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WIC Infant and Toddler Feeding Practices Study-2: Sixth Year Report - Final

June 2024

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Authors
Christine Borger, PhD
Thea Zimmerman, MS, RD
Jill DeMatteis, PhD
Bibi Gollapudi
Shannon Whaley, PhD
Lorrene Ritchie, PhD, RD
Laurie May, PhD

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Christine Borger, PhD, Westat
Thea Zimmerman, MS, RD, Westat
Jill DeMatteis, PhD, Westat
Bibi Gollapudi, Westat
Shannon Whaley, PhD, PHFE WIC
Lorrene Ritchie, PhD, RD, Nutrition Policy Institute, Division of Agriculture and Natural Resources, University of California
Laurie May, PhD, Westat

Submitted to:

Courtney Paolicelli, DrPH, RDN
Office of Policy Support
Food and Nutrition Service, USDA
1320 Braddock Place
Alexandria, Virginia 22314
(703) 605-4370

Submitted by:

Westat
An Employee-Owned Research Corporation®
1600 Research Boulevard
Rockville, Maryland 20850-3129
(301) 251-1500

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1. Study Overview

This report is the seventh report in a series from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).[1] Though this report draws from data collected throughout the previous years of the study, the primary sources of data are the interviews administered at child age 72 months and anthropometric measurements collected around child age 6 years.

1.1 Background

WIC was established to safeguard the health of low-income pregnant women, infants, and children who are at nutritional risk. The program was instituted by Congress as a pilot in 1972 under Public Law 92-433, Section 17 to the Child Nutrition Act of 1966, and made permanent in 1974.[2]

WIC provides nutrition assistance to pregnant, postpartum, and breastfeeding women and their infants and children up to age 5 years, 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)[3] ($47,638 and $48,470 for a family of 4 in 2019 and 2020, respectively[4]) or be eligible based on participation in certain other means-tested benefit programs.

The Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) administers WIC, which is a Federal grant program, to 89 WIC State Agencies (SAs), including Indian Tribal Organizations (ITOs) and U.S. territories. The SAs are responsible for program operations within their jurisdictions, and they provide services primarily through contracts with local WIC-sponsoring

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1 As of this writing, the *Fifth Year Report* has not been released; however, other preceding reports can be found at https://www.fns.usda.gov/wic/infant-and-toddler-feeding-practices-study-2-fourth-year-report.

2 USDA FNS. (2013, October 10). *About WIC: WIC's Mission.* Available at: http://www.fns.usda.gov/wic/about-wic-wics-mission. Retrieved on: June 6, 2020.

3 U.S. Department of Health and Human Services. (n.d.). *U.S. Federal Poverty Guidelines Used to Determine Financial Eligibility for Certain Federal Programs*. Available at: https://aspe.hhs.gov/sites/default/files/documents/713f8ce8345dc6885ed3ce441273191d/HHS-Poverty-Guidelines-Fed-Register-2019.pdf. Retrieved on: June 15, 2020.

4 The income-poverty variable used for analysis in this report is based on the 2019 values. Values vary by state. This is the value for a family of four in the 48 contiguous states and the District of Columbia. In Alaska, the 2019 and 2020 values for a family of four were $59,552 and $60,588, respectively.

agencies (e.g., health departments, community centers, hospitals) that provide services to WIC participants at local service sites or clinics.

WIC ITFPS-2 is a longitudinal study designed to examine the feeding practices employed by 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 regarding feeding practices, the association between WIC services and those practices, and the health- and nutrition-related outcomes of children currently or previously participating in WIC.

WIC ITFPS-2 is heavily predicated on the design used for the 1997 USDA Food and Consumer Service's longitudinal WIC Infant Feeding Practices Study (WIC IFPS-1) (Baydar, McCann, Williams, & Vesper, 1997). While this earlier study only followed infants 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's) Infant Feeding Practices Study II (IFPS II) (Fein et al., 2008), a well-known longitudinal study of infant feeding practices, was used extensively as a frame of reference during planning of WIC ITFPS-2. Previous WIC ITFPS-2 reports also made comparisons to findings from the Gerber/Nestle Feeding Infants and Toddlers Studies (FITS), which were conducted in 2008 and 2016 and addressed the dietary intakes and feeding practices of infants and children (Welker, Jacquier, Catellier, Anater, & Story, 2018). By leveraging these previous studies and their associated literature, the WIC ITFPS-2 study team tailored the study to the WIC population with refined study instruments and methods that minimize respondent burden and maximize longitudinal engagement and study efficiency. The team's efforts allowed for comparisons between the current study findings and past work, and in some cases, facilitated assessment of change over time.

The primary research objectives for WIC ITFPS-2 at age 6 years include:

- Examining the dietary behaviors and health outcomes of children at age 6, a year after they age out of WIC, including providing longitudinal comparisons to examine changes associated with the end of WIC eligibility;

- Describing the food security status of children at age 6 years 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 6 years; and
- Describing the food and health-related environmental characteristics for children at age 6, a year after they age out of WIC.

The study addresses these objectives and answers 20 research questions specified by FNS. These research questions are listed in Appendix A, Table A-1. Study findings from the prenatal period (May et al., 2015), the infant or first year (May et al., 2017), the second year (Borger et al., 2018), third year (Weinfield et al., 2019), fourth year (Borger et al., 2020), and fifth year (Borger et al., 2022) are available online (see https://www.fns.usda.gov/wic/infant-and-toddler-feeding-practices-study-2-fourth-year-report).

Study children turned 6 years old between April 2019 and July 2020; thus, the schedule for data collection for the sixth-year interviews began in April 2019 and concluded in August 2020.[5] This window of data collection is particularly important because on March 13, 2020, a coronavirus disease 2019 (COVID-19) national health emergency was declared. Many Federal agencies, including USDA, urgently implemented activities to support the nation during this unprecedented health crisis. Data collection at study child age 72 months was in progress when the health emergency declaration was issued. In this report, the COVID-19 health emergency declaration is referred to as the COVID ED.

With the exception of extending the window for collecting weight and height measurements,[6] the study continued as originally planned. To contextualize findings, the report includes analyses of select outcomes by whether they occurred prior to or post March 13 (i.e., pre-COVID ED or post-COVID ED). In this context, it is important to note that the COVID-19 pandemic may have influenced children and their families in numerous ways as infection rates and mitigation strategies varied widely across the country. Though important, detailed analysis of the impact of the COVID-19 emergency measures—including the effects of the widespread closures of businesses,

[5] Though scheduled to run through August 2020, the final interview for the cohort took place in July 2020 because the final cases were nonresponse.

[6] To accommodate study mothers, the window for collecting height and weight data was extended to cover a 5-month window on both sides of the study child's sixth birthday. More information can be found in Chapter 6, Section 6.3.

the transition of public schools to virtual learning environments, USDA waivers for school-based meal distributions, and augmented emergency funding from USDA to nutritionally support families—is beyond the scope of this report.[7]

Despite the COVID ED, the WIC ITFPS-2 methodology is unchanged from prior years. Accordingly, this chapter provides a high-level overview of the methodology with emphasis on components specific to this report. For more methodological details, please refer to Harrison, Hirschman, Owens, McNutt, and Sallack (2014) and Chapter 1 in the previous annual reports.

1.2 Study Design

This observational study followed a hybrid design, incorporating a core longitudinal sample (the "core" sample) and a supplemental cross-sectional sample (the "supplemental" sample) to ensure precision in estimates at key points in time during the first 2 years of life. Both the core longitudinal and 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). Study children were followed regularly until they were 72 months old, with up to 18 maternal (or primary caregiver[8]) interviews, which 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. After the 72-month interview, there will be a nineteenth follow-up interview around the time of the study child's ninth birthday.[9] Though interviewed less frequently prior to the study child's second birthday, the supplemental sample received all the interviews that the core sample received from the 24-month interview onward,

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[7] The study team has published one article, Borger et al. (2021), which compares dietary intakes of children who took their 72-month interview prior to the pandemic emergency response and those who took their 72-month interview in the early months after the emergency declaration.

[8] Over 98 percent of respondents are biological mothers. Throughout this and other WIC ITFPS-2 reports, the terms "mother" and "caregiver" are used interchangeably. The term "participant" indicates a mother-child or caregiver-child dyad, and we alternatively refer to the mother/caregiver or child when discussing findings.

[9] The ninth-year follow-up is slated to begin data collection in April 2022. More information about this planned data collection can be found at: https://www.federalregister.gov/documents/2021/05/05/2021-09488/agency-information-collection-activities-special-supplemental-nutrition-program-for-women-infants.

which will total 12 interviews by the time the study child is 9 years old (1 or 3, 7, 13, 24, 30, 36, 42, 48, 54, 60, and 72 months, and at age 9 years).[10]

To be eligible for inclusion in the main analysis sample, participants must have completed either a 1- or 3-month interview (n=3,775). This report focuses on data from the 72-month interview, which includes both the core and supplemental samples. After years of attrition, the number of study participants eligible for the 72-month interview was 3,030.

