentage-point drop in the percentage of households with incomes at or below 100 percent of FPG is the largest of the three levels shown, representing a 38-percent decline in this extreme measure of income poverty over the course of the study.

Figure 2.2. Percentage of study households with incomes at or below 185, 130, and 100 percent of FPG between study baseline and Year 9



Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. It is possible that at the study participant's baseline interview, the study participant may not yet have received food benefits or checks for themselves or their child. The survey item (SD31) used to determine WIC participation reads, "Are you currently getting WIC food or checks for yourself or [CHILD]?" Based on survey responses, the analysis categorized five unweighted cases as not receiving WIC at the study baseline. Numbers reflect rounding.
FPG = Federal poverty guidelines

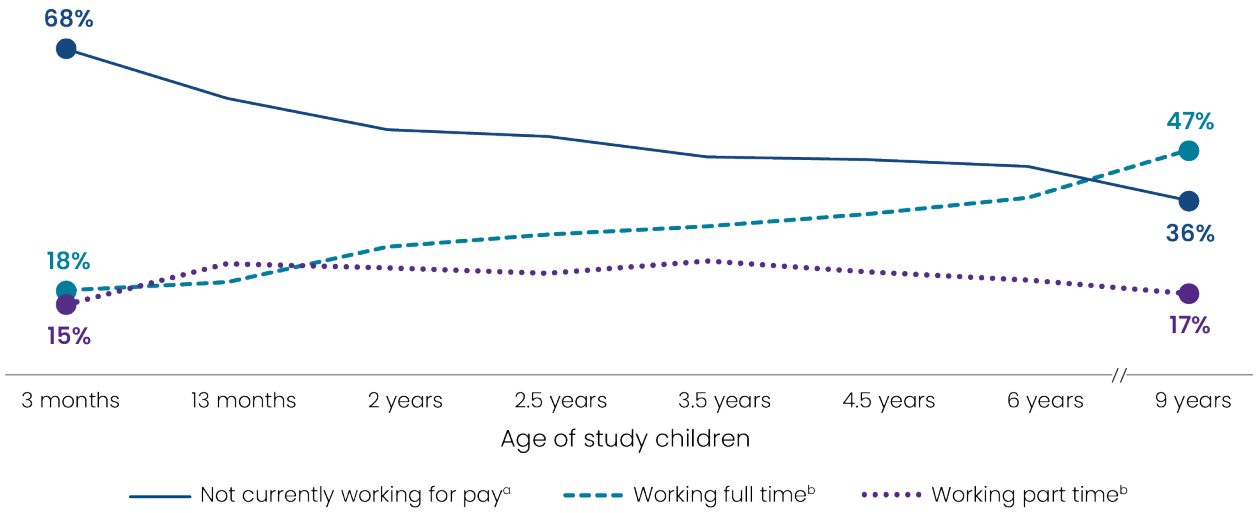
3. Employment

At 3 months postpartum, about 1 in 3 (32%) caregivers reported working for pay, either part time or full time. When the study child was 9 years old, nearly 2 of 3 (64%) caregivers reported working either part time or full time. The increase in employment may provide important contextual information for dietary findings presented in subsequent chapters because previous research using the WIC ITFPS2 data showed an inverse association between caregiver employment and

the number of times that the family eats together in a week, which was, in turn, positively associated with diet quality (Borger, Zimmerman, et al., 2022).

Full-time employment rose nearly 30 percentage points between study baseline and Year 9, from 18 percent to 47 percent (figure 2.3). The 10-percentage-point jump in full-time employment between ages 6 and 9 is particularly striking. It may reflect shifting childcare responsibilities after study children finished kindergarten. The divergence between full- and part-time employment is increasingly evident after age 2 years. About 1 in 5 (20%) caregivers worked part time over the entire interval. The rise in full-time employment explains most of the increase in employment over the course of the study.

Figure 2.3. Percentage of study caregivers by employment status between study baseline and Year 9



Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. More information on the data presented is available in appendix D1. Percentages may not sum to 100 percent because of rounding.
[a] Includes caregivers who attended school but were not employed.
[b] Includes caregivers who were attending school and employed.

C. Nutrition Assistance Program Participation

Household Participation in WIC, SNAP, and School Meals at Age 9

- WIC: 19 percent
- SNAP: 43 percent
- School meals: 79 percent

Federal nutrition assistance programs may play a vital role in augmenting household food resources for many study households. When the study child was age 9, about 8 of 10 (83%) study families reported participating in a combination of programs, including WIC, SNAP, and school meals, where school meals included the School Breakfast Program, the National School Lunch Program, and summer meal programs (see also callout box). Figure 2.4 presents information on participation in WIC, SNAP, and school meal

participation over the course of the study. Because the focus is on the trend, the figure includes the study baseline and Year 9 percentages only. Appendix table D1.6 offers the percentages at each age. In addition to labeling the horizontal axis with the age of the study child, month and year (M/YY) of data collection are reported because nutrition assistance programs underwent programmatic changes over the course of the study.

At the study baseline, 99 percent of study participants were participating with WIC (figure 2.4). This is not 100 percent because study participants may not have received their food benefits by the time of their first interview and the survey item used to assess WIC participation asked whether they had received this benefit.[14] Alternatively, some study participants may have been conditionally enrolled in WIC when they enrolled in WIC ITFPS-2, and by the time of their first interview, they were not eligible for the program. Over the course of the study, the percentage of households participating with WIC declined. Between the study baseline and age 5, the decline may reflect ineligibility due to rising income or barriers associated with accessing the program.[15]

Households Participation in SNAP and School Meals

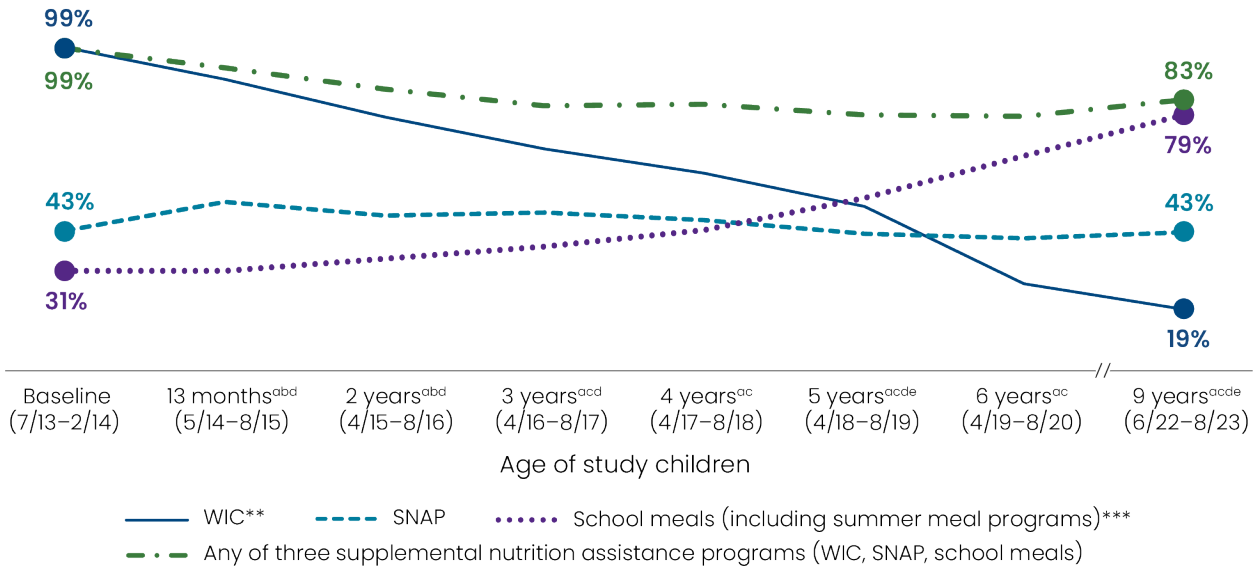
- At study child age 13 months, 3 percent of households were participating in SNAP and/or school meals and not WIC.
- At study child age 9, 64 percent of households were participating in SNAP and/or school meals and not WIC.

The percentage of families that received SNAP benefits rose significantly between the study baseline and study child age 13 months—from 43 percent to 52 percent (figure 2.4). WIC staff refer WIC participants to food assistance programs as needed, which may explain the early uptick. The percentage receiving SNAP declined significantly between age 13 months and 2 years—from 52 percent to 48 percent. Subsequent differences between interviews are not statistically significant.

[14] The survey item (SD31) used to determine WIC participation reads, "Are you currently getting WIC food or checks for yourself or [CHILD]?"

[15] The *WIC ITFPS-2: Fourth Year Report* discusses reasons study participants ceased participating with WIC. About 20 percent ceased participating before the study child's fourth year because they no longer qualified for the program, and about 40 percent of study participants ceased by that age because participating was inconvenient.

Figure 2.4. Percentage of study households by participation in Federal nutrition assistance programs between study baseline and Year 9



Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. WIC sites provided information on study participant enrollment in WIC. It is possible that at the study participant's baseline interview, the study participant may not yet have received food benefits or checks for themselves or their child. The survey item (SD31) used to determine WIC participation reads, "Are you currently getting WIC food or checks for yourself or [CHILD]?" Based on survey responses, the analysis categorized five unweighted cases as not receiving WIC at the study baseline. More information on the data presented is available in appendix D1.
SNAP = Supplemental Nutrition Assistance Program
[a] For WIC participation, pairwise *t* tests indicate that changes from the previous interview (13 months compared with baseline, 2 years compared with 13 months, 3 years compared with 2 years, etc.) in the percentage of study households participating with WIC are statistically significant at $p \leq 0.05$.
[b] For SNAP participation, pairwise *t* tests indicate that changes from the previous interview (13 months compared with baseline, 2 years compared with 13 months) in the percentage of study households receiving SNAP benefits are statistically significant at $p \leq 0.05$.
[c] For school meal participation, pairwise *t* tests indicate that changes from the previous interview (13 months compared with baseline, 2 years compared with 13 months, 3 years compared with 2 years, etc.) in the percentage study households participating in school meals programs are statistically significant at $p \leq 0.05$.
[d] For participation in any of the three supplemental nutrition programs, pairwise *t* tests indicate that changes from the previous interview (13 months compared with baseline, 2 years compared with 13 months, 3 years compared with 2 years, etc.) in the percentage of study families participating with WIC are statistically significant at $p \leq 0.05$.
[e] For participation in WIC, participation in SNAP, and participation in any of the three supplemental nutrition programs, pairwise *t* tests indicate that change from baseline to 5 years, change from baseline to 6 years, and change from baseline to 9 years in the percentage of study families participating are statistically significant at $p \leq 0.05$.
** WIC participation after the study child turns 5 years old was for the caregiver or a non-study child (e.g., a younger sibling of the study child).
*** During the COVID-19 health emergency, school meals were free for all students. Differences in the percentage of study families participating in school meal programs were not tested because the percentage was expected to rise as the study children became age eligible for school.

D. Food Security Status

The Economic Research Service (ERS) defines food security as "access by all people at all times to enough food for an active, healthy life" (ERS, 2023b). From enrollment through study child age 6, WIC ITFPS-2 used the ERS 6-item household food security module to assess household

food insecurity. The number of affirmative responses to the six-item module determined whether a household was food insecure.[16] For the Year 9 interview, WIC ITFPS-2 fielded the ERS 18-item household food security instrument, which includes the items from the 6-item module and uses the same 12-month reference period as the 6-item module. The number of affirmative responses to the 18-item module determined whether a household was food insecure. The Year 9 interview used the longer module because it facilitates assessing food insecurity at both the household and child levels, whereas the six-item module is limited to assessing household food insecurity.

The analysis examined the percentage of households with food insecurity in the study population. Because the focus is on the percentage of the population at a given time, the analysis does not reflect the persistence or duration of food insecurity for a household over the interval between the study baseline and child age 9. When interpreting the findings, it is important to remember that nearly one of four (24%) age 6 interviews were collected after the COVID-19 health emergency was declared and that about 90 percent of the Year 9 interviews were collected before the health emergency expired.

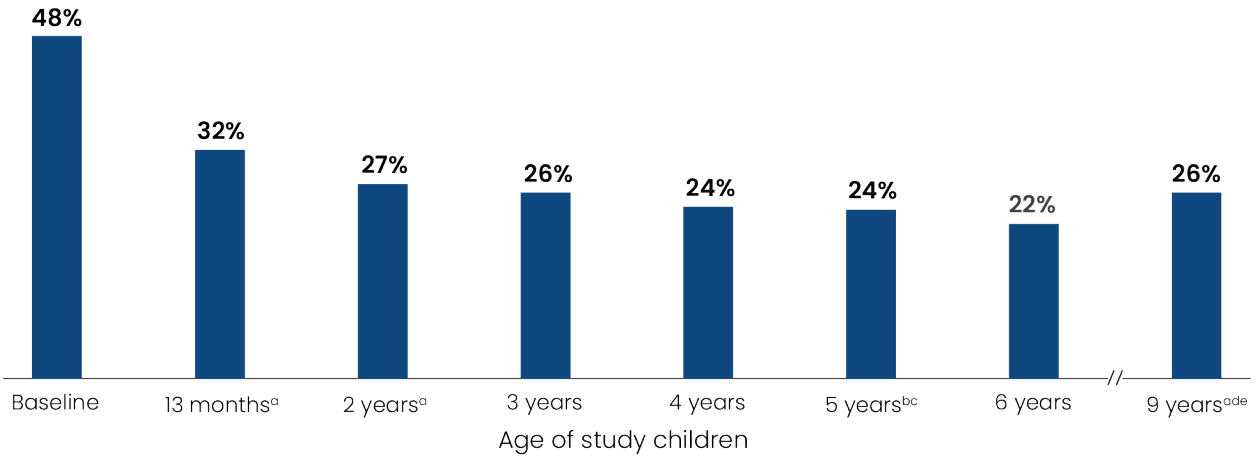
1. Household Food Insecurity

When the study child was 9, about one of four (26%) study households were food insecure. Over the course of the study, there was a downward trend in the percentage of food-insecure households between the study baseline and 6 years and an uptick between 6 and 9 years (figure 2.5). From baseline to age 5 (the period of the child's age eligibility), the prevalence of household food insecurity declined significantly from nearly half (48%) of households to about a quarter (24%).

The change between 5 and 6 years is not statistically significant. The uptick between years 6 and 9, from 22 to 26 percent, is statistically significant. For context, USDA reports that about 14 percent of all households with children reported experiencing food insecurity in 2019, the year that the Year 6 interview opened, compared with 17 percent in 2022, the year that the Year 9 interview opened (Coleman-Jensen et al., 2021). As mentioned, data for 6 and 9 years may have been influenced by the COVID-19 health emergency. Year 6 data were collected between April 2019 and August 2020, and Year 9 data were collected between June 2022 and August 2023.

[16] For detailed information on the algorithm for the 18- and 6-item modules, see *Food Security in the U.S.–Survey Tools* from the ERS at https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/survey-tools/#household.

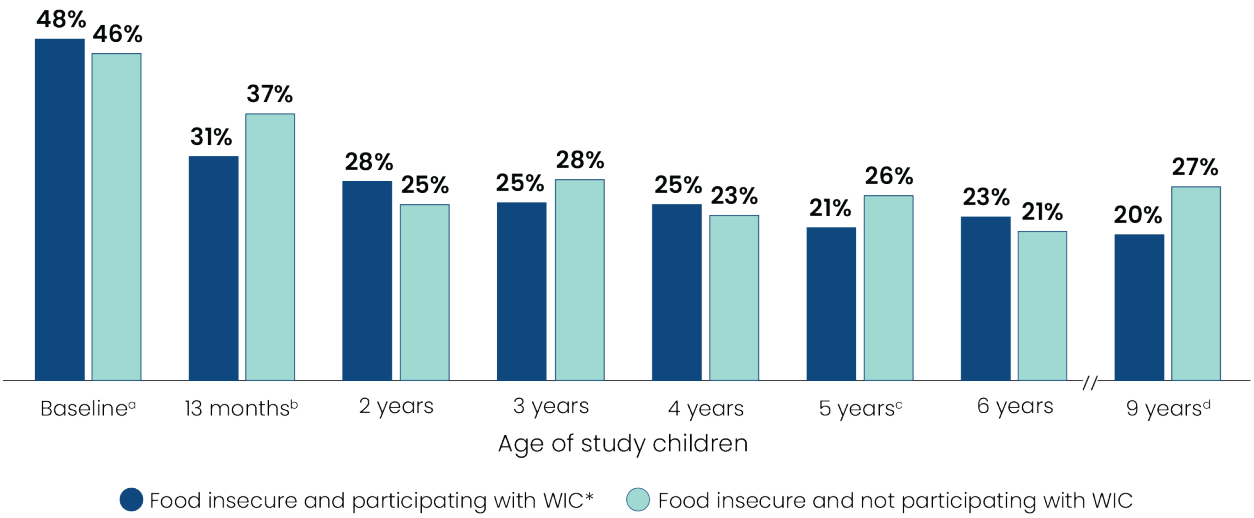
Figure 2.5. Percentage of study households with food insecurity between study baseline and Year 9



Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. More information on the data presented is available in appendix D1.
[a] Pairwise *t* test indicates the change from the previous interview in the percentage of households with food insecurity (e.g., 13 months compared with baseline) is statistically significant at $p \leq 0.05$.
[b] Pairwise *t* test indicates the change between baseline and 5 years in the percentage of households with food insecurity is statistically significant at $p \leq 0.05$.
[c] Pairwise *t* test indicates the change between 13 months and 5 years in the percentage of households with food insecurity is statistically significant at $p \leq 0.05$.
[d] Pairwise *t* test indicates the change between baseline and 9 years in the percentage of households with food insecurity is statistically significant at $p \leq 0.05$.
[e] The Year 9 interview used the 18-item food security module. Previous years used the six-item module. If the same six questions from the two modules are used, 24 percent of study households are food insecure at Year 9. Statistical tests on these percentages were not performed.

Figure 2.6 presents the prevalence of household food insecurity by WIC participation status between baseline and Year 9. When the study child was age 9, 20 percent of households receiving WIC (for a non-study child or the caregiver) reported being food insecure, and 27 percent of households not receiving WIC reported being food insecure. However, none of the differences between households that participated and households that did not participate with WIC are statistically significant. Also, there did not appear to be a clear pattern in the direction of the differences.

Figure 2.6. Prevalence of household food insecurity between child ages 13 months and Year 9 by WIC participation status



Note: More information on the data presented is available in appendix D1.
[a] Though all study participants were participating with WIC when they enrolled, by the baseline interview, 5 (unweighted) study participants were no longer participating with WIC. The 46 percent displayed in the figure is the weighted percentage.
[b] For households participating with WIC, pairwise *t* tests indicate that the change in the percentage of households with food insecurity between baseline and child age 13 months is statistically significant at $p \leq 0.05$.
[c] For households participating with WIC, pairwise *t* tests indicate that the change in the percentage of households with food insecurity between ages baseline and 5 years is statistically significant at $p \leq 0.05$. Statistical tests assessing differences between baseline and age 6 and age 9 were not performed because none of the study children were age eligible for WIC.
[d] The Year 9 interview used the 18-item food security module. Previous years used the six-item module. If the same six questions from both modules are used, the percentage of food-insecure households participating with WIC is 14 percent and 26 percent for households not participating with WIC. Statistical tests on these percentages were not performed.
* WIC participation after the study child turns 5 years old was for the caregiver or a non-study child (e.g., a younger sibling of the study child).

Because the study focuses on change over time, statistical tests assessing the significance of changes between each interview from the study baseline through age 5 (the years of WIC age eligibility for the study child) were also run.[17] Between the baseline interview and study child age 13 months, the percentage of food-insecure households participating with WIC declined significantly from 48 percent to 31 percent. Similarly, between baseline and study child age 5 years, the percentage of food-insecure households that participated with WIC declined by more than half, from 48 percent to 21 percent. In contrast, differences in the percentage of food-insecure households not participating with WIC at these two time points are not statistically significant. The failure to find statistical differences may be an artifact of the relatively high standard error of the estimate of food-insecure households not receiving WIC at the study baseline.[18,19]

[17] These tests did not assess longer term differences between 13 months and age 6 or age 9 because children are only age eligible for WIC until they are 5 years old.
[18] Results of pairwise *t* tests are conservative because the tests do not account for correlation between study participants over time, which means the tests may not identify some significant differences. Because so few cases were not participating with WIC at baseline, statistical tests also examined the difference between 13 months and 5 years for households. The difference is not statistically significant for households that did not participate with WIC.
[19] See table D1.8 in appendix D1.

2. Child Food Insecurity

Because the Year 9 interview incorporated the 18-item food security module, the data permit assessing child food insecurity. This discussion focuses solely on findings from Year 9 because it was the only interview to incorporate the 18-item module.[20] Previous interviews incorporated the six-item food security module. Figure 2.7 presents the prevalence of child food insecurity among households with children in the United States (ERS, 2023a) and subsequently in the WIC ITFPS-2 study households by whether the household participated with WIC (for the caregiver or a non-study child or both). The percentages of study households reporting child food insecurity did not differ significantly by WIC participation status, but the direction of the difference is noteworthy. Among households participating with WIC when the study child was 9 years old, the prevalence of child food insecurity was 10 percent; among households not participating with WIC at this time, the prevalence of child food insecurity was 16 percent. As discussed previously, most WIC Infant and Toddler Feeding Practices Study-2 households had low incomes. It is not surprising, therefore, that the prevalence of child food insecurity from this study is higher than for the entire United States, which includes children from all income brackets.

Figure 2.7. Prevalence of child food insecurity reported at Year 9, by WIC participation for another household member

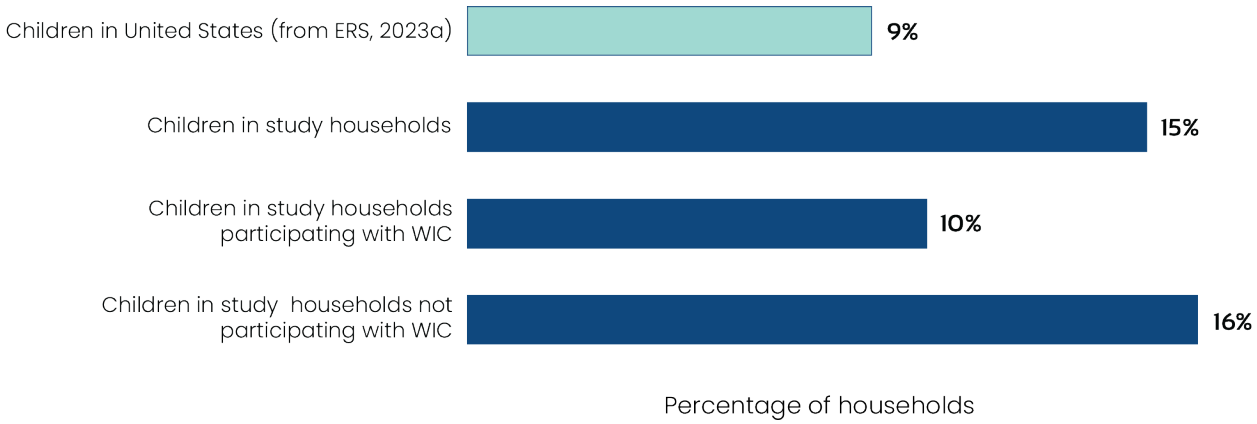
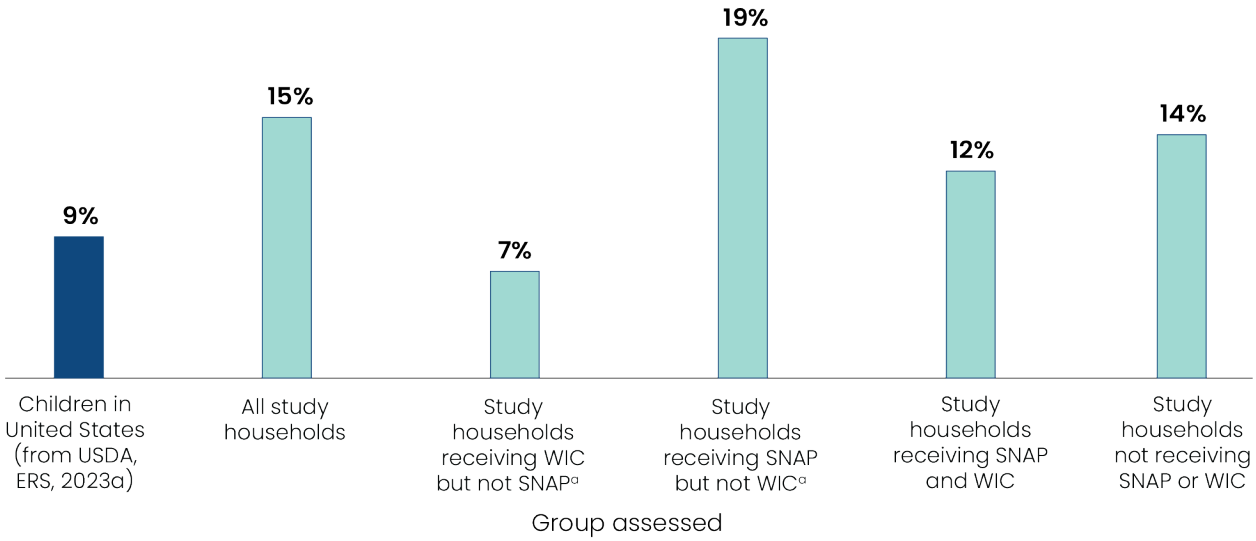


Figure 2.8 presents the prevalence of child food insecurity when the study child was age 9 by participation with WIC and SNAP. Differences are not statistically significant, but the direction of the differences is noteworthy here as well. Among households participating with WIC but not SNAP, the prevalence of child food insecurity was about 7 percent, compared with 9 percent nationally. Among households receiving SNAP but not WIC, the prevalence was about 19 percent. The higher prevalence of child food insecurity among households receiving SNAP but not WIC (19%) compared with households receiving WIC but not SNAP (7%) likely reflects the lower income eligibility requirements for SNAP. Among households receiving both SNAP and WIC, the prevalence of child food insecurity was 12 percent.

[20] The module does not identify which children in the household experienced food insecurity.

Figure 2.8. Prevalence of child food insecurity reported at Year 9, by WIC receipt for another household member and SNAP receipt for the household



SNAP = Supplemental Nutrition Assistance Program

[a] The percentage of households receiving WIC but not SNAP differ significantly at $p \leq 0.05$ from the percentage of households receiving SNAP but not WIC based on an unadjusted *t* test. The difference is not statistically significant when the Bonferroni method of adjustment for multiple comparisons was applied across all the categories.

Chapter 3

Learning From WIC and Food-Related Practices and Beliefs

This chapter discusses the following findings from the Year 9 interview for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2:

- *More than four of five (83%) caregivers used information they previously learned from WIC to make decisions about foods to offer their children when the study child was age 9.*
- *Nearly 9 of 10 (87%) caregivers bought whole grain products consistent with items in the WIC food package in the past month.*
- *About two of three caregivers used information on added sugars (70%) and sodium (66%) from food labels.*
- *Caregivers who reported learning information from WIC nutrition education were more likely to use food labels for information on added sugars and buy whole grain products compared with caregivers who did not report learning from WIC.*
- *Caregivers who reported learning information from WIC were nearly three and a half times more likely to have fruits, over one and a half times more likely to have dark green vegetables, and over two and a half times more likely to have low- or non-fat milks in their homes compared with caregivers who did not report learning from WIC.*

A. Introduction

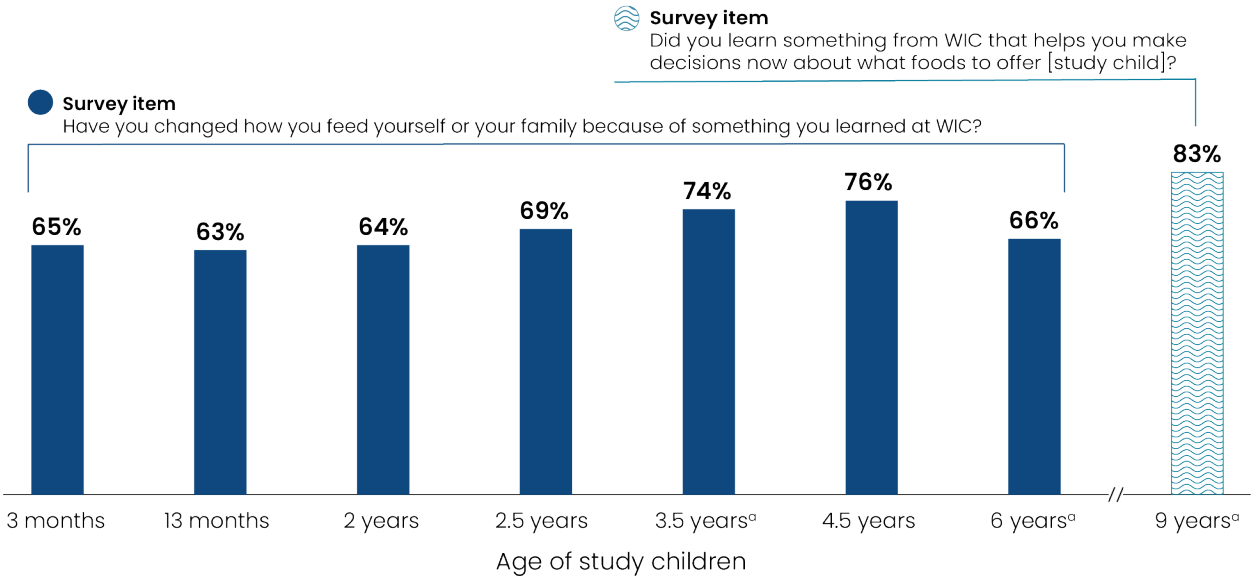
This chapter presents findings on information caregivers previously learned from Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) nutrition education and how this information influenced food-related behaviors and the home food environment when the study child was 9 years old.

B. Learning From WIC

For the first 6 years of the study child's life, the study inquired about changes in caregiver feeding behaviors because of WIC nutrition education. This survey item was reworded for the Year 9 interview to focus on information learned from WIC that was being used when the study child was age 9, rather than a change in behavior. The survey item shifted focus because many of the caregivers had not been affiliated with WIC for several years, and behaviors that originally resulted from WIC nutrition education may not have been understood in terms of a change when the study child was age 9.

At study child age 3 months, about two of three (65%) caregivers indicated they had changed how they feed themselves or their families because of something they learned from WIC (figure 3.1). By age 4.5 years, about three of four (76%) caregivers indicated changing their feeding practices because of WIC. At age 6, after the study child had been age ineligible to participate in WIC for a year, about two of three (66%) caregivers affirmed having changed their feeding practices because of WIC. At Year 9, after rewording the item to focus on the knowledge being currently used, the percentage rose sharply, revealing that more than four of five (83%) caregivers used information gained from WIC nutrition education to help them make decisions on foods to offer their children *when the study child was age 9*. About four of five (81%) study families were not participating with WIC when the Year 9 interview occurred, suggesting that many study participants may have retained the information they learned from WIC for years.

Figure 3.1. Percentage of study caregivers indicating they learned something from WIC about providing food to their child



Note: The wording of the survey item changed between study child ages 6 and 9 to reflect knowledge gained from WIC that was being used when the study child was age 9. More information on the data presented in this figure is available in appendix D2.
[a] Pairwise *t* tests indicate the change from the previous interview (3.5 years compared with 2.5 years and 6 years compared with 4.5 years) in the percentage of caregivers indicating they learned something from WIC is statistically significant at $p \leq 0.05$. The change in the percentages reported at 9 and 6 years is also statistically significant, but the comparison involves questions with different wording.

1. How Caregivers Use Knowledge

Caregivers who indicated they had learned information from WIC that they were using when the study child was age 9 were asked, "What did you learn at WIC that you use now when you make decisions about what foods to offer [your child]?" Respondents could mention more than one type of knowledge gained from WIC. All responses were recorded and coded to create thematically consistent groups.

Knowledge From WIC Being Used by Caregivers at Year 9

- Know how to choose more healthy foods (43%)
- Eat more fruits and vegetables (38%)
- Offer the right amounts of foods (18%)
- Drink/buy fewer sugar-sweetened beverages (10%)
- How to prepare foods (6%)

Among caregivers using information they learned from WIC when the study child was 9 years old (weighted *n* = 362,352 and unweighted *n* = 559), more than 2 of 5 (43%) caregivers indicated having learned how to choose more healthy foods (see callout box). Nearly 2 of 5 (38%) caregivers indicated their families eat more fruits and vegetables. About 1 of 5 (18%) indicated that they offer the right amount of food. These findings suggest that WIC nutrition education may directly affect diets for years after program participation ends.

C. Food-Related Practices and Beliefs at Age 9

WIC nutrition education covers a variety of topics, including both healthy foods and healthy eating environments for children. This section assesses the relationship between nutrition education and caregiver food-related practices and beliefs. Two home eating environment practices are discussed because they have been associated with diet quality and are nutrition education topics at many WIC sites: eating family meals together and television viewing during meals.[21]

1. Food-Related Practices and Beliefs

The Year 9 interview asked about the following food-related practices and beliefs held by the caregiver when the study child was 9 years old:

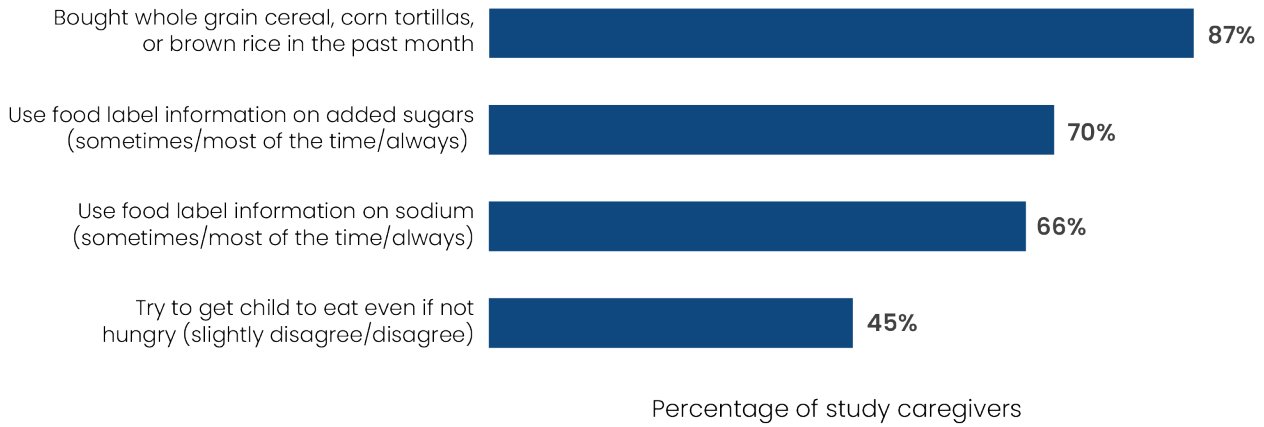
- How often the caregiver used food package labels for information on added sugars
- How often the caregiver used food package labels for information on sodium
- Whether the caregiver bought whole grain cereal, bread, corn tortillas, or brown rice in the past month
- Whether the caregiver believed in trying to get the child to eat if the child says, "I am not hungry"

The analysis focused on healthy approaches. For the survey items assessing food-related practices, this meant that the caregiver *sometimes*, *most of the time*, or *always* used the practice. For the item assessing the belief about getting children to eat even if they are not hungry, caregivers who *slightly disagree*[ed] or *disagree*[ed] with the statement indicated a more responsive feeding approach, which is healthier.

Most caregivers (87%) reported they bought whole grain items consistent with foods offered in the WIC food package in the past month (figure 3.2). More than two of three (70%) caregivers used food package label information on added sugars when the study child was 9 years old. About two of three (66%) caregivers used food package label information on sodium. Almost half (45%) of caregivers did not believe in trying to get the child to eat if the child was not hungry.

[21] The *WIC ITFPS-2: Fifth Year Report* presents the findings.

Figure 3.2. Percentage of study caregivers using select feeding practices and holding select feeding beliefs at Year 9



Note: More information on the data presented in this figure is available in appendix D2.

2. Bivariate Associations Between Learning From WIC and Food-Related Practice or Belief

The translation of WIC nutrition education information to caregiver practice or belief is a critical step in realizing WIC's healthy eating objectives. To examine whether knowledge gained from WIC translated into practices used at age 9, the analysis examined associations between specific types of knowledge caregivers reported learning from WIC and select feeding practices and beliefs assessed in the Year 9 interview. Caregivers provided a variety of responses when asked what they had learned from WIC; not all aligned with the food-related practices and beliefs assessed. For example, several respondents mentioned exercise. The analysis included the subset of the themes identified among the open-ended responses that aligned conceptually with the select feeding practices and beliefs assessed during the Year 9 interview.

Table 3.1 presents the findings from the bivariate analysis. To assess statistically significant differences, the analysis compared the percentages of two groups of caregivers—the group who indicated learning the knowledge from WIC and the group who did not indicate learning from WIC. In general, caregivers who reported learning from WIC were more likely to be using healthy practices or holding beliefs consistent with healthy food-related practices when the study child was 9 years old when compared with caregivers who did not report learning from WIC.[22] Though the text focuses on statistically significant differences, overall, the prevalence of healthy eating practices was high regardless of whether the study participant remembered learning the information from WIC.

Among caregivers who learned from WIC to drink/buy fewer sugar-sweetened beverages (SSBs) and/or limit sweets and junk food, slightly more than 8 of 10 (83%) used the information on added

[22] After years of not participating with the program, some respondents may not have recalled that they learned and adopted healthy eating practices because of their participation with WIC.

sugars from food labels when the study child was 9 years old. Among caregivers who did not indicate learning this from WIC, slightly fewer than 7 of 10 (67%) used the information on added sugars from a food label when the study child was age 9. The difference between 83 and 67 percent is statistically significant.

Among caregivers who learned from WIC to eat more whole grains, almost all (99%) had purchased whole grain food items in the past month when the study child was 9 years old. Among caregivers who did not indicate learning this from WIC, more than 8 of 10 (86%) had purchased whole grain foods in the past month when the study child was age 9. The difference between 99 and 86 percent is statistically significant.

Table 3.1. Percentage of study caregivers endorsing select feeding practices or beliefs by knowledge gained from WIC

Knowledge	Gained from WIC	Feeding practice/belief currently used	Percentage	Weighted n (unweighted n)
Learned to drink/buy fewer sugar-sweetened beverages and/or limit sweets and junk food	Yes	*Sometimes*, *always*, or *most of the time* use information on added sugars from food labels	83*	42,179 (58)
	No	*Sometimes*, *always*, or *most of the time* use information on added sugars from food labels	68*	260,226 (421)
Learned to eat more whole grains	Yes	Bought whole grain cereal, bread, corn tortillas, or brown rice in the past month	99*	13,889 (22)
	No	Bought whole grain cereal, bread, corn tortillas, or brown rice in the past month	86*	363,952 (573)
Learned to limit salt and salty foods	Yes	*Sometimes, always,* or *most of the time* use information on sodium from food labels	87	3,891 (6)
	No	*Sometimes, always,* or *most of the time* use information on sodium from food labels	66	283,831 (436)
Learned to read labels on food packaging	Yes	*Sometimes, always,* or *most of the time* use information on added sugars or sodium from food labels	91	13,435 (16)
	No	*Sometimes, always,* or *most of the time* use information on added sugars or sodium from food labels	77	323,037 (503)
Learned to offer the right amount of food	Yes	*Slightly disagreed* or *disagreed* with trying to get the child to eat even if the child is not hungry	43	28,511 (36)
	No	*Slightly disagreed* or *disagreed* with trying to get the child to eat even if the child is not hungry	44	161,731 (250)

*When comparing caregivers who did and did not endorse learning the information from WIC, there is a statistically significant pairwise difference at $p \leq 0.05$ in the percentages using the feeding practice or holding the belief when the study child is age 9.