1.3 Sample Selection

The WIC ITFPS-2 collects data from a national sample of participants who enroll in WIC prior to 3 months of age. This includes both those 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, first a sample of WIC sites was selected, and then a sample of participants enrolling in WIC at each of the selected WIC sites was selected. A summary of the sampling plan is given below, and further details of these procedures are provided in Appendix B1 and in Siegfried, DeMatteis, and Gollapudi (under review).

1.3.1 Sampling WIC Sites

The WIC sites were selected using a stratified two-stage sampling approach. Because no national list of service sites existed, a summary file at the level of the unit (either local agency or service site/clinic) reported by each SA in the census of April 2010 (the WIC Participant and Program Characteristics 2010, or PC 2010)[11] was used as the sampling frame. Because SAs 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 provided the service site ID in addition to a local agency code, while 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

[10] 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 time periods in the first 2 years of life.

[11] USDA FNS. (2011, December 1). *WIC Participant and Program Characteristics 2010*. Available at: https://www.fns.usda.gov/wic/wic-participant-and-program-characteristics-2010. Retrieved on: March 5, 2021.

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, Northern Mariana Islands, and U.S. Virgin Islands) and sites that were expected to enroll an average of fewer than 30 new pregnant women/newborns per month. As a result, the study sampled from WIC sites that met monthly participant enrollment criteria. 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 in such a way that the units within the strata were more similar to each other (in terms of characteristics related to key survey outcomes) than units in general (i.e., strata should be internally *homogeneous*). Five characteristics of the first-stage sampling unit or its SA were used to group the sites into a total of 40 strata for selection (see Appendix B1, Table B1-1 for more details). The first three of these five characteristics were features of the WIC 2011 SA 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 SA had a breastfeeding peer counseling program in place.[12]
- **Trained Paraprofessionals.** Whether SA policy allowed for trained paraprofessionals to provide nutrition education (vs. requiring that staff members that provide nutrition education have professional training or credentials).
- **Policy to Provide Formula.** Whether SA 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, and this rate was computed by taking the ratio of the number of postpartum women who received the fully breastfeeding package during April 2010 to 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

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

who are "high weight for height"[13] 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.

Within each stratum, two sites were sampled with probabilities proportional to size, where the measure of size was the expected number of eligible enrollees. Thus, a total of 80 WIC sites were sampled. These sites are operated by 27 WIC SAs.

1.3.2 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. 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.[14] 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 based on the estimated amount of time needed to yield 98 eligible new WIC enrollees per site (the target sample size for each site).[15] The start date for the recruitment window was randomly assigned to each site. Because the estimated average number of new WIC enrollees per day into 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. 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.[16]

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[13] For children up to 12 months of age, "high weight for height" was determined based on nutrition risk code 110 (see http://www.fns.usda.gov/sites/default/files/WICPC2010.pdf, retrieved on May 8, 2017). For children 12 to 24 months, it 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, it 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.

[14] Women who had enrolled in WIC for previous pregnancies and/or enrolled other children in WIC were eligible for the study. Women below the age of 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.

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

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

Core and Supplemental Samples. Two samples were selected at each WIC site: a core longitudinal sample and supplemental cross-sectional sample. The core sample was designed as an equal probability sample of all new enrollees. 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 B1.

Multiple Births. For those 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.

1.4 Data Sources and Interview Content

Data were gathered from numerous sources over the course of the study, which began in July 2013.[17] The main source was a series of telephone interviews with the study child's mother or caregiver. In addition, repeated measures of each child's weight and length/height were obtained periodically from several sources, including State Agencies and direct measurements taken at WIC sites or clinics or with qualified healthcare providers. Early in the study, contextual information about the WIC sites and state policies was obtained from clinic and WIC program staff.[18] In total, the study's data sources included the following:

- Screening and enrollment interviews with recruited WIC enrollees;
- Telephone follow-up 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;[19]
- Height and weight measurements taken at WIC sites or by healthcare providers at the child's birth and around 6, 12, 24, 36, 48, 60, and 72 months of age;[20]

[17] The study collected data over a 6-year period in the children's lives, but the length of time a mother was a participant is dependent on when she was recruited for the study. Mothers recruited when they were 1-month pregnant were participants for 6.8 years, whereas mothers who enrolled when their baby was 2.5 months old were in the study for about 5.8 years. These timeframes do not include the planned follow-up interview when the child is 9 years old.

[18] Characteristics of the WIC sites are not used in this report but are used in earlier reports as covariates in exploring the variation in infant feeding practices.

[19] A follow-up interview at child age 9 years is planned.

[20] Height/weight measurements will be requested as part of the follow-up with children at age 9 years.

- WIC administrative records for WIC food packages provided to mothers and infants;[21]
- Site visits to participating WIC sites to collect data on facilities and staffing and conduct 1-hour interviews with a site supervisor or coordinator, and key informant interviews with 27 WIC State Agency representatives affiliated with the study to profile state and local policies and practices focusing on nutrition education and breastfeeding promotion and support (at baseline [2013]); and
- A WIC site staff survey that collected information on local WIC programs and the training and experience of the staff (at baseline [2013]).[22]

Table 1-1 presents an overview of the information (i.e., survey 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 72-month interview (shown in Appendix B4), which collected dietary recall information and also inquired about household food security over the past 12 months and captured lifestyle and feeding practices. Where relevant, WIC ITFPS-2 data collected earlier in the study are presented in this report to provide longitudinal context for current findings.

[21] The maternal food package may be received up to a year after giving birth, depending on the mother's breastfeeding status. Child food package data are not collected after 11 months because there is only one nonmedical food package for children ages 1 to 4 years. 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).

[22] 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 1-1. Domains by data source

Domain	Source of data: WIC ITFPS-2 interview by timing: 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	9 years	WIC admin. data	Staff survey/ key informant interviews
Sociodemographic characteristics	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
WIC site characteristics and policies																							✓
WIC program awareness and utilization			✓		✓		✓			✓			✓			✓		✓		✓			
Maternal health and lifestyle	✓	✓		✓	✓		✓			✓			✓	✓		✓		✓		✓	✓		
Feeding experience, knowledge, attitudes, beliefs, information, advice		✓	✓	✓	✓	✓	✓			✓	✓		✓	✓		✓		✓		✓	✓		
Hospital feeding related practices				✓																			
Current feeding practices				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓		
24-hour dietary recall				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓		
Child health behavior/rearing practices				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Food access and preferences														✓		✓		✓		✓	✓		
Child developmental milestones																✓		✓			✓		
Child weight and length/height[b]														✓	✓		✓		✓	✓	✓	✓	
WIC food package type[c]																						✓	
Caregiver contact information			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
New caregiver characteristics				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

[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] Reported height and weight are gathered from interviews at months 30, 36, 48, 60, and 72. WIC administrative records or healthcare provider records are used for actual height and weight measures when the babies are born and around months 6, 12, 24, 36, 48, 60, and 72.

[c] 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 mid-certification, and 11 months. Food package data are not collected after 11 months because there is only one nonmedical food package for children ages 1-4 years.

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

1.5 Data Collection Procedures

The principal data collection activity for the study was recruiting and interviewing study participants. Study mothers were recruited in person at WIC sites, and surveys are administered in regular follow-up interviews by telephone. In the study's early years, the study also obtained some data on the mother and child from WIC SA administrative records (e.g., child's length and weight, maternal and infant food package type); however, for this *Sixth Year Report*, data on height and weight were primarily obtained from healthcare providers and WIC sites.

1.5.1 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 3 of the 80 sites, an on-site Westat field recruiter screened and enrolled eligible participants into the study.[23] 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 16 years of age, 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 eligible study participants. 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.

1.5.2 Interviewing Study Participants

Once enrolled, trained telephone interviewers conducted follow-up interviews in English or Spanish with study participants. Data collection began in July 2013 and will end in August 2023 after the follow-up interview at child age 9 years. During the first 2 years, study participants assigned to the core sample were interviewed more frequently than those in the supplemental sample. However, all

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

participants (from both the core and supplemental samples) were eligible to complete the 72-month interview (see Table 1-5).

Because the study included both prenatal and postnatal WIC enrollees, children's birthdays span about 15 months. Consequently, any given interview was administered to study participants over a 15-month period. As such, the 72-month interview was fielded between April 2019 and August 2020 (Table 1-2).

Table 1-2. Dates of interviews administered and unweighted interviews completed through the 72-month interview

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

[a] The interview did not include a 24-hour dietary recall.

[b] The interview included a single 24-hour dietary recall.

[c] The interview included a single 24-hour dietary recall for all participants. A second day of 24-hour dietary recall information was collected on a 10 percent subsample of participants.

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, Perloff, Ingwersen, Steinfeldt, & Anand, 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 (NHANES) (Ahluwalia et al., 2016). When fielded, one dietary intake interview was collected on all study participants within a 6-week window. The 6-week window spanned 14 days prior to 28 days after the target interview date. So, for example, if the target date was the 30-month interview, the

window for the interview spanned 14 days prior to the day the child attained 30 months of age to 28 days after the 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 were used to calculate usual intake of energy, nutrients, and food pattern equivalent values for all participants.[24]

1.5.3 Collecting Length/Height and Weight Data

The study collected length/height[25] and weight measurements of the children at birth and around ages 6, 12, 24, 36, 48, 60, and 72 months, and will collect this information again, around child age 9 years. Table 1-3 presents the time periods during which the data collections occurred. Due to the COVID-19 health emergency, which resulted in closure of WIC clinics, the window for collection of height and weight information around age 72 months was extended by approximately 1 month (i.e., 5 months before the sixth birthday to 5 months after the sixth birthday) in order to allow participants additional time to visit a WIC clinic or healthcare provider, have the child weighed and measured, and submit requested information.

Table 1-3. Dates length/height[a] and weight collected and unweighted number received through the 72-month interview

Study child's approximate age[b]	Start date	End date	Number received[c] (unweighted *N*)
6 months	7/25/2013	1/15/2015	2,568
12 months	4/1/2014	7/17/2015	2,577
24 months	4/6/2015	8/11/2016	1,731
36 months	4/6/2016	9/18/2017	1,886
48 months	3/27/2017	9/11/2018	2,115
60 months	3/6/2018	8/30/2019	1,825
72 months	5/24/2019	11/24/2020	1,386

[a] Length was requested up to child age 24 months; subsequently, height was requested.

[b] Data are collected in a window of time around the age listed. More details about the window of time are provided in Chapter 6, Section 6.3.1.

[c] Not all measures reported were in the correct timeframe, so these counts are higher than the number of cases used in analysis.

Up to child age 24 months, WIC administrative records for length/weight were requested for children in the core sample. For core sample members who left WIC during the interval up to the

[24] See Appendix B3 for details of the computation of usual intake using the National Cancer Institute (NCI) method.

[25] Up to child age 24 months, child length was requested; subsequently, child height was requested.

24-month interview, healthcare provider records were sought for information on child length/weight. If core sample children left WIC and were not seen by a healthcare provider, a home health service nurse was offered to be sent to the home to obtain length/weight.

At child age 36 months, WIC administrative records for height/weight were requested for all participants continuing to receive WIC. Study participants who no longer received WIC at this age were mailed a postage-paid 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/weight data or to provide height/weight data from their provider using the measurement card.

At child ages 48, 60, and 72 months, all participants were asked to bring the 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 child's healthcare provider weigh and measure the child. In both cases, information was sent to Westat via a postage-paid measurement card that WIC staff or healthcare professionals were asked to complete.

Participants were offered a monetary incentive for providing measurements other than the ones collected from SA administrative records.

1.6 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 whose mothers were at least 16 years old at the time of WIC enrollment, spoke either English or Spanish, and were enrolling in WIC either while pregnant or postnatally before the child is 3 months of age[26] during the study recruitment period 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

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

characteristics, views, behaviors, and experiences of this population (i.e., study-eligible pregnant/early postpartum women and their infants who enrolled at eligible WIC clinics in 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 data. More information on using the statistical weights is provided in the *WIC ITFPS-2 Data User Manual* (forthcoming).

Because select sociodemographic characteristics were repeatedly used in analysis, any missingness in them was imputed. Imputation was limited to the "key" sociodemographic characteristics subsequently described (see Section 1.7). No outcomes were imputed. Appendix B1 offers additional detail on weighting and imputation.

1.7 Unweighted Study Participation Rates

As shown in Table 1-4, 4,489 new WIC enrollees were eligible to participate in the study, and of those, 4,367 (97%) were enrolled. Of the 4,367, 3,503 (80%) were assigned to the core sample and 864 (20%) were assigned to the supplemental sample. (For informational purposes, the numbers of pregnant and postpartum women in each sample are also presented in the table.)

Across all the sampling groups, 3,775 (86%)[27] respondents completed at least 50 percent of the core baseline module 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 comprised the main analysis sample.[28] By the 72-month interview, 57 percent of those in the main analysis responded to the interview. However, due to attrition over the years, 3,030 of the original 3,775 respondents

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

[28] After the *Fourth Year Report* was submitted, two cases were found to be fraudulent and were removed from the original main analysis sample (*n*=3,777).

received the 72-month interview, which would indicate about a 71 percent (=2,137 out of 3,030) unweighted cooperation rate for this interview (not shown).

Table 1-4. Unweighted study sample participation at 72 months

Sample and enrollment timing	Eligible sample, screened and eligible *n*	Enrolled sample, consented and enrolled *n*	Main analysis sample *n*	Percentage of main analysis sample that completed the 72-month interview % (*n*)
Total sample	4,489	4,367	3,775[a]	56.6% (2,137)
Core sample	3,605	3,503	3,019	55.0% (1,659)
Prenatal core sample	3,122	3,037	2,595	56.2% (1,458)
Postnatal core sample	483	466	424	47.4% (201)
Supplemental sample	884	864	756	63.2% (478)
Prenatal supplemental sample	688	678	588	64.1% (377)
Postnatal supplemental sample	196	186	168	60.1% (101)

[a] There were 3,777 cases in the original main analysis sample; however, after the *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.

Over the course of the study thus far, a total of 1,347 of the 4,367[29] enrolled participants no longer participate with the study. This total reflects both those who were eligible and ineligible[30] to continue participating. By the 72-month interview, nearly 84 percent (*n*=1,125) of those who had left the study were eligible to continue and 16 percent (*n*=222) were not eligible.[31]

Table 1-5 presents the percentage of the main analysis sample that completed each interview through the 72-month interview. Table 1-5 also displays percentages of the core and supplemental samples that completed each interview. At each interview, cases in the core and supplemental samples sum to those used in the main analysis sample. Table 1-6 displays the percentage of participants in the main analysis sample for whom the study received anthropometric and food package data.

[29] The study enrolled 4,367 participants; however, after enrollment, two cases were discovered to be fraudulent.

[30] Participants enrolled in the study could become ineligible for a variety of reasons: pregnancy loss, child decease, adoption, foster care, or moving outside of the United States.

[31] Table B1-2 in Appendix B1 offers additional detail on attrition.

Table 1-5. Percentages of respondents and unweighted counts of respondents who completed interviews, by sample type and interview month, through the 72-month 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)	NA
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)	NA
Month 7	83.0% (3,134)	83.2% (2,514)	81.9% (620)
Month 9	64.9% (2,451)	81.2% (2,451)	NA
Month 11	61.5% (2,322)	76.9% (2,322)	NA
Month 13	74.3% (2,807)	74.1% (2,239)	75.0% (568)
Month 15	54.7% (2,067)	68.4% (2,067)	NA
Month 18	52.7% (1,992)	66.0% (1,992)	NA
Month 24	65.2% (2,461)	64.1% (1,937)	69.2% (524)
Month 30	69.5% (2,625)	68.6% (2,071)	73.2% (554)
Month 36	69.0% (2,608)	67.7% (2,044)	74.5% (564)
Month 42	69.8% (2,636)	68.6% (2,072)	74.5% (564)
Month 48	68.1% (2,572)	67.0% (2,022)	72.7% (550)
Month 54	67.9% (2,563)	66.8% (2,018)	72.1% (545)
Month 60	67.0% (2,529)	65.9% (1,989)	71.4% (540)
Month 72	56.6% (2,137)	55.0% (1,659)	63.2% (478)

[a] Percentages are of the main analysis sample. Initially, there were a total of 3,777 unweighted respondents in the main analysis sample. 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, so that *n*=3,775 for the 54-, 60-, and 72-month 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 is interviewed at either 1 month or 3 months, but not both.

NA denotes not applicable.

Table 1-6. Unweighted counts and percentage of analysis sample respondents for whom the study received anthropometric and food package data

Length/height[a] and weight data and food package data	Unweighted number received	Percentage received[b]
Length/height and weight measurements		
6-month measurements[c]	2,568	68.0%
12-month measurements[c]	2,577	68.2%
24-month measurements	1,731	45.8%
36-month measurements	1,886	49.9%
48-month measurements	2,115	56.0%
60-month measurements	1,825	48.3%
72-month measurements	1,386	36.7%
Infant food package prescriptions[d]		
Initial infant certification	3,199	84.7%
6-month	3,047	80.7%
11-month	2,979	78.9%

[a] Prior to study child age 24 months, child length was measured; subsequently, child height was measured.