3. Home Eating Environment

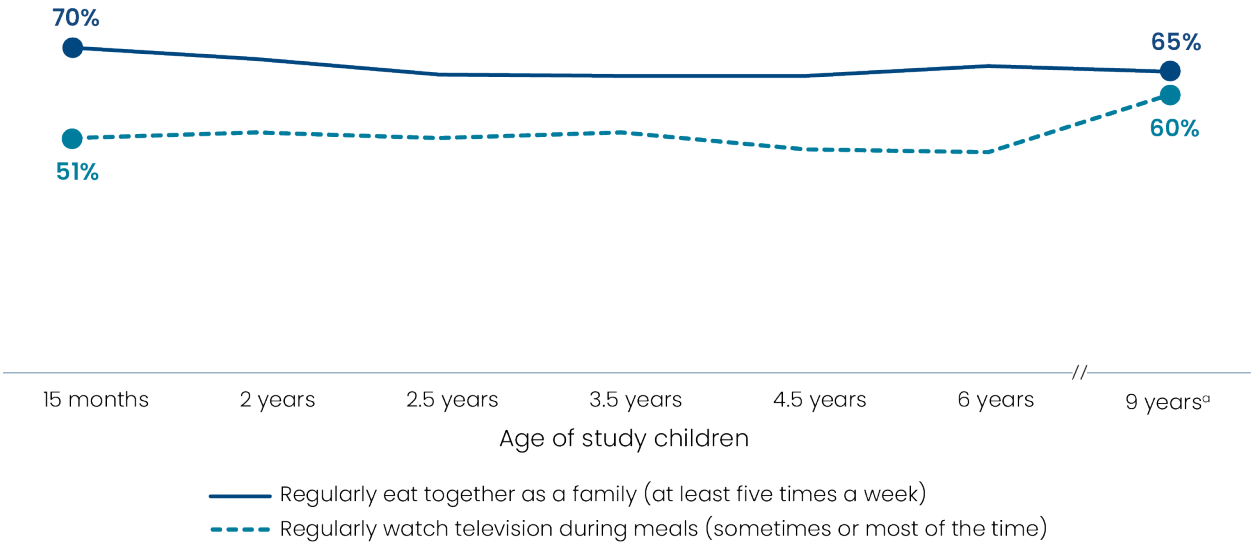
Nutrition education at many WIC sites includes discussion of a healthy home eating environment for the child. The Year 9 interview focused on two home eating environment practices that prior research associates with children's diet quality: the frequency of family meals and the frequency of television viewing while eating. The *WIC ITFPS-2: Fifth Year Report* found a positive association between the frequency of family meals and the study child's diet quality and a negative association between the frequency of television viewing while eating and the study child's diet quality.

When the study child was age 9, about two of three (65%) study families ate together at least five times a week, a practice that research has associated with improved dietary outcomes for children compared with children who do not regularly eat with their families (Gillman et al., 2000). Over the course of the study, the percentage of caregivers reporting that their families ate together at least five times a week was fairly stable, especially since the study child was 2.5 years old (figure 3.3).

When the study child was age 9, about three of five (60%) caregivers reported that the television was on while eating *sometimes* or *most of the time*, a practice that research has associated with poorer dietary outcomes for children relative to those who do not regularly watch television while eating (Avery et al., 2017). There was little change in the percentage of caregivers reporting that their families regularly ate in front of the television until around age 6. Between ages 6 and 9, there was a 12-percentage-point increase from 48 percent to 60 percent. This change may be developmental; COVID-19 mitigation strategies may also have affected family eating habits.[23]

[23] About three-fourths (76%) of the data at study child age 6 were collected before the COVID-19 health emergency declaration; about one-tenth of the data at study child age 9 were collected after the health emergency expired.

Figure 3.3. Percentage of study families regularly eating family meals and regularly having the television on during meals



Note: More information on the data presented in this figure is available in appendix D2.
[a] Pairwise *t* test indicates the change from the previous interview (9 years compared with 6 years) in the percentage of families regularly watching television during meals is statistically significant at $p \leq 0.05$.

D. Food Availability in the Home

The Year 9 survey instrument inquired about the availability of select foods and beverages within the home, asking how frequently the food or beverage was available: *never*, *rarely*, *sometimes*, *often*, or *very often*. Separate survey items assessed the frequency of the availability of the following foods and beverages:

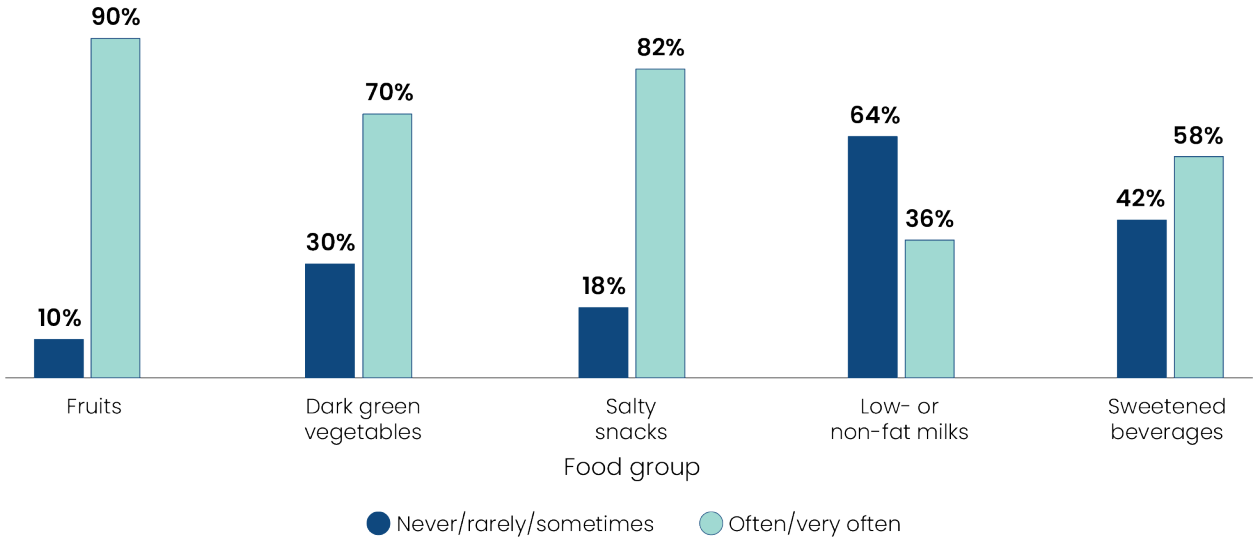
- Fruits (part of the WIC food package)[24]
- Dark green vegetables (part of the WIC food package)
- Salty snacks such as chips and crackers (an easily identifiable source of sodium)
- One percent fat, skim, non-fat, or fat-free milk (part of the WIC food package)
- Sweetened beverages including soda or pop, sports drinks such as Gatorade, fruit-flavored drinks, or fruit punch (an easily identifiable source of added sugars)

Figure 3.4 presents the distributions of responses, with response options collapsed into two groups: never/rarely/sometimes and often/very often. Fruits were most likely to be *often* or *very often* available (90%) in study households when the study child was 9 years old. Salty snacks were second (82%), and dark green vegetables were third (70%). Low-fat (also known as 1

[24] Fruits and vegetables are available in the WIC food packages with a cash value benefit (CVB) that ranged between $9 and $11 for most study participants over many years of WIC ITFPS-2 data collection. The CVB was increased to $35 per month in March 2021 as part of the American Rescue Plan, which would have affected families that continued to participate with WIC after the study child was no longer age eligible. In October 2021, the CVB for children was changed to $24 per month and extended through September 2022. In October 2022, the CVB was adjusted to $25 per month and further extended through December 2022.

percent fat) or non-fat (also known as skim or fat-free) milk was the least likely to be *often* or *very often* available (36%). There was the least difference in the availability of sweetened beverages, though a difference of 16 percentage points is still notable.

Figure 3.4. Percentage of study households by the frequency of the availability of select foods and beverages at Year 9



Note: More information on the data presented in this figure is available in appendix D2.

1. Independent Associations Between Knowledge Gained From WIC and Foods Available in the Home

The analysis employed logistic regression models to assess independent associations between knowledge gained from WIC and the availability of fruits, dark green vegetables, salty snacks, low- and non-fat milks, and sweetened beverages in study households. The callout box summarizes the findings discussed in this section.

Summary of Findings

- Home availability of fruits, dark green vegetables, and reduced-fat milks positively associated with knowledge gained from WIC
- Home availability of salty snacks and sweetened beverages not associated with knowledge gained from WIC

As figure 3.4 displays, the dependent variable in each model was binary, with responses of *never*, *rarely*, and *sometimes* in one category and responses of *often* and *very often* in another. Except for the type of information learned, the same set of covariates was used in all three models:

- Race, ethnicity, and language combined into one variable (Hispanic, Spanish speaking; Hispanic, English speaking; non-Hispanic Black; non-Hispanic White; and non-Hispanic individuals of all other races)

- Pattern of the study child's WIC participation collapsed into categories to improve power (no longer receiving WIC benefits after age 3, still receiving WIC benefits after age 3, and received WIC benefits intermittently during the first 5 years of life)
- Currently receiving SNAP when the study child was 9 years old (yes or no)
- Currently receiving WIC when the study child was 9 years old (yes or no)
- Maternal educational attainment (high school or less or more than high school)

The text in the rest of this chapter focuses on statistically significant associations with learning from WIC, which logistic models identified for the availability of fruits, dark green vegetables, and low- or non-fat milks in study households.[25]

Availability of fruit in the home. Compared with caregivers who did not learn from WIC something that helped them make decisions about foods to offer their children, caregivers who learned this from WIC were about 3.4 times more likely to have fruits in the home when the study child was 9 years old (table 3.2).

Table 3.2. Odds ratios from logistic model assessing factors associated with having fruit in the home at Year 9

Effect[a]	Point estimate	95% confidence interval	
		Lower bound	Upper bound
Hispanic, English speaking vs. non-Hispanic White	0.545	0.192	1.552
Hispanic, Spanish speaking vs. non-Hispanic White	0.528	0.206	1.349
Non-Hispanic Black vs. non-Hispanic White	0.627	0.260	1.511
Non-Hispanic other races vs. non-Hispanic White	0.261	0.027	2.538
Received WIC benefits intermittently vs. still receiving WIC benefits after age 3	1.390	0.446	4.336
No longer receiving WIC benefits after age 3 vs. still receiving WIC benefits after age 3	1.319	0.519	3.352
Currently receiving SNAP	0.630	0.260	1.525
Currently receiving WIC	0.952	0.385	2.352
More than high school vs. high school or less	1.139	0.583	2.226
Learned something from WIC that helps make decisions about foods vs. did not learn this from WIC	3.446*	1.456	8.154

SNAP = Supplemental Nutrition Assistance Program
[a] Unweighted *n* = 672; weighted *n* = 443,690
* Indicates statistically significant

Availability of dark green vegetables in the home. Compared with caregivers who did not learn from WIC something that helped them make decisions about foods to offer their children, caregivers who learned this from WIC were about 1.6 times more likely to have dark green vegetables in the home when the study child was 9 years old (table 3.3).

[25] Variables in the models are statistically significant if the 95 percent confidence interval does not include the value 1.000.

Table 3.3. Odds ratios from the logistic model assessing factors associated with having dark green vegetables in the home at Year 9

Effect[a]	Point estimate	95% confidence interval	
		Lower bound	Upper bound
Hispanic, English speaking vs. non-Hispanic White	0.824	0.487	1.395
Hispanic, Spanish speaking vs. non-Hispanic White	1.080	0.537	2.172
Non-Hispanic Black vs. non-Hispanic White	1.591	0.932	2.716
Non-Hispanic other races vs. non-Hispanic White	1.112	0.417	2.964
Received WIC benefits intermittently vs. still receiving WIC benefits after age 3	1.608	0.774	3.338
No longer receiving WIC benefits after age 3 vs. still receiving WIC benefits after age 3	0.833	0.492	1.412
Currently receiving SNAP	0.701	0.444	1.104
Currently receiving WIC	0.655	0.401	1.069
More than high school vs. high school or less	1.082	0.755	1.550
Learned something from WIC that helps make decisions about foods vs. did not learn this from WIC	1.623*	1.012	2.604

SNAP = Supplemental Nutrition Assistance Program
[a] Unweighted *n* = 672; weighted *n* = 443,690
* Indicates statistically significant

Availability of low- and non-fat milks in the home. Compared with caregivers who did not learn from WIC to drink more reduced-, low- or non-fat milks, caregivers who learned this from WIC were about 2.9 times more likely to have low- or non-fat milks in the home when the study child was 9 years old (table 3.4). Caregivers who were currently receiving WIC were also more likely to drink more reduced-, low-, or non-fat milks, as were caregivers who had more than a high school education.

Table 3.4. Odds ratios from the logistic model assessing factors associated with having low- or non-fat milks in the home at Year 9

Effect[a]	Point estimate	95% confidence interval	
		Lower bound	Upper bound
Hispanic, English speaking vs. non-Hispanic White	0.930	0.447	1.935
Hispanic, Spanish speaking vs. non-Hispanic White	1.764	0.986	3.154
Non-Hispanic Black vs. non-Hispanic White	0.616	0.299	1.266
Non-Hispanic other races vs. non-Hispanic White	0.729	0.306	1.740
Received WIC benefits intermittently vs. Still receiving WIC benefits after age 3	0.611	0.310	1.203
No longer receiving WIC benefits after age 3 vs. Still receiving WIC benefits after age 3	0.758	0.478	1.201
Currently receiving SNAP	1.002	0.652	1.540
Currently receiving WIC	2.568*	1.354	4.868
More than high school vs. high school or less	1.704*	1.075	2.702
Learned to drink more reduced-, low- or non-fat milk vs. did not learn this	2.872*	1.014	8.133

SNAP = Supplemental Nutrition Assistance Program

[a] Unweighted *n* = 672; weighted *n* = 443,690

* Indicates statistically significant

Chapter 4

Children's Food Intake

This chapter discusses the following findings from the Year 9 interview for the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2:

- *Few study children skipped any of their three daily meals.*
- *Less than half of study children met the* Dietary Guidelines for Americans *(DGA)*[26] *recommendations for vegetables, dairy, protein foods, fruit, and whole grains:*
  - *One percent for vegetable intake*
  - *Thirteen percent for dairy intake*
  - *Thirty percent for protein food intake*
  - *Thirty-eight percent for fruit intake*
  - *Less than or equal to 1 percent for whole grain intake*
- *About 7 of 10 (72%) study children met the DGA recommendation for total grains.*
- *Estimates of study children's average intake of total fruits, vegetables, dairy, protein foods, and grains were generally higher than those from a national sample of children ages 6 to 11 years.*
- *The average Healthy Eating Index-2020 total score, a measure of overall diet quality, for study children was 57, higher than the national average for children ages 9 to 13 (52).*

[26] U.S. Department of Agriculture & U.S. Department of Health and Human Services (USDA & HHS). (2020). *Dietary guidelines for Americans, 2020-2025* (9th ed.). https://www.dietaryguidelines.gov/resources/2020-2025-dietary-guidelines-online-materials

A. Introduction

Children need to eat a variety of healthy foods to ensure healthy growth and development. This chapter examines study children's food intake when they are 9 years old, outlining their eating patterns and diet quality and how these have changed over time.

B. Two Approaches to Dietary Assessment

Diet quality can be evaluated in several ways. Analyses reported in this chapter reflect two approaches. The first assesses children's food group intake relative to recommendations in the 2020–2025 *Dietary Guidelines for Americans* (DGA) (USDA & HHS, 2020). In addition to food group recommendations, the DGA also offers recommendations for added sugars, sodium, and water, so they are included in the assessments relative to DGA recommendations.

In previous annual reports for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (ITFPS-2), analyses relied on food groups introduced in the Feeding Infants and Toddlers Studies (FITS; Anater et al., 2018; Fox et al., 2004; Weinfield et al., 2019).[27] The FITS food groups are not independent of the DGA food groups but complement them by looking at groups of foods through a lens relevant to young children. This report continues to use the FITS food groups when reporting on sugary foods and salty snacks. However, when discussing beverages sweetened with sugar—also referred to as sugar-sweetened beverages (SSBs)—the analysis includes all beverages that have added sugars. This deviates from the FITS definition of SSBs, which excludes milks sweetened with sugar (e.g., chocolate milk). Milks sweetened with sugar are included in the definition of SSBs for this report because as children get older, they are more likely to drink milks sweetened with sugar.

The second approach to assessing diet quality uses the Healthy Eating Index-2020 (HEI-2020) for children age 2 and older (Center for Nutrition Policy and Promotion, 2023). The HEI-2020 scoring system incorporates total dietary energy, producing scaled scores that assess dietary adherence to the 2020–2025 DGA recommendations (Shams-White et al., 2023).

All diet quality outcomes at Year 9 discussed in this chapter were tested for differences by child's pattern of WIC participation from birth to age 5. No statistically significant differences were identified. The only statistically insignificant finding mentioned in this chapter involves HEI scores because, at age 6, a statistically significant pattern was identified (Borger et. al, 2024). However, since that time, there has been attrition from the longitudinal cohort—the group of study participants who responded to all interviews—which may have affected findings. Additionally, outcomes of interest were assessed by current WIC participation (for the caregiver or non-study child), and findings are noted in a callout box.

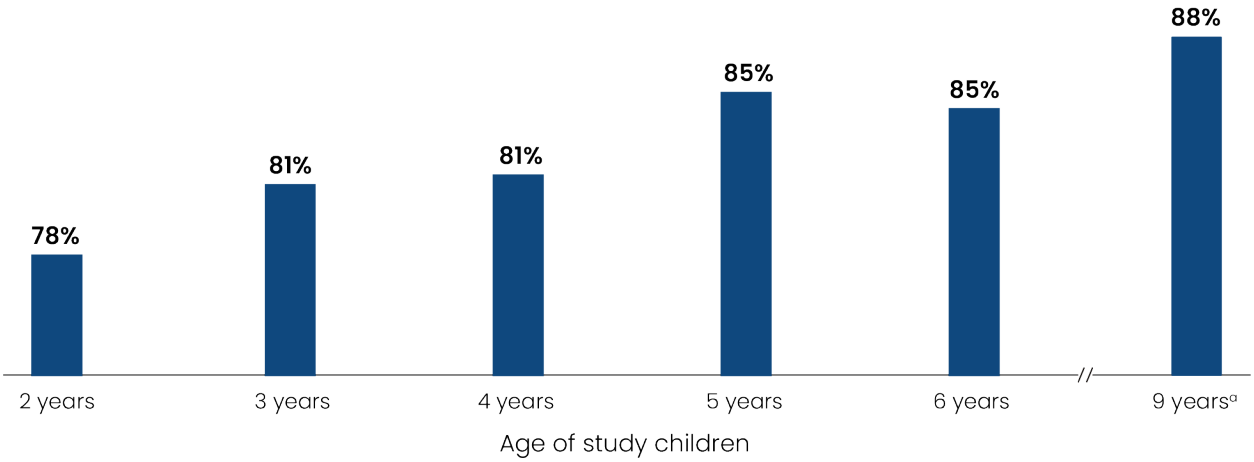
[27] DGA recommendations were not available for children under 2 in the early years of WIC ITFPS-2.

C. Meal and Snack Patterns

Children may skip meals as they get older (Bae et al., 2008). At age 9, almost all (96%) study children ate at least three times a day including meals and snacks: 96 percent had breakfast, 95 percent had lunch, and 95 percent had dinner. The percentages of study children eating breakfast and lunch are somewhat higher than for a national sample of 6–11-year-old children in the United States: 88 percent of the national sample had breakfast (Hoy et al., 2024a), 88 percent lunch (Hoy et al., 2024c), and 94 percent dinner (Hoy et al., 2024b).[28]

Though the percentages of children consuming breakfast, lunch, and dinner on a given day were stable over the study period, the percentage of study children consuming at least one snack increased significantly from 78 percent at age 2 to 88 percent at age 9 (figure 4.1). The mean number of snacks consumed per day was 2.1 at age 9, and the median number was 1.4. The mean and median at age 9 are similar to findings from previous years.

Figure 4.1. Percentage of study children consuming snack(s) on a given day between ages 2 and 9



Note: More information on the data presented in this figure is available in appendix D3.
[a] The difference in percentages at age 2 and at age 9 is statistically significant at $p \leq 0.05$ based on a pairwise *t* test.

[28] Hoy et al. (2024a, 2024b, 2024c) used data from the National Health and Nutrition Examination Survey (NHANES) 2017–2018.

D. Intakes Relative to DGA Recommendations

Analyses assessed diet quality using the 2020–2025 DGA recommendations at each age and usual intake estimates.[29] The five DGA food groups are fruits, vegetables, dairy, protein foods, and grains, including whole grains. The MyPlate website defines the groups as follows (USDA, n.d.-a):

- The fruit group includes all fruit (fresh, frozen, canned, or dehydrated) and 100 percent fruit juice.
- The vegetable group includes all vegetables and 100 percent vegetable juice, as well as beans, peas, and lentils.
- The dairy group includes milk, yogurt, cheese, lactose-free milk, fortified soy milk, and yogurt. The dairy group does not include high-fat foods made from milk that have little calcium such as cream cheese, sour cream, cream, and butter.
- The protein foods group includes "all foods made from seafood; meat, poultry, and eggs; beans, peas, and lentils; and nuts, seeds, and soy products" (USDA, n.d.-b).
- The grains group includes foods made from wheat, rice, oats, cornmeal, barley, or other grain products. Grains are divided into two subgroups: whole grains and refined grains.

Less than half of study children met the DGA recommendation for fruits, vegetables, dairy, protein foods, and whole grains.[30] However, estimates of study children's average intake were generally higher than those from a national sample of children ages 6 to 11 years:

- An estimated 38 percent of study children met the DGA recommendation for fruits. For study children age 9, the estimated mean usual intake of total fruits was 1.7 cup eq. For context, the mean daily intake of total fruits for children ages 6 to 11 years was 1.2 cup eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022).[31]
- An estimated 1 percent of study children met the DGA recommendation for vegetables. For study children age 9, the estimated mean usual intake of total vegetables was 1.1 cup eq. For context, the mean daily intake of total vegetables for children ages 6 to 11 years was 0.83 cup eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022).
- An estimated 13 percent of study children met the DGA recommendation for dairy. For study children age 9, the estimated mean usual intake of total dairy was 2.1 cup eq. For context, the mean daily intake of total dairy for children ages 6 to 11 years was 1.7 cup eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022).

[29] The NCI methods for estimating usual intake account for day-to-day variation in diet and differences between individuals. See appendix C for more information on the methods used for estimating usual intake.

[30] Study children's estimated energy intake was compared with recommendations in table A3-2 in the DGA (USDA & HHS, 2020). Actual energy intake was compared with the midpoint of the kilocalories (kcal) ranges displayed to determine whether the lower or upper recommendation was used. For example, if actual energy intake was 1,450 kcal, the recommendation for 1.5 cup eq. of vegetables was used; if actual energy intake was 1,550 kcal, the recommendation for 2 cup eq. of vegetables was used.

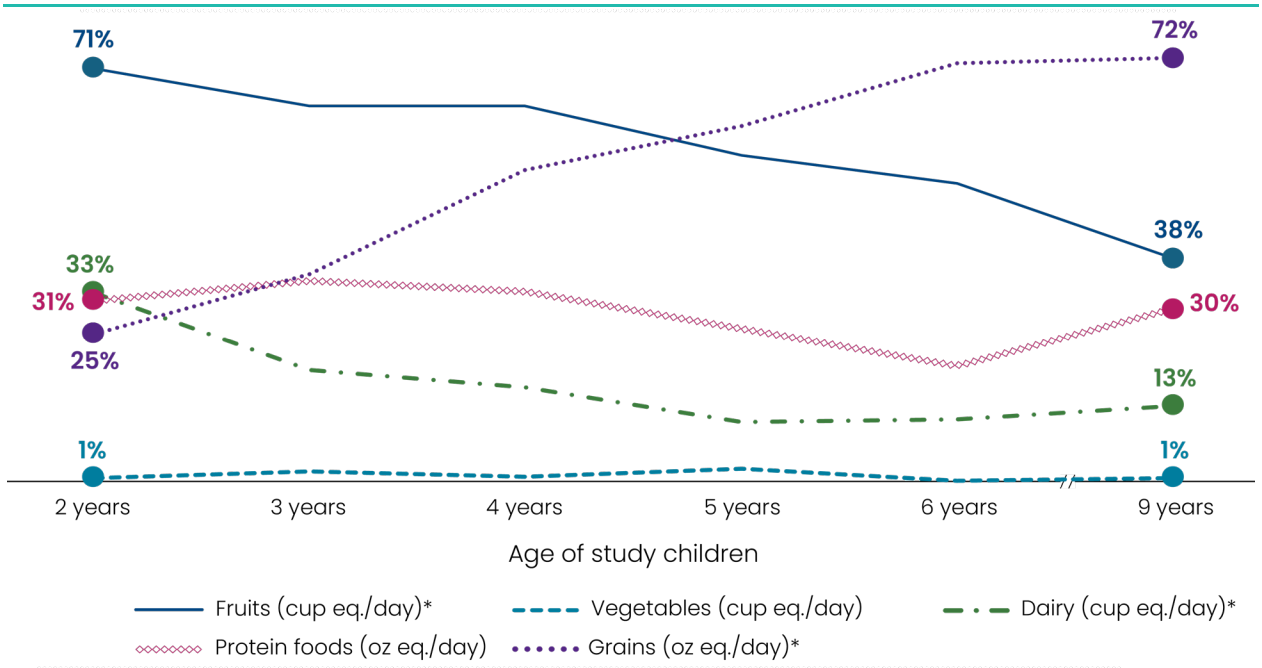
[31] Based on research using WIC ITFPS-2 data and National Cancer Institute methods for usual intake estimation, the mean usual intake does not differ notably from the mean daily intake. Bowman and Clemens (2022) used day 1 dietary data from the What We Eat in America interview, NHANES 2017–2018, to estimate the mean daily intakes for 6–11-year-old children in the United States. Based on background research for this report, the comparison of mean usual intake with mean daily intake is meaningful for contextualization.

- An estimated 30 percent of study children met the DGA recommendation for protein foods. For study children age 9, the estimated mean usual intake of total protein foods was 5.0 oz eq. For context, the mean daily intake of total protein foods for children ages 6 to 11 years was 4.1 oz eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022).
- An estimated 72 percent of study children met the DGA recommendation for total grains. For study children age 9, the estimated mean usual intake of total grains was 7.8 oz eq. For context, the mean intake of total grains for children ages 6 to 11 years, was 7.2 oz eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022). Of note, very few study children (0.1%) met the DGA recommendation for whole grains. For study children age 9, the mean usual intake of whole grains on a given day was 1.1 oz eq. For context, the mean intake of whole grains for children ages 6 to 11 years was 0.95 oz eq. based on data from NHANES 2017–2018 (Bowman & Clemens, 2022).[32]

Figure 4.2 presents the percentage of study children meeting the DGA recommendations for the food groups assessed from age 2 through age 9. Concerningly, very few study children met recommendations for intakes of vegetables, dairy, and protein foods each year assessed between ages 2 and 9. Over this interval, there were also declines in the percentage meeting the DGA recommendation for fruit between age 2 (71%) and age 9 (38%) and in the percentage meeting the DGA recommendation for dairy (33% at age 2 and 13% at age 9).

[32] The analysis used the data in table A3-2 in the DGA (USDA & HHS, 2020).

Figure 4.2. Percentages of study children meeting recommended levels of intake based on the 2020–2025 *Dietary Guidelines for Americans*



Note: More information on the data presented in this figure is available in appendix D3. DGA recommendations vary by age and activity level. For fruit, the analysis used 1 to 1.5 cups eq./day for children ages 2 to 3 and 1 to 2 cups eq./day for children ages 4 to 6. For vegetables, the analysis used 1 to 1.5 cups eq./day for children ages 2 to 3 and 1.5 to 2.5 cups eq./day for children ages 4 to 6. For dairy, the analysis used 2 to 2.5 cups eq./day. For protein foods, the analysis used 2 to 4 oz eq./day for children ages 2 to 3 and 4 to 5 oz eq./day for children ages 4 to 6. For grains, the analysis used 3 to 5 oz eq./day for children ages 2 to 3 and 5 to 6 oz eq./day for children ages 4 to 6. Children's dietary energy intake was assumed appropriate for children's activity level.
cup eq./day = cup equivalent per day; oz eq./day = ounce equivalent per day
*The difference in percentages at age 2 and at age 9 is statistically significant at $p \leq 0.05$ based on a two-tailed *t* test. The *t* test does not account for the correlation between individuals. The correlation is assumed positive, so the *t* test is considered conservative. This means that differences reported to be significant are very likely to actually be significant but that differences not found to be significant may or may not actually be significant.

The vegetable group represents the most striking food group of concern of those displayed in figure 4.2. An estimated 1 to 2 percent of study children met the recommendations each year since age 2 based on usual intake estimates.[33]

The trend in the percentage of children meeting the DGA recommendation for grains rose sharply between age 2 (25%) and age 9 (72%). However, the very low percentage meeting the DGA recommendation for whole grains (0.1%) continued a trend of widespread underconsumption since age 2 (not shown; see table D3.2 in appendix D3). The failure to consume sufficient whole grains over several years presents another area of concern.

[33] The NCI methods for estimating usual intake account for day-to-day variation in diet and differences between individuals. See appendix C for more information on the methods used for estimating usual intake.

The bivariate analysis assessed whether meeting the DGA recommendations for these food groups was associated with WIC participation by another household member when the study child was 9 years old. Participation with WIC by another household member when the study child was age 9 was associated with meeting the DGA recommendation for dairy (see callout box).

Statistically Significant Finding

At age 9, 36 percent of study children in households participating with WIC met the DGA recommendation for dairy compared with 22 percent of study children in households not participating with WIC. The difference is statistically significant (see table D3.3 in appendix D3).

1. Contribution of 100 Percent Fruit Juice to Total Fruit Intake

Because 100 percent fruit juice contributes to total fruit intake and is in the WIC food package, it is a beverage of interest for this study. The DGA recommendation allows for up to half of total fruit consumption to come from fruit juice. About 52 percent of all study children consumed 100 percent fruit juice on a given day at age 9. Among study children who drank 100 percent fruit juice on a given day at age 9 (unweighted *n* = 356; weighted *n* = 228,306), the average intake was about 8.9 fluid ounces (fl. oz),[34] and 100 percent fruit juice accounted for about 50 percent of the group's total fruit intake, on average.

The DGA recommends that children consume mostly whole fruit but notes that consumption of 100 percent fruit juice by children older than 2 years may range from 4 fl. oz to 8 fl. oz depending on the child's calorie intake (USDA & HHS, 2020, p. 88). The American Academy of Pediatrics (AAP) recommends that children who consume 100 percent fruit juice at age 9 consume no more than 8 fl. oz a day. Among all study children—which includes children who do not drink 100 percent fruit juice—85 percent met the AAP recommendations. Among children who consumed 100 percent fruit juice (unweighted *n* = 356; weighted *n* = 228,306), about 71 percent met the AAP recommendation.

2. FITS Food Group for Sugar-Sweetened Foods and Beverages

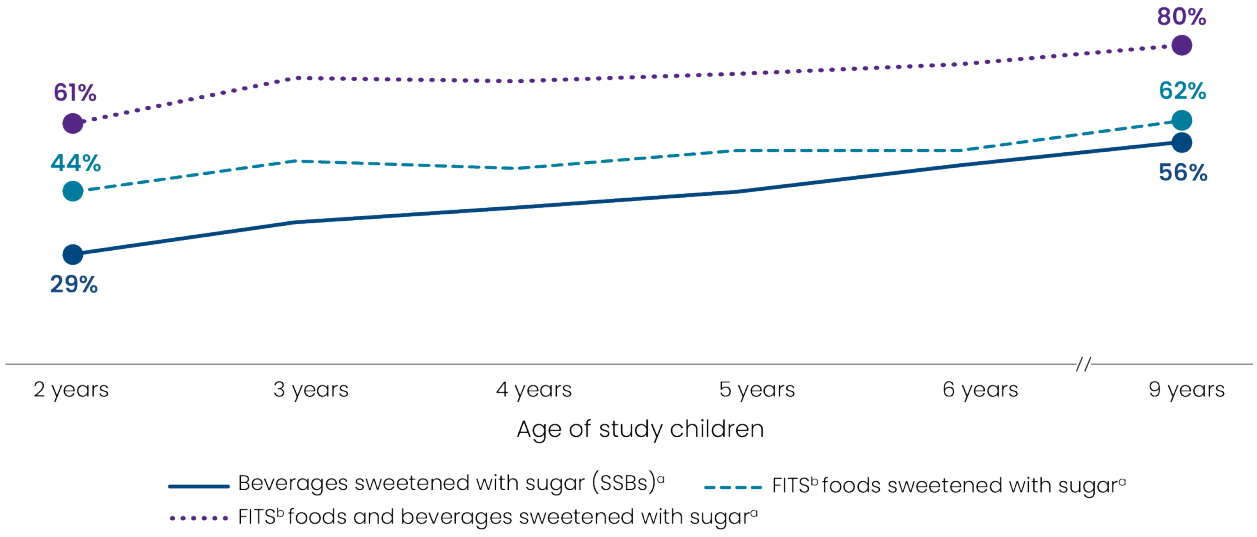
The DGA recommends that added sugars compose no more than 10 percent of total calories. When discussing study children's added sugars intake, the analysis in this report relies on a FITS food group. The FITS group for added sugars includes foods such as ice cream, puddings, sweet rolls, cookies, pies, cakes, and candy. SSBs are also included in this FITS food group. The intent of using the FITS group is to focus on foods with added sugars commonly eaten by young children and readily identifiable by caregivers, which may aid public health messaging.

The percentage of children consuming foods and beverages sweetened with sugar on a given day increased significantly over the course of the study, rising from 61 percent at age 2 to 80 percent at age 9 (figure 4.3). The percentage of study children consuming SSBs increased significantly, as

[34] Across all study children, which includes children who do not drink 100 percent fruit juice, average intake of 100 percent fruit juice on a given day was about 4.6 fl. oz.

did the percentage of study children consuming foods sweetened with sugar. SSBs may displace drinking healthier beverages like water, and foods sweetened with sugar may displace healthier food sources.

Figure 4.3. Percentage of the study children consuming foods and beverages sweetened with sugar on a given day by age

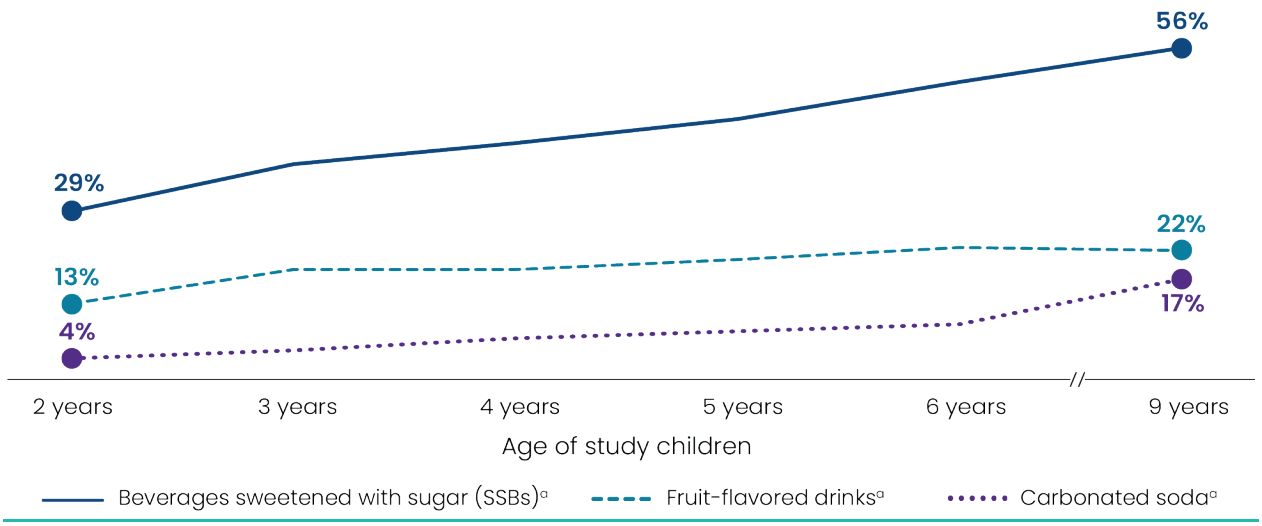


FITS = Feeding Infants and Toddlers Study; SSBs = sugar-sweetened beverages
Note: More information on the data presented in this figure is available in appendix D3.
[a] The difference in percentages at age 2 and at age 9 is statistically significant at $p \leq 0.05$ based on a two-tailed *t* test.
[b] The FITS food group was modified to include all beverages sweetened with sugar.

Cakes, pies, cookies, and pastries were the most frequently consumed sugar-sweetened foods on a given day at age 9 (43%), while fruit-flavored drinks were the most frequently consumed type of SSB (22%). At age 9, study children consumed an average of 7 fl. oz of SSBs on a given day. Among children who consumed SSBs (unweighted *n* = 396; weighted *n* = 245,942) at this age, the mean intake was 12.6 fl. oz on a given day. There was not a significant difference in the percentage of children consuming SSBs at age 9 by whether the caregiver reported learning from WIC to drink or buy fewer SSBs.

Between ages 2 and 9, the percentages of children consuming fruit-flavored drinks and carbonated sodas rose significantly (figure 4.4). Between ages 6 and 9, the percentage consuming carbonated soda significantly jumped.

Figure 4.4. Percentages of study children consuming sugar-sweetened beverages on a given day by age



[a] The difference in percentages at age 2 and at age 9 for each beverage group is statistically significant at $p \leq 0.05$ based on a two-tailed *t* test. Additionally, the increase in the percentage of study children consuming carbonated soda at age 6 and age 9 is statistically significant based on a two-tailed *t* test.

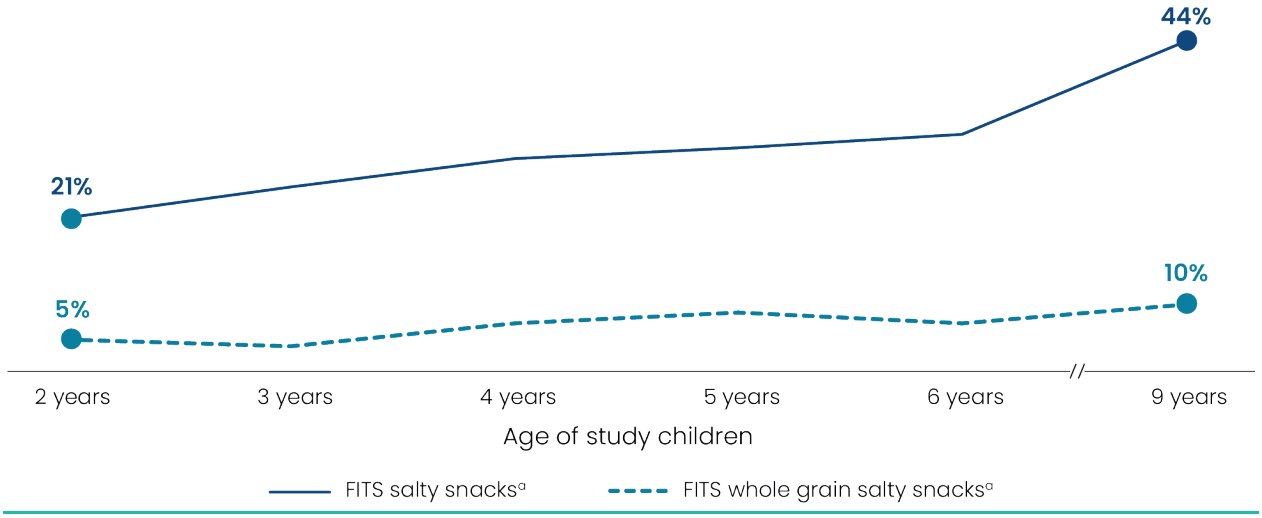
Less than half (45%) of study children met the DGA recommendation that added sugars be limited to less than 10 percent of total calories at age 9. This is down from nearly 82 percent meeting the DGA recommendation at age 2. On average, nearly 11 percent of the calories study children consumed at age 9 came from added sugars. Added sugars intake is discussed in more detail in chapter 5.