[b] Prior to the 60-month measurement data, *n*=3,777 in the main analysis sample; beginning with the 60-month measurement data, *n*=3,775 in the main analysis sample.

[c] These represent the number of observations collected. For analysis, 2,014 cases were used from the 6-month measures and 2,105 cases were used from the 12-month measures because these observations were within the relevant age ranges.

[d] Mothers' food package data were also collected at prenatal and postpartum certifications as applicable and at 6 months.

1.8 Analysis

Using data from the 72-month interviews and anthropometric measurements obtained around the sixth birthday, this report focuses on outcomes reported during the sixth year of life, both for the study population as a whole and for select sociodemographic subgroups. Both days of dietary data, collected as part of the 72-month interview, are used to generate usual intake estimates. These usual intake estimates underlie estimated nutrient and Healthy Eating Index-2015 (HEI-2015) scores. Bivariate analyses highlight associations with a standard set of 12 sociodemographic characteristics which are referred to throughout the remainder of this report as "key" sociodemographic characteristics. Multivariable regression analysis is used for select outcomes.

1.8.1 Usual Intake Estimates

As mentioned, 24-hour dietary recall information was collected as part of the 72-month 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 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 generate children's typical intakes using methods recommended by the National Institutes of Health, National Cancer Institute (NCI).

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 intakes for HEI-2015 scores rely on NCI's multivariate Markov Chain Monte Carlo (MCMC) method.

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 12 sociodemographic characteristics known as "key" characteristics because they are used consistently and repeatedly.[32] (The key sociodemographic characteristics used in this report are discussed in Section 1.8.2.)

NCI's MCMC method is the primary approach for estimating ratios of dietary intakes. HEI-2015 scores assess dietary alignment with the 2015-2020 *Dietary Guidelines for Americans* (DGA) accounting for a person's total dietary energy. HEI-2015 total scores assess overall diet quality and range from 0 to 100, with higher scores indicating better alignment with the 2015-2020 DGA. HEI-2015 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 fats range from 0 to 10. Consequently, each HEI-2015 score involves estimating a ratio of the child's dietary

[32] In the usual intake models, the cross-sectional 1- or 3- through 72-month statistical weights are used to adjust for all key sociodemographic characteristics except pattern of WIC participation. When adjustments include pattern of WIC participation, the 1- or 3- through 72-month longitudinal statistical weights are used because pattern of WIC participation is only available for the longitudinal sample.

intakes. In ratio estimation, it is important to account for correlation among foods and nutrients within a person's diet. The MCMC method accounts for this correlation while allowing children's intakes to be adjusted for the 12 key sociodemographic characteristics used in this report. Throughout this report, the population ratio method (i.e., the ratio of the means) is used to generate HEI-2015 mean scores.

1.8.2 Key Sociodemographic Characteristics

As indicated in Table 1-1, sociodemographic characteristics are measured repeatedly; however, all of the outcomes in this reported are analyzed by a set of 12 sociodemographic characteristics. Because the 12 sociodemographic characteristics are used consistently and repeatedly in analyses, they are referred to as "key" sociodemographic characteristics. The study examines all outcomes of interest by key sociodemographic subgroups (e.g., Hispanic and non-Hispanic).

The key sociodemographic characteristics used included nonmodifiable and modifiable characteristics of the participant and her household. Data on nonmodifiable key sociodemographic characteristics were collected at a baseline interview[33] and updated only if the child's caregiver changed during the course of the study. Data on modifiable key sociodemographic characteristics (i.e., those that change over time) were primarily drawn from the 72-month interview. If the characteristics were not assessed during the 72-month interview, values from the closest (in time) interview prior to the 72-month interview were used. The decision to use contemporaneous key sociodemographic characteristics represented a departure from previous reports that looked at lagged effects. This change was motivated by two considerations. The 72-month interview was the first WIC ITFPS-2 interview with a full year between interviews. Additionally, it was assumed that most children would have transitioned to formal schooling by age 6 years and there was interest in more immediate associations in the school setting.

The key sociodemographic characteristics used in this report were categorized into three general classes: those referencing the mother, those referencing the household, and those referencing the study child.

[33] The term baseline is used to refer to data that may have been collected at enrollment, the 1-month interview, or the 3-month interview.

Maternal key sociodemographic characteristics:

- Maternal[34] ethnorace (i.e., race and ethnicity combined);
- Age of mother at the birth of the study child;
- Parity (birth order) of the study child;
- Self-reported maternal weight status at 72 months;
- Mother's marital status at 72 months;
- Mother's educational attainment at 54 months;[35] and
- Maternal employment status at 72 months.

Household key sociodemographic characteristics:

- Income poverty at 72 months;
- Household food security status at 72 months based on the USDA six-item food security module; and
- Participation in non-WIC benefit programs at 72 months.[36]

Key sociodemographic characteristics of the study child:

- Timing of WIC enrollment; and
- Pattern of (previous) WIC participation (through study child age 60 months).[37]

Though responses to key sociodemographic characteristics were largely complete across the 72-month interview, missing values were imputed.

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[34] The words "mother" and "caregiver" are used interchangeably in this report. Most caregivers are the mother of the child.

[35] Maternal education level was not asked during the 60- or 72-month interviews.

[36] Participation may be by the respondent, the respondent's family, or a child in the respondent's household. Examples of non-WIC benefit programs included are the Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), Medicaid, the National School Lunch Program (NSLP), the School Breakfast Program (SBP), and the Summer Food Service Program (SFSP).

[37] See Appendix A for a definition of this variable.

Table 1-7 presents the unweighted and weighted key sociodemographic characteristics of the WIC ITFPS-2 analysis sample. Though data on modifiable key sociodemographic characteristics are collected at the interview indicated, the percentages are of the main analysis sample (i.e., those who completed their first postnatal interview [*n*=3,775]), as well as the number of respondents to the 72-month interview. Key sociodemographic characteristics describe the unweighted sample used for the 72-month analysis as follows. More than one-third of the sample (37%) self-identifies as Hispanic, and more than one-quarter (29%) self-identifies as non-Hispanic Black. Under one-third (27%) of survey respondents self-report heights and weights consistent with being healthy weight or underweight at 72 months, and slightly more than two-fifths (44%) self-report heights and weights consistent with being obese. The majority (59%) are unmarried and have a high school education or less (53%). About three-fifths (60%) report that they were working for pay (either full-time or part-time) at the time of their child's 72-month interview. Slightly more than two-thirds (68%) report incomes at or below 130 percent of the FPG at 72 months. Many respondents (83%) indicate that their households receive benefits from non-WIC programs including or excluding the Supplemental Nutrition Assistance Program (SNAP). Despite the prevalence of risk factors, most participants (78%) report high or marginal household food security at 72 months. Most women (86%) enrolled in WIC prior to the study child's birth; however, a notable minority (14%) enrolled their baby in WIC shortly after birth. More than one-quarter (29%) of the sample continuously participated with WIC through the study child's fifth year.

Table 1-7. Unweighted and weighted key sociodemographic characteristics of main analysis sample used in this report