3. FITS Food Group for Salty Snacks

The DGA recommends that children age 9 consume less than 1,800 mg of sodium per day, which is also the Chronic Disease Risk Reduction (CDRR) recommendation. When discussing study children's sodium intake, the analysis relied on a FITS food group for salty snacks. Foods in this group include corn chips, popcorn, potato chips, and tortilla chips. These snacks are not the only source of sodium in the child's diet; however, by using this food group, the analysis highlights commonly eaten foods that are high in salt and are easy for caregivers to identify in their children's diets.

The percentage of children consuming salty snacks increased over the course of the study, more than doubling from 21 percent at age 2 to 44 percent at age 9 (figure 4.5). About 10 percent of study children consumed whole grain salty snacks at age 9. There was no significant difference in the percentage of children consuming salty snacks at age 9 by whether the caregiver reported learning from WIC to limit salt and salty foods.

Figure 4.5. Percentage of study children consuming salty snacks on a given day



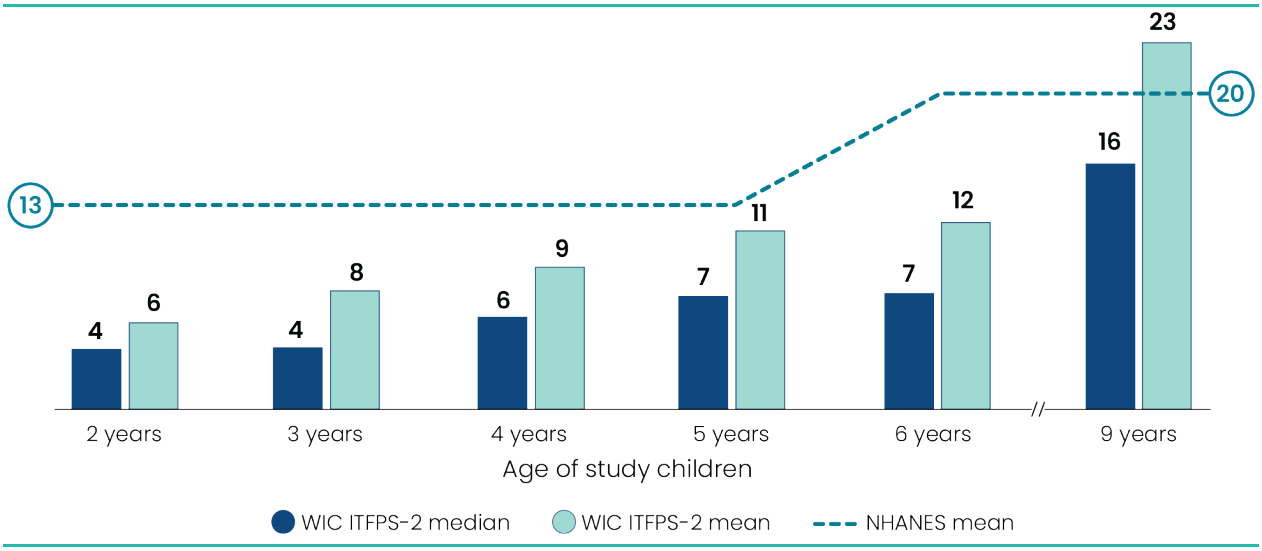
Note: More information on the data presented in this figure is available in appendix D3.
FITS = Feeding Infants and Toddlers Study
[a] The difference in percentages at age 2 and at age 9 is statistically significant at $p \leq 0.05$ based on a two-tailed t test.

4. Water

Though the DGA does not consider water a food group or offer a recommendation, it discusses drinking plain water as an important source of hydration. Because water can be obtained from many foods and beverages, the U.S. Department of Health and Human Services (HHS) has a Dietary Reference Intake (DRI, Otten et al., 2006) for total water intake and for beverage water intake. At age 9, the DRI is about 80 fl. oz (about 10 cups) per day of total water, which includes about 60 fl. oz (about 8 cups) of total beverages, including plain drinking water (Otten et al., 2006).

Based on data from NHANES 2015–2018, children in the United States ages 2 to 5 drank an average of 13 fl. oz of plain water on a given day, and children ages 6 to 11 drank an average of 20 fl. oz of plain water (Centers for Disease Control and Prevention, 2024). On a given day at age 9, study children drank an average of 23 fl. oz of plain water, which is slightly higher than national findings for children ages 6 to 11 (figure 4.6).

Figure 4.6. Median and mean fluid ounces of plain water consumed on a given day



Note: More information on the data presented in this figure is available in appendix D3.
NHANES = National Health and Nutrition Examination Survey

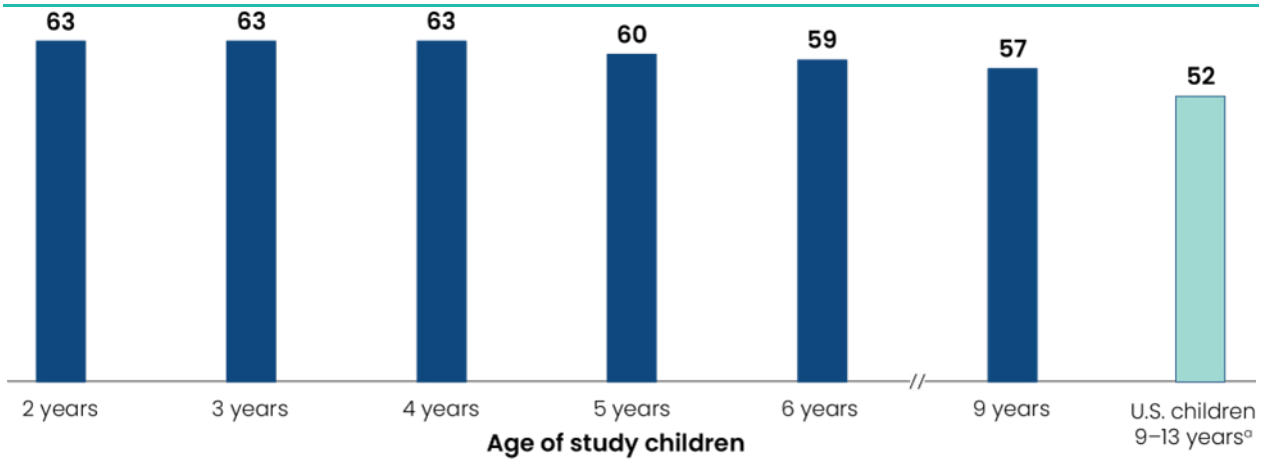
E. HEI-2020 Scores

The analysis also assessed diet quality using HEI-2020 scores. Total HEI-2020 scores range from 0 to 100, with higher scores indicating better alignment with the 2020–2025 DGA (Shams-White et al., 2023). HEI-2020 scores for dietary components rate intakes of specific foods and nutrients relative to DGA recommendations. HEI-2020 component scores for total fruits, whole fruits, total vegetables, greens and beans, total protein foods, and seafood and plant proteins range from 0 to 5. Component scores for whole grains, dairy, fatty acids ratio (the ratio of monounsaturated and polyunsaturated fatty acids to saturated fatty acids), refined grains, sodium, added sugars, and saturated fat range from 0 to 10. The 13 individual components are subdivided into two groups: adequacy (evaluated based on consumption above a minimum amount) and moderation (evaluated based on consumption below a maximum amount).

Data from NHANES 2017–2018 indicate the average HEI-2020 total for all children ages 9 to 13 was 52 (USDA & HHS, 2020). The average HEI-2020 total score for study children at age 9 was about 57 (figure 4.7). The average HEI total score for study children's diets at age 9 appears higher than the average score for a nationally representative group of children.[35] However, the average score for study children has trended downward since age 4.

[35] A test of statistical difference was not performed because the standard effect for the estimate of all children in the Nation was not available.

Figure 4.7. Average HEI-2020 total scores from WIC ITFPS-2 with national comparison for ages 9–13



[a] The score for U.S. children ages 9–13 is from the 2020–2025 *Dietary Guidelines for Americans* (page 82). The estimates are based on NHANES data.
HEI-2020 = Healthy Eating Index-2020; NHANES = National Health and Nutrition Examination Survey; WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2

Examination of component scores showed that total dairy scores fell from nearly a perfect 10 at age 2 to about 7 at age 9, representing about a 24-percent decline (table 4.1). This decrease may have contributed to improvements in fatty acid scores but raises concern about the adequacy of intakes of calcium and vitamin D.[36] The HEI-2020 score for refined grains fell from around 8 at age 2 to around 5 at age 9, representing a 36-percent decline. Because this is a moderation component, a declining score over time means that study children consumed more refined grains as they grew older. There were also declines in scores for sodium and added sugars component scores over the interval, which, as discussed in chapter 5, means that study children consumed more sodium and added sugars as they grew older.

[36] Study children's calcium intake is discussed in chapter 5.

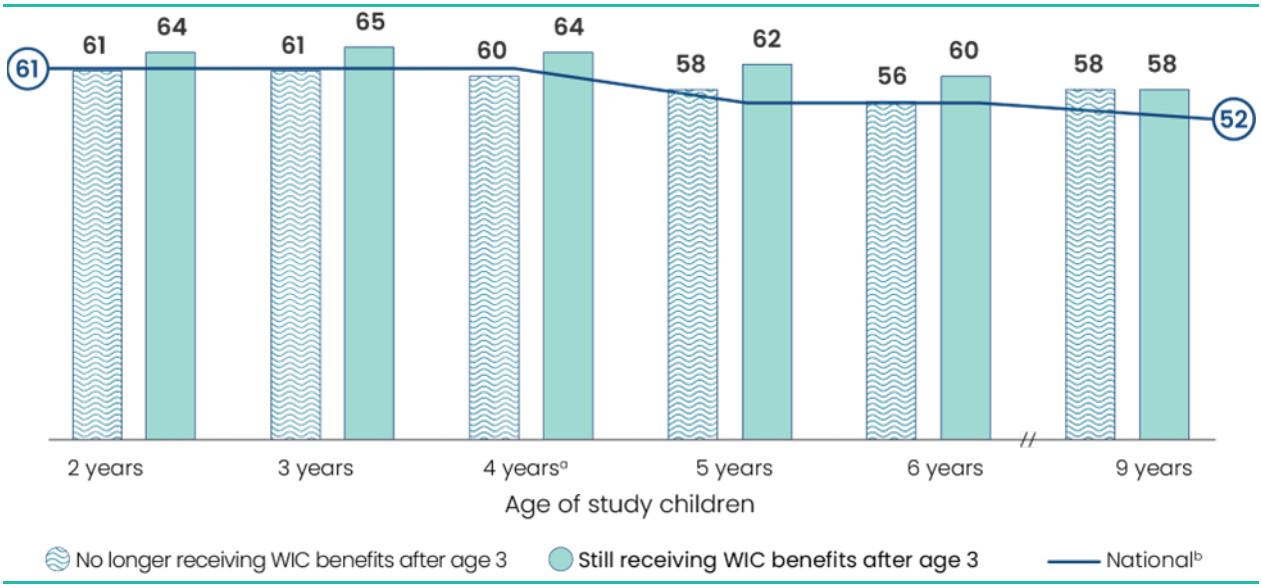
Table 4.1. Select average HEI-2020 component scores

HEI-2020	2 years mean (SE)	3 years mean (SE)	4 years mean (SE)	5 years mean (SE)	6 years mean (SE)	9 years mean (SE)
Total score (maximum score = 100)	62.6 (0.8)	63.1 (0.9)	62.9 (0.9)	60.4 (1.0)	59.0 (1.2)	57.4 (1.0)
Select component scores						
Adequacy component						
Dairy (maximum score = 10)	9.6 (0.1)	9.2 (0.2)	9.1 (0.2)	9.0 (0.2)	8.9 (0.2)	7.3 (0.3)
Moderation component						
Fatty acids[a] (maximum score = 10)	1.6 (0.2)	2.7 (0.2)	3.3 (0.2)	3.5 (0.2)	3.1 (0.3)	3.6 (0.2)
Refined grains (maximum score = 10)	7.5 (0.3)	6.8 (0.2)	6.0 (0.3)	5.1 (0.3)	4.6 (0.3)	4.8 (0.2)
Sodium (maximum score = 10)	5.7 (0.2)	5.2 (0.2)	4.5 (0.2)	4.1 (0.2)	4.2 (0.3)	4.9 (0.2)
Added sugars (maximum score =10)	9.2 (0.1)	8.7 (0.1)	8.4 (0.1)	8.3 (0.1)	8.1 (0.2)	7.7 (0.1)

Note: Information on all component scores is available in appendix D3.
HEI-2020 = Healthy Eating Index-2020; SE = standard of error
[a] Ratio of poly- and monounsaturated fatty acids to saturated fatty acids

Analysis of the longitudinal cohort used in the *WIC ITFPS-2: Sixth Year Report* (Borger et al., 2024)—which included all study participants who had responded to all interviews through age 6—found differences in mean HEI total scores by the study child's duration of WIC participation. Compared with the longitudinal cohort used for age 6 analyses, the Year 9 longitudinal cohort is small in size because it includes only study participants who responded to all surveys through age 9. Using the Year 9 longitudinal cohort, the mean HEI-2020 scores tended to be higher through age 6 for children with longer duration of WIC participation (figure 4.8). However, the difference by pattern of WIC participation was not statistically significant at age 9. The only statistically significant difference identified between children who were no longer receiving WIC after age 3 and children who were still receiving WIC after age 3 occurred at age 4—59 versus 63, respectively. Figure 4.8 also incorporates the mean HEI-2020 scores from a nationally representative sample of all children in the United States. These scores declined faster than the mean for study participants, regardless of duration of WIC participation.

Figure 4.8. Average HEI-2020 scores at ages 2 through 9 by duration of WIC participation



HEI-2020 = Healthy Eating Index-2020

[a] Difference between 59 and 63 is statistically significant.

[b] National average scores are from the 2020–2025 *Dietary Guidelines for Americans* as reported for children ages 2 through 4 (page 77), 5 through 8 (page 79), and 9 through 13 (page 82).

Chapter 5

Children's Energy and Nutrient Intake

This chapter discusses the following findings from the Year 9 interview for the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2:

- *Median intakes of macronutrients, including fat, carbohydrate, and protein, were within recommended ranges.*
- *Study children had higher median intake of protein and dietary fiber than a nationally representative sample of children ages 9 to 13, though dietary fiber intake was lower than recommended.*
- *Intakes of potassium and vitamins D and E compared favorably with findings from a nationally representative sample of children ages 9 to 13. However, about 82 percent of study children had inadequate intake of vitamin D, a nutrient of public health concern.*
- *About 46 percent of study children had inadequate intake of calcium, another nutrient of public health concern.*
- *About 13 percent of study children met the* Dietary Guidelines for Americans *(DGA) recommendation for saturated fat intake.*
- *About 45 percent of study children met the DGA recommendation for added sugars intake.*
- *Nearly all study children exceeded the recommended limit for sodium.*

A. Introduction

This chapter focuses on study children's energy and nutrient intakes. The study examined essential nutrient intakes relative to Dietary Reference Intakes (DRIs). Comparisons between intakes and standards are important indicators of the nutrition security of the study children. Nutrition security, distinct from food security, addresses whether intakes of important nutrients are appropriate to maintain optimal health.

Macronutrients examined in this chapter include total fat, carbohydrate, protein, fiber, saturated fat, and added sugars. Micronutrients assessed include potassium, sodium, calcium, and vitamins D and E. Prior years of reports indicated that many of these focal nutrients are typically over- or underconsumed relative to the DRIs. Both over- and underconsumption reduce the likelihood of maintaining good health and may increase the risk of chronic diseases later in life.

The DRIs for nutrients include the following:

- Estimated Average Requirements (EARs). EARs represent levels of daily intake sufficient to meet the nutrient requirements of half of all healthy individuals and are the standard used within each age group to estimate the prevalence of inadequate intakes in a population. The prevalence of inadequate intakes is estimated as the proportion of the population with intakes below the EAR (Murphy et al., 2006).
- Recommended Dietary Allowances (RDAs). RDAs represent levels of daily intake sufficient to meet the needs of nearly all individuals (97 to 98%) in the population and are typically used as a point of comparison when assessing individual-level dietary intakes. RDAs are dependent on the establishment of an EAR.
- Adequate Intakes (AIs). In the absence of sufficient data to produce EARs, AIs are used for standards. AIs represent average nutrient intake levels believed to meet the nutrient requirements of most or all healthy members of a given age group. If the mean group intake meets or exceeds the AI, the exact prevalence of low intakes cannot be determined, and a low prevalence of inadequate intake is assumed (Murphy et al., 2006).
- Chronic Disease Risk Reduction (CDRR). In 2019, the National Academies of Sciences, Engineering, and Medicine (NASEM) recommended expanding the DRIs to include a new category based on chronic disease, the CDRR level. A CDRR is an intake level above which scientific evidence suggests that intake reduction might reduce the risk of chronic disease in a healthy population. To date, a CDRR has been established for sodium only (NASEM, 2019).
- Acceptable Macronutrient Distribution Range (AMDR). In addition to comparing absolute values of macronutrients with standards, several macronutrients can be expressed as percentages of daily energy intake. These percentages can be examined using a range known as the AMDR. Like other DRIs, the AMDR is based on the ideal range necessary to promote health and growth while reducing chronic disease risk. Fiber does not have an AMDR, but the recommendation is 14 grams/1,000 kcal/day (USDA & HHS, 2020).

When children are age 9, several of the recommendations are sex specific. This chapter, therefore, notes sex-specific intake levels where relevant, either because the recommendation is sex specific or for comparison with nationally representative findings from the National Health and Nutrition Examination Survey (NHANES) 2017–2018.

Moreover, when assessing dietary intake, usual intake estimates are used when available.[37] The findings include both median and mean intakes. The median level of a single nutrient is reported because it is less sensitive to outliers. However, means of intake as a percentage of dietary energy are also reported because these means can be compared with national findings. To calculate mean percentage of dietary energy using usual intake estimates, the population ratio method was used, which involves dividing the mean of the numerator by the mean of the denominator.

Because added sugars, saturated fat, and sodium are of particular interest, the study examined the top five foods contributing to intakes of each nutrient. The food groups used for this study rely on food groups used for the Gerber/Nestlé Feeding Infants and Toddlers Studies (FITS). The FITS food groups align well with food groups in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food packages and may help public health nutritionists more easily identify specific foods that are commonly contributing to the overconsumption of added sugars, saturated fat, and sodium at specific ages.

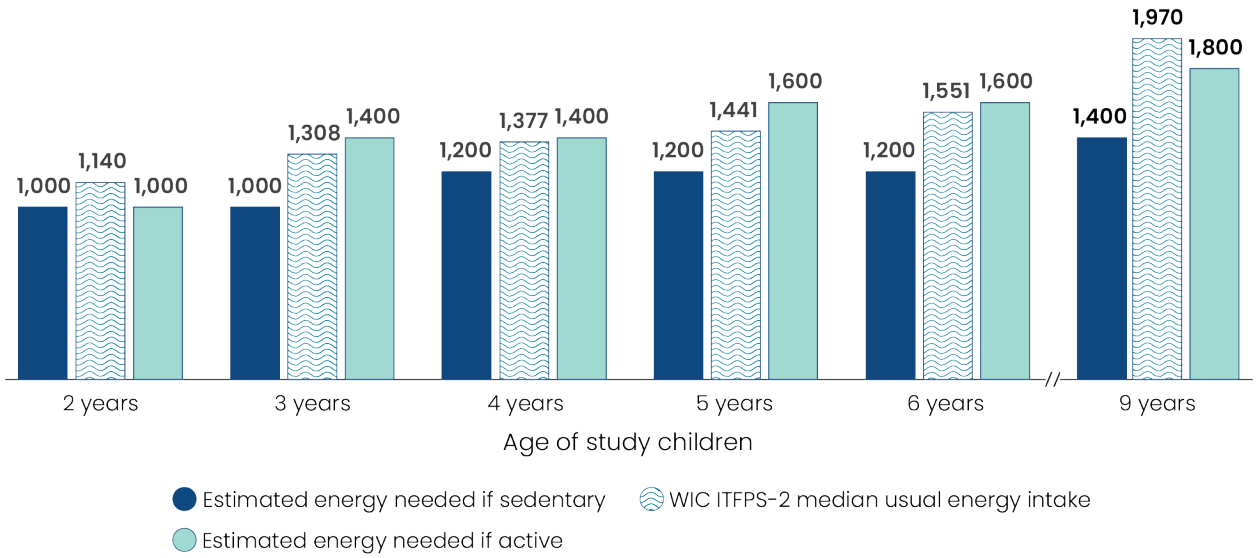
Finally, the analysis did not identify any statistically significant bivariate associations between the study child's pattern of WIC participation and usual intake of macro- and micronutrient intakes assessed at age 9. Exploratory logistic regression analyses using 1 day of dietary recall on all study children at age 9 did not identify any statistically significant independent associations between learning information from WIC and the likelihood of meeting the *Dietary Guidelines for Americans* (DGA) recommendations for added sugars or saturated fats. Therefore, outcomes from these research activities are not discussed.

B. Dietary Energy Intake

When the study children were age 9, the median energy intake was 2,119 kcal/day (standard error [SE] = 46.2). The median intake for female children was 1,970 kcal/day (SE = 51.5; figure 5.1a), and the median intake for male children was 2,265 kcal/day (SE = 75.0; figure 5.1b). Figures 5.1a and 5.1b present findings for usual calorie intake with the estimated calorie needs associated with levels of physical activity. Sedentary is the lowest level of physical activity for which the DGA offers estimated dietary energy needs, and active is the highest level of physical activity. At age 9, the estimated median usual energy intake by study female children (1,970 kcals) exceeded the level necessary for active female children (1,800 kcals) (figure 5.1a). Similarly, at age 9, the estimated median usual energy intake by study male children (2,265 kcals) exceeded the estimate for active males (2,000 kcals) (figure 5.1b).

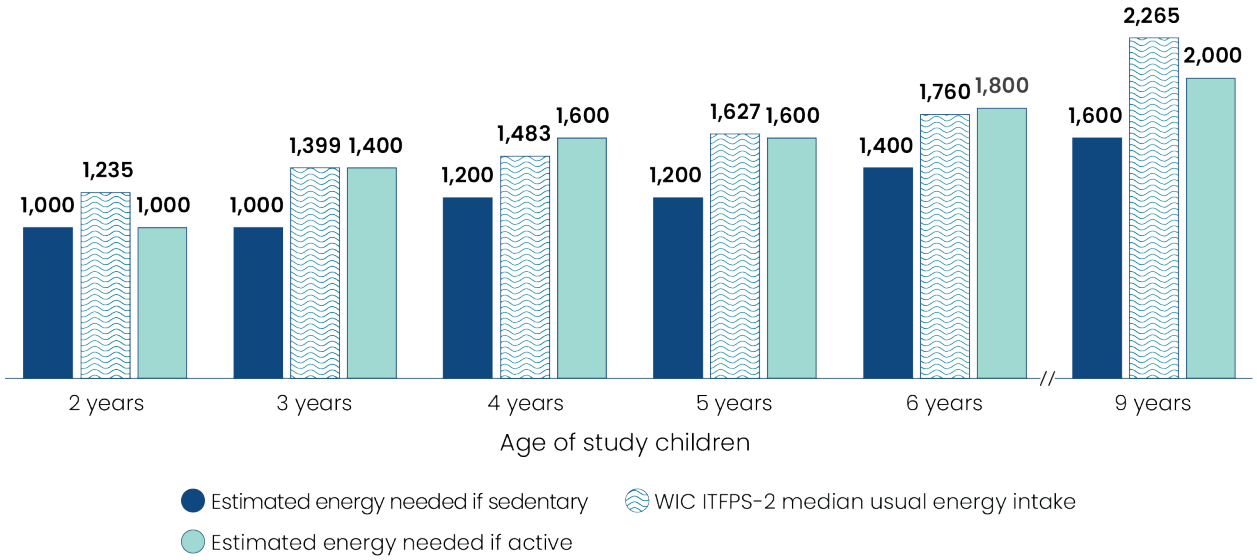
[37] The National Cancer Institute (NCI) methods for estimating usual intake account for day-to-day variation in diet and differences between individuals. See appendix C for more information on the methods used for estimating usual intake.

Figure 5.1a. Median usual energy intake (kcal) for study females with DGA estimates of energy needs



DGA = Dietary Guidelines for Americans; kcal = kilocalorie

Figure 5.1b. Median usual energy intake (kcal) for study males with DGA estimates of energy needs



DGA = Dietary Guidelines for Americans; kcal = kilocalorie

C. Macronutrient Intake

When the study child was age 9, the median levels of intakes of total fat, carbohydrates, and protein were above recommended levels (table 5.1)[38] but as a percentage of total energy intake, continued to be within the AMDRs as in previous years. Intake of dietary fiber continued to be below the AI.

Table 5.1. Usual intake of select macronutrients and Dietary Reference Intakes

Macronutrients and DRIs	Median usual daily intake[a] g/d (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Fat	41.9 (1.0)	46.6 (1.1)	48.3 (1.4)	53.3 (1.5)	58.3 (1.4)	81.4 (2.0)
AI	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Carbohydrate	154.9 (2.6)	182.2 (3.8)	197.9 (4.1)	207.4 (4.4)	223.1 (4.4)	272.3 (6.1)
EAR	*100*	*100*	*100*	*100*	*100*	*100*
Protein	47.6 (0.8)	53.3 (1.2)	55.0 (1.1)	59.2 (1.1)	62.9 (1.3)	77.7 (1.7)
RDA[b]	*13*	*13*	*19*	*19*	*19*	*34*
Fiber						
Males	9.4 (0.3)	10.9 (0.4)	12.1 (0.5)	13.5 (0.3)	14.1 (0.5)	18.5 (0.5)
Females	9.0 (0.3)	11.1 (0.3)	12.5 (0.4)	12.4 (0.4)	13.1 (0.4)	16.4 (0.6)
AI	19	19	25	25	25	31 (m) 26 (f)
	Mean percentage of energy intake[c] % (SE)					
Fat	31.9 (0.4)	31.4 (0.4)	31.0 (0.5)	31.8 (0.4)	32.1 (0.4)	34.7 (0.3)
AMDR[d]	*30–40*	*25–35*	*25–35*	*25–35*	*25–35*	*25–35*
Carbohydrate	53.0 (0.5)	53.8 (0.5)	54.9 (0.5)	53.9 (0.4)	53.8 (0.4)	51.8 (0.4)
AMDR[d]	*45–65*	*45–65*	*45–65*	*45–65*	*45–65*	*45–65*
Protein	16.1 (0.2)	15.9 (0.2)	15.4 (0.1)	15.5 (0.2)	15.2 (0.2)	14.7 (0.2)
AMDR[d]	*5–20*	*5–20*	*10–30*	*10–30*	*10–30*	*10–30*
Dietary fiber	7.9 (0.2)	8.3 (0.2)	8.8 (0.2)	8.5 (0.1)	8.3 (0.1)	8.3 (0.2)
14 g/1000 kcal	14	14	14	14	14	14

AI = Adequate Intake; AMDR = Acceptable Macronutrient Distribution Range; DRI = Dietary Reference Intake; EAR = Estimated Average Requirement; g/d = grams per day; kcal = kilocalorie; ND = not determined; RDA = Recommended Dietary Allowance; SE = standard error

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.

[b] For protein, RDA was used as a point of comparison instead of EAR. EAR is expressed in grams of protein per kilogram of body weight, and because the study did not obtain body weight measurements at the time of the interview, the comparison with EAR could not be made.

[c] The population ratio method was used to estimate the means for the percentage of energy.

[d] AMDR is measured as calories from macronutrients as a percentage of energy.

Sources: Otten et al., 2006; Ross et al., 2011.

[38] In chapter 4, 30 percent of study children met the DGA recommendation for protein foods. The DGA and AI assess protein intake from different perspectives.

At age 9, male study children had higher median usual intakes (grams/day [g/d]) of carbohydrate, protein, and fiber than a nationally representative sample of 9–13-year-old males (table 5.2, top half). At age 9, female study children had higher median usual intakes (g/d) of protein and fiber than a nationally representative sample of 9–13-year-old females. The study children's intakes as a percentage of dietary energy at age 9 are consistent with those based on a national sample of children in families with low incomes and children in families nationally (table 5.2, lower half).

Table 5.2. Median usual intake of select macronutrients at study child age 9 compared with national findings from NHANES

Macronutrients by child sex	Median usual intake[a] g/d (SE)		
	WIC ITFPS-2 study children at age 9 Years	NHANES 9–13-year-olds in families under 131% of poverty level[b]	NHANES 9–13-year-olds nationally[c]
Fat			
Males	87.1 (3.2)	74.7 (2.2)	80.0 (1.6)
Females	75.7 (2.2)	69.4 (2.1)	74.3 (1.9)
Carbohydrate			
Males	293* (10.6)	253 (6)	265 (5)
Females	252 (7.5)	237 (4)	249 (4)
Protein			
Males	81.5* (2.2)	67.1 (1.8)	70.8 (2.3)
Females	73.5* (2.2)	61.9 (2.0)	65.3 (2.1)
Fiber[d]			
Males	18.5* (0.5)	13.9 (0.5)	15.1 (0.5)
Females	16.4* (0.6)	13.7 (0.4)	14.8 (0.3)
	Mean percentage of energy intake[e] % (SE)		
Fat			
Males	34.8 (0.3)	34.1 (0.3)	34.7 (0.4)
Females	34.7 (0.4)	34.0 (0.4)	34.5 (0.4)
Carbohydrate			
Males	52.1 (0.5)	52.9 (0.6)	52.5 (0.4)
Females	51.4 (0.5)	53.1 (0.7)	52.8 (0.4)
Protein			
Males	14.5 (0.3)	14.1 (0.3)	14.2 (0.2)
Females	15.0 (0.3)	14.0 (0.3)	14.1 (0.2)

g/d = grams per day; NHANES = National Health and Nutrition Examination Survey; SE = standard error; WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.

[b] Source: Agricultural Research Service (ARS), 2021a

[c] Source: ARS, 2021b

[d] NHANES data on fiber intake as a percentage of energy were not available, so fiber is excluded from the bottom half of the table.

[e] The population ratio method was used to estimate the means for the percentage of energy.

* The WIC ITFPS-2 value is significantly different from the national sample at $p \leq 0.05$.

Longitudinal analysis of median intakes of saturated fat and added sugars showed rising levels of median intake and intake as a percentage of total calories (table 5.3). The mean intake of saturated fat as a percentage of total calories exceeded the DGA recommendation every year since age 2. The mean intake of added sugars rose steadily, exceeding the DGA recommendation at age 6 and at age 9.

Table 5.3. Daily usual intake of saturated fat and added sugars at select ages

Macronutrients	Median daily usual intake[a] g/d (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Saturated fat	16.1 (0.4)	16.2 (0.4)	16.3 (0.5)	17.9 (0.5)	20.0 (0.6)	27.3 (0.7)
Added sugars	19.1 (0.9)	26.9 (1.1)	33.0 (1.6)	36.7 (1.6)	42.6 (1.5)	55.5 (2.3)
Macronutrients and DGA recommendation	**Mean percentage of energy intake[b] % (SE)**					
Saturated fat (%)	12.1 (0.2)	11.1 (0.2)	10.7 (0.2)	10.9 (0.2)	11.2 (0.2)	11.8 (0.1)
DGA recommendation	<10% kcal	<10% kcal	<10% kcal	<10% kcal	<10% kcal	<10% kcal
Added sugars (%)	7.2 (0.4)	8.5 (0.4)	9.6 (0.4)	9.7 (0.3)	10.3 (0.4)	10.8 (0.3)
DGA recommendation	<10% kcal	<10% kcal	<10% kcal	<10% kcal	<10% kcal	<10% kcal

DGA = *Dietary Guidelines for Americans*; g/d = grams per day; kcal = kilocalorie; SE = standard error
[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.
[b] The National Cancer Institute multivariate model was used to estimate the ratios of intake to dietary energy.

Longitudinal analyses revealed a U-shaped trend in the percentage of study children exceeding the DGA recommendation for saturated fat intake between ages 2 and 9 (table 5.4). The percentage of study children exceeding the DGA recommendation for added sugars rose steadily from a low of nearly 19 percent at age 2 to about 55 percent at age 9.

Table 5.4. Percentage of study children exceeding recommended levels of intake of saturated fat and added sugars at select ages

Macronutrients[a]	Percentage[a] (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Saturated fat	88.5 (3.3)	69.2 (4.7)	58.5 (5.3)	62.7 (4.8)	72.7 (7.0)	86.9 (2.7)
Added sugars	18.5 (3.7)	28.4 (4.0)	39.4 (4.7)	42.1 (4.5)	50.2 (4.9)	55.1 (3.5)

SE = standard error
[a] The National Cancer Institute multivariate model was used to estimate the ratios of intake to dietary energy.

Though there was a steady upward trend in the percentage of study children exceeding the DGA recommendation for added sugars, the mean intake of added sugars intake by study females was significantly lower at age 9 than the mean for children ages 6 to 11 nationally (table 5.5).

Table 5.5. Median usual intake of saturated fat and mean usual intake of added sugars at study child age 9 years and intakes from NHANES by sex

Macronutrients	Median usual intake[a] g/d (SE)		
	WIC ITFPS-2 study children at age 9	NHANES 9–13-year-olds in families under 131% of poverty level[b]	NHANES 9–13-year-olds nationally[c]
Saturated fat			
Males	29.3 (1.2)	25.9 (0.8)	27.6 (0.7)
Females	25.2 (0.8)	24.1 (0.8)	25.7 (0.6)
	Mean usual intake[a] g/d (SE)		
Added sugars			
All children	N/A	72.3 (2.9)	N/A
Male	67.2 (4.7)	N/A	74.3 (3.5)
Females	55.3* (2.4)	N/A	70.4* (2.5)

g/d = grams per day; N/A = not available; NHANES = National Health and Nutrition Examination Survey; SE = standard error; WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.

[b] Source: Agricultural Research Service (ARS), 2021a

[c] Source: ARS, 2021b

[d] Source: ARS, n.d.

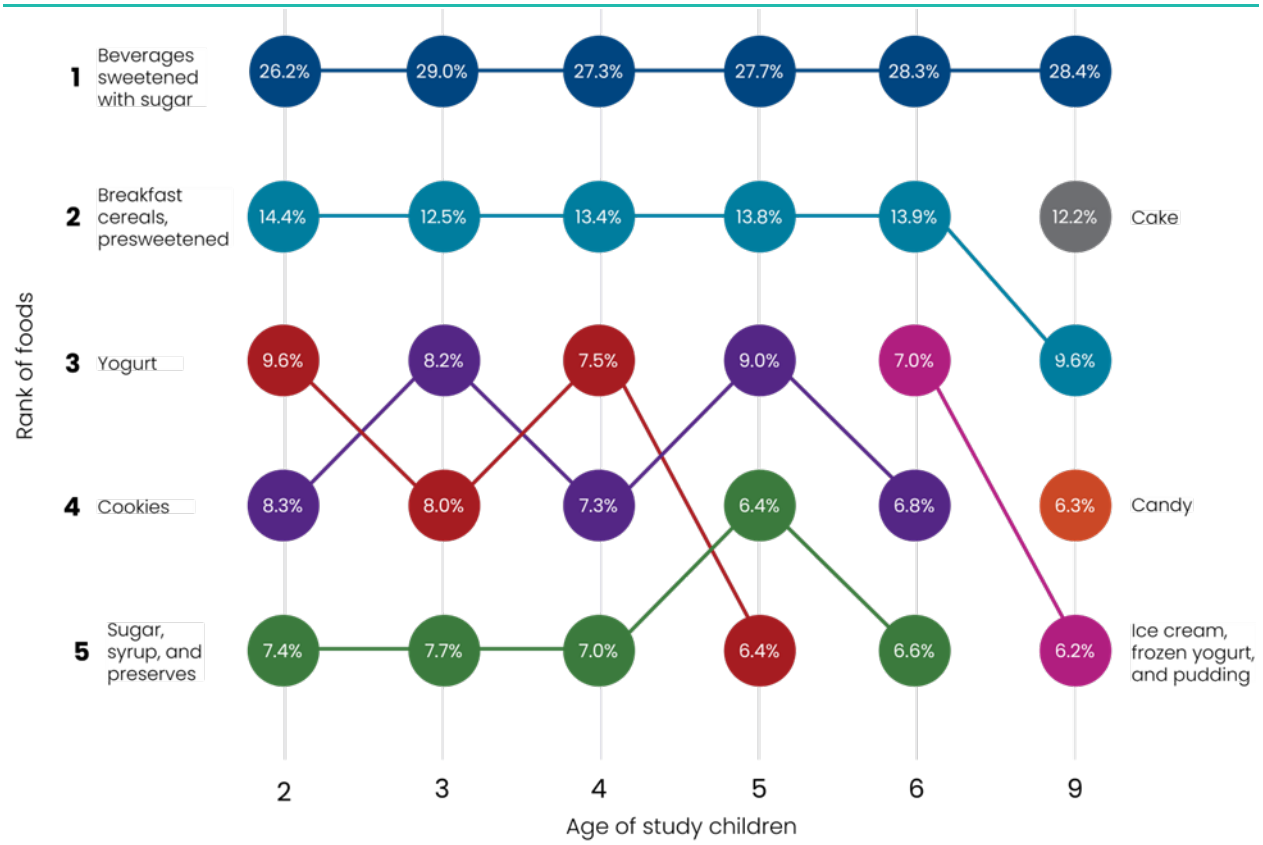
* Difference is statistically significant at $p \leq .05$ based on a two-tailed *t* test.

1. Top Contributors to Added Sugars and Saturated Fat Intakes

The analysis explored which foods contributed most to the intake of added sugars and saturated fats at each age among study children. Figures 5.2 and 5.3 present the top five most common foods contributing to added sugars and saturated fat intakes as a percentage of total added sugars and total saturated fat intake. Each food is represented by a unique color. The largest contributor at each age is at the top of the chart, and the fifth-largest contributor is at the bottom. Each circle contains the percentage that the food contributes to the nutrient. For example, beverages sweetened with sugar or SSBs—mostly in the form of fruit-flavored drinks with added sugar—contributed about 26 percent of total sugar intake at age 2 and 28 percent at age 9 (figure 5.2).

As figure 5.2 shows, SSBs were consistently the largest contributors to added sugars intake between ages 2 and 9, accounting for between 25 and 30 percent of study children's total added sugars intake. For most years, presweetened breakfast cereals were the second-largest contributor, contributing between 10 and 15 percent to total added sugars intake. However, at age 9, the contribution of cake surpassed that of presweetened breakfast cereals; presweetened cereals fell from second to third rank.

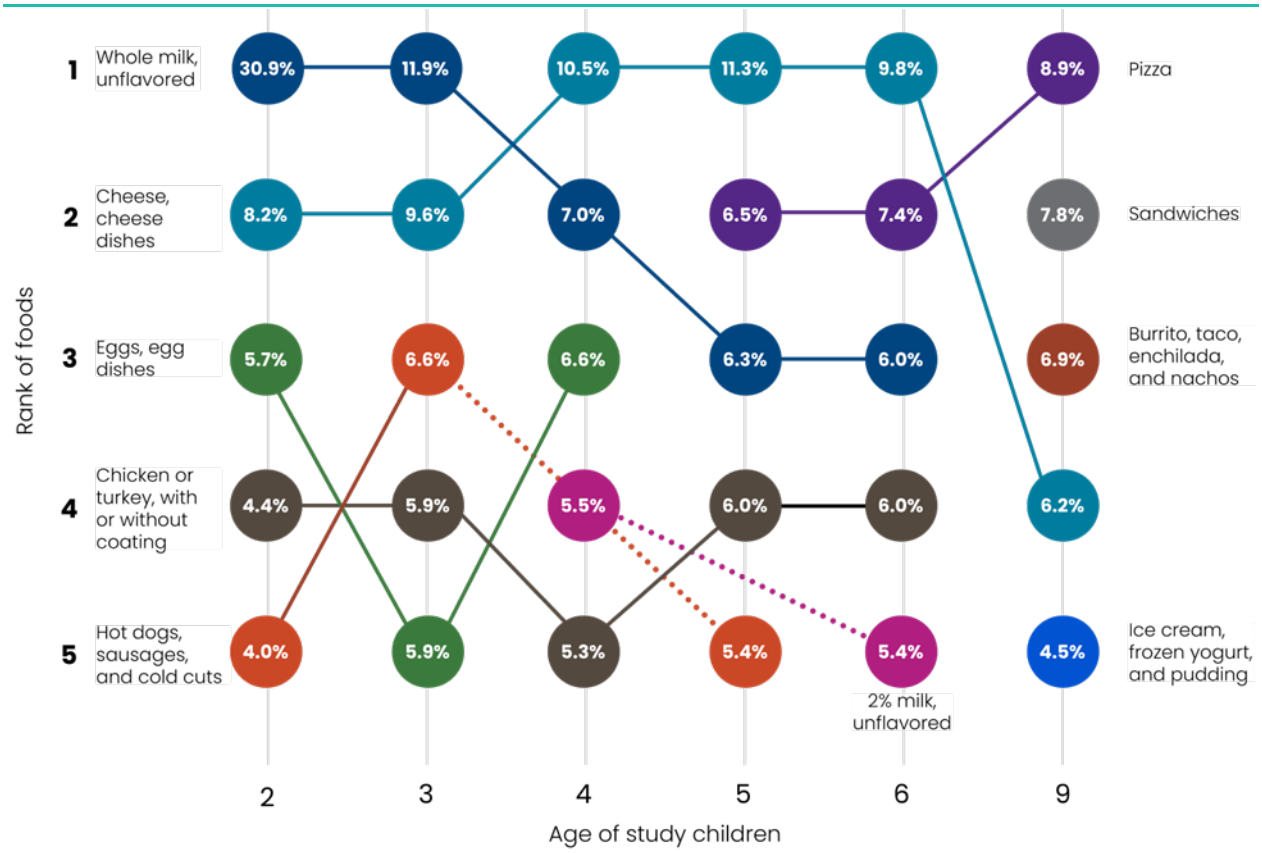
Figure 5.2. Top five foods contributing to added sugars intakes at ages 2 through 9



Note: Data for figure 5.2 are available in table D4.2 in appendix D4.

Whole milk was the largest contributor to saturated fat intake at ages 2 and 3 but fell to third by age 5 and dropped out of the top five by age 9 (figure 5.3). Dishes containing cheese became the largest contributors at ages 4, 5, and 6 but fell to fourth at age 9. Pizza, which for this analysis was considered a separate food from cheese and dishes containing cheese, became a top five contributor at age 5 and was the number one contributor at age 9. Ice cream, frozen yogurt, and pudding made the top five list for the first time at age 9.

Figure 5.3. Top five foods contributing to saturated fat intakes at ages 2 through 9



Note: Data for figure 5.3 are available in table D4.2 in appendix D4.

D. Micronutrient Intake

Micronutrients assessed in this report are potassium, sodium, calcium, and vitamins D and E (table 5.6). Except for at age 3, median potassium intake did not meet the AI standard at any of the ages assessed. Similarly, median vitamin D intake did not meet the EAR at any age assessed. The median intake of sodium was more than double the AI at all years assessed. The median intake of calcium exceeded the EAR at all years assessed. Median vitamin E intake hovered around the EAR for most years.

Table 5.6. Median usual intake of select micronutrients

Micronutrients[a] and DRIs	Median usual intake per day[a] (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Potassium (mg)	1,800 (38)	2,000 (36)	2,011 (45)	2,059 (37)	2,169 (54)	2,671 (69) (m) 2,496 (74) (f)
AI[b]	*2,000*	*2,000*	*2,300*	*2,300*	*2,300*	*2,500(m)* *2,300 (f)*
Sodium (mg)	1,793 (62)	2,078 (45)	2,233 (58)	2,501 (63)	2,631 (59)	3,275 (87)
AI[b]	*800*	*800*	*1,000*	*1,000*	*1,000*	*1,200*
Calcium (mg)	872 (25)	923 (21)	905 (30)	956 (15)	1,001 (37)	1,139 (40)
EAR[b]	*500*	*500*	*800*	*800*	*800*	*1,100*
Vitamin D (mcg)	7.5 (0.3)	7.5 (0.2)	7.4 (0.2)	7.4 (0.3)	7.5 (0.4)	8.0 (0.5)
EAR[b]	*10*	*10*	*10*	*10*	*10*	*10*
Vitamin E (mg)	4.1 (0.2)	5.4 (0.2)	6.6 (0.4)	6.4 (0.3)	7.0 (0.3)	10.0 (0.5)
EAR[b]	*5*	*5*	*6*	*6*	*6*	*9*

AI = Adequate Intake; EAR = Estimated Average Requirement; f = females; m = males; mcg = microgram; mg = milligram; SE = standard error

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.

[b] Sources: Otten et al., 2006; Ross et al., 2011

Comparisons of the WIC ITFPS-2 median micronutrient intakes at age 9 with the medians from a national sample of 9–13-year-old children from NHANES found that study males and females had statistically significant higher median intakes of potassium and vitamins D and E than children of similar ages nationally (table 5.7). Study males had higher intakes of calcium than children of similar ages nationally.

Table 5.7. Median usual intake of select micronutrients at study child age 9 and median intakes from NHANES by sex

Micronutrients	Median usual intake per day[a] (SE)		
	WIC ITFPS-2 study children at age 9 years	NHANES 9–13-year-olds in families under 131% of poverty level[b]	NHANES 9–13-year-olds nationally[c]
Potassium (mg)			
Males	2,671* (69)	2,068 (69)	2,183 (72)
Females	2,496* (74)	1,980 (59)	2,088 (45)
Sodium (mg)			
Males	3,498 (126)	3,110 (97)	3,254 (74)
Females	3,052 (96)	2,840 (98)	2,972 (79)
Calcium (mg)			
Males	1,226* (54)	970 (37)	1,019 (42)
Females	1,049 (46)	903 (33)	949 (21)

Micronutrients	Median usual intake per day[a] (SE)		
	WIC ITFPS-2 study children at age 9 years	NHANES 9–13-year-olds in families under 131% of poverty level[b]	NHANES 9–13-year-olds nationally[c]
Vitamin D (mcg)			
Males	8.7* (0.8)	5.1 (0.4)	5.1 (0.1)
Females	7.3* (0.4)	4.4 (0.3)	4.4 (0.2)
Vitamin E (mg)			
Males	10.5* (0.6)	7.3 (0.4)	8.1 (0.4)
Females	9.4* (0.5)	6.8 (0.3)	7.6 (0.2)

mcg = microgram; mg = milligram; NHANES = National Health and Nutrition Examination Survey; SE = standard error; WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.

[b] Source: Agricultural Research Service (ARS), 2021a

[c] Source: ARS, 2021b

* The WIC ITFPS-2 value is significantly different from the national sample at $p \leq 0.05$.

The study assessed the proportion of study children with usual intake of select nutrients at age 9 relative to the EAR when available or to the AI when there was not an EAR. Usual intake below the EAR is referred to as inadequate intake.

While the median usual intake of potassium by both male and female study children exceeded the AI, nearly two of five study children (39%, males, and 38%, females) had usual intake below the AI (table 5.8). Similarly, the median usual intake of calcium exceeded the EAR, but about 46 percent of study children had inadequate intake. Though the median usual intake of vitamin D was higher than medians from nationally representative samples (table 5.7), about 82 percent of study children had intake below the AI at age 9 (table 5.8). The median intake of vitamin E was also higher than medians from nationally representative samples (table 5.7), but about 41 percent of study children had inadequate intake of vitamin E (table 5.8). The median usual intake of sodium was about 2.5 times the AI, and no study children had usual intake below the AI.

Table 5.8. Median usual intake and percentage of study children with usual intake of select micronutrients below the recommended levels (EAR or AI) at age 9

Micronutrients	AI/EAR/DGA children ages 9–13	Median usual intake by study children Median (SE)	Percentage of study children not meeting recommended levels % (SE)
Potassium[a] (mg/d)			
Males	2,500[b]	2,670.5 (68.6)	39.2 (4.7)
Females	2,300[b]	2,495.6 (74.4)	37.7 (5.4)
Sodium (mg/d)	1,200[b]	3,275.2 (86.7)	0.0 (0.0)
Calcium (mg/d)	1,100[c]	1,139.1 (39.8)	46.3 (9.1)
Vitamin D (mcg/d)	10[b]	8.0 (0.5)	82.3 (9.2)
Vitamin E (mg/d)	9[c]	10.0 (0.5)	41.3 (6.5)

Note: Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.
AI = Adequate Intake; DGA = *Dietary Guidelines for Americans*; EAR = Estimated Average Requirement; mcg/d = micrograms per day; mg/d = milligram per day; SE = standard error
[a] The percentage usual intake below the AI by sex is reported for potassium because the recommendation is sex specific.
[b] AI
[c] EAR

Though inadequate intake of micronutrients is concerning at any age, trends in inadequate intakes are more so because they highlight the potential for long-term deficiency. Between study children ages 2 and 6, about 7 of 10 (70–75%) study children had intake below the AI for vitamin D; the percentage rose to about 8 of 10 (82%) at age 9 (table 5.9). The prevalence of inadequate intake of calcium nearly doubled between ages 6 and 9, rising from about one of five (24%) study children at age 6 to more than two of five (46%) at age 9.

The prevalence intake of potassium below the AI declined between ages 2 and 9, as did the prevalence of inadequate intake of vitamin E, albeit more modestly. Few, if any, children had intake below the AI for sodium over the course of the study.

Table 5.9. Percentage of study children with usual intakes of select micronutrients below recommended levels (EAR or AI) at select ages

Micronutrients[a]	Percentage % (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Potassium (mg/d)[a]	64.2 (8.2)	50.0 (2.6)	66.4 (2.6)	64.9 (2.2)	57.5 (5.1)	38.5 (4.3)
Sodium (mg/d)[b]	0.0 (1.7)	0.2 (0.4)	1.5 (0.9)	0.0 (0.1)	0.3 (0.3)	0.0 (0.0)
Calcium (mg/d)[c]	5.2 (3.4)	4.3 (2.9)	37.1 (4.7)	30.2 (2.7)	23.7 (7.2)	46.3 (9.1)
Vitamin D (mcg/d)[d]	76.2 (3.5)	75.8 (3.3)	73.4 (4.3)	69.4 (2.7)	71.0 (3.6)	82.3 (9.2)
Vitamin E (mg/d)[e]	62.4 (2.9)	44.8 (3.3)	41.6 (13.1)	45.1 (3.0)	40.1 (3.0)	41.3 (6.5)

Note: Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.
AI = Adequate Intake; EAR = Estimated Average Requirement; mcg = microgram; mg = milligram; mg/d = milligrams per day; SE = standard error
[a] AI is 2,000 mg/d for ages 2 and 3; 2,300 mg/d for ages 4 through 6; 2,500 mg/d for males at age 9; and 2,300 mg/d for females at age 9.
[b] AI is 800 mg/d for ages 2 and 3; 1,000 mg/d for ages 4 through 6; and 1,200 mg/d at age 9.
[c] EAR is 500 mcg/d for ages 2 and 3; 800 mcg/d for ages 4 through 6; and 1,100 mcg/d at age 9.
[d] EAR is 10 mcg/d at all ages.
[e] EAR is 5 mg/d for ages 2 and 3; 6 mg/d for ages 4 through 6; and 9 mg/d at age 9.

The study also assessed excessive intakes of sodium (table 5.10). Almost all study children had intakes of sodium that exceeded the CDRR. Though there was a 10-percentage-point drop in the percentage of study children exceeding the sodium recommendation at age 4, more than 8 of 10 (86%) study children still exceeded the recommended limit at that age. Generally speaking, almost all study children exceeded the recommendation between ages 2 and 9.

Table 5.10. Percentage of study children with sodium intake exceeding recommended levels at select ages

Nutrient	Percentage % (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
Sodium (mg/d)[a]	99.6 (8.1)	96.0 (2.0)	86.8 (3.0)	97.5 (2.1)	94.7 (1.5)	99.2 (1.2)

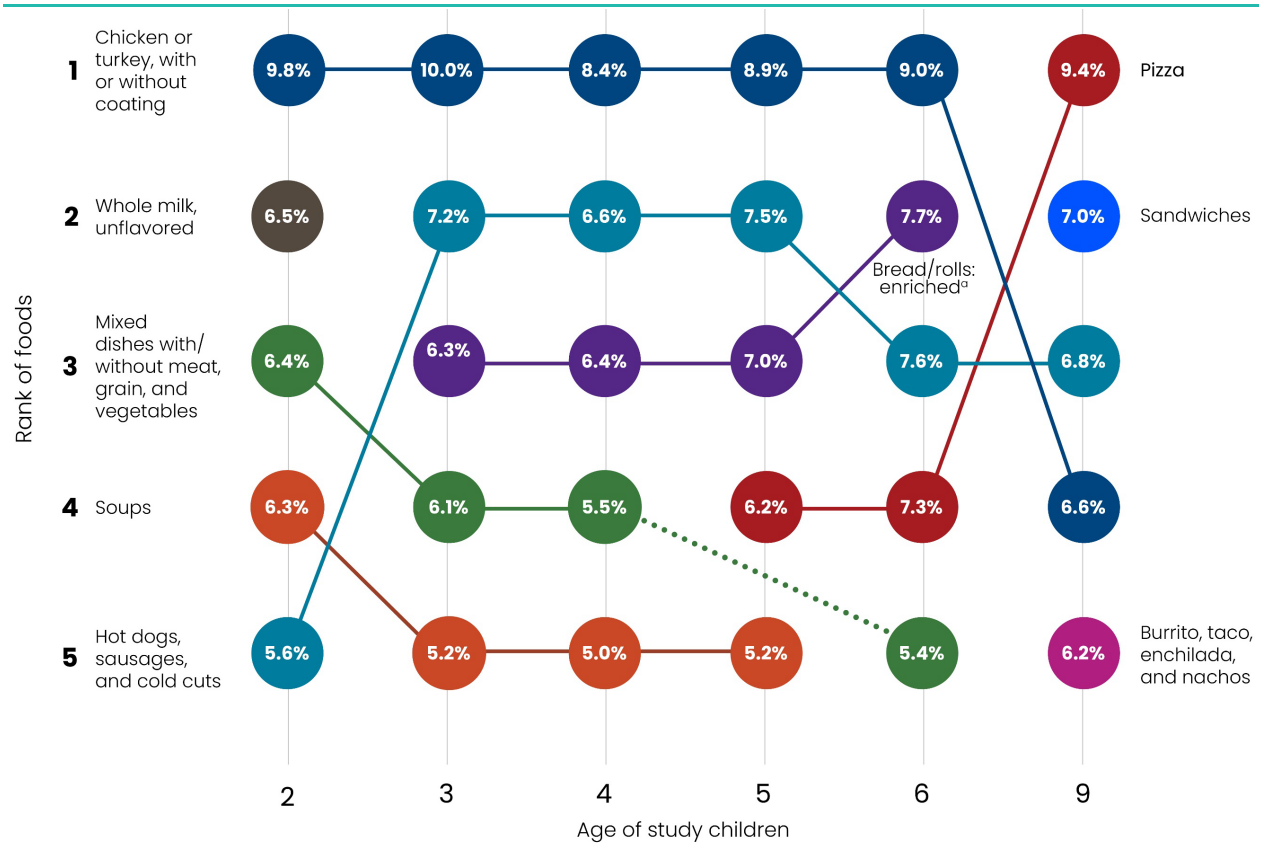
Note: Usual intakes were estimated using the univariate model offered by the National Cancer Institute. Unweighted and weighted *n*'s are not reported because estimates were derived from a larger pseudo-population.
mg/d = milligrams per day; SE = standard error
[a] Chronic Diseases Risk Reduction recommendation is 1,200 mg/d at ages 2 and 3; 1,500 mg/d at ages 4 through 6; and 1,800 at age 9.
Source: National Cancer Institute, 2023

1. Top Contributors to Sodium Intake

Figure 5.4 presents the five most common foods contributing to the study children's sodium intakes between ages 2 and 9. Each food is represented by a unique color, with lines connecting a food across ages. Each circle contains the percentage that the food contributes to total sodium intake. For example, chicken or turkey (with or without coating) contributed nearly 10 percent to study children's total sodium intake at age 2 and 7 percent at age 9. At ages 2 through 6, chicken

or turkey was the top contributor to sodium intake, but it fell to fourth by the time the study children were 9. Pizza made the top five list starting at age 5 and became the top contributor by age 9. At age 9, burritos, tacos, enchiladas, and nachos made the top five list for the first time.

Figure 5.4. Top five foods contributing to sodium intake at ages 2 through 9



Data for figure 5.4 are available in table D4.3 in appendix D4.
[a] Whole grain-rich breads and rolls

Chapter 6

Discussion

This chapter highlights top-line findings from this report, noting strengths and limitations of the study.

A. Summary of Findings

The WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) went into the field in 2013 enrolling participants in a study that was originally intended to follow new WIC enrollees from their first enrollment visit at a sampled WIC clinic for their pregnancy or newborn less than 3 months old until the child turned age 2 years. Because of highly successful recruitment and retention efforts and research findings that informed program operations, the study was extended several times to follow children every year until they turned 6, with a final follow-up at age 9 to assess the lasting impacts of WIC. This report focuses on findings from when the study children were age 9 but looks back over the years to assess outcomes longitudinally.

1. WIC Education Has Lasting Impact

The findings in this report indicate that WIC participation had a lasting impact on the behavior of WIC participants. The knowledge that caregivers gained from WIC continued to influence food-related behaviors 4 years after the study children were no longer age eligible to participate in WIC. Caregivers who learned to reduce added sugars intake were more likely to use food labeling information on added sugars when the study child was 9. Additionally, caregivers who reported learning nutrition information from WIC were more likely to have fruit, dark green vegetables, and low- or non-fat milk available in their homes than caregivers who did not report learning from WIC.

2. WIC Participation Impacts Diet Quality

Based on Healthy Eating Index-2020 (HEI-2020) scores, the diet quality of the typical study child at age 9 was better than the diet quality of a typical child of similar age nationally. This finding is notable because most study children lived in households with low incomes, which tend to have lower quality diets and face challenges to food security. Previous WIC ITFPS-2 research found a positive association between the duration of WIC participation and children's HEI-2020 scores at ages 2, 3, 5, and 6. This study did not identify an association at age 9. This may reflect an inability to capture the increasingly numerous factors that affect children's diets as they get older, as well as the relatively small sample size of the Year 9 longitudinal cohort.

3. WIC Participation Impacts Nutrient Intake

Focusing on nutrients of public health concern, intakes of potassium and vitamin D tended to be higher than findings from a nationally representative sample of children ages 9–13. However, about 82 percent of study children had inadequate intake of vitamin D. Study children's fiber intake was also well below recommended levels, though higher on average than intake from a nationally representative sample of children ages 9–13. Practically all study children exceeded the recommended limit for sodium, and 87 percent of study children met the DGA recommendation for saturated fat intake. These findings are consistent with findings from previous years of the study and with estimates for children nationally.

Taken together, findings from the longitudinal WIC ITFPS-2 indicate that through supplemental nutritious foods, nutrition education, and referrals, WIC not only impacts children and caregivers while they are enrolled in the program, but it also has a lasting positive impact on caregiver food-related behaviors, foods available at home, and the diet quality of children long after they are no longer age eligible for the program. However, similar to children nationally, the diets of children from families with low incomes could be improved. Ongoing efforts are needed to help children and their families adopt and maintain a healthier lifestyle to optimize diet-related outcomes and prevent childhood chronic diseases.

B. Study Limitations

As with all research studies, design decisions and study-specific goals for WIC ITFPS-2 limit the conclusions that the study team can draw. These limitations are most evident when estimating usual intake, establishing causal relationships, and generalizing beyond the population represented by our probability sample. However, they also include sample attrition over the years and the unique period when data were collected.

1. Estimating Usual Intake

Estimates of usual intake are model dependent and, therefore, may differ if alternative variables are used in the models recommended by the National Cancer Institute (2023) to estimate usual intake using the 10-percent subsample that had a second 24-hour dietary recall. Consequently, estimates in analyses presented may differ from those in another study even if that study uses WIC ITFPS-2 data. In this report, a few sociodemographic variables and cross-sectional and longitudinal weights were used in models to adjust for usual intake.

When analyzing ratios of intakes, the analyses presented sometimes relied on the population ratio method (i.e., the ratio of the means, where the adjusted intakes used to generate the means of numerator and the denominator cannot be linked at the individual level). This approach does not account for the correlation within a person's intake, which may overstate the standard errors of estimates, which means that statistical tests of outcomes based on usual intake estimates may not find significant differences when they exist.

2. Establishing Causal and Direct Relationships

As an observational longitudinal study, WIC ITFPS-2 is well suited to evaluate the lasting impact of WIC participation on the diet and health outcomes of participants. It would not be feasible to randomly assign participants to a treatment group that participates in the program and a control group that does not participate. Instead, WIC ITFPS-2 uses the differences in program exposure that arise over time between children who stay and children who leave the program. Given the lack of a comparison group of WIC-eligible infants who never enrolled in the program, findings can infer causality between program predictors and outcomes rather than establishing it with

certainty because differences in outcomes may be influenced by unobserved differences that also shape patterns of participation.

3. Generalizing Findings

Study eligibility rules and sample design limited the generalizability of the findings by excluding portions of the WIC population. Eligible mothers were either pregnant or had infants no more than 2.5 months old, and they were enrolling in WIC for the first time for that pregnancy or child. Mothers were at least 16 years old at the time of enrollment and spoke either English or Spanish. The weighted sample represents infants from the eligible population who enrolled in WIC during our 20-week enrollment period. The sample does not represent the entire WIC population. The sample may not have captured characteristics or feeding patterns that pertain to mothers who are very young, who speak a language other than English or Spanish, or who enroll in WIC for the first time after 2.5 months postpartum or in seasons not reflected in the enrollment window.

The sampling frame excluded WIC clinics expected to enroll fewer than 30 new participants each month. The study team chose these eligibility characteristics to encompass a large portion of the WIC population, but this population is concentrated in less than half of WIC clinics nationally. The sampling frame accounts for about 87 percent of the total WIC population and about 37 percent of 2010 WIC Participant and Program Characteristics reporting units. Findings may not generalize well to those who receive services at WIC clinics serving smaller populations.

It is important to acknowledge that the lingering effects of COVID-19 may affect the generalizability of findings. Along with the rest of society, study families were rebounding from the pandemic during data collection around ages 6 and 9. The pandemic and corresponding mitigation efforts, including pandemic-related expansions of nutrition assistance programs and alternative modes of delivery, may have altered food access, diet, and health trajectories permanently or in ways that are unique to the data collection periods.

4. Attrition, Wave Response, and Weighting

Though retention of participants was high for a longitudinal study that was in the field for over a decade, both sample attrition and wave nonresponse (i.e., nonresponse to a particular interview, for those who remained in the study) occurred.[39] Sample weights account for attrition and wave nonresponse using characteristics of the sample, but if other characteristics are associated with nonresponse even after accounting for the characteristics used in computing the sample weights, there is the potential for bias to remain in the estimates.

5. Additional Study Limitations

The limitations previously discussed apply to the entire study. Two limitations of note apply to this report. First, the longitudinal sample size was smaller than in previous years, which may have limited the power to detect statistically significant differences. Second, some of the statistical

[39] Appendix B, sections B.8 and B.9, offers additional information on imputation and attrition.

tests were conservative in that they used Bonferroni adjustment when there were multiple tests and, in the case of longitudinal comparisons, assumed independent samples over time.

C. Final Notes

Originally designed to follow a prospective cohort to age 2, WIC ITFPS-2 was extended several times because it was highly successful in recruiting and retaining study participants and offered informative data and analyses. The study's data and findings provide a valuable resource to understand success and better target challenges related to WIC.

Looking back over the decade of data collection, the study provided evidence of improved perceptions of breastfeeding (May et al., 2015; Panzera et al., 2017); documented increases in breastfeeding initiation and duration rates, particularly by Black and African American women (May et al., 2017); and highlighted reductions in the percentage of caregivers introducing complementary foods before child age 4 months (May et al., 2017).

The concept of the duration of participation evolved as a significant predictor of study children's diet quality and intakes (Anderson et al., 2022; Borger, Paolicelli, & Sun, 2022; Borger, Paolicelli, Sun, Zimmerman, et al., 2022; Borger, Zimmerman, et al., 2022; Plank et al., 2019; Weinfield et al., 2020). As detailed in the *WIC ITFPS-2: Fifth Year Report* (Borger, Zimmerman, et al., 2022), the study found that many study participants experienced a hiatus in WIC participation because of life circumstances. The study documented in the *WIC ITFPS-2: Sixth Year Report* (Borger et al., 2024) found that the duration of WIC participation through the first 5 years of the child's life was independently associated with better diet quality at age 6 (Borger et al., 2024). It also demonstrated associations between consumption of WIC foods (e.g., low-fat milk) and duration of participation (Au et al., 2024; Borger et al., 2024). This Year 9 report highlights that age 9 children in families with low incomes who were exposed to WIC have diets that are at least as healthy as their peers' diets and for several measures (e.g., protein and fiber intake, intake of plain drinking water, HEI total scores), they were healthier.

WIC has changed tremendously since 2013, the year WIC ITFPS-2 entered the field. At that time, most State agencies did not offer food benefits through EBT/eWIC (electronic benefit transfer/electronic WIC); remote service delivery was not available; and the DGA, which informs WIC nutrition education, did not include recommendations for children under age 2. The recent approval of revised food packages and funding of modernization efforts are further changing the program. Additionally, there have been shifts in the composition of the WIC population and modifications to the WIC packages since the study was initiated. Taken together, the changes since WIC ITFPS-2 launched imply that WIC has evolved in the past decade.

To understand associations between new programmatic features of the WIC program and program retention, breastfeeding, diet, and health outcomes, new research efforts are needed. Specifically, rigorous longitudinal studies are needed to determine how new service-delivery models, revised food packages, and updated and expanded DGA recommendations affect maternal and child program experience and diet and health in the modern era.

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Appendix A

Study Overview

This appendix provides background on the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2.

A. Background

The following discussion provides important background information for contextualizing the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITPFS-2). It offers information on the data collection and response rates and concludes with a description of the approach to analyses. Because this report focuses on the dyad's pattern of WIC participation, this appendix includes an overview of the methodology used to derive that variable, which was originally documented in the *WIC ITFPS-2: Fifth Year Report* (Borger, Zimmerman, et al., 2022).

1. WIC

WIC was established to safeguard the health of pregnant and postpartum women, infants, and children who have low incomes and are at nutritional risk. The program was instituted by Congress as a pilot in 1972 under Public Law 92–433, section 17 of the Child Nutrition Act of 1966, and made permanent in 1974 (U.S. Department of Agriculture, Food and Nutrition Service [USDA, FNS], 2025). WIC provides nutrition assistance to pregnant, postpartum, and breastfeeding women and their infants and children up to age 5, all of whom are at nutritional risk. Participants must meet the residency requirements and have a household income at or below 185 percent of the Federal poverty guidelines (FPG; U.S. Department of Health and Human Services, 2024) (e.g., $51,338 and $55,500 for a family of four in 2022 and 2023, respectively[40]) or be eligible according to participation in certain other means-tested benefit programs.

USDA FNS administers WIC, which is a Federal grant program, to 89 WIC State agencies, including Indian Tribal Organizations and U.S. territories. The State agencies are responsible for program operations within their jurisdictions, and they provide services primarily through local WIC-sponsoring agencies (e.g., health departments, community centers, hospitals) that provide services to WIC participants at local service sites or clinics.

2. Influential National Studies

WIC ITFPS-2 is a longitudinal study designed to examine the feeding practices of caregivers and the nutrition-related outcomes of children who enrolled in WIC around the time of birth. By capturing data on caregivers and their children over the first 6 years of the child's life and again at age 9, the study informs a series of research questions about feeding practices, the association between WIC services and those practices, and the health- and nutrition-related outcomes of children currently or previously participating with WIC.

WIC ITFPS-2 is heavily predicated on the design used for the USDA's first longitudinal WIC Infant Feeding Practices Study (WIC IFPS-1) (Baydar et al., 1997). While this earlier study followed

[40] These are the values for a family of 4 in the 48 contiguous states and the District of Columbia. In Alaska, the 2022 and 2023 values for a family of four were $64,177 and $69,375, respectively. In Hawaii, the 2022 and 2023 values for a family of four were $59,052 and $63,825. The study children were recruited in 2013, when the values were lower. These income values are provided to help contextualize income requirements in current dollar amounts.

infants only through the first year of life, comparisons between the two studies describe the major shifts in infant feeding practices that occurred between the mid-1990s and mid-2010s (May et al., 2015).

The design of WIC ITFPS-2 also complemented other more recent national studies that did not focus specifically on the WIC population. For example, the U.S. Food and Drug Administration (FDA) and Centers for Disease Control and Prevention's (CDC) longitudinal Infant Feeding Practices Study-II (IFPS-II) (Fein et al., 2008) was used extensively as a frame of reference during the planning of WIC ITFPS-2. Previous WIC ITFPS-2 reports also made comparisons with findings from the Gerber/Nestlé Feeding Infants and Toddlers Studies (FITS), which were conducted in 2002 (Devaney et al., 2004), 2008 (Briefel et al., 2010), and 2016 (Welker et al., 2018) and addressed the dietary intakes and feeding practices of infants and children. While drawing on these previous studies and their associated literature, the WIC ITFPS-2 team tailored the study to the WIC population with refined study instruments and methods that minimized respondent burden and maximized longitudinal engagement and study efficiency. The team's efforts enabled comparisons between the current study findings and past work, including WIC IFPS-1, FDA/CDC IFPS-II, and Gerber/Nestlé FITS.

3. WIC ITFPS-2 Objectives

The primary research objectives for WIC ITFPS-2, when the study children are age 9, included:

- Examining the dietary behaviors and health outcomes of children at age 9 (4 years after the study child was no longer age eligible for WIC), including providing longitudinal comparisons to examine changes from when the children were age eligible for WIC
- Describing the food security status of children at age 9 and their households, considering the role of other food assistance programs from which they benefit
- Describing feeding practices of caregivers for their children at age 9
- Describing the food and health-related environmental characteristics for children at age 9

The study addressed these objectives by focusing on 21 research questions specified by FNS (table A.1).

Table A.1. WIC ITFPS-2 Year 9 research questions for the study

Research questions
■ What are the food/beverage (including water), energy, and nutrient intakes of the study children both overall and by subgroups of interest?[a]
■ What are the meal and snack patterns both overall and by subgroups of interest?[a]
■ How many 9-year-olds exhibit unhealthy eating patterns, and what characteristics, including weight-for-height status, are associated with these habits?[a]
■ Describe energy, macronutrient, and food group intake at age 9 years in comparison to trends during the first 6 years of the WIC ITFPS-2.[a]
■ What is the independent relationship, if any, between various patterns of WIC participation (e.g., continuous participation, participation at certain ages, intermittent participation) and dietary behaviors and energy and nutrient intake around 9 years?[a] – Are differences affected by eligibility for and/or participation in other food benefit programs (e.g., National School Lunch Program [NSLP]/School Breakfast Program [SBP]/Summer Food Service Program [SFSP], Supplemental Nutrition Assistance Program [SNAP])?[a] – Do dietary patterns of children with longer durations of participation in WIC more closely reflect nutrients emphasized by WIC than those who have shorter duration/more intermittent benefits?[a] – Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to feeding practices, meal/snack patterns, and food and nutrient intakes at age 9 years? How do these vary based on characteristics of WIC participation of the child/household?[a]
■ How are early feeding practices (e.g., breastfeeding, early introduction of complementary foods, introduction of sugary drinks and other sweet foods, etc.) independently associated with children's health outcomes (e.g., weight and height status, food allergies, etc.) during the ninth year of life?
■ Do early feeding practices, meal/snack patterns, or food, energy, and nutrient intakes relate to the health status and weight trajectories or childhood overweight/obesity of 9-year-olds?
■ What is the influence of caregiver practices at home and broader environmental factors—such as the media—on dietary behaviors that may affect childhood obesity? Describe the media usage, screen time, and physical activity behaviors of WIC ITFPS-2 children.[a]
■ What is the impact of participation in other Federal food assistance programs (e.g., NSLP/SBP/SFSP, SNAP) on feeding practices and health outcomes (i.e., weight status, developmental outcomes) during the ninth year of life?
■ Are there associations between dietary behaviors, feeding practices, and patterns of WIC participation in early childhood and academic performance in the ninth year of life?
■ Estimate the food security status for children and their households overall and for key subgroups and characteristics of interest.[a]
■ How does food security status change across the course of the WIC ITFPS-2? To what extent does prior or current WIC participation influence food security status during the ninth year of life?[a]
■ How does participation in other food assistance programs by the child or their household impact household food security overall and by subgroups of interest?[a]
■ To what extent do feeding practices during the ninth year of life vary by household's continued participation in WIC (i.e., someone else in the household is receiving WIC benefits) and/or by the household's participation in other Federal food assistance programs?[a]
■ To what extent do feeding practices during the ninth year of life vary by cumulative years of participation in WIC, and by reasons for exiting the WIC program?[a]
■ Do caregivers continue to purchase the foods they previously received in their child's WIC food package, even when no one in the household is receiving WIC?[a]
■ How do feeding practices vary with caregiver work/school status (e.g., part-time, full-time), family circumstances (e.g., number and age of household members, household member's participation in WIC, SNAP, etc.), and childcare/preschool/school circumstances?

Research questions
■ In what food environments (home, school, childcare, etc.) do children consume meals and snacks during the ninth year of life? How do these environments vary by subgroups of interest? ■ What proportion of intake is consumed in the various food environments? To what extent does this vary across subgroups of interest? ■ What are the characteristics of the food environments (supervision of meals/snacks, availability of healthy foods/beverages, style of food service, meal/snack schedules) in which study children are provided meals and snacks?[b]

WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2

[a] This research question is addressed, at least in part, in this *WIC ITFPS-2: Ninth Year Report*.

[b] This research question replaces, "To what extent do caregivers seek out nutrition information [i.e., nutrition education] once their households no longer participate in WIC?"

Study children turned 9 years old between April 2022 and July 2023. The data collection for the Year 9 interviews began in June 2022 and concluded in August 2023.[41] Though study children are too old to participate with WIC, their caregivers and/or younger household members may participate with the program. The service provision landscape for those families continuing with WIC after the study child became too old for services has changed dramatically since 2013. For example, State agencies no longer offer vouchers for prescribed food benefits. All have transitioned to an electronic benefit transfer system so that participants purchase foods using a WIC card. Many State agencies also accepted the physical presence waivers offered during the COVID-19 national health emergency and transitioned to offering virtual appointments. WIC sites currently provide services in a wider array of formats (virtual, hybrid, in person) than they did when study children were originally recruited; thus, associations found between the study child's pattern of WIC participation over the first 5 years of life may not match those found for children currently participating in the program. For this study, it is important to note that even though the data were collected 2 to 3 years after the initial emergency declaration, residual impacts of the pandemic may have affected study families.

Despite changes in the service provision landscape, WIC ITFPS-2 methodology is unchanged from prior years because the study child has not been age eligible for WIC since turning age 5. This appendix provides a high-level overview of the methodology with emphasis on components specific to this report. For more methodological details, please refer to Harrison et al. (2014) and Siegfried et al. (2023).

B. Study Design

Originally envisioned to follow children through age 24 months, this observational study followed a hybrid design, incorporating a core longitudinal sample (the "core" sample) and a single supplemental cross-sectional sample (the "supplemental" sample) to ensure precision in estimates at key points during the first 24 months of life. Both the core longitudinal and

[41] Though scheduled to begin in April 2022, the interviews were fielded from June 2022 because of the low number of cases in the initial months.

supplemental samples of women and their infants were enrolled in the study as they enrolled in WIC either prenatally or before their infant was 2.5 months old if they did not enroll prenatally.[42]

The study was extended several times, so study children were followed regularly until they were 72 months old, with the supplemental and core samples combined after the 24-month interview. Interviews of the core sample took place prenatally and at child age 1, 3, 5, 7, 9, 11, 13, 15, 18, 24, 30, 36, 42, 48, 54, 60, and 72 months.[43] Though interviewed less frequently before the study child's second birthday, the supplemental sample received all the interviews that the core sample received starting with the 24-month interview. The Year 9 interview was planned as an additional final interview for the entire cohort. Over the course of the study, the core sample received a maximum total of 19 caregiver interviews, and the supplemental sample received a maximum total of 12 caregiver interviews.[44]

To be eligible for inclusion in the main analysis sample for the entire study, study participants must have completed either a 1- or 3-month interview (n = 3,775).[45] This report focuses on data from the Year 9 interview, which includes both the core and supplemental samples. After 10 years of attrition, 2,867 study participants were eligible for the Year 9 interview.[46]

C. Sample Selection

WIC ITFPS-2 collects data from a national sample of participants who enroll in WIC before 3 months of age. This sample includes participants who enroll in WIC while pregnant and those who enroll soon after giving birth. To obtain a representative sample of WIC participants for WIC ITFPS-2, a sample of WIC sites was selected; subsequently, a sample of participants enrolling in WIC at each of the selected WIC sites was selected. The following subsections summarize the sampling plan, and further details of these procedures are provided in appendix B and in Siegfried et al. (2023).

1. Sampling WIC Sites

The WIC sites were selected using a stratified two-stage sampling approach. Because no national list of service sites existed, the study team used a summary file at the level of the unit (either local agency or service site/clinic) reported by each WIC State agency in the April 2010 census (the WIC Participant and Program Characteristics 2010 [PC 2010]; FNS, 2011) as the sampling frame. Because State agencies had flexibility in how they reported local agency and service site/clinic identifiers (IDs) for PC 2010, the IDs provided in the records varied. Some State agencies provided

[42] For sampling, the age cutoff for the child was 3 months. To provide time to respond to the interview, this age was operationalized during recruitment as eligible for enrollment if the child was less than 3 months old, assuming other eligibility criteria were met.

[43] Study interviews were more frequent during the infant year to capture the rapid changes in feeding practices and less frequent in subsequent years to reduce burden on participants. The supplemental sample interviews were selected with attention to achieving desired precision levels for subgroups at key periods in the first 2 years of life.

[44] The supplemental sample was interviewed at 1 or 3 months and at 7, 13, 24, 30, 36, 42, 48, 54, 60, and 72 months and at age 9 years.

[45] In the early years of the study, n = 3,777; however, two fraudulent cases were discovered and excluded.

[46] During the fielding period for the Year 9 interview, the study was suspended temporarily. There were 31 eligible study participants whose interview windows opened and closed during the suspension period. Though they are included in the total eligible (n = 2,867), their interview data when the child was age 9 were not collected.

the service site ID in addition to a local agency code, whereas others included only a local agency code. As a result, two stages of selection were used to sample sites. The first stage involved the sampling of "PC 2010 tabulation units"—the units for which IDs were provided in the PC 2010 data. The second stage involved the sampling of local sites/clinics for situations in which the sampled tabulation unit was a local agency.

Some WIC sites were excluded for operational and design reasons, including geographic location (American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and U.S. Virgin Islands) and sites that were expected to enroll an average of fewer than 30 new pregnant women and newborns per month. Thus, study findings may not be generalizable to participants who first enrolled at WIC sites with lower enrollment.