Sociodemographic characteristics	Main analysis sample (unweighted *n*=3,775) % (count)[a,b]	Unweighted percentage of 72-month respondents (unweighted *n*=2,137) % (count)[b]	Weighted percentage of 72-month respondents (weighted *n*=441,226) % (count)[b]
Maternal ethnorace			
Non-Hispanic Black	24.2% (915)	29.0% (619)	20.4% (90,005)
Non-Hispanic White	31.6% (1,193)	28.5% (610)	26.8% (118,390)
Non-Hispanic Other[c]	5.9% (224)	5.5% (118)	6.0% (26,602)
Hispanic	38.2% (1,443)	37.0% (790)	46.7% (206,229)
Age of mother or caregiver at childbirth			
16-19 years	11.8% (446)	9.2% (197)	11.0% (48,680)
20-25 years	41.6% (1,569)	40.6% (868)	40.6% (178,978)
26 years or older	46.6% (1,760)	50.2% (1,072)	48.4% (213,569)
Parity			
Firstborn	41.7% (1,575)	40.6% (867)	42.5% (187,515)
Second born	27.0% (1,018)	27.5% (588)	27.0% (119,010)
Third or subsequently born	31.3% (1,182)	31.9% (682)	30.5% (134,702)
Self-reported weight status of mother at 72 months[d]			
Normal or underweight	27.8% (1,051)	26.7% (571)	28.5% (125,743)
Overweight	30.6% (1,155)	29.7% (634)	28.2% (124,626)
Obese	41.6% (1,569)	43.6% (932)	43.3% (190,857)
Maternal/caregiver marital status at 72 months			
Married	37.9% (1,430)	40.7% (869)	43.0% (189,886)
Not married (including divorced and widowed)	62.1% (2,345)	59.3% (1,268)	57.0% (251,341)
Maternal/caregiver educational attainment at 54 months[e]			
High school or less	56.3% (2,127)	52.9% (1,130)	53.4% (235,738)
More than high school	43.7% (1,648)	47.1% (1,007)	46.6% (205,489)
Maternal employment status at 72 months			
Working full-time for pay	38.8% (1,465)	39.4% (843)	38.9% (171,855)
Working part-time for pay	20.0% (755)	19.9% (426)	20.4% (89,927)
Not working for pay	41.2% (1,555)	40.6% (868)	40.7% (179,444)
Income poverty at 72 months			
75% of Federal Poverty Guidelines (FPG) or below	38.9% (1,467)	39.0% (833)	37.7% (166,295)
Above 75% but ≤ 130% of FPG	28.9% (1,092)	28.9% (618)	30.0% (132,546)
Above 130% of FPG	32.2% (1,216)	32.1% (686)	32.3% (142,385)
Household food security (measured using 6-item module) at 72 months			
High or marginal	77.7% (2,934)	77.6% (1,659)	79.7% (351,764)
Low	12.3% (465)	12.4% (264)	12.2% (53,728)
Very low	10.0% (376)	10.0% (214)	8.1% (35,735)
Participation in non-WIC programs at 72 months			
Does not participate in other programs[f]	17.5% (661)	16.8% (358)	16.2% (71,611)
Participates in Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[f]	41.0% (1,546)	42.4% (906)	41.2% (181,856)
Participates in other programs[f] excluding SNAP	41.5% (1,568)	40.9% (873)	42.6% (187,759)

Table 1-7. Unweighted and weighted key sociodemographic characteristics of main analysis sample used in this report (continued)

Sociodemographic characteristics	Main analysis sample (unweighted *n*=3,775) % (count)[a,b]	Unweighted percentage of 72-month respondents (unweighted *n*=2,137) % (count)[b]	Weighted percentage of 72-month respondents (weighted *n*=441,226) % (count)[b]
Timing of WIC enrollment			
First trimester	29.6% (1,118)	31.1% (665)	31.8% (140,480)
Second trimester	38.9% (1,470)	40.2% (859)	40.1% (176,965)
Third trimester	16.1% (607)	14.8% (316)	14.9% (65,935)
Postnatal	15.4% (580)	13.9% (297)	13.1% (57,847)
Pattern of WIC participation for the study child			
On WIC in first year only	6.6% (248)	7.1% (152)	6.7% (29,731)
On WIC into second or third years	17.6% (666)	16.3% (349)	14.8% (65,340)
On WIC into fourth or fifth years	15.0% (566)	12.7% (271)	13.0% (57,201)
On WIC consistently throughout the first 5 years	24.8% (936)	28.5% (608)	31.9% (140,713)
On WIC intermittently[g]	15.5% (586)	12.9% (275)	12.6% (55,548)
Ineligible[h]	0.5% (17)	0.2% (4)	0.2% (911)
Not applicable[i]	20.0% (756)	22.4% (478)	20.8% (91,783)

[a] The main analysis sample includes 3,775 cases who completed a 1- and/or 3-month interview. Counts may sum to less than 3,775 due to item or survey nonresponse.

[b] Percentages may not sum to 100 percent due to rounding.

[c] Non-Hispanic Other includes respondents who indicated multiple races.

[d] Derived from survey respondent report of weight and height.

[e] Data used to determine maternal educational status are not collected at the 72-month interview. They are collected at the 54-month interview. The values at 54 months are imputed if missing.

[f] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[g] Participants receiving WIC benefits intermittently are those who indicated that they were receiving WIC benefits for any number of interviews but receipt was inconsistent over the course of the study and typically more limited than for other groups of participants. Interviews are more closely spaced in the first 2 years of the study than they are in later years, so a count of number of interviews does not provide a meaningful estimate of duration of participation. The intermittent group, therefore, does not reflect a specific duration of program participation. Appendix A1 provides a summary of the criteria used to determine the pattern of WIC participation across interview months.

[h] Respondent reported that they are not participating with WIC at each postnatal interview between the 1- and 60-month interview.

[i] Supplemental sample cases.

Data source: Interview questions SD1, SD2, SD3, SD4, SD14, SD15, SD16, SD18, SD19, SD21, SD29, SD31, SD36-SD40, MH1, and MH13.

It is important to note that many of the key sociodemographic characteristics used in the analyses for this report are significantly associated. Table 1-8 summarizes statistically significant associations between the key sociodemographic characteristics using the main analysis sample.[38] The many statistically significant associations suggest that several of the key sociodemographic variables may, to some extent, be measuring the same underlying phenomenon.

Table 1-8. Significant[a] associations among key sociodemographic characteristics used in this report

	Maternal characteristics							Household characteristics			Study child characteristics	
	Ethnorace	Age at child's birth	Parity	Reported weight status	Marital status	Educational attainment at 54 months	Employment status	Income poverty	Food security	Participation in non-WIC benefit programs	Timing of WIC enrollment	Pattern of WIC participation
Maternal characteristics												
Ethnorace		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Age at child's birth	✓		✓		✓	✓					✓	✓
Parity		✓			✓	✓	✓	✓		✓		
Reported weight status	✓									✓	✓	
Marital status	✓	✓	✓			✓		✓	✓	✓	✓	✓
Educational attainment at 54 months	✓	✓	✓		✓		✓	✓		✓	✓	✓
Employment status	✓		✓			✓		✓		✓	✓	✓
Household characteristics												
Income poverty	✓		✓		✓	✓	✓		✓	✓	✓	✓
Food security	✓				✓			✓		✓		
Participation in non-WIC benefit programs	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Study child characteristics												
Timing of WIC enrollment	✓	✓		✓	✓	✓	✓	✓		✓		✓
Pattern of WIC participation	✓	✓			✓	✓	✓	✓		✓	✓	

[a] Checkmarks indicate a statistically significant association at $p \leq 0.05$.

Data source: Interview questions SD2, SD3, SD4, SD14, SD15, SD18, SD19, SD21, SD26, SD29, SD31, SD36–SD40, MH1, MH2, MH29, KA2, and KA6.

[38] The main analysis sample consists of those who responded to the 1- or 3-month interview. The analysis uses the 72-month statistical weights because the majority of modifiable key sociodemographic characteristics are assessed at the 72-month interview. Chi-square tests are appropriately adjusted for our complex sample design. Statistical significance is at the 95 percent confidence level.

1.8.3 Descriptive Analyses

Many of the research questions (see Appendix A) 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 (e.g., the percentage of study participants consistently participating in WIC).

1.8.4 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 if there is a statistically significant association between the outcome and the key sociodemographic characteristic (e.g., whether feeding practices vary across maternal ethnoracial subgroups). Subsequently, pairwise t-tests, adjusted for the complex sample design and multiple comparisons, are used to assess which differences between subgroups are statistically significant (e.g., whether the percentages of non-Hispanic Black and non-Hispanic White caregivers employing a particular feeding practice are significantly different).[39] If the outcome of interest is a mean or median, an appropriately adjusted t-test is used to determine whether the differences were statistically significant. In all cases, the Bonferroni correction method is employed to adjust for multiple comparisons.

Continuous variables cannot be assessed using chi-square tests. Consequently, if the outcome of interest is a continuous variable, univariate regression is typically used. As with other statistical tests in this report, the regression approach is appropriately adjusted for the complex sample design.

Throughout this and all other previously published WIC ITFPS-2 reports, statistical significance for analyses is at the level of $p \leq 0.05$. For subgroup findings that are both statistically significant and large enough in magnitude to be practically meaningful in context, the bivariate chi-square results and the follow-up pairwise t-test results are described in the text.[40] Bivariate associations explored in this report were not limited to the key sociodemographic characteristics but typically include them.

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[39] T-tests are two-tailed unless otherwise specified.

[40] Differences in proportions are typically discussed if they are more than 3 percentage points in magnitude and/or form a pattern over time or items. This is done to reduce the likelihood of Type I (false positive) error and avoid overinterpreting these very small effect sizes (Cohen, 1988).

Bivariate findings should be interpreted with caution because associations are not adjusted for potential confounders.

1.8.5 Multivariate Models

For the subset of research questions that focus on identifying the factors independently associated with the outcomes observed, bivariate analyses alone are often not sufficient. Accordingly, multivariable regression analysis[41] 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. For example, regression is used in this report to assess the association between pattern of WIC participation and HEI-2015 total scores after accounting for feeding practices and sociodemographic factors (see Chapter 5, Section 5.7). When compared to bivariate analyses, multivariable regression analysis typically finds a more limited set of variables has a statistically significant association with the outcome.