The sample was stratified to improve the precision of survey estimates. To achieve this goal, the strata were formed so that the units within the strata were more similar to one another (regarding characteristics related to key survey outcomes) than to units in general (i.e., strata should be internally homogeneous). Five characteristics of the first-stage sampling unit or its State agency were used to group the sites into a total of 40 strata for selection (see appendix B, table B.1 for more details). The first three of these five characteristics were features of the WIC 2011 State Agency Plan and were included because they may be associated with key survey outcomes related to breastfeeding and nutrition. The five characteristics were the following:

- **Peer counseling program.** Whether the State agency had a breastfeeding peer counseling program in place.[47]
- **Trained paraprofessionals.** Whether the State agency policy allowed for trained paraprofessionals to provide nutrition education (vs. requiring staff members who provide nutrition education to have professional training or credentials).
- **Policy to provide formula.** Whether State agency policy permitted providing one can of formula for breastfeeding infants during the first 30 days of life.
- **Percentage of women who used the fully breastfeeding package.** The PC 2010 data were used to measure food package selection by first-stage sampling unit. The percentage was calculated by dividing the number of postpartum women who received the fully breastfeeding package during April 2010 by the total number of postpartum women receiving any food package that same month.
- **Average of children's and mothers' high weight-for-height rates.** The PC 2010 data were used to estimate the percentage of children and the percentage of mothers who were "high weight for height"[48] at the first-stage sampling unit level, and these percentages were averaged together to get a measure of risk of being overweight for all participants at the first-stage sampling unit level.

[47] Ultimately, there was no variation in this characteristic: All States reported offering a breastfeeding peer counseling program.

[48] For children up to 12 months of age, high weight for height was determined according to nutrition risk code 110 (see FNS, 2011). For children 12 to 24 months, this term was defined as at risk of being overweight by virtue of having a mother or father who is obese (body mass index [BMI] of 30 or greater). For children 24 months and older, this term is defined as higher than the 95th percentile of BMI-for-age. For mothers, the criterion was a reported pregravid BMI of 25 kg/m^2 or higher.

Within each stratum, two sites were sampled with probabilities proportional to size, where the measure of size was the expected number of eligible enrollees. Therefore, 80 WIC sites, operated by 27 different WIC State agencies, were sampled.

2. Sampling WIC Enrollees

The study sampled new WIC participants who enrolled at the sampled sites during a prespecified time period deemed the "recruitment window." The recruitment window varied for the sites selected for the study, but all recruitment windows fell between July and November 2013. The start date for the recruitment window was randomly assigned to each site. The recruitment window was a series of consecutive enrollment days during the study recruitment period in which all new WIC enrollees in that site were screened for eligibility and recruited into the WIC ITFPS-2. The length of the recruitment window for each site was predetermined according to the estimated amount of time needed to yield 98 eligible new WIC enrollees per site (the target sample size for each site).[49] Because the estimated average number of new WIC enrollees per day at the 80 sites varied substantially, the window length was much shorter in sites with a high estimated rate of new enrollees per day than in sites with a low estimated rate.

Specifically, the sample included all women enrolling in WIC for the first time for either their current pregnancy or their newborn at the site during the recruitment window.[50] The study participants must have enrolled in WIC at the site during the recruitment period, although the study screening and enrollment could occur at a later date.[51]

Core and supplemental samples. Two samples were selected at each WIC site: a core longitudinal sample and a supplemental cross-sectional sample. The core sample was designed as an equal probability sample of all new enrollees. Identified during recruitment, the supplemental sample was designed to increase the sample size at key time periods and to focus, to the extent possible, on subpopulations of interest such as African American mothers and infants who had no prenatal WIC exposure. Details of the selection of the core and supplemental samples throughout the study recruitment period are discussed in more detail in appendix B.

Multiple births. For study mothers who had multiple births such as twins, a single infant was randomly selected to participate in the study at enrollment or the first postnatal contact.

[49] The estimated amount of time needed to yield 98 new WIC enrollees was based on July 2012 enrollment figures from the sites.

[50] Women who had enrolled in WIC for previous pregnancies, enrolled other children in WIC, or both were eligible for the study. Women below age 16, those who did not speak English or Spanish, and those enrolling a child over 2.5 months of age were not eligible for the study.

[51] The majority (74.7%) were enrolled on the same day. Of the rest, most were enrolled within 30 days, with less than 1 percent enrolling beyond 30 days.

D. Data Sources and Interview Content

The study team gathered data from numerous sources over the course of the study, which began in July 2013. The main source was a series of telephone interviews with the study child's mother or caregiver. In addition, the team obtained repeated measures of each child's weight and length/height periodically from several sources: State agency administrative records were primary sources before 24 months; direct measurements at WIC sites or clinics or with qualified healthcare providers were primary sources after 24 months. Early in the study, contextual information about the WIC sites and State policies was obtained from clinic and WIC program staff.[52] In total, the study's data sources included the following:

- Screening and enrollment interviews with recruited WIC enrollees
- Telephone interviews with study participants conducted prenatally and at child age 1, 3, 5, 7, 9, 11, 13, 15, 18, 24, 30, 36, 42, 48, 54, 60, and 72 months, with a final interview at age 9
- Height and weight measurements taken at WIC sites or by healthcare providers at the child's birth and at approximately 6, 12, 24, 36, 48, 60, and 72 months of age, with final collection at about age 9, which before 24 months came primarily from State agencies and after 24 months came primarily from participants using prepaid postcards
- WIC administrative records for WIC food packages provided to mothers and infants[53]
- Site visits to participating WIC sites to collect data on facilities and staffing and to conduct 1-hour interviews with a site supervisor or coordinator
- Telephone key informant interviews with 27 WIC State agency representatives affiliated with the study to profile State and local policies and practices focused on nutrition education and breastfeeding promotion and support (at baseline [2013])[54]
- A WIC site staff survey that collected information on local WIC programs and the training and experience of the staff (at baseline [2013])[55]

Table A.2 presents an overview of the information (i.e., data domains) obtained from each data source. Survey domains include sociodemographic characteristics, knowledge, and lifestyle; feeding practices and experiences; child-rearing practices; and weight and length outcomes. As mentioned, this report focuses on data gathered at the Year 9 interview (appendix E), which collected dietary recall information and sociodemographic, lifestyle, and diet-related information on families. Where relevant, WIC ITFPS-2 data collected earlier in the study are presented in this report to provide longitudinal context for current findings.

[52] Data on the characteristics of the WIC sites are not used in this report. They were used in earlier reports as covariates in exploring the variation in infant feeding practices.

[53] These data are not used in this report. More detail on them can be found in chapter 1 of the *WIC ITFPS-2: Third Year Report* (Weinfield et al., 2019).

[54] These data are not used in this report. More detail on them can be found in chapter 1 of the *WIC ITFPS-2: Third Year Report* (Weinfield et al., 2019).

[55] These data are not used in this report. More detail on them can be found in chapter 1 of the *WIC ITFPS-2: Third Year Report* (Weinfield et al., 2019).

Table A.2. Domains by data source

Domain	Source of data																						
	WIC ITFPS-2 interview by timing																					WIC admin. data	Staff survey/kay informant interviews
	Screening/ enrollment	Baseline[a]	Prenatal	1 month	3 months	5 months	7 months	9 months	11 months	13 months	15 months	18 months	24 months	30 months	36 months	42 months	48 months	54 months	60 months	72 months	Year 9		
Sociodemographic characteristics	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
WIC site characteristics and policies																							●
WIC program awareness and utilization			●		●		●			●			●			●		●		●			
Maternal health and lifestyle	●	●		●	●		●			●			●	●		●		●		●	●		
Feeding experience, knowledge, attitudes, beliefs, information, and advice		●	●	●	●	●	●			●	●		●	●		●		●		●	●		
Hospital feeding–related practices				●																			
Current feeding practices				●	●	●	●	●	●	●	●	●	●	●		●		●		●	●		
24-hour dietary recall for child				●	●	●	●	●	●	●	●	●	●		●		●		●	●	●		

Domain	Source of data																						
	WIC ITFPS-2 interview by timing																					WIC admin. data	Staff survey/kay informant interviews
	Screening/ enrollment	Baseline[a]	Prenatal	1 month	3 months	5 months	7 months	9 months	11 months	13 months	15 months	18 months	24 months	30 months	36 months	42 months	48 months	54 months	60 months	72 months	Year 9		
Child health behavior/rearing practices				●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●		
Food access and preferences														●		●		●		●	●		
Child developmental milestones																●		●			●		
Child weight and length/height														●	●		●		●	●	●	●	
WIC food package type[b]																						●	
Caregiver contact information			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
New caregiver characteristics				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

admin. = administrative; WIC ITFPS-2 = WIC Infant and Toddler Feeding Practices Study-2.

[a] After screening/enrollment, baseline module questions are asked at the first interview (which could be the prenatal, 1-month, or 3-month interview, depending on when the participant enrolled in the study) in addition to the other survey modules completed at that same interview.

[b] Maternal food package data are collected at prenatal and postnatal certifications as applicable and at 6 months. Infant food package data are collected at initial infant certification, 6-month midcertification, and 11 months. Food package data are not collected after 11 months because children aged 1–4 years have only one nonmedical food package.

* New caregiver characteristics are asked anytime someone permanently replaces the primary caregiver.

E. Data Collection Procedures

The principal data collection activities for the study were recruiting and interviewing study participants. Study mothers were recruited in person at WIC sites, and surveys were administered in telephone interviews. In the study's early years, the study also obtained data on the mother and study child (e.g., child's length and weight, maternal and infant food package type) from WIC State agency administrative records; however, for this Year 9 report, data on height and weight were primarily obtained from healthcare providers and WIC staff using prepaid postcards the caregiver sent to Westat.

1. Recruiting WIC Participants

Recruitment activities occurred over a 12-week period in the 80 sampled sites, with recruitment starting July 1, 2013, and ending November 18, 2013. In all but three of the 80 sites, an onsite Westat field recruiter screened and enrolled eligible participants in the study.[56] For additional detail on how the study recruited WIC participants, see section 1.5.1 of the *WIC ITFPS-2: Infant Year Report* (May et al., 2017).

To be eligible for the study, the participant needed to speak English or Spanish, be at least age 16, and be enrolling in WIC for the first time for her current pregnancy or baby less than 2.5 months old. WIC staff certifying new WIC enrollees identified and referred eligible study participants to study recruiters. All participants were given a $50 incentive for enrolling in the study and subsequent financial incentives for participating in each telephone interview and (after age 24 months) obtaining their child's anthropometric measurements when not available from WIC administrative data.

2. Interviewing Study Participants

After Westat enrolled study participants, trained telephone interviewers conducted interviews in English or Spanish with study participants. Interview data collection for the study began in July 2013 and ended in August 2023.

Because the study included both prenatal and postnatal WIC enrollees, children's birthdays spanned about 15 months. Consequently, any given interview was administered to study participants over a 15-month period. Specifically, the Year 9 interview was fielded between June 2022 and August 2023 (table A.3).

All postbirth interviews, except the 30-, 42-, and 54-month interviews, included a 24-hour dietary recall using the USDA's Automated Multiple Pass Method (AMPM) (Raper et al., 2004). The AMPM has been used to assess infant and child diet in other nationally representative studies, including the National Health and Nutrition Examination Survey (Ahluwalia et al., 2016).

[56] In three sites, WIC staff identified eligible women and sent their contact information to Westat; Westat interviewers recruited the women by telephone.

When fielded, one dietary intake interview was collected on all study children. Originally, the window for data collection was 4 weeks on either side of the target interview date, but at age 2, the window expanded to 6 weeks. The 6-week window spanned 14 days before the target interview date to 28 days after the target interview date. For example, if the target date was the 36-month interview, the window for the interview spanned 14 days before the day the child turned 36 months of age to 28 days after that day. In addition, within 10 days of the initial dietary intake interview, the study collected a second 24-hour dietary recall on a randomly selected 10 percent subsample of children. These second recalls were collected at 13, 15, 18, 24, 36, 48, 60, and 72 months and, for a final time, at age 9 years. The second-day recalls were used to calculate usual intake of energy, nutrients, and food pattern–equivalent values for all participants.[57]

Table A.3. Dates of interviews administered and unweighted interviews completed through the Year 9 interview

Interview	Number of dietary recalls	Date interview opened	Date interview closed	Interviews completed (unweighted N)
Prenatal	0	7/12/2013	2/5/2014	2,649
Month 1	1	7/3/2013	8/28/2014	3,397
Month 3	1	7/11/2013	10/31/2014	2,788
Month 5	1	10/1/2013	12/17/2014	2,615
Month 7	1	11/11/2013	2/28/2015	3,134
Month 9	1	2/1/2014	4/17/2015	2,451
Month 11	1	4/1/2014	6/17/2015	2,322
Month 13	2[a]	5/11/2014	8/28/2015	2,807
Month 15	2[a]	8/1/2014	10/17/2015	2,067
Month 18	2[a]	11/1/2014	1/17/2016	1,992
Month 24	2[a]	4/11/2015	8/11/2016	2,461
Month 30	0	10/15/2015	2/11/2017	2,625
Month 36	2[a]	4/11/2016	8/11/2017	2,608
Month 42	0	10/11/2016	2/11/2018	2,636
Month 48	2[a]	4/11/2017	8/11/2018	2,572
Month 54	0	10/11/2017	2/11/2019	2,563
Month 60	2[a]	4/11/2018	8/11/2019	2,529
Month 72	2[a]	4/28/2019	8/11/2020	2,137
Year 9	2[a]	6/30/2022	8/15/2023	1,363

[a] A single day of 24-hour dietary recall information was collected for all study participants. A second day of 24-hour dietary recall information was collected from a 10-percent subsample of participants.

[57] See appendix C for details of the computation of usual intake using the National Cancer Institute method.

Collecting Length/Height and Weight Data

The study collected length/height[58] and weight measurements of the children at birth and at about ages 6, 12, 24, 36, 48, 60, and 72 months and 9 years. As the study child grew older, respondents were allowed several months to obtain the information.[59] Accordingly, except for the birth measurements, the ages reflect a range around the desired date. The study refers to these ranges at early infancy, late infancy, toddlerhood, and ages 3, 4, 5, 6, and 9 years. Table A.4 presents the time periods during which the data collection occurred. Because of the COVID-19 health emergency, which resulted in the closure of WIC clinics, the window for collection of height and weight information at around age 6 years was extended by approximately 1 month to give participants additional time to visit a WIC clinic or healthcare provider, have the child weighed and measured, and submit requested information. The extended timeframe was retained for height and weight data collection at around age 9.

Table A.4. Dates length/height and weight collected and unweighted number received through the Year 9 interview

Measurement period[a]	Start date	End date	Number received[b] (unweighted N)
Birth[c]	7/27/2013	4/15/2015	3,499
Early infancy	7/25/2013	1/15/2015	2,568
Late infancy	4/1/2014	7/17/2015	2,577
Toddlerhood	4/6/2015	8/11/2016	1,731
Age 3	4/6/2016	9/18/2017	1,886
Age 4	3/27/2017	9/11/2018	2,115
Age 5	3/6/2018	8/30/2019	1,825
Age 6	5/24/2019	11/24/2020	1,386
Age 9	7/15/2022	2/02/2024	1,081

Note: Length was requested up to child age 24 months; subsequently, height was requested.
[a] Data are collected in a window of time at approximately the age listed.
[b] Not all measures reported were in the correct timeframe, so these counts are higher than the number of statistically weighted cases (See table A.7).
[c] Study administrators requested hospital records for the core sample. Birth measurements for both the core and supplemental samples were included in the request for data in early infancy.

The study team requested WIC administrative records for length and weight for children in the core sample up to age 24 months. For core sample members who left WIC during the interval up to the 24-month interview, the study team sought healthcare provider records for information on child length and weight. If core sample children left WIC and were not seen by a healthcare provider, the study team offered to send a home health service nurse to the home to obtain length and weight.

WIC administrative records for height and weight were requested for all participants continuing to receive WIC at child age 36 months. Study participants who no longer participated in WIC at this

[58] Up to child age 24 months, child length was requested; subsequently, child height was requested.
[59] The WIC ITFPS-2 Data User Manual—Enrollment to Year 9 (forthcoming) details the age ranges.

age were mailed a prepaid measurement card and asked to bring children back to a WIC location for measurements and to return the completed card to the study. If participants did not wish to return to a WIC location, they were asked to complete a medical records release authorization and to provide contact information for the child's healthcare provider to obtain child height and weight data or to provide height and weight data from their provider using a prepaid postcard (also referred to as a measurement card) that identified the provider.

When the study child was ages 48, 60, and 72 months and 9 years, all participants were asked to bring the study child to a WIC site to have them weighed and measured. Those who did not want to return to a WIC location were asked to have the study child's healthcare provider weigh and measure the child. In both cases, information was sent to Westat via a prepaid postcard that WIC staff or healthcare professionals were asked to complete.

Participants were offered a monetary incentive for providing measurements other than those collected from State agency administrative records.

F. Weighting and Imputation

In each WIC ITFPS 2 annual report, including this one, the sample under analysis is weighted to represent the national population of infants enrolled in WIC for the first time in July through November 2013 who met the following criteria:

- Were at least age 16 at the time of WIC enrollment
- Spoke either English or Spanish
- Were enrolling in WIC for the first time—either while pregnant or postnatally before the child was age 2.5 months[60]—at a site expected to enroll at least 30 new pregnant women or infants per month

The statistical weights inflate the sample to represent the study-eligible population by compensating for both the unequal sampling rates and nonresponse. All study findings represent the characteristics, views, behaviors, and experiences of this population (i.e., study-eligible pregnant and early postpartum women and their infants who enrolled at eligible WIC clinics from July through November 2013). Because the recruitment period for the study spanned 20 weeks, the weighted number of cases shown in the report tables is an estimate of the number of infants in the represented population who enrolled nationally during that 20-week period (July through November 2013). It is not an estimate of the monthly or annualized total number of WIC participants nationally and should not be interpreted as such.

The complex sample design of WIC ITFPS-2 affects variance estimation. Replicate weights that facilitate accurately estimating the variances given the sample design are available with the

[60] For sampling, the age cutoff for the child was 3 months. To provide time to respond to the interview, this age was operationalized during recruitment as eligible for enrollment if the child was less than 2.5 months old, assuming other eligibility criteria were met.

data.[61] More information on using the statistical weights is provided in the WIC ITFPS-2 Data User Manual—Enrollment to Year 9 (forthcoming).

Select sociodemographic characteristics were repeatedly used in analyses for this report; therefore, any missingness in them was imputed. No outcomes or site characteristics were imputed. Appendix B offers additional detail on weighting and imputation.

G. Unweighted Study Participation Rates

As table A.5 shows, a total of 4,489 new WIC enrollees were eligible to participate in this study, and of those, 97 percent (*n* = 4,367) were enrolled. Of those enrolled, 80 percent (*n* = 3,503) were assigned to the core sample, and 20 percent (*n* = 864) were assigned to the supplemental sample. For informational purposes, table A.5 also presents the numbers of pregnant and postpartum women in each sample.

Across all the sampling groups, 3,775 (86%) respondents completed at least 50 percent of a standard set of questions in their first postnatal interview (i.e., either the 1- or 3-month interview) and were, therefore, eligible to continue in the study. These 3,775 individuals composed the main analysis sample.[62]

As a result of attrition over the years of the study,[63] 2,867 of the original 3,775 respondents received the Year 9 interview, and 1,382 responded. Based on unweighted counts, about 37 percent of the main analysis sample (= 1,382 / 3,775) completed the Year 9 interview.

[61] For general information on variance estimation including replication methods, see Wolter (2007) and Rust and Rao (1996).
[62] After the *WIC Infant and Toddler Feeding Practices Study-2: Fourth Year Report* was submitted, two cases were found to be fraudulent and were removed from the original main analysis sample (*n* = 3,777).
[63] Table B.2 in appendix B offers additional detail on attrition.

Table A.5. Unweighted study sample participation at age 9 years

Sample and enrollment timing	Eligible sample, screened and eligible n	Consented and enrolled sample n	Main analysis sample n	Percentage of main analysis sample that completed the Year 9 interview % (n)
Total sample	4,489	4,367	3,775[a]	36.6 (1,382)
Core sample	3,605	3,503	3,019	35.8 (1,082)
Prenatal core sample	3,122	3,037	2,595	36.8 (955)
Postnatal core sample	483	466	424	30.0 (127)
Supplemental sample	884	864	756	39.7 (300)
Prenatal supplemental sample	688	678	588	41.0 (241)
Postnatal supplemental sample	196	186	168	35.1 (59)

[a] The original main analysis sample comprised unweighted 3,777 cases; however, after the *WIC Infant and Toddler Feeding Practices Study-2: Fourth Year Report* was submitted, two fraudulent cases were identified. These cases were excluded from the main analysis sample for the 54-month interview onward, so *n* = 3,775.

Table A.6 presents the percentage of the main analysis sample that completed each interview, including the percentages of the core and supplemental samples. At each interview, cases in the core and supplemental samples sum to those used in the main analysis sample. Table A.7 displays the number of participants for whom the study received anthropometric data, which were not analyzed for this report but were collected at around age 9.[64, 65]

Table A.6. Percentages and unweighted counts of analysis sample respondents, by sample type and interview month, through the Year 9 interview

Interview	Percentage of sample that completed the interviews		
	Main analysis sample % (unweighted n)[a]	Core sample % (unweighted n)[b]	Supplemental sample % (unweighted n)[c]
Prenatal	70.1 (2,649)	87.7 (2,649)	N/A
Month 1	90.0 (3,398)	90.5 (2,734)	87.7 (664)
Month 3	76.3 (2,881)	92.3 (2,788)	12.3 (93)
Month 5	69.8 (2,636)	87.3 (2,636)	N/A
Month 7	83.0 (3,134)	83.2 (2,514)	81.9 (620)
Month 9	64.9 (2,451)	81.2 (2,451)	N/A
Month 11	61.5 (2,322)	76.9 (2,322)	N/A
Month 13	74.3 (2,807)	74.1 (2,239)	75.0 (568)
Month 15	54.7 (2,067)	68.4 (2,067)	N/A
Month 18	52.7 (1,992)	66.0 (1,992)	N/A
Month 24[d]	65.2 (2,461)	64.1 (1,937)	69.2 (524)
Month 30[d]	69.5 (2,625)	68.6 (2,071)	73.2 (554)

[64] The WIC ITFPS-2 Data User Manual—Enrollment to Year 9 (forthcoming) offers additional detail on the anthropometric data.

[65] Food package data were collected in earlier years of the study. These data were not analyzed for this report. The WIC ITFPS-2 Data User Manual—Enrollment to Year 9 (forthcoming) provides information on these data.

Interview	Percentage of sample that completed the interviews		
	Main analysis sample % (unweighted n)[a]	Core sample % (unweighted n)[b]	Supplemental sample % (unweighted n)[c]
Month 36[d]	69.0 (2,608)	67.7 (2,044)	74.5 (564)
Month 42[d]	69.8 (2,636)	68.6 (2,072)	74.5 (564)
Month 48[d]	68.1 (2,572)	67.0 (2,022)	72.7 (550)
Month 54[d]	67.9 (2,563)	66.8 (2,018)	72.1 (545)
Month 60[d]	67.0 (2,529)	65.9 (1,989)	71.4 (540)
Month 72[d]	56.6 (2,137)	55.0 (1,659)	63.2 (478)
Year 9[d]	36.6 (1,382)	35.8 (1,082)	39.7 (300)

N/A = not applicable

[a] Percentages are of the main analysis sample. Initially, the main analysis sample comprised 3,777 unweighted respondents. After the 48-month interview, two cases, one from the core sample and one from the supplemental sample, were discovered to be fraudulent and were removed from the main analysis sample; therefore, *n* = 3,775 for the 54-, 60-, and 72-month and Year 9 interviews.

[b] Percentages are of the core sample: 3,020 unweighted respondents through the 48-month interview and 3,019 subsequently.

[c] Percentages are of the supplemental sample: 757 unweighted respondents through the 48-month interview and 756 subsequently. The supplemental sample was interviewed at either 1 month or 3 months but not both.

[d] Beginning with the 24-month interview, core and supplemental samples received all interviews.

Table A.7. Unweighted counts of anthropometric data received and statistically weighted for analyses

Measurement period[a]	Number received n	Number statistically weighted n	Percentage of the analysis sample[b] %
Birth[c]	3,499	1,624	43
Early infancy	2,568	2,014	53
Late infancy	2,577	2,015	53
Toddlerhood	1,731	1,731	46
Age 3	1,886	1,886	50
Age 4	2,115	2,115	56
Age 5	1,825	1,825	48
Age 6	1,386	1,386	37
Age 9	1,081	1,052	28

[a] Before child age 24 months, child length was measured; subsequently, child height was measured.
[b] Initially, the main analysis sample comprised 3,777 unweighted respondents. After the 48-month interview, two cases—one from the core sample and one from the supplemental sample—were discovered to be fraudulent and were removed from the main analysis sample; therefore, *n* = 3,775 for ages 5, 6, and 9 years.
[c] Study administrators requested hospital records for the core sample. Birth measurements for both the core and supplemental samples were included in the request for data around early infancy.

Using data from the Year 9 interview, this report focuses on outcomes reported when the child is age 9. Both days of dietary data are used to generate usual intake estimates. When feasible, usual intake estimates underlie estimated nutrient and Healthy Eating Index-2020 (HEI-2020) scores. This report also focuses on the study child's pattern of WIC participation over the first 5 years of life using bivariate analyses. Additionally, multivariable regression analyses highlight independent associations for select outcomes.

1. Usual Intake Estimates

As mentioned, 24-hour dietary recall information was collected as part of the Year 9 interview. This interview collected a first dietary recall on all study participants and a second recall on a 10-percent subsample of participants. After collection, the dietary data were coded and analyzed for nutrient and food group content and for snack and meal frequency, using version 5.0 (2009-2010) of the USDA Food and Nutrient Database for Dietary Studies.

In this report, dietary outcomes that rely on a single day of dietary recall information are estimates of children's intake on a given day. Dietary outcomes that incorporate both days of dietary information are referred to as usual intake estimates because the 2 days of dietary data were used to adjust for day-to-day variation in diet. Methods recommended by the National Institutes of Health's National Cancer Institute (NCI, 2023) were employed to develop usual intake estimates.

NCI offers different methods for calculating usual intake estimates, depending on the type of dietary component under analysis. In this report, usual intakes for single nutrients are estimated

using the NCI's univariate method. Usual intake estimates for HEI-2020 scores rely on NCI's multivariate Markov Chain Monte Carlo (MCMC) method.[66]

NCI's univariate approach fits a measurement error model for a single dietary component. In the univariate model used for this report, the single-nutrient estimates generated are adjusted for a select set of sociodemographic characteristics.[67] Additionally, all the univariate models incorporate the statistical weights that adjust the sample to reflect the nationally representative population eligible for this study.[68]

NCI's MCMC method is the primary approach for estimating ratios of dietary intakes. HEI-2020 scores assess dietary alignment with the 2020–2025 *Dietary Guidelines for Americans* (DGA) accounting for a person's total dietary energy. HEI-2020 total scores assess overall diet quality and range from 0 to 100, with higher scores indicating better alignment with the 2020–2025 DGA. HEI-2020 component scores assess how well the person's intake meets the specific recommendations within the USDA healthy meal pattern. Component scores for total fruits, whole fruits, total vegetables, greens and beans, total protein foods, and seafood and plant proteins range from 0 to 5. Component scores for whole grains, dairy, fatty acids ratio (the ratio of monounsaturated and polyunsaturated fatty acids to saturated fatty acids), refined grains, sodium, added sugars, and saturated fat range from 0 to 10. Consequently, each HEI-2020 score involves estimating a ratio of the child's dietary intakes, with most HEI-2020 components using dietary energy as the denominator.

In ratio estimation, it is important to account for the correlation between foods and nutrients within a person's diet. The MCMC method accounts for this correlation while enabling children's intakes to be adjusted for the important sociodemographic characteristics. Throughout this report, the population ratio method (i.e., the ratio of the means) is used to generate HEI-2020 mean scores.

2. Pattern of WIC Participation

Data used to quantify the durations or patterns of WIC participation are drawn from self-reported program participation at the time of each study interview. At every interview, study respondents are asked about their ongoing participation in WIC with the following question:[69] "Are you currently getting WIC food or checks for yourself or {CHILD}?" Respondents may continue with the study regardless of whether they continue to receive WIC benefits. Though the item refers to the caregiver and the study child, the variable described subsequently is often referred to as the "child's pattern of WIC participation" because the study follows the study child, not the caregiver.

[66] For more information, see NCI (2023).
[67] The covariates included in the univariate NCI models included the child's sex; the caregiver's race, ethnicity, and language; the caregiver's education level; the household's food security status; the households participation in benefit programs; and the child's pattern of WIC participation.
[68] In the usual intake models, the cross-sectional statistical weights are used to adjust for all sociodemographic characteristics except the pattern of WIC participation. When adjustments include the pattern of WIC participation, the Year 1 or Year 3 through Year 9 longitudinal statistical weights are used because the pattern of WIC participation is available only for the longitudinal sample.
[69] See item SD31 on the annotated instrument, which can be found in appendix B4 of the *WIC ITFPS-2 Fifth Year Report*.

Participants can be categorized according to their responses to the interview question and whether they receive WIC at any given interview month. Close examination of responses over time permits the categorization of respondents by the approximate number of study years for which they participated with WIC for themselves or the study child. Table A.8 displays the criteria for determining the length or type of participation with WIC. The groups are mutually exclusive.

It is important to note that participating with WIC in a given year does not necessarily mean the respondent received WIC benefits at the time of the final interview in that year. For example, respondents may be categorized as receiving WIC in Year 2 even if they did not indicate receiving benefits at 24 months, meaning they participated with WIC in Year 2 but did not necessarily receive WIC through the end of Year 2. It is also important to note that the group participating intermittently with WIC differs from the other groups. The intermittent group includes participants who indicated they received WIC benefits for any number of interviews, but receipt was inconsistent and typically much more limited over the course of the study than for other groups.[70] The intermittent group, therefore, does not reflect a specific length of time participating with WIC.

Table A.8. Criteria for determining pattern of participation in WIC

Pattern of WIC participation	Criteria (interview month requirements)
In Year 1 only	Receiving WIC at 13-month interview or not receiving WIC at this interview but receiving WIC at all interviews previously[a] and not receiving WIC subsequently
Into Years 1 and 2 only	Receiving WIC in Year 1 and either (1) receiving WIC at 24 months and not receiving WIC subsequently or (2) not receiving WIC at 24 months but receiving WIC at 15 and 18 months and not receiving WIC subsequently
Into Years 1, 2, and 3 only	Receiving WIC in Years 1 and 2 and receiving WIC at 30 or 36 months or both and not receiving WIC subsequently
Into Years 1, 2, 3, and 4 only	Receiving WIC in Years 1 and 2 and receiving WIC at 30 or 36 months or both and receiving WIC at 42 or 48 months or both and not receiving WIC subsequently
Into Years 1, 2, 3, 4, and 5	Receiving WIC in Years 1 and 2 and receiving WIC at 30 or 36 months or both and receiving WIC at 42 or 48 months or both and receiving WIC at 54 or 60 months or both but not consistently
Consistently	Received WIC in Years 1 and 2 and receiving WIC at every interview month subsequent to the 24-month interview through the 54-month interview[b]
Intermittently	Receiving WIC benefits sporadically throughout the first 60 months of the study

[a] Month 1 is not considered to ensure respondents have sufficient time immediately after birth.
[b] The 60-month interview is excluded because some children may no longer be eligible for WIC (because they are older than 5 years) when the 60-month interview is administered.

In both univariate and multivariable regression analyses, the seven categories representing patterns of WIC participation are collapsed into five mutually exclusive categories: in Year 1 only, into Years 2 and 3 only, into Years 4 and 5, consistently, and intermittently (table A.9). The category "Years 2 and 3 only" includes families that participated through the study child's first year and into the study child's second year and those who participated through the study child's first and second years and into the study child's third year of life. The category "Years 4 and 5"

[70] Interviews are more closely spaced in the first 2 years of the study than they are in later years. Therefore, a count of number of interviews does not provide a meaningful estimate of duration.

includes families that participated through the study child's first 3 years and into the study child's fourth year of life and those who participated through the study child's first 4 years and into the fifth year of life but did not participate consistently with WIC through the first 5 years of the study child's life.

The categories were collapsed for parsimony of presentation and because power analysis indicated the power of statistical tests would be improved by collapsing categories. Coverage data (FNS, 2019) guided the collapsing of the seven categories of WIC participation into the five categories chosen. Table A.9 presents the distribution of this version of patterns of WIC participation using the longitudinal cohort through age 5—the years of age eligibility for WIC. Because the variable is used as a covariate in regression analyses, any missingness was imputed. Appendix B discusses imputation.

Table A.9. Percentage of study mothers and/or children by patterns of participation in WIC (longitudinal cohort through age 5)

Patterns of WIC participation[a] (collapsed categories)	% (Standard error)	Unweighted n
In first year only (Year 1 only)	9.4 (1.2)	99
Into the second and third years only (Years 2 and 3 only)	18.2 (1.8)	206
Into the fourth year only and into fifth year but not consistently for 5 years (Years 4 and 5)	15.1 (1.5)	157
Consistently[b]	43.5 (2.8)	461
Intermittently	13.9 (1.4)	148
Unweighted *n*	1,071	1,071
Weighted *n*	439,965	439,965

[a] Categories of WIC receipt are mutually exclusive.
[b] "Consistently" means the respondent indicated that either the mother or child was receiving WIC in Years 1 and 2 and all subsequent survey months through the 54-month interview.

To increase cell sizes for the Year 9 analysis, categories of participation were collapsed from the five-category specification (table A.9) to three categories (table A.10). The first category, "No longer receiving WIC benefits after age 3," includes study children who participated with WIC up to age 3. The second category, "Still receiving WIC benefits after age 3," includes study children who participated with WIC beyond age 3. The third category, "Received WIC benefits intermittently during the first 5 years of life," captures families that cycled in and out of the program. It does not reflect the duration of WIC participation.

Table A.10. Percentage of study participants by pattern of participation in WIC (longitudinal cohort through age 9)

Patterns of WIC participation[a]	Study child and/or caregiver	
	% (Standard error)	Unweighted n
No longer receiving WIC benefits after age 3[b]	25.0 (2.8)	173
Still receiving WIC benefits after age 3[c]	62.7 (2.9)	423
Received WIC benefits intermittently during the first 5 years of life	12.3 (1.6)	86
Unweighted *n*[d]	N/A	682
Weighted *n*	N/A	439,117

N/A = not applicable
[a] Categories of WIC participation are mutually exclusive.
[b] Study children may have stopped participating with WIC after their first, second, or third year of life.
[c] Study children may have stopped participating with WIC after their fourth year, participated into their fifth year, or participated consistently over the first 5 years of life. "Consistently" means the respondent indicated that either the study child or the caregiver was receiving WIC in Years 1 and 2 and in all subsequent survey months through the 54-month interview.
[d] One of the prenatal WIC enrollees who enrolled in the study indicated at every postnatal interview that she was not participating with WIC. This study participant is excluded from this table.

3. Descriptive Analyses

Many of the research questions in this Year 9 report are addressed by descriptive analyses that tabulated the responses to specific interview questions. Descriptive statistics (e.g., counts, proportions, means, medians, and cross-tabulations) are, therefore, used throughout the report to describe findings.

4. Statistical Tests

When the outcome of interest is a categorical variable, a second-order Rao-Scott adjusted chi-square test described by Rao and Scott (1987), appropriately adjusted for the complex sample design, is used to determine whether there is a statistically significant association between the outcome and the key sociodemographic characteristic. Subsequently, pairwise *t* tests, adjusted for the complex sample design and multiple comparisons, are used to assess which differences between subgroups are statistically significant.[71] In all cases, the Bonferroni correction method is employed to adjust for multiple comparisons.

Some outcomes of interest are not categorical. They are continuous. Continuous variables cannot be assessed using chi-square tests. Consequently, if the outcome of interest is a continuous variable, univariate regression is typically used to assess a bivariate association. If the outcome of interest is a mean or median, an appropriately adjusted *t* test is used to determine whether the differences are statistically significant.

Throughout this and all other previously published WIC ITFPS-2 reports, statistical significance for analyses is at the level of $p \leq 0.05$. Bivariate associations discussed in this report are not limited

[71] In this report, *t* tests are two-tailed unless otherwise specified.

to the key sociodemographic characteristics but typically include them. Bivariate findings should be interpreted with caution because associations are not adjusted for potential confounders.

5. Multivariate Models

For the subset of research questions focused on identifying the factors independently associated with the outcomes observed, whether categorical or continuous, bivariate analyses alone are often not sufficient. Accordingly, multivariable regression analysis[72] is used to explore how choices and characteristics are independently associated with outcomes when they are jointly determined by or related to a variety of factors. Multivariable regression isolates the unique association between an individual variable and an outcome while holding constant the influence of other variables in the model. When compared with bivariate analyses, multivariable regression analysis typically finds that a more limited set of variables has a statistically significant association with the outcome.

6. Missing Item Data

Item nonresponse is reflected in the total number of observations available for analysis. Responses of "Don't know" and "Refused" are typically considered item nonresponse and are, therefore, treated as missing for the purposes of analysis. The one exception involves statements of belief or intention. In such cases, the response of "Don't know" is included as a valid response. With the exception of questions that are not relevant to the respondent and are, therefore, validly skipped during the interview, most differences in sample sizes (*n*'s) reported with analyses are attributable to item nonresponse.

[72] Regression approaches are appropriately adjusted for the complex sample design. The data are weighted in all regression analyses.

Appendix B

Details of Sampling and Weighting Procedures and Attrition

This appendix describes the procedures used for sampling and weighting. Additional information can be found in Siegfried et al. (2023). Information on attrition over the course of the study is also presented.

A. Selection of WIC Sites

WIC service sites were selected using a stratified two-stage sampling approach. Because no national list of service sites exists, the study team used, as a sampling frame, a summary file at the level of the unit reported by each State agency in the census of April 2010 (the WIC Participant and Program Characteristics 2010, or PC 2010). This census resulted in a file with one record for each participant being served by WIC in that month. Because State agencies had flexibility for PC 2010 for reporting service location identifiers, the IDs provided in the records by the State agencies varied; some State agencies provided the site ID in addition to a local agency code, whereas other State agencies included only a local agency code. As a result, two stages of selection were used to sample sites.

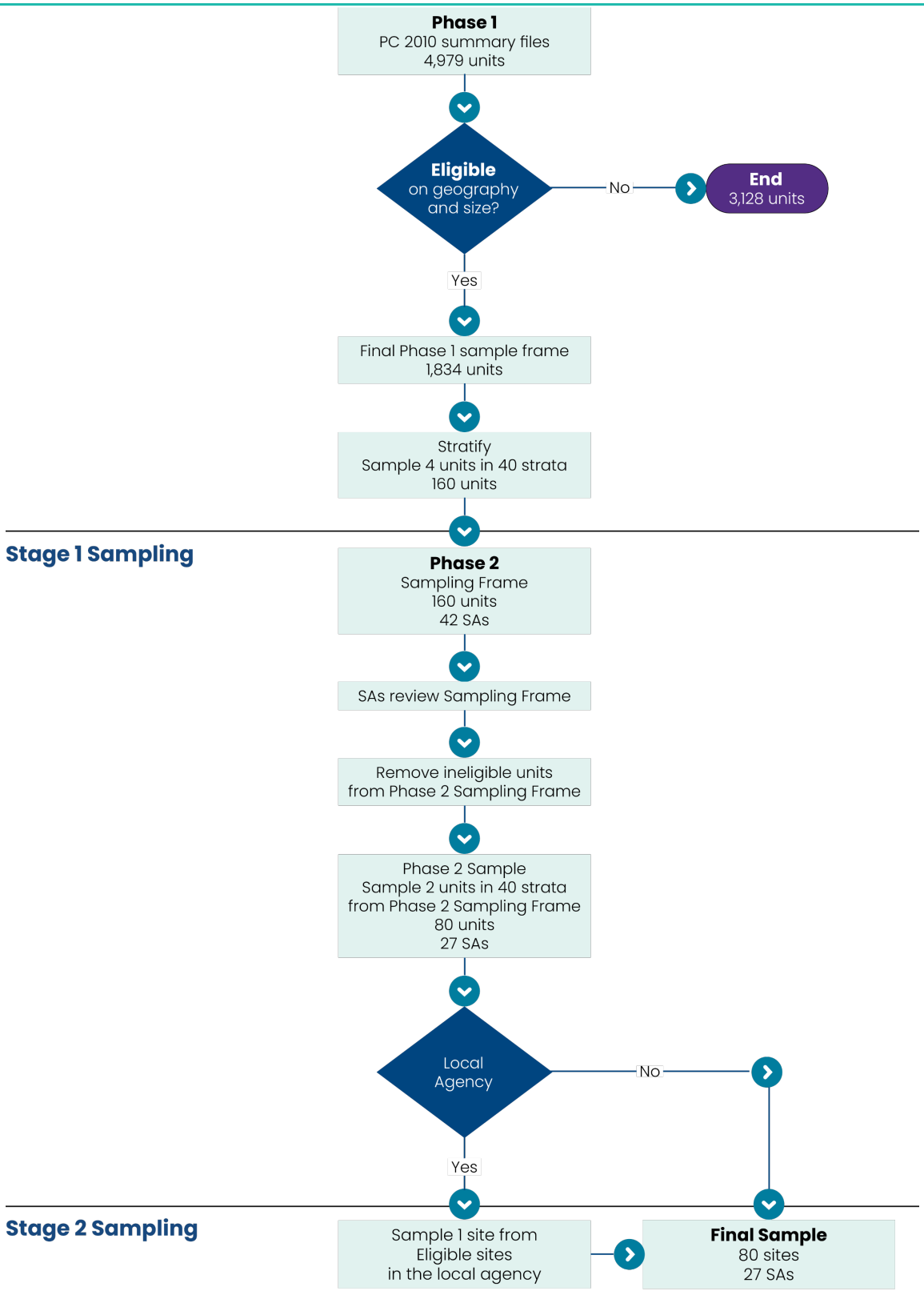
The first stage involved the sampling of "PC 2010 tabulation units"—the units for which IDs were provided in the PC 2010 data. The second stage involved the sampling of sites for situations in which the sampled tabulation unit was a local agency. (For the remainder of this report, these tabulation units will be referred to, using standard statistical terminology, as "first-stage" sampling units.) Additionally, because the information needed to determine the final eligibility of sites (namely, current enrollment information and whether the site was expected to be operational during the study recruitment period) was not available in the PC 2010 data, the first-stage sample was selected in two phases to contact State agencies to obtain additional eligibility information about the sites. The ultimate goal was the selection of 80 WIC sites. The flowchart in figure B.1 provides a general overview of the WIC site sampling process.

As figure B.1 shows, Phase 1 of Stage 1 involved the selection of 4 first-stage sampling units in each of 40 strata to create a Phase 2 sampling frame of 160 units. Stratification involved partitioning the sampling frame into four homogeneous groups and was used to improve the precision of estimates and to ensure representation in the sample of different types of sites. In Phase 2 of Stage 1, the study team contacted State agencies to determine the eligibility of each unit sampled in the first phase and then sampled two units from among the eligible first-stage sampling units in each stratum for a total of 80 units. In Stage 2, the study team sampled the service sites within the sampled units that were local agencies (rather than service sites) and selected one site from each local agency.

Site eligibility was based on enrollment flow. A minimum average flow of 1.5 new enrollees per day was required for a site to be eligible and ensure a sufficient volume of participants. Additionally, to ensure that recruitment could be completed within the study recruitment period, the study team imposed a restriction requiring that eligible sites yield the target number of eligible enrollees within a 4-month period.

Following the completion of the site sampling for the study, the study team began site recruitment efforts in earnest to eliminate the adverse effects of site-level nonresponse on sample yield. Sampled service sites that were unable to participate in the study were replaced by members of a matched sample.

Figure B.1. Overview of WIC site sampling process



PC 2010 = WIC Participant and Program Characteristics 2010; SAs = WIC State agencies

B. Construction of the Sampling Frame

The study team constructed the sampling frame from the WIC PC 2010 dataset. In October 2011, FNS provided the PC 2010 data in a total of 90 individual SAS data files—one for each WIC State agency. Once received, the study team merged all 90 files into a single analytic file and thoroughly reviewed the PC 2010 documentation to familiarize themselves with each field and to identify fields required for developing the first-stage sampling frame file, including the following variables that the study team derived from information provided in the PC 2010 database:

- Unit (i.e., a unique identifier for the PC 2010 tabulation unit described in Section B1, which was either the WIC site or the local agency)
- Unit Source
- Number of Exclusively Breastfeeding Women
- Number of Postpartum Women, Not Breastfeeding
- Number of Prenatal Women Enrolled in April 2010 (PC 2010 reference month)
- Number of Infants Under Age 3 Months Enrolled in April 2010
- Total Number of Infants Enrolled in April 2010
- Percentage of Infants Enrolled in April 2010 Who Were Under Age 3 Months
- Total Number of Participants (all categories)
- Number of Women Participants Under Age 18 Years in April 2010
- Number of Women Participants Under Age 16 Years in April 2010
- Percentage of Women With High Weight for Height Risk Code
- Percentage of Children With High Weight for Height Risk Code

C. Stage 1 Sampling: Selection of the Phase 1 Sample

The study team conducted the Stage 1 sampling in two phases. The process used to select the Phase 1 sample involved three steps: computation of the measure of size (MOS) used for Phase 1 selection, exclusion of ineligible units, and stratification and selection of the units.

1. MOS Computation

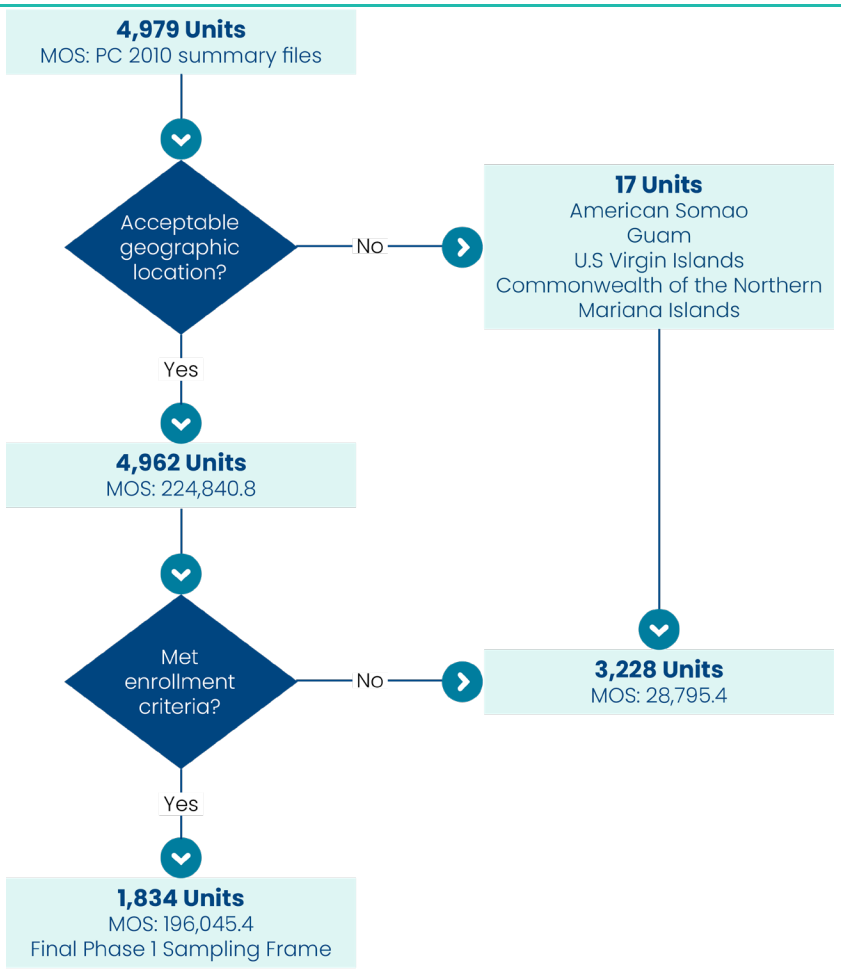
The sample design involved sampling sites with probabilities proportional to an MOS (i.e., probability proportional to size [PPS] sampling). For the Phase 1 sample, the MOS was the expected number of eligible enrollees for the first-stage sampling unit, based on the April 2010 enrollment counts from the PC 2010. That is, the MOS was calculated for each first-stage sampling unit by summing the total prenatal enrollment and 20 percent of the total enrollment of

infants less than age 3 months. Based on the aforementioned eligibility considerations, units with a value less than 30 for this MOS (i.e., fewer than 1.5 enrollees per day, assuming 20 enrollment days per month) were considered ineligible.

2. Exclusion of Ineligible Units

As figure B.2 shows, a total of 4,979 units appeared on the PC 2010 summary file that served as the basis for creating the sampling frame. Of these, a very small proportion (17 units) was dropped because of geographic location (American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and U.S. Virgin Islands). Because the units in these territories represented only 0.3 percent of the total sampling frame, their removal did not affect the representativeness of the frame. The remaining 4,962 units had a total MOS of 224,840.8. Of these, 3,128 units (with a total MOS of 28,795.4, about 12.8% of the total among geographically eligible units) were dropped because their MOS value was less than 30. As a result, the final Phase 1 sampling frame contained a total of 1,834 units, with a total MOS of 196,045.4.

Figure B.2. Exclusion of ineligibles from unit selection process



MOS = measure of size; PC 2010 = WIC Participant and Program Characteristics 2010

3. Stratification and Selection of the Phase 1 Sample

As noted in section B1, the sample was designed to yield 80 sampled service sites. To achieve this, a total of 40 strata were formed, and ultimately (after 2 phases of selection) 2 sites were sampled from each of these strata. Five characteristics of the first-stage sampling unit or its State agency were used to form the strata (note that the first three of these five characteristics are features of the WIC State Agency Plan that were used to group the WIC State agency programs into categories):

- Peer Counseling Program. Whether the State agency has a breastfeeding peer counseling program in place.[73]
- Trained paraprofessionals. Whether State agency policy allows for trained paraprofessionals to provide nutrition education (vs. requiring that staff who provide nutrition education have professional training or credentials).
- Policy to provide formula. Whether State agency policy is to provide one can of formula for breastfeeding infants during the first 30 days of life.
- Percentage of women prescribed the fully breastfeeding package. This variable was an estimate of the percentage of women in the first-stage sampling unit who were prescribed the fully breastfeeding food package during the postpartum period. The PC 2010 data were used to measure food package selection by first-stage sampling unit. The study team computed the percentage by dividing the number of postpartum women who received the fully breastfeeding package in April 2010 by the total number of postpartum women who received any food package that month.
- Average of children's and mothers' high weight-for-height rates. The PC 2010 data were used to estimate the percentages of children and of mothers who are "high weight for height"[74] at the first-stage sampling unit level, and these percentages were averaged together to get a measure of risk of being overweight for all participants at the first-stage sampling unit level.

Using these characteristics (i.e., combinations of different levels of these variables), the first-stage sampling units were grouped to form 40 fairly homogenous strata of roughly equal size (in relation to total MOS). Specifically, the first-stage sampling units in a given stratum all came from State agencies in the same WIC State Agency Plan classification (based on the three State agency Plan characteristics discussed earlier in this section) and, to the extent possible, had similar fully breastfeeding and high weight-for-height rates.

One first-stage sampling unit (PHFE WIC, in California) was, by itself, large enough (in relation to the total MOS) to constitute a stratum. That is, this unit (a local agency) was a certainty stratum,

[73] There was no variation in this characteristic; all State agencies reported offering a breastfeeding peer counseling program.

[74] For children up to 12 months of age, high weight for height was determined according to nutrition risk code 110 (see USDA, FNS, 2011). For children 12 to 24 months, this term was defined as at risk of being overweight by virtue of having a mother or father who is obese (body mass index [BMI] of 30 or greater). For children 24 months and older, this term is defined as higher than the 95th percentile of BMI-for-age. For mothers, the criterion was a reported pregravid BMI of 25 kg/m2 or higher.

meaning the unit was included in the first-stage sample with certainty. The service sites associated with the local agency were enumerated and sampled as described subsequently.

Table B.1 presents a tabulation of how the strata were defined. Specifically, each particular combination shown in the (1) cross-tabulation of the features of the WIC State Agency Plan, (2) exclusively breastfeeding range, and (3) high weight-for-height range constitutes a stratum. This tabulation shows, for each stratum, the total MOS, the number of units on the sampling frame, the number of units selected in the first phase, the number of sampled Phase 1 units that were eligible for Phase 2 selection, and the number of units sampled in Phase 2. Each of the unit counts was broken down by local agencies and individual sites.

Besides the certainty stratum, there were a few cases in which a particular first-stage sampling unit was sufficiently large to be sampled with certainty in the first phase of selection; that is, the unit's MOS was greater than one-fourth of the total MOS for its stratum so that its probability of selection in a PPS design was 1.

Table B.1. Definitions of the strata used for site sampling and key sampling statistics by stratum

Stratum ID	Features of the State WIC program	Percentage of women who used fully breastfeeding package	Children's and mothers' high weight for height rates (%)	Total stratum measure of size	Number of											
					Units on frame			Phase 1 units sampled			Phase units sampled eligible for Phase 2			Phase 2 units sampled		
					Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites
101	Does the state operate a breastfeeding peer counseling program? YES Does the state require that general nutrition education be provided by a professional staff member (e.g., dietitian, nurse)? NO Is infant formula issued in the first month to partially breastfed infants? NO	0–10.5691	0–36.7147	4,997.2	65	1	64	4	0	4	4	0	4	2	0	2
102		0–10.5691	36.7147–45.9689	4,952.0	62	0	62	4	0	4	3	0	3	2	0	2
103		10.5691–14.4928	0–35.5971	4,994.0	61	4	57	4	0	4	4	0	4	2	0	2
104		10.5691–14.4928	35.5971–44.0943	5,000.0	49	3	46	4	0	4	3	0	3	2	0	2
105		14.4928–20.3863	0–33.5319	4,973.4	66	4	62	4	0	4	4	0	4	2	0	2
106		14.4928–20.3863	33.5319–44.3548	4,980.8	63	9	54	4	1	3	2	0	2	2	0	2
107		20.3863–63.5838	0–30.7242	5,019.4	59	28	31	4	3	1	4	3	1	2	1	1
108		20.3863–63.5838	30.7242–33.0749	4,988.0	43	16	27	4	2	2	4	2	2	2	1	1
109		20.3863–63.5838	33.0749–35.2011	4,999.6	52	14	38	4	2	2	4	2	2	2	1	1
110		20.3863–63.5838	35.2011–52.7565	4,968.4	67	22	45	4	2	2	2	0	2	2	0	2
200	Does the state operate a breastfeeding peer counseling program? YES Does the state require that general nutrition education be provided by a professional staff member (e.g., dietitian, nurse)? NO Is infant formula issued in the first month to partially breastfed infants? YES	0–100	0–100	6,340.4	1	1	0	1	1	0	1	1	0	1	1	0
201		0–14.2857	0–28.7699	4,874.6	64	14	50	4	1	3	4	1	3	2	0	2
202		0–14.2857	28.7699–30.9995	4,905.0	47	11	36	4	2	2	3	1	2	2	1	1
203		0–14.2857	30.9995–33.0338	4,839.8	47	10	37	4	1	3	3	1	2	2	0	2
204		0–14.2857	33.0338–34.1299	4,913.8	45	14	31	4	3	1	4	3	1	2	1	1
205		0–14.2857	34.1299–35.0733	4,893.4	48	12	36	4	1	3	4	1	3	2	1	1
206		0–14.2857	35.0733–35.8987	4,853.8	45	17	28	4	2	2	3	2	1	2	1	1
207		0–14.2857	35.8987–36.6585	4,881.4	45	18	27	4	3	1	4	3	1	2	2	0
208		0–14.2857	36.6585–37.5487	4,868.6	40	18	22	4	4	0	4	4	0	2	2	0
209		0–14.2857	37.5487–39.0369	4,961.8	39	18	21	4	1	3	4	1	3	2	0	2
210		0–14.2857	39.0369–40.9907	4,768.6	38	17	21	4	3	1	4	3	1	2	2	0
211		0–14.2857	40.9907–44.6064	4,982.6	53	21	32	4	3	1	4	3	1	2	1	1

Stratum ID	Features of the State WIC program	Percentage of women who used fully breastfeeding package	Children's and mothers' high weight for height rates (%)	Total stratum measure of size	Number of											
					Units on frame			Phase 1 units sampled			Phase units sampled eligible for Phase 2			Phase 2 units sampled		
					Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites
212	(continued) Does the state operate a breastfeeding peer counseling program? YES Does the state require that general nutrition education be provided by a professional staff member (e.g., dietitian, nurse)? NO Is infant formula issued in the first month to partially breastfed infants? YES	0–14.2857	44.6064–61.7659	4,874.4	55	24	31	4	3	1	3	2	1	2	1	1
213		14.2857–20.9273	0–31.9917	4,934.6	36	9	27	4	2	2	4	2	2	2	2	0
214		14.2857–20.9273	31.9917–34.1434	4,837.4	45	7	38	4	1	3	4	1	3	2	1	1
215		14.2857–20.9273	34.1434–35.2664	5,028.0	29	10	19	4	1	3	3	1	2	2	1	1
216		14.2857–20.9273	35.2664–37.6706	4,989.8	47	19	28	4	2	2	3	2	1	2	1	1
217		14.2857–20.9273	37.6706–41.8135	4,935.6	49	17	32	4	2	2	4	2	2	2	2	0
218		14.2857–20.9273	41.8135–55.0665	4,860.4	49	19	30	4	2	2	3	2	1	2	2	0
219		20.9273–29.3196	0–32.3818	4,892.6	39	8	31	4	2	2	4	2	2	2	1	1
220		20.9273–29.3196	32.3818–36.7067	4,924.8	56	20	36	4	3	1	4	3	1	2	1	1
221		20.9273–29.3196	36.7067–38.5783	4,897.2	23	13	10	4	4	0	4	4	0	2	2	0
222		20.9273–29.3196	38.5783–52.1351	4,912.4	44	22	22	4	3	1	4	3	1	2	2	0
223		29.3196–35.9756	0–32.5106	4,823.4	30	18	12	4	4	0	3	3	0	2	2	0
224		29.3196–35.9756	32.5106–49.5159	4,706.6	36	20	16	4	2	2	4	2	2	2	1	1
225		35.9756–69.1358	0–32.6778	4,878.4	28	24	4	4	3	1	3	3	0	2	2	0
226		35.9756–69.1358	32.6778–47.0875	4,954.0	38	32	6	4	4	0	3	3	0	2	2	0
301	Does the state operate a breastfeeding peer counseling program? YES Does the state require that general nutrition education be provided by a professional staff member (e.g., dietitian, nurse)? YES Is infant formula issued in the first month to partially breastfed infants? N/A	0–7.6336	0–100	4,222.0	47	4	43	4	1	3	3	1	2	2	1	1
302		7.6336–33.3992	0–34.2542	4,262.8	37	10	27	4	3	1	3	2	1	2	2	0
303		7.6336–33.3992	34.2542–50.2087	4,154.4	47	6	41	4	1	3	4	1	3	2	1	1
Total				196,045.4	1,834	554	1,280	157	78	79	139	70	69	79	42	37

N/A = not applicable

4. Selection of the Phase 2 Sample

Following the selection of the Phase 1 sample of 160 first-stage units, the study team enumerated individual service sites (when the first-stage unit was a local agency), ascertained each unit's eligibility, and selected the final sample of sites. In April 2012, the study team sent 42 State agencies an introductory letter asking them to review a list of local agencies in their State in the Phase 1 sampling frame of 160 units and provide information needed for Phase 2 of sampling.

The study team divided the 42 State agencies into two groups based on the information they reported for the PC 2010 census. The 21 State agencies in Group A reported their local agencies on the census but not the service sites under the local agencies. The 21 State agencies in Group B reported their local agencies but also reported IDs for the sites under the local agencies. The study team sent Group A a list of all their local agencies on the sampling frame, along with the names of the sites within each local agency, based on information the team obtained from their State and local websites. The team asked Group A sites to review the list of local agencies and service sites, remove inactive sites, and add sites that were missing from the list. The team sent State agencies in Group B a list of local agencies and the ID numbers of service sites under the local agencies and asked them to provide the name of the sites corresponding to the site numbers and indicate whether the sites were expected to continue as operational sites for the next 12 months.

The study also asked State agencies to provide five items of information about their sites on the frame that would be operational for the next 12 months: (1) number of days the site was open to conduct prenatal and infant enrollments during January 2012, (2) total number of participants served that month, (3) number of prenatal women enrolled during that month, (4) number of infants enrolled during that month, and (5) whether any of the prenatal and infant participants were enrolled at outreach locations affiliated with the site.

The study team used the information State agencies provided to determine eligibility for the Phase 2 sample. The team designated sites that were not expected to remain in operation for the next 12 months and sites that did not meet the eligibility criteria (based on enrollment flow) as ineligible. If the first-stage sampling unit was a local agency, the team designated that unit as ineligible if all sites associated with the local agency were ineligible; otherwise, that unit was eligible.

The study team subsampled (second-phase selection) first-stage sampling units to arrive at the final sample of first-stage sampling units. In each of the 40 strata (the same strata used for the Phase 1 sample), the team sampled two first-stage units with equal probability from among the eligible units.

D. Stage 2 Sampling

As figure B.1 shows, Stage 1 sampling units selected in the Phase 2 sample that were local agencies (i.e., consisted of more than one service site) went through a second stage of sampling

to select one service site. For each first-stage sampling unit that was a local agency, the eligible service sites were listed. An MOS that reflected the expected average daily enrollment was obtained for each service site by summing the January 2012 prenatal enrollment and 20 percent of the January 2012 infant enrollment and dividing this total by the number of enrollment days in January 2012. Within each local agency in the Phase 2 sample, exactly one service site was sampled from the eligible sites with probabilities proportional to this MOS. The final sample of service sites contained a total of 80 sites in 27 State agencies.

E. Site Replacements

During site sampling, candidate replacement sites were designated for each sampled site. These replacements were available for use if the sampled site was unable or unwilling to participate in the study. All replacements were selected at the same time as the original sample from the same stratum as the sampled sites and had a similar MOS. This replacement of sites by matched substitutes is similar to imputation and thus does not affect the weights of any member of the sample. A total of six sites were replaced.

F. Sampling New WIC Enrollees

1. Recruitment Windows

The sample included all prenatal mothers or their babies less than 3 months old who were newly enrolled into WIC at the sampled site during a prespecified recruitment window. Mothers were eligible to participate even if they had enrolled in WIC for a previous pregnancy or previous child.

The recruitment window was a consecutive string of days in which all new WIC enrollees in that site were designated to be screened for eligibility and recruited into WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2). The length of the recruitment window for each site was predetermined based on the estimated amount of time that would have been needed in July 2012[75] to yield 98 new WIC enrollees per site (the target sample size for each site). Because the flow of new WIC enrollees into the 80 sampled sites was decidedly different, the window length was much shorter in clinics with a "high flow" of new enrollees compared with clinics with a "low flow." The study screening and enrollment processes did not necessarily occur during the recruitment window, but the study participants must have enrolled in WIC at the service site during the recruitment period.

After notifying the sites of their selection into the study, the study team provided them with enrollment data obtained from the WIC PC 2010 dataset on their participation, prenatal and infant enrollment rates, and the site days of operation for January 2012. The sites were asked to identify any significant changes to the information (such as increases or decreases in

[75] July 2012 was the month the sites provided updated enrollment counts and schedule information before calculating recruitment windows.

participation or prenatal/infant enrollments between January and August) and to update the site schedule for enrolling new participants.

The length of the recruitment window for each site was calculated based on the updated enrollment figures, and the total recruitment period was set at 20 weeks. The recruitment windows ranged from 4 to 77 days per site. The recruitment protocol called for staggering the launch of recruitment in the 80 sites over 9 weeks and each site was randomly assigned to a "release group," which corresponded to 1 of the 9 weeks that recruitment was launched. A site's eligibility for a given release group depended on the length of that site's recruitment window. For example, a site that required a 3-month recruitment window could not be assigned to the last release group. Therefore, the randomization of recruitment windows accounted for each site's window length but was also ensured the planned number of sites was assigned to each release group. The first and last release groups each included 5 sites, while the remaining release groups each included 10 sites. In general, recruitment in the sites was launched on the Monday of the recruitment week.

The 20-week recruitment period began July 1, 2013, and ended November 18, 2013. Before starting recruitment, the study team increased the recruitment window for each site by 3 percent to serve as a buffer based on new enrollment data that suggested the WIC enrollment was declining. However, even with the 3 percent buffer, after 4 weeks into recruitment with 40 sites in the field (August 1, 2013), the team projected reaching about 84 percent of the estimated number of eligible WIC women relative to the expected numbers that were estimated in July 2012. As a result, all recruitment windows were extended by an additional 10 percent (with the exception of five sites where the full 10 percent extension could not be achieved while still ending recruitment on November 18).

2. Core and Supplemental Samples

Two samples were selected at each service site: a core longitudinal and a supplemental cross-sectional sample. The core sample was originally designed to be an equal probability sample of all new enrollees. The supplemental sample was designed to focus on subpopulations with specific characteristics such as African American mothers and infants enrolled postnatally with no prenatal WIC exposure. The supplemental sample was not designed to be analyzed by itself but only in conjunction with the core sample. Under the original design, the two samples were to start out as equal in size with an average of 49 (one-half of the total of 98) new enrollees each per service site. The supplemental sample was designed to be considerably smaller after screening and subsampling.

During recruitment, study team recruiters asked each pregnant client whether this was the first time she had enrolled in WIC during this pregnancy, and each mother of a newly enrolling infant was asked whether she was enrolled in WIC during her pregnancy for the infant at hand. For both prenatal and postnatal enrollees, only first-time enrollees were eligible for the sample. With this approach, ineligible postpartum mothers and infants were immediately screened out of the sample. During recruitment, the sample was screened to determine race, ethnicity, trimester at

enrollment, prepregnancy BMI, household composition, and income, and new enrollees not required to achieve the subgroup targets were subsampled from the supplemental sample. This approach was designed to drop approximately 68 percent of White mothers, 81 percent of Hispanic mothers, 71 percent of mothers in their first trimester, 68 percent of mothers in their second or third trimester, 18 percent of mothers enrolling postnatally, 58 percent of obese mothers, 29 percent of overweight mothers, 71 percent of mothers with low or normal prepregnancy BMI, 54 percent of mothers with income at or below 75 percent of poverty, 64 percent of mothers with income between 76 and 130 percent of the Federal poverty guidelines (FPG), and 69 percent of mothers with income above 130 percent of the FPG. These rates were based on the sample sizes needed to support the precision requirements (power projections) and were determined by taking into account estimated population distributions.

Following the decision to extend the recruitment windows by 13 percent, the sample was closely monitored to determine whether recruitment targets could be met. Several weeks of tracking the enrollment of prenatal mothers and their infants into WIC in each of the 80 sites confirmed that the study team could not meet the projected study recruitment targets. To compensate, the team altered the study participant sampling process to eliminate the subsampling of participants in the supplemental sample. Additionally, the proportion of sampled cases designated for the core (vs. supplemental) sample was revised to 87.5 percent (a change from the original 50%).

These changes were designed to meet the core target sample size (based on the lower-than-expected WIC enrollment flows that had been observed to date) and meet or exceed the overall target sample size. The core sample remains nationally representative. Following these changes, no eligible participant was subsampled out; thus, the demographic characteristics of the supplemental sample after the change differed considerably from the demographic profile before the change. These changes went into effect as of August 27, 2013. Cases completing the screener before August 27, 2013, were sampled using the original rates, and cases completing the screener on or after August 27, 2013, were sampled using the revised rates.

3. Multiple Births

For those study mothers who had twins, triplets, and so on, a single infant was sampled at the first postnatal interview.

G. Details of the Weighting Procedures

1. Computation of Survey Weights

For the analyses in this report, survey weights were computed for the following respondents:

- The prenatal respondents
- Participants who responded (separately) to the 1-month interview, 3-month interview, 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month

interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, 60-month interview, 72-month interview, and Year 9 interview

- A set of participants who responded to either the 1- or 3-month interview
- A set of participants who responded to the prenatal interview, the 1-month interview, 3-month interview, 5-month interview, 7-month interview, 9-month interview, t11-month interview, and 13-month interview
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, and 24-month interview
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, and 36-month interview
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, and 48-month interview
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, and 60-month interview
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, 60-month interview, and 72-month interview

- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, 60-month interview, 72-month interview, and Year 9 interview
- A set of participants for whom birth length and weight measurements were available
- A set of participants for whom 6-month length and weight measurements were available
- A set of participants for whom 12-month length and weight measurements were available
- A set of participants for whom 24-month height and weight measurements were available
- A set of participants for whom 36-month height and weight measurements were available
- A set of participants for whom 6-month, 12-month, 24-month, and 36-month length/height and weight measurements were available
- A set of participants for whom 48-month height and weight measurements were available
- A set of participants for whom 60-month height and weight measurements were available
- A set of participants for whom 72-month height and weight measurements were available
- A set of participants for whom Year 9 height and weight measurements were available
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, and 36-month interview and also provided 36-month height and weight measurements
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, and 48-month interview and also provided 48-month height and weight measurements
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, and 60-month interview and also provided 60-month height and weight measurements
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, and 60-month interview and also provided 60-month height and weight measurements plus length and weight measurements from at least one

at birth, 6 months, 12 months, 24 months, 36 months, and 48 months and also provided responses for all potential covariates used in growth model analysis at 60 months

- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, 48-month interview, 54-month interview, 60-month interview, and 72-month interview and also provided 72-month height and weight measurements
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the Year 9 interview and also provided Year 9 height and weight measurements
- A set of participants who responded to either the 1-month or the 3-month interview and also responded to the 36-month interview, 48-month interview, 60-month interview, 72-month interview, and Year 9 interview and also provided height and weight measurements at 36 months, 48 months, 60 months, 72 months, and Year 9

These weights account for differential probabilities of selection and nonresponse. For some analyses, weights were computed for the "combined" set of respondents (including both core and supplemental sample cases); for other analyses, weights were computed for the core sample only.

For each sampled site, the site-level base weight was computed as the reciprocal of the probability of selection of the site. For example, if a site was sampled with probability equal to 1/100, its base weight was 100. Because sites were sampled within strata with probabilities proportionate to their estimated size, these probabilities varied. The site-level base weights varied from 4.9 to 64.9.

The site-level base weights were adjusted to account for the probability of sampling the participants within the site. This adjustment accounts for the length of the recruitment window at the site (relative to the total number of days the site was enrolling participants during the study recruitment period). The resulting weight was the participant-level base weight, and these weights varied from 23.2 to 245.0.

As discussed in appendix A, section C, two samples were selected at each site: a core longitudinal sample and a supplemental sample. For some interviews, both the core sample and supplemental sample (combined) were interviewed, while for other interviews, only the core sample was interviewed. The participant weights for these interviews include factors to account for the subsampling of participants for the core sample and for the subsampling of participants in the supplemental sample to produce core-only sample weights and combined sample weights. The weights for a particular interview are based on the sample to which the interview was administered.

For those study mothers who had multiple births, a single infant was sampled at the first postnatal interview, and the weights account for the sampling of the particular infant.

2. Adjusting for Nonresponse

Nonresponse occurs as a result of respondents refusing or being unable to participate in some interviews. Because the set of participants who respond differs from interview to interview, the weights used to analyze data from a particular interview were developed to adjust for nonresponse to that particular interview. Some analyses involve participants who respond to a given combination of interviews or those who respond to either one interview or another. In such cases, custom weights that adjust for nonresponse to the particular combination of interviews were developed.

Specifically, to reduce the potential nonresponse bias, the base weights were adjusted to compensate for differential nonresponse. A weighting class adjustment (Brick & Kalton, 1996) was used to adjust for nonresponse. With this approach, weighting classes are formed (using variables known for respondents and nonrespondents), and nonrespondents' weights are redistributed to respondents within the same weighting class. Characteristics used to form the weighting classes should be associated with the probability of response and key survey outcome variables (Little & Vartivarian, 2003). In the early stages of recruitment for WIC ITFPS-2, however, very limited information was available for both respondents and nonrespondents. The characteristics used to form weighting classes to adjust for nonresponse at each stage were as follows:

- Adjusting for log nonresponse and nonresponse to the screener: service site
- Adjusting for nonresponse to the enrollment instrument or failure to consent to the study: mother's age, timing of WIC enrollment (first trimester, second trimester, third trimester, postnatal), mother's weight category (overweight, obese, other), mother's Hispanic origin, mother's race, poverty status, and language
- Adjusting for prenatal interview nonresponse: timing of WIC enrollment, mother's age, language, and race
- Adjusting for 1-month interview nonresponse:
  - Core-only sample: timing of WIC enrollment, food security, mother's Hispanic origin, mother's weight category, mother's race, age, language, and poverty status
  - Combined sample (core and supplemental): timing of WIC enrollment, mother's race, mother's weight category, mother's Hispanic origin, age, food security, language, and poverty status
- Adjusting for 3-month interview nonresponse (core-only sample): mother's weight category, food security, language, poverty status, race, timing of WIC enrollment, and mother's age
- Adjusting for nonresponse to both the 1- and 3-month interviews:
  - Core-only sample: food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race

- Combined sample (core and supplemental): food security, mother's weight category, mother's age, language, mother's race, timing of WIC enrollment, and poverty status

- Adjusting for 5-month interview nonresponse (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for 7-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race
- Adjusting for 9-month interview nonresponse (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for 11-month interview nonresponse (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for 13-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, mother's race, and WIC enrollment status at 7 months
- Adjusting for nonresponse to any interview from the prenatal interview through the 13-month interview (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the 13-month interview (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the 24-month interview (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race
- Adjusting for 15-month interview nonresponse (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 13 months, and mother's race
- Adjusting for 18-month interview nonresponse (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, WIC enrollment status at 15 months, and mother's race
- Adjusting for 24-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, WIC enrollment status at 13 months, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the 36-month interview (core-only sample):

food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race

- Adjusting for 30-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for 36-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the 48-month interview (core-only sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for 42-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, mother's Hispanic origin, and mother's race
- Adjusting for 48-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the 60-month interview (core-only sample): mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for 54-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for 60-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for 72-month interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, and mother's race
- Adjusting for Year 9 interview nonresponse (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race
- Adjusting for nonresponse to the 1-month interview and the 3-month interview or to any interview from the 5-month interview through the Year 9 interview (core-only sample): mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, mother's race, and food security
- Adjusting for nonresponse (i.e., lack of availability) to the birth length and weight measurements (combined sample): food security, mother's weight category, mother's

age, timing of WIC enrollment, mother's Hispanic origin, poverty status, WIC enrollment status at 1 month, and mother's race

- Adjusting for nonresponse (i.e., lack of availability) to the 6-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 3 months, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 12-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 7 months, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 24-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, WIC enrollment status at 13 months, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 36-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 48-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 60-month length and weight measurements (combined sample): food security, mother's weight category, mother's age (two variables used), timing of WIC enrollment, poverty status, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the 72-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the Year 9 length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's race, and mother's Hispanic origin
- Adjusting for nonresponse (i.e., lack of availability) to any of the 6-month, 12-month, 24-month, and/or 36-month length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, language, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month through 36-month interviews and/or 36-month length and weight measurements (core sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race

- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month through 48-month interviews and/or 48-month length and weight measurements (core sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month through 60-month interviews and/or 60-month length and weight measurements (core sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month through 60-month interviews and/or 60-month length and weight measurements and/or any of the variables considered as covariates for the 60-month growth model (core sample): food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, mother's race, and baby's sex
- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month through 72-month interviews and/or 72-month length and weight measurements (core sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, and mother's race
- Adjusting for nonresponse (i.e., lack of availability) to the Year 9 interview and/or Year 9 length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, mother's race, and mother's Hispanic origin
- Adjusting for nonresponse (i.e., lack of availability) to any of the 1- or 3-month, 36-month, 48-month, 60-month, 72-month, and/or Year 9 interview and/or 36-month, 48-month, 60-month, 72-month, and/or Year 9 length and weight measurements (combined sample): food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, mother's race, mother's Hispanic origin, and language

These adjustments were performed sequentially; that is, the base weights were adjusted for log nonresponse and nonresponse to the screener, these adjusted weights were adjusted for nonresponse to the enrollment instrument or failure to consent, and these adjusted weights were adjusted for nonresponse to the particular interview(s). Within these weighting classes, a weighted response rate was computed (using the weights produced in the previous adjustment) and applied to the weights from the previous adjustment (i.e., the weights from the previous adjustment were divided by the weighted response rate in the weighting class) to obtain the corresponding nonresponse-adjusted weights.

3. Replicate Weights

In addition to the full sample weights, a series of replicate weights were created and attached to each data record for variance estimation. Replication methods provide a relatively simple and robust approach to estimating sampling variances for complex survey data (Rust & Rao, 1996). The basic replication approach is to repeatedly select portions of the sample ("replicates") and then apply the weighting process developed for the full sample to each replicate separately. The

estimate of interest is calculated for each replicate. The variability among these estimates is then used to estimate the variance of the full sample statistics. The replicate weights were used to calculate standard errors of the survey-based estimates and to conduct significance tests and other analyses.

Different approaches can be used to create these replicates. For WIC ITFPS-2, the study team created 40 replicates and used a modified balanced repeated replication (BRR) method, suggested by Fay (Judkins, 1990), for the replication approach. When estimating the variance of ratios of rare subsets, one problem that occasionally arises from standard BRR is that one or more replicate estimates will be undefined because of zero denominators. Instead of increasing the weights of one half-sample by 100 percent and decreasing the weights of the other half-sample to zero as in standard BRR, Fay's method perturbs the weights by ±100 (1−K) percent where K is referred to as "Fay's factor." The perturbation factor for standard BRR is 100 percent, or K = 0. For WIC ITFPS 2, K = 0.3 was used.

4. Determining Which Survey Weight to Use for a Particular Analysis

As discussed, several different sets of weights have been computed for different analysis purposes. In planning for an analysis, a critical early step is to identify the weight that is appropriate for that analysis. To do this, the analyst should determine how the set of cases being used in the analysis is defined. It is important to note that the choice of survey weight is not a function specifically of the variables being used but rather of the set of cases being used in the analysis. For example, if the analysis involves estimating the proportion of infants with medical conditions affecting feeding by age 5 months, by whether they were exclusively breastfed through 5 months, then the set of cases included in the analysis are respondents who completed the 5-month interview; thus, the appropriate weight is the 5-month interview (cross-sectional) weight.

To consider another example, if the analysis involves examining how the introduction of sugar-sweetened beverages by age 13 months is related to prenatal nutrition education provided by the WIC program and duration of breastfeeding (as measured by whether the infant was still being breastfed at each of the 5-, 7-, 9-, 11-, and 13-month interviews), the set of cases included in the analysis are those who completed the prenatal interview, a baseline (1- or 3-month) interview, and each of the 5-, 7-, 9-, 11-, and 13-month interviews. Therefore, the appropriate weight for that analysis would be the (longitudinal) weight computed for the set of participants who responded to the prenatal interview and the 1-, 3-, 5-, 7-, 9-, 11-, and 13-month interviews.

H. Imputation

Imputation was selectively used to adjust for limited item nonresponse (i.e., missing data for particular items among those who respond to a given interview). For analytical purposes, a subset of sociodemographic variables were imputed at study child age 9 for the total sample: the caregiver's level of education, household food security status, household participation in benefit

programs (WIC, the Supplemental Nutrition Assistance Program, school meal programs, Temporary Assistance for Needy Families, and Medicaid), and the study child's pattern of WIC participation. As with weighting, a carefully designed imputation procedure aimed to reduce bias because of nonresponse (in this case, item nonresponse). The hot-deck imputation method was used to generate the imputations (Kalton & Kasprzyk, 1982). With this approach, imputation cells were formed by cross-classifying variables associated with the variable being imputed and, where possible, with the probability of response to the variable being imputed.