1.8.6 Missing Item Data

Item nonresponse is reflected in the total number of observations available for analysis. Responses of "Don't Know" 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.

Missing responses for key sociodemographic variables are imputed, so these variables do not have any missing values. 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 between interview questions are attributable to item nonresponse.

[41] The data are weighted in all regression analyses.

2. Personal and Household Characteristics of WIC ITFPS-2 Families

Key Findings at 72 Months:

- Over half of study households (52%) self-reported household income at or below 100 percent of the 2019 Federal Poverty Guidelines (FPG).
- Sixty-four percent of study mothers reported that they were working, going to school, or doing both; however, employment after the coronavirus disease 2019 (COVID-19) public health emergency declaration (COVID ED) on March 13, 2020 (53%) was significantly lower than prior to the COVID ED (61%).
- The vast majority of study children (91%) were either in kindergarten or were rising first-graders (i.e., they had completed kindergarten and were waiting to start first grade).
- About two-thirds (66%) of study mothers reported that their child received, at least, some food for lunch from school. Of all calories consumed for lunch by study children on a given day, an average of 36 percent were consumed away from home; however, this percentage fell dramatically after the COVID ED to 3 percent consumed away from home.
- About 12 percent of study respondents indicated low food security and about 8 percent indicated very low food security.
- Over half (52%) of families that continuously participated with the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) during the first 5 years of the study child's life reported that they purchased skim, nonfat, or 1 percent milk, which was significantly higher than the percentages of families that either intermittently participated with WIC (30%) or of families that participated into the study child's second or third year of life only (24%).
- About 25 percent of study families indicated that they had a (non-study) child participating with WIC.
- Forty-one percent of study families participated in the Supplemental Nutrition Assistance Program (SNAP), and after accounting for self-reported household income, SNAP participation was positively associated with the likelihood of reporting very low household food security.
- The percentage of study participants reporting participation in federally funded school and summer meal programs significantly increased between study child age 60 and 72 months (from 52% to 65%).

2.1 Overview

This chapter focuses on the personal and household characteristics of the families in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2). Topics covered in this chapter include household size, household income, sources of children's food, and household or child participation in federally funded nutrition assistance programs. The array of topics provides important information for contextualizing the food security status of study families. The topics also provide context for

interpreting the diet-related findings discussed in subsequent chapters of this report. The analyses presented in this chapter specifically address the following research questions:[42]

- 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, Supplemental Nutrition Assistance Program [SNAP], etc.), and childcare/preschool/school circumstances?
- In what food environments (home, school, childcare, etc.) do children consume meals and snacks during the sixth 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?
- To what extent do feeding practices during the sixth year of life vary by the 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?
- For caregivers who received referrals through WIC, how do they get referred or connected to other health, welfare, and social services once the household is no longer receiving WIC services?
- 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?
- What is the food security status for children and their households overall and for key subgroups and characteristics of interest?
- How does food security status change when the child ages out of WIC? To what extent does prior WIC participation, or current household WIC participation, influence food security status during the sixth year of life?
- How does participation in other food assistance programs by the child or their household impact household food security overall and by subgroups of interest?

2.2 Background

WIC ITFPS-2 is the first national longitudinal study following caregiver-child dyads that enrolled in WIC around the time of the child's birth. The study follows these dyads through child age 72 months (i.e., 6 years) and follows up with them, again, at child age 9 years. This report focuses on

[42] A complete list of research questions appears in Appendix A.

findings from data collected during the 72-month interview. As the first of its kind, this study addresses the gap in knowledge about the transitional period between child ages 60 and 72 months (i.e., 5 and 6 years). It looks specifically at household food security status of study families after many have transitioned off WIC and the nutritional outcomes of study children during the sixth year of the child's life.

Readers are strongly encouraged to review the previous WIC ITFPS-2 reports for more detailed background on the relevant research related to the personal and household characteristics when study children were younger.[43] For this report, one of the primary contextualizing elements is that at child age 72 months (i.e., 6 years), study children are no longer age-eligible for WIC benefits. Their families, however, may continue to participate in WIC for another (younger) child or if the mother is pregnant or postpartum, so households may still receive benefits but not specifically for the study child.

A second important contextual factor is that the majority of study children are in school by age 6 years (Section 2.6). However, depending on school age-eligibility requirements for their school districts, there may be a minority of children who are neither age-eligible for WIC nor for school. If these children do not participate in childcare programs that offer federally funded meals, they may experience a nutrition assistance gap. Consequently, rates of food insecurity are of particular interest.

In this study, household food security is assessed using the U.S. Department of Agriculture (USDA) six-item household food security module, which inquires about circumstances over the past 12 months. Arteaga, Heflin, and Gable (2016) documented an increase in rates of food insecurity for children when they become age-ineligible for WIC and have not yet started kindergarten. After reviewing a wide range of contextualizing findings, this chapter explores how food security differs by whether children are in school or not, or participating in Federal nutrition assistance programs or not.

A final important contextualizing factor for this entire report is the emergence of the coronavirus disease 2019 (COVID-19) pandemic. As mentioned in Chapter 1, a national public health emergency was declared during the latter part of the 72-month data collection period. The subsequent

[43] Earlier reports can be found at https://www.fns.usda.gov/wic/infant-and-toddler-feeding-practices-study-2-fourth-year-report.

widespread closure of school buildings and businesses, as well as the rapid changes made to the Federal nutrition assistance safety net, undoubtedly affected study participants in a variety of ways. This report examines select outcomes, including employment, household food security, and nutritional intakes through March 13, 2020, and post March 13, 2020—subsequently referred to as pre- and post-COVID-19 emergency declaration (COVID ED).

2.3 Sample and Analysis Approach

2.3.1 Sample

In this chapter, analyses primarily use data from the 72-month interview.[44] This is the first interview in this study to occur a full year after the prior interview (i.e., between ages 1 to 60 months, dyads were interviewed every 2 to 6 months; however, there was a 12-month gap between the 60- and 72-month interviews). This chapter includes findings from previous interviews, particularly the 54- and 60-month interviews, to provide context.

Table 2-1 shows the unweighted number of respondents to the 72-month interview. Both the core and supplemental samples were eligible for this interview. Of these unweighted number of respondents, 24 percent had data collection dates after March 13, 2020, the date on which a national health emergency was declared. All were prenatal enrollees; thus, the pre-/post-COVID ED analysis presented may not reflect the characteristics or feeding practices of postnatal enrollees, which may differ from those of prenatal enrollees.

Table 2-1. Unweighted number of respondents at 72-month interview

Sample structure	72-month interview
Core prenatal sample	1,458
Core postnatal sample	201
Supplemental prenatal sample	377
Supplemental postnatal sample	101
Total	2,137

[44] Table 1-1 in Chapter 1 provides a summary of the content domains by interview month.

2.3.2 Analysis

In analyses, the responses to the interview are weighted so that findings reflect the national study-eligible population as described in Chapter 1. The statistical weights account for nonresponse and are described more fully in Appendix B1.

This chapter uses bivariate analysis to examine associations between the 12 key sociodemographic variables presented in Chapter 1 and the outcomes of interest in this chapter (i.e., personal and household characteristics). Nonmodifiable sociodemographic characteristics assessed at the time of the first interview were refreshed as needed (i.e., if the caregiver changed). However, for characteristics that may change over time, such as household food security status or income relative to Federal Poverty Guidelines (FPG), bivariate analyses typically used values reported at the 72-month interview.[45] In this chapter, food insecurity is defined as either low or very low food security as determined using the USDA six-item household food security instrument.[46]

Chi-square tests were used to assess associations between key sociodemographic characteristics and outcomes of interest. If a significant association was found, two-tailed t-tests were typically used to determine which pairwise subgroup differences were statistically significant.[47] Subgroup differences discussed in the chapter were limited to those that form a pattern over time or across questions and were large in magnitude, to avoid focusing on findings that, while statistically significant, may have little practical importance.[48] Statistical significance, when indicated, was at the level of $p \leq 0.05$.

This study was not originally designed to analyze 72-month interviews by their temporal timing; therefore, preliminary research was undertaken to determine feasibility of analyzing the 72-month data by whether it was collected pre-COVID ED or post-COVID ED. We compared the pre- and post-COVID ED groups on several sociodemographic characteristics: mother's educational attainment at child age 54 months; mother's employment status at child age 54 months and at

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[45] Education level was not collected during the 72-month interview, so reports from the 54-month interview, the most recent information, were used.

[46] Source: https://www.ers.usda.gov/media/8282/short2012.pdf.

[47] If the outcome and sociodemographic characteristic under analysis were both binary, then the follow-up pairwise tests were not performed, as the chi-square was sufficient to determine differences. If the outcome was continuous, univariate regression was used to assess the association.

[48] Differences are typically discussed if they are more than 3 percentage points in magnitude and/or form a pattern over time or items. Chapter 1 offers additional details.

72 months; maternal race, ethnicity, marital status, and self-reported weight status at child age 72 months; and household income relative to FPG, food security status, and participation in nutrition assistance programs at child age 72 months. These sociodemographic characteristics were chosen because work reported in prior WIC ITFPS-2 reports indicated that these characteristics are associated with various aspects of children's dietary intake. We used the 72-month interview weights and tested for significance using a second-order Rao-Scott adjusted chi-square test. We found no evidence to suggest fundamental differences in the groups. This preliminary work supported analyses involving comparisons of the pre- and post-COVID ED groups.

This chapter begins with an overview of household size and self-reported income. Subsequently, it presents findings on sources of food including while at childcare, participation in federally funded nutrition assistance programs, purchasing of foods available in the WIC food package, and referrals for social services. Drawing from the bivariate analyses and previously published WIC ITFPS-2 reports, the chapter concludes with multivariable analyses of factors associated with household food security at child age 72 months. More specifically, multivariable logistic regression assesses factors associated with the likelihood of the household experiencing low or very low food security at child age 72 months. Of particular interest is whether the child is participating in school-based nutrition programs or not, and whether the pattern of WIC participation[49] by the study child is significantly associated with household food security status 1 year after the study child's WIC eligibility ended.

Table Presentation. In tables presenting associations between key sociodemographic characteristics and household characteristics, child behaviors, or other outcomes, row percentages for each key sociodemographic characteristic subgroup are presented with the corresponding unweighted and weighted sample size (*n*). The sample size reported in these tables will vary if there is missingness in the (non-key) household characteristic, behavior, or outcome being analyzed. In these tables, statistically significant differences between subgroups are indicated by matching letters of the alphabet in a column; thus, results indicate statistically significant differences between subgroups of the particular key sociodemographic characteristic being examined for the response option or outcome in question.

[49] See Appendix A for a definition of pattern of WIC participation for the study child.

In tables that summarize the percentage of all study children by a characteristic or outcome, the sample size is listed in a footnote to the table. Pairs of matching letters are, again, used to indicate statistically significant pairwise differences.

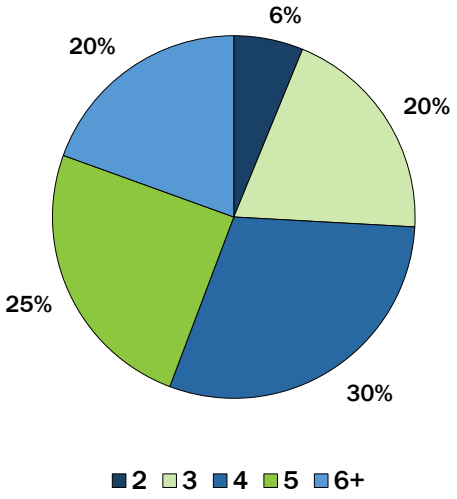
2.4 Household Size and Household Income

Both household size and household income may be associated with food security status. Though related, individually they also provide important contextual information for understanding study families.

2.4.1 Household Size

Figure 2-1 presents the distribution of study households by number of household members. At 72 months, half of study households had three or four household members, and the typical (average) study household had about four members. Drilling down more deeply into the composition of the households, the typical (average) household had one child between the ages of 0 and 4 years and two children between the ages of 5 and 17 years. These average numbers were slightly higher than the medians for the distributions (0 for children ages 0-4 years and 1 for children ages 5-17 years), indicating that the distributions for each group were somewhat skewed toward larger households.

Figure 2-1. Distribution of study households by number of household members at 72 months[a]



[a] Unweighted *n*=2,135; weighted *n*=441,032. Appendix Table B2a-1 offers additional detail.

Percentages may not sum to 100 percent due to rounding.

Chi-square analyses indicated that household size varied with almost all of the key sociodemographic characteristics used in this study: maternal ethnorace, age, marital status, maternal educational attainment at 54 months, employment status, income poverty, and household food security status. Table 2-2 presents the findings, with statistically significant pairwise differences indicated. As discussed in Chapter 1, several of the key sociodemographic variables are correlated, so bivariate analyses should be interpreted with caution.

Table 2-2. Row percentages of key sociodemographic characteristics associated with household size at 72 months

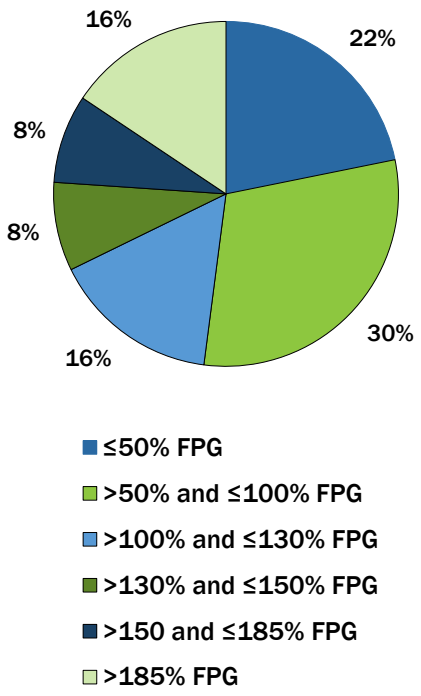
Key sociodemographic characteristic	Household size: Number of members % (standard error) 2	3	4	5	6+	Unweighted *n*	Weighted *n*
Maternal ethnorace							
Non-Hispanic Black	9.9[a,b,c]	27.1[a]	25.1	20.2	17.7		
	(1.2)	(1.7)	(1.9)	(1.6)	(1.5)	617	89,811
Non-Hispanic White	5.8[a]	16.7[a]	32.2	24.2	21.1		
	(1.1)	(1.7)	(1.9)	(2.1)	(2.2)	610	118,390
Non-Hispanic Other	2.4[b]	16.5	37.7	31.5	11.9		
	(1.6)	(5.0)	(7.1)	(6.0)	(3.1)	118	26,602
Hispanic	5.2[c]	18.6	29.6	26.3	20.3		
	(1.1)	(2.9)	(2.0)	(2.6)	(2.1)	790	206,229
Maternal age at study child's birth							
16-19 years	10.6	27.8	30.4	19.0	12.2[a]		
	(3.1)	(5.9)	(5.4)	(3.6)	(3.3)	197	48,680
20-25 years	8.2[a]	22.2[a]	32.4	22.7	14.5[b]		
	(1.0)	(1.8)	(1.4)	(2.0)	(1.5)	867	178,842
26+ years	3.4[a]	15.7[a]	27.6	27.9	25.4[a,b]		
	(0.6)	(1.4)	(1.5)	(1.7)	(1.7)	1,071	213,510
Marital status							
Married	0.0[a]	9.2 [a]	31.6	31.9[a]	27.3[a]		
	(0.0)	(1.3)	(1.7)	(1.9)	(1.6)	868	189,827
Not married	10.8[a]	27.6[a]	28.5	19.4[a]	13.6[a]		
	(1.1)	(1.8)	(1.2)	(1.5)	(1.3)	1,267	251,205
Maternal educational attainment at 54 months							
High school or less	5.5	18.4	27.8	26.1	22.2[a]		
	(1.1)	(1.8)	(1.4)	(1.6)	(1.9)	1,130	235,738
More than high school	6.9	21.1	32.2	23.4	16.4[a]		
	(0.8)	(2.1)	(1.8)	(1.6)	(1.5)	1,005	205,294
Employment status							
Full-time	9.4[a]	24.8[a]	29.3	23.2	13.4[a]		
	(1.1)	(2.3)	(2.0)	(1.8)	(1.6)	843	171,855
Part-time	6.6	18.7	33.3	24.6	16.8[b]		
	(1.6)	(2.3)	(2.7)	(2.6)	(2.0)	426	89,927
Not employed	2.9[a]	15.3[a]	28.7	26.4	26.7[a,b]		
	(0.6)	(1.8)	(1.4)	(2.5)	(1.8)	866	179,250
Income poverty							
≤75% of Federal Poverty Guidelines (FPG)	4.6[a]	19.6	29.6[a]	22.8	23.4[a]		
	(0.8)	(2.2)	(1.8)	(2.0)	(2.1)	832	166,159
>75% of FPG and ≤130% of FPG	6.5	19.2	23.6[a,b]	30.8	19.9		
	(1.2)	(3.0)	(1.6)	(2.8)	(2.1)	617	132,487
>130% of FPG	7.7[a]	20.2	35.9[b]	21.6	14.5[a]		
	(1.1)	(2.2)	(2.5)	(2.3)	(1.5)	686	142,385
Household food security status							
High or marginal	5.9	20.2	30.0	25.0	19.0[a]		
	(0.8)	(1.8)	(1.3)	(1.5)	(1.4)	1,657	351,569
Low	8.7	14.8	33.3	25.5	17.7		
	(1.6)	(2.1)	(2.9)	(2.7)	(2.4)	264	53,728
Very low	4.8	21.9	23.6	22.3	27.4[a]		
	(1.6)	(3.4)	(3.2)	(2.1)	(3.4)	214	35,735

[a,b,c] Given the key characteristic and household size under analysis, pairs of matching letters in a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, the percentage of two-member households among all households with non-Hispanic Black caregivers (9.9%) significantly differs from the percentage of two-member households among all households with non-Hispanic White caregivers (5.8%). In other words, the comparisons are between percentages within a column for a key sociodemographic characteristic, not across columns.