I. Attrition

Table B.2 presents the percentages of enrolled study participants who left the study at select interview months. Most were eligible to continue with the study.

Table B.2. Attrition of enrolled participants up to the age 9 interview

Attrition of enrolled participants (N = 4,367)[a]	13-month interview % (n)	24-month interview % (n)	36-month interview % (n)	48-month interview % (n)	60-month interview % (n)	72-month interview % (n)	Age 9 interview % (n)
Total	17.6 (769)	21.6 (944)	26.1 (1,139)	28.9 (1,260)	30.2 (1,317)	30.9 (1,347)	35.0 (1,530)
Eligible[a]	12.9 (563)	16.8 (735)	21.2 (924)	23.8 (1,039)	25.0 (1,093)	25.8 (1,125)	29.9 (1,305)
Ineligible[b]	4.7 (206)	4.8 (209)	4.9 (215)	5.1 (221)	5.1 (224)	5.1 (222)	5.2 (225)

[a] This number includes two cases that were subsequently determined to be fraudulent.
[b] Participants not eligible to continue in the study; includes nonparticipation reasons such as pregnancy loss, child decease, and moving out of the country

Appendix C

Dietary Intake Coding Procedures and Estimating Usual Intake

A. Dietary Intake Procedures for Year 9

The procedures for child dietary intake include a 24-hour dietary recall using the same system used in the What We Eat in America interview, part of the National Health and Nutrition Examination Survey (NHANES). This system consists of three components: the Automated Multiple Pass Method (AMPM) 24-hour recall interview system, the Post Interview Processing System (PIPS), and the SurveyNet coding application (Raper et al., 2004). The system uses the U.S. Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies (FNDDS) 2017-2018 as the source of the nutrient values (Food Surveys Research Group, 2018). The WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) collects the child's dietary intake from the child's caregiver at child age 9, with a 10 percent subsample of respondents completing a second intake to enable estimation of "usual" intake.

1. AMPM Interview Data Entry

The AMPM interview asks the mother[76] to recall her child's dietary intake for the previous day in a systematic fashion. The interviewer guides the mother through the day and asks her to report all foods, beverages, and dietary supplements for each eating event during the 24-hour period; the interviewer records all responses. The interview produces a 24-hour snapshot of all foods, beverages, and dietary supplements consumed by the child. Before the 13-month interview, participants received a package of measuring guides to help them report their child's portion sizes during the interview and were asked to keep the measuring guides throughout the study. If caregivers report they do not know what the child ate while away from the caregiver, the dietary interviewer asks the caregiver to obtain the missing details about those foods from a knowledgeable source; after the interview, the data retrieval interviewer contacts the caregiver within 2 working days to obtain the missing information.

2. PIPS

Westat processes the recall data through the PIPS. During PIPS processing, approximately 70 percent of foods are autocoded, meaning the system assigns a food code, a portion quantity, or both to the interview data. The PIPS also creates SurveyNet batches of no more than 20 intake days each. The online Coder Tracking System tracks each batch through the various coding and review steps. Dietary coders assign themselves batches and complete the coding for all intake days within a single assigned batch using SurveyNet.

3. Standard SurveyNet Processing

SurveyNet displays a shorthand version of each interview question and the selected response for all food description and portion data in a text box at the top of the food-coding screen. Dietary coders review these interview data, select the appropriate food code, and enter the quantity

[76] The interview was with a primary caregiver for the study child. The primary caregiver was usually the mother; therefore, this report uses the terms mother and caregiver interchangeably.

reported. If the PIPS automatically assigns the food code or quantity, the dietary coder merely reviews the prefilled fields to ensure no changes are needed. Changes to these preassigned data might be required if the interviewer entered a comment or a text response in any field that would cause the coder to change the preassigned food code or quantity. For all foods not autocoded during the PIPS, the dietary coders review all question responses to determine the most appropriate food code to apply.

Recipe Modifications

Coding supervisors have the ability to create recipe modifications to more closely match the reported food. Coding supervisors follow the same modification guidelines used in NHANES, which allow modification of a recipe for the type of fat used in cooking; the type of milk used in preparing selected foods (e.g., beverages, pudding, cooked cereal); the amount of liquid used to prepare condensed soup (when different from instructions); and the type of salad dressing used in salads, such as coleslaw or chicken salad.

Coding Guidelines

The coders use NHANES coding guidelines to resolve common coding problems and to establish consistent coding methods. These guidelines contain rules for coding foods when not enough information is available (e.g., how much meat to code in a sandwich when the respondent did not report the amount; how to handle reports of nonstick spray). The study team developed a second set of coding guidelines for coding amounts of dietary supplements because the default dose for nonchildren's supplements in the NHANES Dietary Supplement Database is generally appropriate for adults rather than infants and children. The study team develops additional guidelines throughout the study as they encounter and resolve new issues. Coding staff document these guidelines in a decision log maintained throughout the study.

Entering Quantities

Once the food code is assigned or reviewed (in the case of autocoding), coders review the autocoded quantity or enter the amount of food reported. SurveyNet allows entry of portions using the same food models presented in the AMPM and provides predetermined weights for foods in commonly eaten portions (e.g., one-half grapefruit, one medium chicken leg). SurveyNet automatically converts food amounts entered as a shape—with dimensions (length, width, and height), volume, or weight in imperial units—to a weight in grams. Coders also use SurveyNet to code imprecise measures, such as "handful," "medium bowl," or "swallow." When respondents report "Don't know" for the quantity consumed, coders are instructed to first consult the coding guidelines, which provide default amounts for items in a sandwich or salad and other common combinations. If no coding guideline exists, coders select the "quantity not specified" portion option available in SurveyNet.

Combinations

SurveyNet flags foods added to another food (e.g., milk added to cereal) or eaten in combination (e.g., a sandwich containing bread, meat, cheese, and spread) using combination codes. The system usually identifies combinations during data collection by AMPM, and the PIPS assigns the combination code in SurveyNet. If coders need to add additional food codes to represent the reported food, the coder uses the combination code to link the foods.

Review

After the dietary coders assign food codes, coders and supervisors conduct a quality control (QC) review by verifying, adjudicating, and editing the assigned food codes and portion amounts. Verifying involves a detailed review of coded intakes by a second coder. A coding supervisor reviews and adjudicates any notepad entries made by the second coder that highlight questions or disagreement between coders. The supervisor reviews and edits all adjudicated records and makes decisions on notepad questions and unfound foods. The adjudication process also facilitates the evaluation of the accuracy of each coder's work. This QC process selects two intakes from every batch for calculation of accuracy, assessing 10 percent of each coder's work. Coders must maintain 95 percent accuracy.

Analysis

Coding supervisors use SurveyNet to process the coded intakes and obtain the nutrient analysis. The system automatically generates error reports that document unresolved issues such as missing or invalid food codes, recipe modifications, or portion codes. Supervisors resolve all errors and rerun the analysis. The system produces two analysis data files: an "ANA" file, which contains one line of data for every food or supplement the respondent reported on the intake day, and a "TOT" file, which contains one line of data for each respondent for a single intake day. The analysis files include 65 nutrients from FNDDS 2017–2018.

QC Review

The study team performs standard QC checks on the analyzed data as a means of identifying errors. Outlier reports identify unusually high or low portions for key food items and high or low amounts of key nutrients. Coding supervisors review outliers and correct any deemed to be the result of coding errors. These outlier checks include the following reviews:

Portion outliers. Portion outlier reports identify errors in the reported amount of foods consumed. They also serve as a check for intakes where coders applied an incorrect form of the food when specifying the amount.[77] The USDA SurveyNet software used to code AMPM intakes also identifies intakes in which the portion of the reported food is either below or above the

[77] For example, the coder mistakenly entered 1 cup of rice as uncooked when the respondent reported cooked rice.

established portion size range for that food item; these portion size ranges are specific for the age of the respondent.

In addition to portion outliers, reports identify total calorie and macro- and micronutrient outliers. Coding supervisors examine all records flagged as outliers and correct any interviewer or coding errors. The records are reanalyzed before generating outlier reports for the remaining nutrients.

Minimum criteria for inclusion in the dataset. When conducting reviews of the intakes identified in the outlier reports, coding supervisors determine whether the intake met minimum criteria. In general, an intake does not meet minimum criteria if any of the following situations are noted:

1. **Interview is broken off before completing the time and occasion pass.** If the breakoff happens before the time and occasion are recorded for every food in the intake, the intake fails the minimum criteria, and coding supervisors delete it from the dataset. Without time and occasion information for each food, it is not possible to determine that the reported foods span an entire day's intake.
2. **Intake is judged as "unreliable."** Although interviewers do not provide feedback on whether a respondent is reliable, coding supervisors implement guidelines developed in previous studies.
3. **Meals with missing foods.** Coding supervisors apply this flag when a respondent reports a meal but cannot recall foods eaten at the meal, and data retrieval for these foods was unsuccessful. For example, the respondent reports the child eating a meal at a friend's house but cannot recall the foods eaten.

USDA Food Pattern Food Groups

The study team edits and finalizes all dietary recall data files before rerunning the SurveyNet analysis to obtain corrected nutrient values. Using the Food Patterns Equivalents Database (FPED) 2017–2018 (Bowman et al., 2020), the study team appends food pattern–equivalent values to the dietary data.

Feeding Infants and Toddler Study Food Groups

To facilitate comparisons of the WIC ITFPS-2 dietary data with the Feeding Infants and Toddler Study (FITS), the study team assigns each FNDDS food code to one of the food groups developed for FITS 2002 and 2008 (Fox et al., 2004). The FITS adapted the food groups from the Continuing Survey of Food Intakes by Individuals (CSFII), a nationwide dietary intake study available at the time of the 2002 FITS. The FITS adjusted some CSFII food groups to enable slightly different analyses of foods of interest to the diets of infants and toddlers. For example, because diets of young infants are largely milk based, FITS moved yogurt, milk desserts, and cheese into other groups, leaving milk (breast milk, formula, cow's milk, and other fluid milks) in a group of its own.

B. The National Cancer Institute Method for Analyzing Usual Intake Data

The study used methods recommended by the National Cancer Institute (NCI, 2023) for estimating "usual" intake. These methods rely on data from repeated administrations of a 24-hour dietary recall within a narrow time window. Both univariate and Markov Chain Monte Carlo models were used, with the latter primarily employed to estimate FPED food group values and Healthy Eating Index-2020 (HEI-2020) scores (Shams-White et al., 2023). For more information, see the NCI method for adjusting for dietary measurement error. Tooze et al. (2010) offer an introduction to the model.

Using 2 days of dietary recall information to estimate usual intake has several differences from an analysis based on a single recall. First, the repeated measures over time enable the estimate of measurement variance (variability within a person over time) separately from between-person variance. Second, the NCI method employs algorithms to transform the data to distribute outcomes more like a symmetric normal distribution (Box & Cox, 1964). This approach reduces the bias created by outliers (nutrient data are often highly skewed) and supports the validity of the assumption that errors are normally distributed, which is an assumption of the mixed model underlying the approach (SAS Institute Inc., 2008). Third, the NCI method produces model-based estimates of distributions of food and nutrient intakes that have decreased bias and error by using covariates to obtain outcome estimates. Fourth, the NCI method enables the valid estimation of "episodically" consumed food (i.e., foods not consumed daily) by employing a two-part model in which one part of the model estimates the probability that the food will be consumed on a given day and the other part of the model estimates the amount of the food that is consumed if it is consumed at all.

All intakes were adjusted for the following:

- Child's sex
- Caregiver race, ethnicity, and language spoken (Spanish or English)
- Caregiver education level
- Household food security status when the study child was 9
- Participation in benefit programs when the study child was 9
- The study child's pattern of WIC participation

As a result, the usual intake estimates produced are tailored to this report. Alternative estimates of children's usual intake would result if different variables were included in the NCI models.

Additionally, the NCI models generate a "pseudo-population." For this pseudo-population, the number of pseudo-individuals must be chosen; this report used 100 pseudo-individuals per observed respondent. Finally, the dietary data contain foods that study children infrequently consume. Episodically consumed foods were those that had zero values for 10–90 percent of the sample. Some foods were so rarely consumed that they were considered "never" consumed. Foods considered never consumed had zero values for more than 90 percent of the sample.

Appendix D1

Information Accompanying Chapter 2

This appendix provides the data supporting figures presented in chapter 2.

Table D1.1. Distribution of household size categories at study baseline and study child age 9

Household size	Percentage (SE) by interview							
	Study baseline	13 months	2 years	3 years	4 years	5 years	6 years	9 years
1–2	9.1 (1.4)	8.4 (1.4)	6.7 (1.0)	6.7 (0.9)	9.3 (1.5)	8.3 (1.5)	5.8 (1.2)	4.3 (1.0)
3	26.1 (2.1)	27.2 (2.8)	25.6 (1.9)	23.8 (2.3)	19.7 (2.2)	20.0 (2.0)	18.7 (2.4)	20.4 (2.3)
4	27.4 (2.2)	31.5 (2.8)	31.3 (2.0)	32.2 (2.3)	31.3 (2.1)	29.4 (2.0)	31.1 (1.8)	27.7 (2.0)
5	20.0 (1.8)	18.9 (1.8)	20.3 (1.4)	21.3 (1.8)	22.8 (1.5)	25.6 (2.3)	25.0 (2.0)	25.4 (1.9)
6 or more	17.4 (2.0)	14.0 (2.4)	16.2 (2.1)	16.0 (2.0)	16.9 (2.0)	16.7 (2.1)	19.4 (2.0)	22.2 (2.0)
Unweighted *n*	683	679	683	683	681	680	683	682
Weighted *n*	440,188	438,891	440,188	440,188	439,160	438,483	440,188	439,830

Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected.
SE = standard error

Table D1.2. Percentage of caregivers by household income relative to the Federal poverty guidelines at study baseline and study child age 9

Income poverty	Percentage (SE) by interview							
	Study baseline	13 months	2 years	3 years	4 years	5 years	6 years	9 years
Up to 50% FPG (include 50%)	34.0 (2.7)	35.4 (3.1)	32.0 (2.3)	22.8 (2.7)	22.8 (2.5)	18.6 (1.8)	22.7 (2.6)	16.8 (1.6)
Above 50% and up to 100% FPG (include 100%)	39.4 (2.2)	36.9 (2.3)	34.2 (2.2)	37.4 (2.9)	37.5 (2.8)	36.5 (2.6)	29.5 (2.2)	28.3 (2.7)
Above 100% and up to 130% FPG (include 130%)	15.2 (1.4)	8.0 (1.2)	12.4 (1.4)	17.3 (2.0)	17.7 (2.1)	15.0 (1.4)	16.0 (2.3)	18.4 (2.3)
Above 130% and up to 185% FPG (include 185%)	8.8 (1.6)	14.5 (1.9)	12.7 (1.6)	13.5 (1.5)	12.2 (1.7)	16.2 (1.7)	18.2 (2.0)	15.8 (2.7)
Above 185% FPG	2.5 (0.7)	5.2 (1.2)	8.7 (1.4)	9.0 (1.2)	9.8 (1.7)	13.7 (2.1)	13.6 (1.7)	20.6 (2.2)
Unweighted *n*	655	643	643	649	649	648	641	600
Weighted *n*	426,264	414,665	414,397	422,523	420,820	418,873	415,146	387,833

Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected.
FGP = Federal poverty guidelines; SE = standard error

Table D1.3. Percentage of study households with incomes at or below 185, 130, and 100 percent of FPG between study baseline and Year 9

Household income poverty	Percentage (SE)			Unweighted n	Weighted n
	At or below 185% FPG	At or below 130% FPG	At or below 100% FPG		
Baseline	97.5 (0.7)	88.7 (1.9)	73.4 (2.3)	655	426,264
13 months	94.8 (1.2)	80.2 (2.4)	72.3 (2.4)	643	414.665
2 years	91.3 (1.4)	78.6 (2.4)	66.2 (2.6)	643	414,397
3 years	91.0 (1.2)	77.5 (1.9)	60.2 (2.3)	649	422,523
4 years	90.2 (1.7)	78.0 (2.2)	60.3 (2.7)	649	420,820
5 years	86.3 (2.1)	70.1 (2.7)	55.1 (2.5)	648	418,873
6 years	86.4 (1.7)	68.2 (2.7)	52.2 (3.2)	641	415,146
9 years	79.4 (2.2)	63.5 (3.7)	45.1 (3.2)	600	387,833

FGP = Federal poverty guidelines; SE = standard error

Table D1.4. Percentage of caregivers by employment status between study baseline and study child age 9

Employment status	Percentage (SE) by interview							
	3 m	13 m	2 y	3 y	4 y	5 y	6 y	9 y
Working full time	17.5 (1.8)	19.2 (1.6)	26.7 (2.1)	29.3 (2.1)	30.9 (2.4)	33.5 (2.2)	36.9 (2.4)	46.8 (3.1)
Working part time	14.5 (1.9)	23.1 (2.4)	22.1 (2.0)	21.0 (1.9)	23.7 (1.7)	21.5 (2.2)	19.7 (1.9)	16.9 (2.0)
Not working for pay	68.0 (2.5)	57.6 (2.4)	51.2 (2.4)	49.7 (2.6)	45.4 (1.9)	45.0 (2.1)	43.3 (2.4)	36.2 (2.6)
Unweighted *n*	676	682	682	682	681	681	682	677
Weighted *n*	437,237	439,091	439,091	439,091	438,719	438,416	439,421	435,458

Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected.
m = months; SE = standard error; y = years

Table D1.5. Percentage of households by participation in Federal nutrition assistance programs between study baseline and study child age 9

Household size	Percentage (SE) by interview							
	Study baseline	13 m	2 y	3 y	4 y	5 y	6 y	9 y
Current WIC participation	99.2 (0.3)	89.5 (1.7)	77.9 (2.5)	68.4 (2.9)	60.8 (3.0)	50.4 (3.6)	26.7 (2.2)	19.0 (2.7)
Supplemental Nutrition Assistance Program (SNAP) participation across the study	43.0 (2.6)	52.0 (2.5)	48.0 (2.5)	48.7 (2.7)	46.5 (2.7)	42.1 (2.9)	40.7 (2.3)	42.7 (2.8)
Participation in school meal programs across the study	30.8 (2.5)	31.0 (2.3)	34.6 (2.6)	38.4 (2.2)	43.2 (2.4)	53.2 (2.3)	65.9 (2.8)	78.7 (2.1)
Participation in any of three programs (WIC, SNAP, or school meal)	99.2 (0.3)	92.9 (1.5)	86.4 (1.9)	81.4 (2.3)	82.0 (2.1)	78.5 (2.6)	78.2 (2.3)	83.2 (1.8)

Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected. WIC sites provided information on study participant enrollment in WIC. It is possible that at the study participant's baseline interview, the study participant may not yet have received food benefits or checks for themselves or their child.
m = months; SE = standard error; y = years

Table D1.6. Percentage of households with food insecurity between study baseline and study child age 9

Food insecurity	Percentage (SE) by interview							
	Study base-line	13 m	2 y	3 y	4 y	5 y	6 y	9 y
Prevalence of household food insecurity	47.8 (2.7)	31.9 (2.6)	27.2 (2.0)	25.9 (2.3)	24.0 (2.7)	23.5 (1.9)	21.5 (2.2)	25.9 (2.1)
Unweighted *n*	683	683	683	683	683	683	683	683
Weighted *n*	440,188	440,188	440,188	440,188	440,188	440,188	440,188	440,188

Note: WIC Infant and Toddler Feeding Practices Study-2 collected baseline information during the study enrollment process or at the earliest interview where the data were collected.
m = months; SE = standard error; y = years

Table D1.7. Prevalence of household food insecurity between child ages 13 months and 9 years by WIC participation status

Household food insecurity	All study households	Households receiving WIC	Households not receiving WIC
Prevalence of household food insecurity at 13 months % (SE)	31.9 (2.6)	31.3 (2.3)	37.3 (8.4)
Unweighted *n*	683	610	73
Weighted *n*	440,188	394,119	46,070
Prevalence of household food insecurity at 2 years % (SE)	27.2 (2.0)	27.9 (2.2)	24.6 (3.5)
Unweighted *n*	683	528	155
Weighted *n*	440,188	342,816	97,372
Prevalence of household food insecurity at 3 years % (SE)	25.9 (2.3)	24.9 (2.7)	28.1 (3.2)
Unweighted *n*	683	464	219
Weighted *n*	440,188	300,945	139,244
Prevalence of household food insecurity at 4 years % (SE)	24.0 (2.7)	24.7 (2.8)	23.1 (3.7)
Unweighted *n*	683	413	270
Weighted *n*	440,188	267,440	172,749
Prevalence of household food insecurity at 5 years % (SE)	23.5 (1.9)	21.3 (2.8)	25.9 (2.9)
Unweighted *n*	683	335	347
Weighted *n*	440,188	221,624	218,021
Prevalence of household food insecurity at 6 years % (SE)	21.5 (2.2)	22.8 (4.0)	21.0 (2.3)
Unweighted *n*	683	169	514
Weighted *n*	440,188	117,457	322,731
Prevalence of household food insecurity at 9 years % (SE)	25.9 (2.1)	20.4 (4.2)	27.2 (2.3)
Unweighted *n*	683	119	564
Weighted *n*	440,188	83,543	356,646

SE = standard error

Table D1.8. Prevalence of child food insecurity reported at study child age 9, by WIC receipt

Child food insecure	All study households	Households receiving WIC at 9 years	Households not receiving WIC at 9 years
Child food insecurity % (SE)	14.8 (1.8)	10.0 (3.1)	15.9 (2.0)
Unweighted *n*	682	119	563
Weighted *n*	439,544	83,543	356,002

SE = standard error

Table D1.9. Prevalence of child food insecurity reported at Year 9, by WIC receipt for another household member and SNAP receipt for the household

Child food insecure	All study households	Households receiving WIC but not SNAP	Households receiving SNAP but not WIC	Households receiving SNAP and WIC	Households not receiving SNAP or WIC
Child food insecurity % (SE)	14.8 (1.8)	6.7 (4.2)	19.3 (3.3)	11.8 (4.0)	13.8 (3.0)
Unweighted n	682	40	195	79	367
Weighted n	439,544	29,069	133,206	54,473	222,524

SE = standard error; SNAP = Supplemental Nutrition Assistance Program

Appendix D2

Information Accompanying Chapter 3

This appendix provides the data supporting figures presented in chapter 3.

Table D2.1. Percentage of study caregivers indicating they learned something from WIC about providing food to their child

Households	Interview							
	3 m	13 m	2 y	2.5 y	3.5 y	4.5 y	6 y	9 y
Learned from WIC % (SE)	64.5 (2.4)	63.1 (2.9)	64.3 (3.1)	68.6 (3.2)	73.8 (2.5)	75.8 (2.0)	66.0 (2.0)	83.3 (1.9)
Unweighted *n*	676	682	681	683	683	682	682	674
Weighted *n*	437,238	439,721	439,121	440,188	440,188	439,930	439,890	435,033

m = months; SE = standard error; y = years

Table D2.2. Percentage of study caregivers using select feeding practices and holding select feeding beliefs at study child age 9

Frequency of using select feeding practices when study child is 9	Caregivers % (SE)
Use information on added sugars from a food label	
Sometimes/most of the time/always	69.5 (2.1)
Never/seldom or rarely	30.5 (2.1)
Use information on sodium from a food label	
Sometimes/most of the time/always	66.0 (2.3)
Never/seldom or rarely	34.0 (2.3)
Try to get child to eat anyway even if child not hungry	
Slightly agree/agree	44.8 (2.7)
Neither agree or disagree	11.1 (1.1)
Disagree/slightly disagree	44.1 (2.7)
Bought whole grain cereal, bread, corn tortillas, or brown rice in the past month	
Yes	86.7 (2.1)
No	13.3 (2.1)
Unweighted *n*	679
Weighted *n*	438,045

SE = standard error

Table D2.3. Percentage of study families regularly eating family meals and regularly having the television on during meals

Home eating environment	Percentage (SE) by interview						
	15 m	2 y	2.5 y	3.5 y	4.5 y	6 y	9 y
Family eats together							
At least five times a week	69.8 (2.2)	67.4 (2.6)	64.0 (2.2)	63.8 (2.5)	63.7 (2.4)	65.9 (2.3)	64.8 (2.4)
Less than five times a week	30.2 (2.2)	32.6 (2.6)	36.0 (2.2)	36.2 (2.5)	36.3 (2.4)	34.1 (2.3)	35.2 (2.4)
Television on while eating							
Sometimes or most of the time	50.7 (2.4)	51.9 (2.6)	50.7 (2.3)	51.9 (2.3)	48.2 (2.1)	47.6 (2.6)	59.8 (2.2)
Rarely or never	49.3 (2.4)	48.1 (2.6)	49.3 (2.3)	48.1 (2.3)	51.8 (2.1)	52.4 (2.6)	40.2 (2.2)
Unweighted *n*	683	683	683	683	683	683	678
Weighted *n*	440,188	440,188	440,188	440,188	440,188	440,188	437,101

m = months; SE = standard error; y = years

Table D2.4. Percentage of study households by the frequency of the availability of select foods and beverages at Year 9

Child food insecure	All study households % (SE)	Unweighted n	Weighted n
Have fruits available at home: *Never/Rarely/Sometimes*	10.2 (1.5)	75	44,820
Have fruits available at home: *Often/Very often*	89.8 (1.5)	604	393,225
Have dark green vegetables available at home: *Never/Rarely/Sometimes*	30.1 (2.3)	204	132,021
Have dark green vegetables available at home: *Often/Very often*	69.9 (2.3)	475	306,024
Have salty snacks available at home: *Never/Rarely*	18.4 (2.5)	122	80,502
Have salty snacks available at home: *Sometimes/Often/ Very often*	81.6 (2.5)	557	357,543
Have reduced-fat milks available at home: *Never/Rarely/Sometimes*	63.8 (2.8)	428	279,530
Have reduced-fat milks available at home: *Often/Very often*	36.2 (2.8)	251	158,516
Have soft drinks available at home: *Never/Rarely*	41.6 (2.7)	279	182,041
Have soft drinks available at home: *Sometimes/Often/ Very often*	58.4 (2.7)	399	255,490

SE = standard error

Appendix D3

Information Accompanying Chapter 4

This appendix provides the data supporting figures presented in chapter 4.

Table D3.1. Percentage of study children consuming meals and snack(s) on a given day

Households	Percentage (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Breakfast	96.5 (0.7)	97.4 (0.9)	97.2 (0.8)	99.1 (0.4)	98.2 (0.7)	95.7 (1.2)
Lunch	91.3 (1.3)	94.2 (0.9)	94.4 (1.1)	96.0 (0.9)	95.0 (0.6)	95.2 (0.9)
Dinner	93.9 (1.3)	96.0 (1.1)	94.6 (1.2)	95.1 (1.4)	97.4 (0.8)	94.9 (1.2)
Snack(s)	77.6 (2.6)	80.9 (2.6)	81.4 (2.3)	85.3 (1.7)	84.5 (1.8)	87.9 (1.7)
At least three eating occasions on a given day (including snacks)	94.6 (1.4)	96.0 (1.1)	96.1 (1.0)	97.6 (0.9)	98.9 (0.4)	96.1 (1.4)
Unweighted *n*	678	679	681	674	679	679
Weighted *n*	437,062	436,053	437,127	435,493	437,837	438,178

Note: Data use the first day of dietary recall information.
SE = standard error

Table D3.2. Percentages of study children meeting recommended levels of intake based on the 2020–2025 *Dietary Guidelines for Americans*

Households	Percentage (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Fruit (cup eq/day)	70.6 (6.3)	64.3 (4.6)	64.2 (7.1)	55.8 (5.1)	51.1 (5.3)	38.3 (3.4)
Vegetables (cup eq./day)	1.0 (1.2)	2.0 (1.2)	1.1 (1.3)	2.4 (1.3)	0.5 (1.9)	0.9 (1.2)
Dairy (cup eq./day)	32.5 (4.0)	19.3 (3.3)	16.4 (3.1)	10.4 (4.3)	10.9 (5.6)	13.2 (4.5)
Protein foods (oz eq. day)	31.1 (4.0)	34.5 (4.1)	32.7 (5.2)	26.3 (4.1)	20.0 (8.2)	29.6 (4.7)
Grains (oz eq./day)	25.4 (3.9)	35.7 (3.7)	53.2 (4.9)	60.7 (5.6)	71.4 (5.6)	72.3 (3.3)
Whole grains (oz eq./day)	0.7 (0.6)	0.2 (0.9)	2.0 (1.7)	0.0 (0.3)	0.0 (0.4)	0.1 (0.9)

Note: Estimates are based on usual intake analyses. Sample size is not reported because the National Cancer Institute method generates a pseudo-population.
cup eq./day = cup equivalent per day; SE = standard error; oz eq./day= ounce equivalent per day

Table D3.3. Percentages of study children meeting recommended levels of intake based on the 2020–2025 *Dietary Guidelines for Americans* by WIC status of the household when the study child was age 9

Households	Receiving WIC and met DGA % (SE)	Not receiving WIC and met DGA % (SE)	p value
Fruit (cup eq./day)	44.6 (5.95)	42.8 (2.69)	0.7799
Vegetables (cup eq./day)	5.1 (2.26)	7.9 (1.32)	0.3026
Dairy (cup eq./day)	35.9 (5.72)	22.0 (2.07)	0.0229
Protein foods (oz eq./day)	33.9 (5.40)	39.5 (2.10)	0.3862
Grains (oz eq./day)	68.6 (5.68)	60.4 (2.10)	0.1682
Whole grains (oz eq./day)	4.6 (2.41)	8.1 (1.65)	0.2547
Unweighted *n*	119	560	N/A
Weighted *n*	83,543	354,635	N/A

cup eq./day= cup equivalent per day; DGA = *Dietary Guidelines for Americans*; N/A = not applicable; oz eq./day= ounce equivalent per day; SE = standard error

Table D3.4. Percentage of the study children consuming foods and beverages sweetened with sugar on a given day by age

FITS food groups	Percentage (SE)					
	2 years	3 years	4 years	5 years	6 years	9 years
FITS foods and beverages sweetened with sugar[a]	60.7 (2.1)	71.9 (2.1)	71.1 (2.3)	73.0 (2.1)	75.2 (1.9)	79.9 (1.8)
FITS foods sweetened with sugar	44.0 (1.9)	51.5 (2.7)	49.8 (1.8)	54.1 (2.6)	54.1 (2.3)	61.5 (2.4)
Beverages sweetened with sugar	28.5 (2.3)	36.5 (2.5)	40.1 (2.0)	44.1 (2.1)	50.4 (2.2)	56.1 (2.4)
Unweighted *n*	678	679	681	676	680	679
Weighted *n*	437,062	436,053	437,127	436,194	438,287	438,178

Note: Data use the first day of dietary recall information.
FITS = Feeding Infants and Toddlers Study; SE = standard error
[a] The FITS food group was modified to include all beverages sweetened with sugar.

Table D3.5. Percentages of study children consuming sugar-sweetened beverages on a given day by age

Sugar-sweetened beverages	Percentage (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Any sugar-sweetened beverage	28.5 (2.3)	36.5 (2.5)	40.1 (2.0)	44.1 (2.1)	50.4 (2.2)	56.1 (2.4)
Fruit-flavored drinks	12.8 (1.9)	18.7 (2.1)	18.6 (1.8)	20.3 (1.4)	22.3 (1.6)	21.9 (1.9)
Carbonated sodas	3.6 (0.8)	5.0 (1.2)	7.0 (1.1)	8.1 (1.1)	9.4 (1.3)	17.0 (2.0)
Unweighted *n*	678	679	681	676	680	679
Weighted *n*	437,062	436,053	437,127	436,194	438,287	438,178

SE = standard error

Table D3.6. Percentage of study children consuming salty snacks on a given day

FITS food group	Percentage (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
FITS salty snacks	20.8 (1.8)	24.8 (2.1)	28.4 (2.3)	29.8 (2.8)	31.7 (3.0)	43.7 (2.9)
FITS whole grain salty snacks	5.2 (0.9)	4.3 (0.9)	7.2 (1.2)	8.6 (1.1)	7.3 (1.3)	9.7 (1.2)
Unweighted *n*	678	679	681	676	680	679
Weighted *n*	437,062	436,053	437,127	436,194	438,287	438,178

Note: Data use the first day of dietary recall information.
FITS = Feeding Infants and Toddlers; SE = standard error

Table D3.7. Median and mean fluid ounces of plain water consumed on a given day

Plain water intake	Fluid ounces (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Mean	5.5 (0.3)	7.5 (0.4)	9.0 (0.5)	11.3 (0.5)	11.9 (0.6)	23.2 (1.1)
Median	3.8 (0.4)	3.9 (0.2)	5.9 (0.7)	7.2 (0.3)	7.4 (0.4)	15.6 (1.0)
Unweighted *n*	678	679	681	676	680	679
Weighted *n*	437,062	436,053	437,127	436,194	438,287	438,178

Note: Data use the first day of dietary recall information.
SE = standard error

Table D3.8. Healthy Eating Index-2020 scores

Healthy Eating Index-2020	Mean (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Total score	62.6 (0.8)	63.1 (0.9)	62.9 (0.9)	60.4 (1.0)	59.1 (1.2)	57.4 (1.0)
Component scores						
Total fruit	4.9 (0.1)	4.7 (0.1)	4.8 (0.3)	4.6 (0.2)	4.7 (0.3)	4.2 (0.3)
Whole fruit	4.8 (0.3)	4.2 (0.3)	4.6 (0.4)	4.6 (0.2)	4.6 (0.4)	4.2 (0.4)
Total vegetables	2.5 (0.1)	2.6 (0.1)	2.6 (0.1)	2.6 (0.1)	2.7 (0.1)	2.6 (0.1)
Greens and beans	1.8 (0.2)	2.4 (0.2)	1.9 (0.2)	1.8 (0.2)	2.3 (0.2)	1.9 (0.2)
Whole grains	3.2 (0.3)	3.2 (0.2)	3.6 (0.2)	3.1 (0.2)	2.8 (0.2)	3.6 (0.2)
Dairy	9.6 (0.1)	9.2 (0.2)	9.1 (0.2)	9.0 (0.2)	8.9 (0.2)	7.3 (0.3)
Total protein foods	4.4 (0.1)	4.6 (0.1)	4.6 (0.1)	4.5 (0.1)	4.5 (0.1)	4.5 (0.1)
Seafood and plant protein	62.6 (0.8)	63.1 (0.9)	62.9 (0.9)	60.4 (1.0)	59.1 (1.2)	57.4 (1.0)
Fatty acids	1.6 (0.2)	2.7 (0.2)	3.3 (0.2)	3.5 (0.2)	3.1 (0.3)	3.6 (0.2)
Refined grains	7.5 (0.3)	6.8 (0.2)	6.0 (0.3)	5.1 (0.3)	4.6 (0.3)	4.8 (0.2)
Sodium	5.7 (0.2)	5.2 (0.2)	4.5 (0.2)	4.1 (0.2)	4.2 (0.3)	4.9 (0.2)
Added sugars	9.2 (0.1)	8.7 (0.1)	8.4 (0.1)	8.3 (0.1)	8.1 (0.2)	7.7 (0.1)
Saturated fats	4.9 (0.2)	5.9 (0.2)	6.5 (0.2)	6.3 (0.2)	6.0 (0.3)	5.3 (0.2)

Note: Estimates are based on usual intake analyses. Sample size is not reported because the National Cancer Institute method generates a pseudo-population.
SE = standard error

Table D3.9. Mean Healthy Eating Index-2020 scores at ages 2 through 9 by duration of WIC participation

Healthy Eating Index-2020	No longer receiving WIC benefits after age 3 Mean (SE)	Still receiving WIC benefits after age 3 Mean (SE)	Received WIC intermittently Mean (SE)
2 years			
Total score	61.4 (1.3)	63.5 (1.0)	61.3 (1.9)
Total fruit	4.9 (0.1)	4.9 (0.1)	4.9 (0.1)
Whole fruit	4.8 (0.3)	4.7 (0.3)	4.9 (0.3)
Total vegetables	2.6 (0.2)	2.5 (0.1)	2.1 (0.2)
Greens and beans	1.5 (0.4)	2.2 (0.2)	1.0 (0.4)
Whole grains	3.1 (0.4)	3.3 (0.3)	3.0 (0.5)
Dairy	9.7 (0.1)	9.6 (0.1)	9.0 (0.4)
Total protein foods	4.4 (0.2)	4.4 (0.1)	4.5 (0.2)
Seafood and plant protein	2.3 (0.4)	2.8 (0.3)	2.8 (0.4)
Fatty acid ratio	1.4 (0.2)	1.6 (0.2)	2.3 (0.4)
Refined grains	7.6 (0.4)	7.5 (0.3)	6.9 (0.5)
Sodium	5.3 (0.4)	5.8 (0.3)	5.5 (0.5)
Added sugar	9.4 (0.2)	9.1 (0.2)	9.2 (0.4)
Saturated fats	4.3 (0.3)	5.0 (0.3)	5.2 (0.6)
3 years			
Total score	60.6 (1.8)	64.6 (1.1)	61.6 (1.9)
Total fruit	4.6 (0.2)	4.7 (0.1)	4.6 (0.2)
Whole fruit	4.4 (0.3)	4.2 (0.3)	4.1 (0.3)
Total vegetables	2.6 (0.2)	2.5 (0.2)	2.8 (0.4)
Greens and beans	1.7 (0.4)	2.7 (0.3)	2.1 (0.6)
Whole grains	3.2 (0.4)	3.2 (0.3)	2.9 (0.4)
Dairy	9.4 (0.2)	9.3 (0.2)	8.4 (0.5)
Total protein foods	4.5 (0.1)	4.7 (0.1)	4.7 (0.1)
Seafood and plant protein	2.5 (0.4)	3.4 (0.3)	2.8 (0.4)
Fatty acid ratio	2.1 (0.3)	2.9 (0.3)	3.0 (0.6)
Refined grains	6.8 (0.4)	6.8 (0.2)	6.4 (0.6)
Sodium	5.3 (0.3)	5.0 (0.3)	5.5 (0.4)
Added sugar	8.6 (0.3)	8.8 (0.2)	8.6 (0.4)
Saturated fats	4.9 (0.4)	6.3 (0.3)	5.6 (0.5)
4 years			
Total score	60.0 (1.2)	64.4 (1.1)	61.6 (2.4)
Total fruit	4.6 (0.4)	4.9 (0.3)	4.6 (0.4)
Whole fruit	4.6 (0.4)	4.7 (0.5)	4.2 (0.5)
Total vegetables	2.7 (0.2)	2.6 (0.1)	2.6 (0.3)
Greens and beans	1.6 (0.3)	2.0 (0.2)	2.0 (0.4)
Whole grains	3.1 (0.3)	3.9 (0.3)	3.2 (0.5)
Dairy	9.2 (0.3)	9.1 (0.2)	8.5 (0.4)

Healthy Eating Index-2020	No longer receiving WIC benefits after age 3 Mean (SE)	Still receiving WIC benefits after age 3 Mean (SE)	Received WIC intermittently Mean (SE)
Total protein foods	4.6 (0.2)	4.5 (0.1)	4.7 (0.1)
Seafood and plant protein	2.8 (0.3)	3.1 (0.2)	3.5 (0.4)
Fatty acid ratio	2.9 (0.3)	3.4 (0.2)	3.9 (0.5)
Refined grains	6.3 (0.5)	5.9 (0.3)	5.6 (0.7)
Sodium	4.1 (0.5)	4.8 (0.2)	4.4 (0.7)
Added sugar	8.4 (0.3)	8.4 (0.2)	8.3 (0.4)
Saturated fats	5.2 (0.4)	7.1 (0.2)	6.0 (0.5)
5 years			
Total score	57.7 (1.3)	61.8 (1.1)	58.9 (1.7)
Total fruit	4.6 (0.2)	4.7 (0.1)	4.3 (0.3)
Whole fruit	4.8 (0.2)	4.5 (0.3)	4.4 (0.4)
Total vegetables	2.5 (0.2)	2.7 (0.1)	2.7 (0.3)
Greens and beans	1.3 (0.3)	2.0 (0.3)	1.9 (0.4)
Whole grains	2.6 (0.3)	3.3 (0.3)	2.9 (0.4)
Dairy	8.8 (0.3)	9.2 (0.2)	8.6 (0.6)
Total protein foods	4.4 (0.1)	4.5 (0.1)	4.5 (0.2)
Seafood and plant protein	2.9 (0.3)	2.6 (0.2)	3.2 (0.4)
Fatty acid ratio	3.2 (0.4)	3.6 (0.2)	3.8 (0.6)
Refined grains	4.9 (0.4)	5.2 (0.4)	5.1 (0.7)
Sodium	4.1 (0.4)	4.3 (0.2)	3.4 (0.5)
Added sugar	8.0 (0.3)	8.3 (0.2)	8.6 (0.3)
Saturated fats	5.5 (0.4)	6.8 (0.2)	5.5 (0.4)
6 years			
Total score	56.2 (1.4)	59.9 (1.6)	62.0 (1.8)
Total fruit	4.5 (0.3)	4.7 (0.3)	4.7 (0.3)
Whole fruit	4.6 (0.4)	4.6 (0.4)	4.6 (0.4)
Total vegetables	2.6 (0.3)	2.6 (0.1)	2.9 (0.2)
Greens and beans	1.6 (0.4)	2.5 (0.3)	2.8 (0.6)
Whole grains	2.6 (0.3)	2.9 (0.2)	3.3 (0.5)
Dairy	8.8 (0.3)	8.8 (0.3)	9.1 (0.4)
Total protein foods	4.4 (0.1)	4.6 (0.1)	4.3 (0.2)
Seafood and plant protein	2.7 (0.3)	2.7 (0.2)	2.9 (0.4)
Fatty acid ratio	2.8 (0.3)	3.1 (0.3)	3.7 (0.6)
Refined grains	4.4 (0.4)	4.6 (0.4)	5.2 (0.6)
Sodium	4.0 (0.4)	4.3 (0.4)	4.1 (0.6)
Added sugar	8.0 (0.2)	8.1 (0.2)	8.2 (0.4)
Saturated fat	5.0 (0.4)	6.3 (0.3)	6.4 (0.7)

Healthy Eating Index-2020	No longer receiving WIC benefits after age 3 Mean (SE)	Still receiving WIC benefits after age 3 Mean (SE)	Received WIC intermittently Mean (SE)
9 years			
Total score	58.2 (1.5)	57.5 (1.6)	55.6 (2.0)
Total fruit	4.3 (0.3)	4.2 (0.3)	3.7 (0.4)
Whole fruit	4.5 (0.3)	4.1 (0.4)	3.9 (0.4)
Total vegetables	2.9 (0.2)	2.6 (0.1)	2.5 (0.2)
Greens and beans	1.7 (0.5)	2.0 (0.3)	1.5 (0.5)
Whole grains	4.1 (0.3)	3.3 (0.3)	4.1 (0.4)
Dairy	7.0 (0.4)	7.3 (0.3)	7.8 (0.6)
Total protein foods	4.7 (0.1)	4.5 (0.1)	4.2 (0.3)
Seafood and plant protein	2.4 (0.3)	3.1 (0.2)	2.7 (0.4)
Fatty acid ratio	3.7 (0.4)	3.6 (0.2)	3.2 (0.8)
Refined grains	5.5 (0.4)	4.6 (0.3)	4.7 (0.6)
Sodium	4.6 (0.4)	5.0 (0.2)	4.8 (0.7)
Added sugar	7.4 (0.3)	7.8 (0.2)	7.7 (0.5)
Saturated fats	5.5 (0.4)	5.3 (0.2)	4.8 (0.6)

Note: Estimates are based on usual intake analyses. Sample size is not reported because the National Cancer Institute method generates a pseudo-population.
HEI-2020 = Healthy Eating Index-2020; SE = standard error

Appendix D4

Information Accompanying Chapter 5

This appendix provides the data supporting figures presented in chapter 5.

Table D4.1. Median usual energy intake for by sex

Sex	Median usual energy intake (SE) by interview					
	2 years	3 years	4 years	5 years	6 years	9 years
Females	1,139.6 (28.0)	1,307.5 (29.7)	1,376.6 (40.8)	1,440.8 (42.9)	1,551.2 (45.5)	1,970.2 (51.5)
Males	1,234.6 (25.6)	1,399.3 (41.0)	1,482.8 (35.9)	1,627.4 (35.0)	1,760.3 (38.2)	2,264.6 (75.0)

Note: Estimates are based on usual intake analyses. Sample size is not reported because the National Cancer Institute method generates a pseudo-population.
Source: National Cancer Institute, 2023
SE = standard error

Table D4.2. Top five foods contributing to added sugars and saturated fat intakes at ages 2 through 9

Nutrient	Year 2		Year 3		Year 4		Year 5		Year 6		Year 9	
	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)
Added sugars	Beverage sweetened with sugar	26.2 (2.8)	Sweetened beverage, sweetened with sugar	29.0 (1.8)	Sweetened beverage, sweetened with sugar	27.3 (1.7)	Sweetened beverage, sweetened with sugar	20.7 (1.6)	Sweetened beverage, sweetened with sugar	28.3 (1.6)	Sweetened beverage, sweetened with sugar	28.4 (1.8)
	Breakfast cereals, presweetened	14.4 (1.4)	Breakfast cereals, presweetened	12.5 (1.1)	Breakfast cereals, presweetened	13.4 (1.3)	Breakfast cereals, presweetened	13.8 (1.1)	Breakfast cereals, presweetened	13.9 (1.2)	Cake	12.2 (1.6)
	Yogurt	9.6 (1.2)	Other cookies	8.2 (0.8)	Yogurt	7.5 (1.0)	Other cookies	9.0 (1.0)	Ice cream, frozen yogurt, pudding	7.0 (0.9)	Breakfast cereals, presweetened	9.6 (0.9)
	Other cookies	8.3 (1.0)	Yogurt	8.0 (1.1)	Other cookies	7.3 (0.8)	Sugar, syrup, preserves	6.4 (0.7)	Other cookies	6.8 (0.7)	Candy	6.3 (0.9)
	Sugar, syrup, preserves	7.4 (0.9)	Sugar, syrup, preserves	7.7 (1.3)	Sugar, syrup, preserves	7.0 (0.6)	Yogurt	6.4 (0.6)	Sugar, syrup, preserves	6.6 (0.6)	Ice cream, frozen yogurt, pudding	6.2 (1.3)
Saturated fat	Whole milk, unflavored	30.9 (1.5)	Whole milk, unflavored	11.9 (1.1)	Cheese, cheese dishes	10.5 (1.1)	Cheese, cheese dishes	11.3 (1.2)	Cheese, cheese dishes	9.8 (0.8)	Pizza	8.9 (0.9)
	Cheese, cheese dishes	8.2 (0.9)	Cheese, cheese dishes	9.6 (1.0)	Whole milk, unflavored	7.0 (0.8)	Pizza	6.5 (0.9)	Pizza	7.4 (0.9)	Sandwiches	7.8 (0.8)
	Eggs, egg dishes	5.7 (0.6)	Hot dogs, sausages, and cold cuts	6.6 (0.8)	Eggs, egg dishes	6.6 (0.7)	Whole milk, unflavored	6.3 (0.7)	Whole milk, unflavored	6.0 (0.6)	Burrito, taco, enchilada, nachos	6.9 (1.0)
	Chicken or turkey, with or without coating	4.4 (0.4)	Chicken or turkey, with or without coating	5.9 (0.4)	2% milk, unflavored	5.5 (0.5)	Chicken or turkey, with or without coating	6.0 (0.5)	Chicken or turkey, with or without coating	6.0 (0.6)	Cheese, cheese dishes	6.2 (0.7)
	Hot dogs, sausages, and cold cuts	4.0 (0.6)	Eggs, egg dishes	5.9 (0.5)	Chicken or turkey, with or without coating	5.3 (0.3)	Hot dogs, sausages, and cold cuts	5.4 (0.7)	2% milk, unflavored	5.4 (0.8)	Ice cream, frozen yogurt, pudding	4.5 (0.9)

SE = standard error

Table D4.3. Top five foods contributing to sodium intake at ages 2 through 9

Nutrient	Year 2		Year 3		Year 4		Year 5		Year 6		Year 9	
	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)	Top contributors	% (SE)
Sodium	Chicken or turkey, with or without coating	9.8 (1.0)	Chicken or turkey, with or without coating	10.0 (0.7)	Chicken or turkey, with or without coating	8.4 (0.4)	Chicken or turkey, with or without coating	8.9 (0.6)	Chicken or turkey, with or without coating	9.0 (0.8)	Pizza	9.4 (1.0)
	Whole milk, unflavored	6.5 (0.4)	Hot dogs, sausages, and cold cuts	7.2 (0.8)	Hot dogs, sausages, and cold cuts	6.6 (0.7)	Hot dogs, sausages, and cold cuts	7.5 (0.7)	Bread/rolls: enriched and whole grain-rich	7.7 (0.4)	Sandwiches	7.0 (0.6)
	Mixed dishes, with/without meat, grain, vegetables	6.4 (0.6)	Bread/rolls: enriched and whole grain-rich	6.3 (0.5)	Bread/rolls: enriched and whole grain-rich	6.4 (0.4)	Bread/rolls: enriched and whole grain-rich	7.0 (0.4)	Hot dogs, sausages, and cold cuts	7.6 (0.7)	Hot dogs, sausages, and cold cuts	6.8 (0.5)
	Soups	6.3 (1.0)	Mixed dishes, with/without meat, grain, vegetables	6.1 (0.7)	Mixed dishes, with/without meat, grain, vegetables	5.5 (0.7)	Pizza	6.2 (0.8)	Pizza	7.3 (0.9)	Chicken or turkey, with or without coating	6.6 (0.6)
	Hot dogs, sausages, and cold cuts	5.6 (0.7)	Soups	5.2 (0.7)	Soups	5.0 (0.8)	Soups	5.2 (0.8)	Mixed dishes, with/without meat, grain, vegetables	5.4 (0.5)	Burrito, taco, enchilada, nachos	6.2 (0.9)

SE = standard error

Appendix E

Year 9 Instrument

This appendix provides the items in the Year 9 instrument. If "New!" precedes the item, then the item was new for the Year 9 extension of the study. If "Modified" precedes the item, then it was modified from previous administrations during the Special Supplemental Nutrition Program for Women, Infants, and Children Infant and Toddler Feeding Practices Study-2.

The Special Supplemental Nutrition Program for Women, Infants, and Children Infant (WIC) and Toddler Feeding Practices Study-2 (ITFPS-2) YEAR 9 TELEPHONE INTERVIEW – ENGLISH

I'd like to start today by asking you some background questions about yourself and your family.

SD14. Are you …? [Source: WIC IFPS-1]

Married, ... 01
Separated, ... 02
Divorced, ... 03
Widowed, or..... 04
Never Married?..... 05
DON'T KNOW 98
REFUSED..... 99

SD21. Are you or your family currently receiving any of the following: [Source: WIC IFPS-1; modified]

a. Supplemental nutrition assistance benefits, sometimes called SNAP or Food Stamps?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

b. Temporary assistance to needy families, sometimes called TANF or welfare?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

c. Medicaid or [state specific name for Medicaid]?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

d. During the school year, does {CHILD} receive free or reduced price meals or snacks from school?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

New! e. During the summer months when there is no school, does {CHILD} receive free meals or snacks through school or another program?

YES 01
NO 02
DON'T KNOW 98

SD26. What is the highest year or grade you finished in school?
(DO NOT READ – ENDORSE BASED ON PARTICIPANT RESPONSE, PROBE IF NEEDED)

NEVER ATTENDED SCHOOL 01
GRADES 1 TO 11, ENTER NUMBER 02
HIGH SCHOOL DIPLOMA OR GED 03
SOME COLLEGE/SOME POSTSECONDARY VOCATIONAL COURSES 04
2-YEAR OR 3-YEAR COLLEGE DEGREE (AA DEGREE) OR VOCATIONAL SCHOOL DIPLOMA 05
4-YEAR COLLEGE DEGREE (BA, BS DEGREE 06
SOME GRADUATE WORK/NO GRADUATE DEGREE 07
DOCTORAL OR GRADUATE DEGREE (MA, MBA, PHD, JD, MD)..... 08

Next, I'd like to ask you questions about your WIC participation.

SD31a. Are you or any of your children currently getting food from WIC or a WIC electronic benefits card for WIC foods? [Source: FDA IFPS-2; modified]

YES 01
NO 02

New! SD31b. Counting all of your {IF R IS MALE: partner's/ELSE blank} pregnancies and children, about how many months or years in total have you received WIC services? [Source Los Angeles County WIC Survey]

NUMBER OF MONTHS 0-12 ..... [NUMBER]
NUMBER OF YEARS 1-25 ..... [NUMBER]

SD18. How many people live in your household? By household I mean people who live together and share living expenses. Please include yourself in this count. If you or your partner living with you are pregnant right now. Please add 1 to the total for your household. [Source: FITS 2002, modified, and new development]

NUMBER OF PEOPLE IN HOUSEHOLD [NUMBER]

SD18a. Including yourself, how many are adults age 18 or older?
NUMBER OF PEOPLE 18 OR OLDER [NUMBER]

Modified! SD18b. How many are children between the ages of 0 and 17? If you are pregnant, please add 1 to the total number of children between ages 0 and 17.
NUMBER OF CHILDREN 0-17 [NUMBER]

SD19. During [PREVIOUS MONTH], what was your total household income before taxes? Please include any income in the past month from you, your family members who live with you, and any other people who live with you and share living expenses with you [Source: WIC IFPS-1, modified]

INCOME ..... [AMOUNT] GO TO "18-item food security"
DON'T KNOW 98
REFUSED 99

(OR if respondent cannot provide specific amount): I'll read some ranges, and you can stop me when I get to the one that is your best estimate of your total household income before taxes for [PREVIOUS MONTH]

$500 or less 01
$501-$1000 02
$1001-$1500 03
$1501-$2000 04
$2001-$2500 05
$2501-$3000 06
$3001-$3500 07
$3501-$4000 08
$4001-$4500 09
$4501-$5000 10
$5001+ 11
DON'T KNOW 98
REFUSED 99

These next questions are about the food eaten in your household in the last 12 months, since {NAME OF CURRENT MONTH} of last year and whether you were able to afford the food you need.

SD. I'm going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for your household in the last 12 months—that is, since last {NAME OF CURRENT MONTH}. [Source: USDA food security 18-item see https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/survey- tools/#household]

New! SD50. The first statement is "We worried whether our food would run out before we got money to buy more." Was that often true, sometimes true, or never true for (you/your household) in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON'T KNOW 98
REFUSED 99

SD36. “The food that we bought just didn’t last, and we didn’t have money to get more.” Was that often true, sometimes true, or never true for your household in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON’T KNOW 98
REFUSED 99

SD37. “We couldn’t afford to eat balanced meals.” Was that often true, sometimes true, or never true for your household in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON’T KNOW 98
REFUSED 99

IF SD50 = 01 OR 02, OR SD 36 = 01 OR 02, OR SD37 = 01 OR 02, GO TO SD38. ELSE GO TO CH31.

SD38. In the last 12 months, since last (NAME OF CURRENT MONTH), did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?

YES ..... 01 → GO TO SD38a
NO ..... 02 → GO TO SD39
DON’T KNOW ..... 98 → GO TO SD39
REFUSED ..... 99 → GO TO SD39

SD38a. [IF YES TO SD38, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

ALMOST EVERY MONTH 01
SOME MONTHS BUT NOT EVERY MONTH 02
ONLY 1 OR 2 MONTHS 03
DON’T KNOW 98
REFUSED 99

SD39. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

YES 01
NO 02
DON’T KNOW 98
REFUSED 99

SD40. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

YES 01
NO 02
DON'T KNOW 98
REFUSED 99

New! SD51. In the last 12 months, did you lose weight because there wasn't enough money for food?

YES 01
NO 02
DON'T KNOW 98
REFUSED 99

IF SD38 = 01, OR SD 39 = 01, OR SD40 = 01, OR SD51 = 01 GO TO SD52. ELSE GO TO CH31.

New! SD52. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?

YES ..... 01 → GO TO SD52a
NO ..... 02 → GO TO CH31
DON'T KNOW ..... 98 → GO TO CH31
REFUSED ..... 99 → GO TO CH31

SD52a. [If SD52 = 01, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

ALMOST EVERY MONTH 01
SOME MONTHS BUT NOT EVERY MONTH 02
ONLY 1 OR 2 MONTHS 03
DON'T KNOW 98
REFUSED 99

Now I'm going to read you several statements that people have made about the food situation of their children. For these statements, please tell me whether the statement was OFTEN true, SOMETIMES true, or NEVER true in the last 12 months for (your child/children living in the household).

IF SD18a≥1 AND SD18B=1, THEN USE "WE" AND "OUR CHILD" WHERE OPTIONAL.
IF SD18A≥1 AND SD18b≥1 THEN USE "WE" "THE CHILDREN" OR "ANY OF THE CHILDREN" WHERE OPTIONAL.

IF SD18A=1 AND SD18B=1 THEN USE "I" AND "MY CHILD" WHERE OPTIONAL.

IFSD18A=1 AND SD18B≥1 THEN USE "I" AND "MY CHILDREN" OR "ANY OF THE CHILDREN" WHERE OPTIONAL.

New! CH31. “(I/We) relied on only a few kinds of low-cost food to feed ((my/our) child/the children) because (I was/we were) running out of money to buy food.” Was that often, sometimes, or never true for (you/your household) in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON’T KNOW 98
REFUSED 99

New! CH32. “(I/We) couldn’t feed ((my/our) child/the children) a balanced meal, because (I/we) couldn’t afford that.” Was that often, sometimes, or never true for (you/your household) in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON’T KNOW 98
REFUSED 99

New! CH33. "((My/Our) child was/The children were) not eating enough because (I/we) just couldn't afford enough food." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

OFTEN TRUE 01
SOMETIMES TRUE 02
NEVER TRUE 03
DON’T KNOW 98
REFUSED 99

IF CH31 = 01 OR 02, OR CH32 = 01 OR 02, OR CH33 = 01 OR 02 GO TO CH34. ELSE GO TO MH13.

New! CH34. In the last 12 months, since (current month) of last year, did you ever cut the size of (your child's/any of the children's) meals because there wasn't enough money for food?

YES 01
NO 02
DON’T KNOW 98
REFUSED 99

New! CH35. In the last 12 months, did ({CHILD}/any of the children) ever skip meals because there wasn't enough money for food?

YES ..... 01 → GO TO CH35a
NO ..... 02 → GO TO CH36
DON’T KNOW ..... 98 → GO TO CH36
REFUSED ..... 99 → GO TO CH36

New! CH35a. [IF CH35 = 01, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months??

ALMOST EVERY MONTH 01
SOME MONTHS BUT NOT EVERY MONTH 02
ONLY 1 OR TWO MONTHS 03
DON'T KNOW 98
REFUSED.....99

New! CH36. In the last 12 months, (was your child/were the children) ever hungry but you just couldn't afford more food?

YES 01
NO 02
DON'T KNOW 98
REFUSED.....99

New! CH37. In the last 12 months, did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food?

YES 01
NO 02
DON'T KNOW 98
REFUSED.....99

Now I'd like to change topics and ask you some questions about health, and about work, school, and child care.

MH13. Right now, about how much do you weigh, without shoes?
[Source: PHFE WIC Postpartum Questionnaire 2010]
POUNDS [NUMBER]

Modified! SD29.Are you currently working for pay? [Modified, Source: LA WIC Survey]

YES 01
NO 02
DON'T KNOW 98
REFUSED.....99

[IF SD29=01, ASK] SD29a. Are you working ...? [Modified, Source: LA WIC Survey]

Full time, at least 35 hours per week or 01
Part time, less than 35 hours per week? 02
DON'T KNOW 98
REFUSED.....99

The next few questions are about your use of regular child care. By child care, we mean any kind of arrangement where someone other than you or {CHILD}'s other parent takes care of {CHILD} on a regular basis.

Modified! MH34. Do you currently use regular child care for [CHILD]?

YES 01
NO .....02 → GO TO MH30
DON'T KNOW .....98 → GO TO MH30
REFUSED.....99 → GO TO MH30

Modified! MH35. When do you use regular child care for {CHILD} before school, after school, or when school is not in session such as weekends, holidays, or during summer break? (INTERVIEWER CHECK ALL THAT APPLY)

BEFORE SCHOOL 01
AFTER SCHOOL 02
WHEN SCHOOL IS NOT IN SESSION 03

The next questions are about who provides the food {CHILD} eats for breakfast, lunch, snacks, and dinner or supper during the regular school year. We want to know about who provides the food {child name} eats, not the location where it is actually eaten.

MH30. During a typical Monday to Friday when the child attends school, {CHILD} may get {his/her} breakfast foods from home, from a child care program, from school, or from somewhere else. How many days each week is the food {CHILD} eats for breakfast...

a. from home?
DAYS [0 to 5]
[IF MH30a=5, SKIP TO MH31]
b. (ASK ONLY IF MH35 = 01) from a child care provider?
DAYS [0 to 5]
c. from school?
DAYS [0 to 5]
[IF MH30a + MH30b =5, SKIP TO MH31]
d. from somewhere else?
DAYS [0 to 5]

(IF d > 0): [What is the other place where {CHILD} gets breakfast foods?]
SPECIFY

(SOFT EDIT: Sum of a, b, c, and d = 5. If ≠ 5, interviewer should review with respondent to confirm whether child does not eat breakfast every day (<5), or has more than one breakfast some days (>5).)

MH31. During a typical Monday to Friday when the child attends school, {CHILD} may bring {his/her} lunch from home or get it from school, or from somewhere else. How many days each week is the food {CHILD} eats for lunch...

a. from home?
DAYS [0 to 5]
[IF MH31a=5, SKIP TO MH33]
b. from school?
DAYS [0 to 5]
[IF MH31a + MH31b =5, SKIP TO MH33]
c. from somewhere else?
DAYS [0 to 5]

(IF c > 0): [What is the other place where {CHILD} gets lunch foods?]
SPECIFY

(SOFT EDIT: Sum of a, b, c, and d = 5. If ≠ 5, interviewer should review with respondent to confirm whether child does not eat lunch every day (<5), or has more than one lunch some days (>5).)

New! MH33. During a typical Monday to Friday when the child attends school, {CHILD} may get {his/her} snacks from home or get them from a child care program, from school, or from somewhere else. How many days each week are the snacks {CHILD} eats...

a. from home?
DAYS [0 to 5]
b. from school?
DAYS [0 to 5]
c. from somewhere else?
DAYS [0 to 5]

(IF c > 0): [What is the other place where {CHILD} gets lunch foods?]
SPECIFY

New! MH36. During a typical Monday to Friday school week, {CHILD} may get {his/her} dinner or supper at home or from a child care program, from school, or from somewhere else. How many days each week is the food {CHILD} eats for dinner or supper...

a. from home?
DAYS [0 to 5]
[IF MH36a=5, SKIP TO J21]
b. from school?
DAYS [0 to 5]
[IF MH36a + MH36b =5, SKIP TO J21]
c. from somewhere else
DAYS [0 to 5]

(IF c > 0): [What is the other place where {CHILD} gets dinner or supper foods?]
SPECIFY

(SOFT EDIT: Sum of a, b, c, and d = 5. If ≠ 5, interviewer should review with respondent to confirm whether child does not eat dinner or supper every day (<5), or has more than one lunch some days (>5).)

Now I'm going to ask some questions about {CHILD's} eating habits and some things that you may do that involve food for your family.

New! J21. How often do you have fruits available at home? Would you say…?
[Source: NHANES Flexible Consumer Behavior Survey, 2009-2010, CBQ020]

Never, ... 1
Rarely, ... 2
Sometimes, ... 3
Often, or 4
Very Often? 5
DON'T KNOW 98
REFUSED 99

New! J22. How often do you have any of these dark green vegetables available at home? Broccoli; spinach and other greens like collard, mustard, and turnip greens; and dark green leafy lettuce like romaine. Would you say…?
[Source: NHANES Flexible Consumer Behavior Survey, 2009-2010, CBQ030]

Never, ... 1
Rarely, ... 2
Sometimes, ... 3
Often, or 4
Very Often? 5
DON'T KNOW 98
REFUSED 99

New! J23. How often do you have salty snacks such as chips and crackers available at home? Do not include nuts. Would you say…?
[Source: NHANES Flexible Consumer Behavior Survey, 2009-2010, CBQ040]

Never, ... 1
Rarely, ... 2
Sometimes, ... 3
Often, or 4
Very Often? 5
DON'T KNOW 98
REFUSED 99

New! J24. How often do you have 1% fat, skim, non-fat or fat-free milk available at home? Do not include 2% milk or whole milk. Would you say…?
[Source: Modified NHANES Flexible Consumer Behavior Survey, 2009-2010, CBQ050]

Never, ... 1
Rarely, ... 2
Sometimes, ... 3
Often, or 4
Very Often? 5
REFUSED ..... -1
DON'T KNOW ..... -2

New! J25. How often do you have soft drinks such as soda or pop, sports drinks such as Gatorade, fruit-flavored drinks, or fruit punch available at home? Do not include diet drinks or 100% juice. Would you say…?
[Source: Modified NHANES Flexible Consumer Behavior Survey, 2009-2010, CBQ060]

Never, ... 1
Rarely, ... 2
Sometimes, ... 3
Often, or 4
Very Often? 5
DON'T KNOW 98
REFUSED 99

Now I'm going to ask you about {CHILD's} eating or some things that you may do or believe about {CHILD's} eating. Please tell me how much you agree or disagree with each of the following statements

New! KA91. {CHILD} enjoys a wide variety of foods. Would you say you . . .

Disagree, ... 01
Slightly disagree, ... 02
Neither disagree nor agree, ... 03
Slightly agree, or 04
Agree? 05
DON'T KNOW 98
REFUSED 99

Modified! CF51c. If {CHILD} says 'I am not hungry,' I try to get (him/her) to eat anyway. Would you say you . . .

Disagree, ... 01
Slightly disagree, ... 02
Neither disagree nor agree, ... 03
Slightly agree, or 04
Agree? 05
DON'T KNOW 98
REFUSED 99

New! KA92. If I did not guide or regulate {CHILD'S} eating, (she/he) would eat too many junk foods or sweets. Would you say you . . .

Disagree, ... 01
Slightly disagree, ... 02
Neither disagree nor agree, ... 03
Slightly agree, or 04
Agree? 05
DON'T KNOW 98
REFUSED 99

CH19. When you and your child eat meals or snacks at home, how often is a television on while you are eating? Would you say...[Source: CDC 2010 Youth Physical Activity and Nutrition Survey, modified]

Most of the time, ... 01
Sometimes, ... 02
Rarely, or 03
Never?..... 04
DON'T KNOW 98
REFUSED..... 99

CH20. During the past week, including weekdays and weekends, how many times did all or most of your family sit down and eat a meal together? [Source: NHANES Flexible Consumer Behavior Survey (CBQ) 2009-2010, modified]

7 OR MORE TIMES EACH WEEK..... 01
5-6 TIMES DURING THE WEEK 02
3-4 TIMES/WEEK 03
1-2 TIMES/WEEK 04
NEVER..... 05
DON'T KNOW 98
REFUSED..... 99

Modified! WC21. Did you learn something from WIC that helps you make decisions now about what foods to offer {CHILD}? [Source: New Development]

YES ..... 01 → GO TO WC22
NO ..... 02 → GO TO KA42
DON'T KNOW ..... 98 → GO TO KA42

Modified! WC22. (IF YES TO WC21) What did you learn at WIC that you use now when you make decisions about what foods to offer {CHILD}? (OPEN-ENDED; INTERVIEWER RECORD RESPONSE; MARK ALL THA APPLY) [Source: New Development]

I/WE EAT MORE FRUITS AND VEGETABLES 01
I/WE EAT MORE WHOLE GRAINS..... 02
I/WE DRINK MORE REDUCED FAT/LOW-FAT/
NON-FAT MILK 03
WE HAVE MORE FAMILY MEALS/EAT TOGETHER 04
WE DON'T WATCH TV WHEN EATING MEALS 05
WE DRINK/BUY FEWER SUGAR SWEETENED BEVERAGES.... 06
I/WE LIMIT THE SWEETS AND/OR JUNK FOOD WE EAT..... 07
I/WE OFFER THE RIGHT AMOUNT OF FOODS (PORTION) 08
I/WE KNOW HOW TO CHOOSE MORE HEALTHY FOODS
FOR MYSELF/MY FAMILY 09
I READ LABELS ON FOOD PACKAGING..... 10
I/WE LIMIT THE SALT AND SALTY FOODS WE EAT..... 11
OTHER (Specify)..... 12
DON'T KNOW 98
REFUSED..... 99

Modified! KA42.Within the past year, did you seek out nutrition information on topics related to feeding {CHILD} such as picky eating, healthy weight, growth, and development? [Source: New development]

YES ..... 01 → GO TO KA43
NO ..... 03 → GO TO CF56INTRO
DON'T KNOW ..... 98 → GO TO CF56INTRO
REFUSED..... 99 → GO TO CF56INTRO

Modified! KA43. Within the past year, from what sources have you sought nutrition information? (OPEN-ENDED; INTERVIEWER RECORD RESPONSE; MARK ALL THAT APPLY) [Source: New development]

HEALTHCARE PROFESSIONAL SUCH AS DOCTOR,
SCHOOL NURSE OR HEALTH CLINIC OR HOSPITAL..... 01
SCHOOL OR CHILDCARE OR DAYCARE PROVIDER..... 02
INTERNET OR SOCIAL MEDIA..... 03
BOOKS OR LIBRARY OR MAGAZINES..... 04
FAMILY AND/OR FRIENDS..... 05
FARMER'S MARKET..... 06
WORK OR SCHOOL THAT CAREGIVER ATTENDS
SUCH AS COLLEGE..... 07
COMMUNITY CENTER 08
FOOD PANTRY 09
OTHER (Specify)

[CF56INTRO] Let's talk about some things that you may do when you buy food.

New! CF56a How often do you shop with a grocery list? [Source: Faithful Families]
Would you say. . .

Never,.....01
Seldom or rarely, ...02
Sometimes, ...03
Most of the time, or.....04
You always shop with a grocery list? ...05
DON'T KNOW 98
REFUSED.....99

New! CF56b How often do you plan meals ahead of time? [Source: Faithful Families]
Would you say . . .

Never,.....01
Seldom or rarely, ...02
Sometimes, ...03
Most of the time, or.....04
You always plan meals ahead of time? 05
DON'T KNOW 98
REFUSED.....99

Next, we have some questions about food labels. A food label usually is on the back or the side of the food package. It has two parts, a Nutrition Facts panel and a list of ingredients. The "Nutrition Facts panel" of a food label lists the amount of calories, fat, fiber, carbohydrates and some other nutritional information.

New! CF51J How often do you use information on added sugars from a food label? Would you say . .

Never, ... 01
Seldom or Rarely, ... 02
Sometimes, ... 03
Most of the time, or..... 04
You always use information on added sugars from a food label? 05
You never use information on added sugars from a food label? 06
DON'T KNOW 98
REFUSED..... 99

New! CF51K How often do you use information on sodium from a food label? Would you say . . .

Never, ... 01
Seldom or Rarely 02
Sometimes, ... 03
Most of the time, or..... 04
You always use the information on sodium from a food label? 05
DON'T KNOW 98
REFUSED..... 99

AP7. In the past month did you buy any of the following foods for yourself or your family that you used to get from WIC? Please be sure to include foods paid for with SNAP benefits, too. [Source: New development]

a. In the past month did you buy cold or hot whole grain breakfast cereal like corn flakes, bran flakes, plain Cheerios, oatmeal, grits, or cream of wheat?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

b. In the past month did you buy whole grain bread, whole wheat or corn tortillas, or brown rice?

YES 01
NO 02
DON'T KNOW 98
REFUSED..... 99

The next questions are about {CHILD'S} health and behavior

CH2. Has the doctor told you that {CHILD} has any long-term physical or developmental medical problems or conditions that may affect what or how (he/she) eats or {CHILD'S} diet? [Source: FITS 2008, modified]

[IF NEEDED: The medical problems or conditions may be things like food allergies, diabetes, obesity, metabolic disorders, gastrointestinal problems such as celiac disease or gastric reflux, developmental concerns such as ADHD, Autism, Autism Spectrum Disorder, or a sensory processing disorder or mental health concern like anxiety or depression or any long-term problem that influences your child's eating or diet.]

YES ..... 01 → GO TO CH2a
NO ..... 02 → GO TO DM23
DON'T KNOW..... 98 → GO TO DM23
REFUSED..... 99 → GO TO DM23

CH2a. (IF YES) What medical problems or conditions does {CHILD} have? If your child has more than one medical problem or condition, please include them all. [MARK ALL THAT APPLY]

FOOD ALLERGIES 01
DIABETIC OR PREDIABETIC OR DIABETES 02
GASTROINTESTINAL DISORDER SUCH AS CELIAC DISEASE, CYCLIC VOMITING, OR GASTRIC REFLUX 04
OVERWEIGHT OR OBESE 06
ATTENTION DEFICIT DISORDER (ADD)..... 07
ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)..... 08
AUTISM OR AUTISM SPECTRUM DISORDER..... 09
CONSTIPATION OR DIFFICULTY POOPING..... 10
BLOOD DISORDER SUCH AS SICKLE CELL ANEMIA OR ANEMIC..... 11
MENTAL HEALTH CONCERN SUCH AS ANXIETY OR DEPRESSION 12
OTHER (Specify)

New! DM23. Last week, how many days was {CHILD} physically active for a total of at least 60 minutes per day? Please include all the days (he/she) spent in any kind of physical activity that increased (his/her) heart rate and made (him/her) breathe hard some of the time. [School Activity and Nutrition Survey]

DAYS [0 to 7]

New! DM24. Last week, how many days did {CHILD} play outside for 30 minutes or more? Please do not include outdoor play during school hours. [School Activity and Nutrition Survey]

DAYS [0 to 7]

Modified! CH29 During the past week, how many hours of sleep did {CHILD} get on most weeknights? [Modified based on NSCH]

HOURS [0 to 15]

CH17a. Thinking of an average school day, that is, Monday through Friday, how many hours does {CHILD} watch television or play video games? Just give your best estimate. [Source: PHFE WIC survey 2011, modified]

LESS THAN ONE HOUR 01
NUMBER OF HOURS (1 OR MORE)..... [NUMBER 1-18]
DON'T KNOW..... 98
REFUSED..... 99

CH17b. Thinking about a typical day when school is not in session, how many hours a day does {CHILD} watch television or play video games? Just give your best estimate.
[Source: PHFE WIC survey 2011, modified]

LESS THAN ONE HOUR 01
NUMBER OF HOURS (1 OR MORE)..... [NUMBER 1-18]
DON'T KNOW..... 98
REFUSED..... 99

[If CH2a=07 OR 08 OR 09, THEN AUTOCODE DM13=01 AND GO TO DM13aMOD ELSE GO TO DM13.]
Modified! DM13.Has a doctor, other health care provider, or educator EVER told you that {CHILD} has any of the following...
[IF NEEDED Examples of educators are teachers and school nurses.]
Behavioral or conduct problems, developmental delay, an intellectual disability, speech or language disorder, a learning disability, attention deficit disorder, or Autism or Autism Spectrum Disorder? [Source: NSCH A25-A30, Modified]

YES ..... 01 → GO TO DM13a
NO ..... 02 → GO TO DM16
DON'T KNOW..... 98 → GO TO DM16
REFUSED..... 99 → GO TO DM16

[If CH2a=07, 08 AND/OR 09, THEN ASK DM13aMOD; ELSE ASK DM13a]

Modified! DM13aMOD "You mentioned that {CHILD} has {DISPLAY FORMATTED TEXT FROM CH2a=07, 08, AND/OR 09}, does {CHILD} have any other developmental conditions that a doctor, nurse, or teacher has ever told you about? These may include developmental delay, an intellectual disability, or behavioral or conduct problems. [MARK ALL THAT APPLY UNDER DM13a, INCLUDING TEXT FROM CH2a=07]

Modified! DM13a. (IF DM13 YES) What developmental condition does {CHILD} have? If {CHILD NAME} has more than one developmental condition, please include them all. [Revised based on NSCH, MARK ALL THE APPLY]?

DEVELOPMENTAL DELAYS 01
SPEECH OR OTHER LANGUAGE DISORDER LEARNING DISABILITY 02
ATTENTION DEFICIT DISORDER 03
BEHAVIORAL OR CONDUCT PROBLEMS 04
AUTISM OR AUTISM SPECTRUM DISORDER 05
INTELLECTUAL DISABILITY (FORMERLY KNOWN AS MENTAL RETARDATION) 06
OTHER (Specify)

New! DM13b. To what extent does {CHILD's} health condition(s) or problem(s) affect {CHILD's} daily life? [Source NSCH, Modified] Would you say . . .

Very little, ... 01
Somewhat, or 02
A lot? 03
DON'T KNOW 98
REFUSED 99

New! [IF YES TO DM13] DM14. Some children have difficulty in school because of the health problem, condition, or disability you mentioned. These children may have an Individual Education Plan also called an IEP or receive services from a program called Special Education or receive accommodations through a 504 plan. Is {CHILD} currently enrolled in any of these special education classes or services or accommodations? [Source: National Household Education Survey, modified]

YES ..... 01 → GO TO DM14a
NO ..... 02 → GO TO DM16
DON'T KNOW ..... 98 → GO TO DM16
REFUSED ..... 99 → GO TO DM16

New! DM14a. (IFYES TO DM14) Does the condition for which {CHILD} is receiving special education interfere with {HIS/HER} ability to attend school on a regular basis? [Source: National Household Education Survey, modified]

YES 01
NO 02
DON'T KNOW 98
REFUSED 99

DM16. What grade is {CHILD} currently in or if school has ended for the school year, what grade did your child just finish?

SECOND GRADE.....01
THIRD GRADE 02
FOURTH GRADE.....03
FIFTH GRADE.....04
OTHER.....05
DON'T KNOW.....98
REFUSED.....99

DM 17. Thinking back on the last full school year, about how many days did {CHILD} miss school? [Modified from National Study of Children's Health https://www.census.gov/content/dam/Census/programs-surveys/nsch/tech-documentation/questionnaires/2019/NSCH-T2.pdf, see page 13]

NO MISSED DAYS.....01
1-3 DAYS.....02
4-6 DAYS.....03
7-10 DAYS.....04
11 OR MORE DAYS 05
THE CHILD WAS NOT ENROLLED IN SCHOOL 06
DON'T KNOW.....98
REFUSED.....99

DM 18. Thinking back on the last full school year, how many times has {CHILD's} school contacted you or another adult in your household about any problems {CHILD} is having with school? [Modified, National Study of Children's Health]

NONE.....01
1 TIME 02
2 OR MORE TIMES.....03
DON'T KNOW.....98
REFUSED.....99

DM 19. Since {CHILD} started school, has [CHILD] repeated any grades or has {CHILD's} school ever recommended that [CHILD] repeat any grades? [Modified, National Study of Children's Health]

YES 01
NO 02
DON'T KNOW.....98
REFUSED.....99

DM 21. During the current school year, or thinking back to the last school year if {CHILD} is not currently in school, how many days a week did {CHILD} participate in school-related activities? Examples of school-related activities may include clubs, band, sports, dance, theater, scouts, or volunteer work.

DAYS [0 to 7]

DM22. Compared to other children {CHILD's} age, how much difficulty does {CHILD} have making or keeping friends? [Same source as above] Would you say {he/she} has . . .

No difficulty,.....01
A little difficulty, or.....02
A lot of difficulty making or keeping friends?.....03
DON'T KNOW.....98
REFUSED.....99