2.4.2 Household Income

The study asked respondents to report their household income over the last month.[50] Given the timing of responses to the 72-month interview, the reference period spanned March 2019 through June 2020.[51] Over half of study households (52%) reported income at or below 100 percent of the 2019 FPG at 72 months (Figure 2-2), after income referenced in the FPG was divided into equal monthly amounts. Close to an additional one-third (32%) reported household incomes between 100 percent FPG and 185 percent FPG. Only 16 percent of households reported household income greater than 185 percent of the FPG, a common income cutoff for WIC participation and for receiving reduced price meals through the National School Lunch Program (NSLP) and the School Breakfast Program (SBP).

Figure 2-2. Reported household income at 72 months relative to the 2019 Federal Poverty Guidelines (FPG)[a]



[a] Unweighted *n*=2,003; weighted *n*=415,310. Appendix Table B2a-2 offers additional detail.

Bivariate chi-square analyses indicated that the distribution of household income was associated with several key sociodemographic characteristics used in this study: parity, marital status, maternal educational attainment at 54 months, employment status, household food security status, participation in non-WIC benefit programs, timing of WIC enrollment (for the study child), and the study child's pattern of WIC participation. Table 2-3 presents the key sociodemographic characteristics associated with reported household income, with statistically significant pairwise differences indicated.

[50] Study participants self-reported their income at the 72-month interview; income was not verified.

[51] Though the data collection window remained open until August 2020, the last 72-month interview occurred in late June 2020.

Table 2-3. Row percentages of key sociodemographic characteristics associated with reported household income[a] at 72 months

Key sociodemographic characteristic	Reported household income: Percentage relative to 2019 Federal Poverty Guidelines (FPG) % (standard error) ≤50% FPG	>50% and ≤100% FPG	>100% and ≤130% FPG	>130% and ≤150% FPG	>150% and ≤185% FPG	>185% FPG	Unweighted *n*	Weighted *n*
Parity								
Firstborn	16.7[b] (2.4)	25.7[b] (2.0)	17.0 (2.9)	8.6 (1.1)	11.1[b,c] (1.5)	20.8[b] (2.2)	804	174,725
Second born	22.4 (2.2)	32.0 (2.0)	15.7 (2.3)	8.0 (1.6)	6.4[b] (1.0)	15.6[c] (2.0)	560	113,362
Third or subsequent born	28.2[b] (2.7)	34.7[b] (2.7)	14.0 (2.1)	8.2 (1.4)	6.3[c] (1.1)	8.6[b,c] (1.8)	639	127,222
Marital status								
Married	12.4[b] (1.5)	29.6 (2.4)	15.6 (1.6)	10.7[b] (1.2)	10.5[b] (1.4)	21.3[b] (2.5)	812	177,787
Not married	28.9[b] (2.1)	30.7 (1.7)	15.8 (2.3)	6.6[b] (0.7)	6.7[b] (0.7)	11.4[b] (1.1)	1,191	237,523
Maternal educational attainment at 54 months								
High school or less	29.4[b] (2.2)	36.6[b] (1.9)	12.4[b] (1.6)	5.8[b] (0.8)	6.4[b] (1.0)	9.5[b] (1.4)	1,057	220,088
More than high school	13.2[b] (2.0)	23.0[b] (1.6)	19.5[b] (2.6)	11.1[b] (1.4)	10.6[b] (1.4)	22.6[b] (2.3)	946	195,222
Employment status								
Full-time	6.3[b,c] (1.1)	24.0[b,c] (2.1)	21.1[b] (2.9)	11.8[b] (1.5)	11.8[b] (1.5)	25.1[b,c] (2.5)	800	165,487
Part-time	23.9[b,d] (2.7)	35.4[b] (3.1)	15.0 (2.3)	6.8 (2.0)	7.1 (1.4)	11.8[b] (1.8)	395	82,438
Not employed	36.1[c,d] (2.5)	33.8[c] (2.4)	10.7[b] (1.2)	5.6[b] (0.8)	5.5[b] (1.1)	8.2[c] (1.5)	808	167,385
Household food security status								
High or marginal	19.9[b] (1.7)	29.2 (1.8)	15.6 (1.6)	8.5 (0.7)	8.9 (0.9)	17.9[b,c] (1.6)	1,541	328,422
Low	26.4 (3.3)	31.0 (3.3)	19.1 (4.2)	7.9 (1.9)	6.3 (2.0)	9.3[b,d] (1.9)	255	52,351
Very low	32.9[b] (4.9)	38.1 (4.0)	11.2 (2.7)	7.8 (2.7)	6.2 (2.4)	3.7[c,d] (1.7)	207	34,537
Participation in non-WIC benefit programs								
Does not participate in any other programs[e]	7.2[b] (2.6)	7.5[b,c] (1.8)	12.2 (1.9)	11.5[b] (1.8)	13.1[b] (2.3)	48.6[b,c] (4.1)	320	64,914
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[e]	39.5[b,c] (2.4)	37.4[b] (2.0)	12.7[b] (1.5)	3.3[b,c] (0.8)	3.5[b,c] (0.7)	3.6[b,d] (0.7)	859	173,243
Participates in other program(s) excluding SNAP[e]	9.8[c] (1.5)	31.5[c] (2.3)	20.0[b] (2.9)	12.1[c] (1.2)	11.4[c] (1.3)	15.3[c,d] (2.0)	824	177,154

Table 2-3. Row percentages of key sociodemographic characteristics associated with reported household income[a] at 72 months (continued)

Key sociodemographic characteristic	Reported household income: Percentage relative to 2019 Federal Poverty Guidelines (FPG) % (standard error) ≤50% FPG	>50% and ≤100% FPG	>100% and ≤130% FPG	>130% and ≤150% FPG	>150% and ≤185% FPG	>185% FPG	Unweighted *n*	Weighted *n*
Timing of WIC enrollment								
1st trimester	22.9 (2.5)	33.3 (2.8)	16.1 (3.3)	7.6 (1.4)	7.8 (1.3)	12.3 (1.9)	629	133,658
2nd trimester	23.8 (2.4)	31.3[b] (2.1)	16.2 (1.6)	6.4 (0.8)	8.0 (1.2)	14.3 (1.6)	798	164,005
3rd trimester	17.8 (2.7)	22.9[b] (2.4)	16.0 (2.3)	10.7 (2.5)	12.7[b] (2.5)	19.9 (2.5)	296	63,033
Postnatal	17.5 (2.1)	27.8 (3.9)	13.0 (2.3)	13.2 (2.5)	5.6[b] (1.6)	22.9 (3.3)	280	54,613
Pattern of study child's WIC participation[f]								
1st year only	4.6[b,c] (3.2)	15.2[b] (4.8)	16.2 (4.9)	15.8 (4.9)	15.48 (4.3)	32.9[b,c] (6.1)	78	33,792
2nd or 3rd year only	13.4[d,g] (4.0)	29.7 (4.2)	12.2 (3.2)	5.3 (1.7)	13.2 (3.1)	26.3[d] (4.4)	164	69,561
4th or 5th year only	34.0[b,d,h] (5.1)	27.9 (4.2)	16.0 (3.0)	3.8 (1.7)	6.6 (2.3)	11.6[b] (3.9)	138	66,354
Consistently	26.9[c,g,i] (3.0)	37.0[b] (2.6)	15.1 (1.6)	8.5 (1.8)	6.6 (1.8)	5.8[c,d,g] (1.2)	397	186,572
Intermittently	11.0[h,i] (3.0)	25.6 (4.5)	16.3 (3.9)	17.4 (4.0)	11.0 (3.1)	21.5[g] (4.5)	121	54,853

[a] The reference period for income reports spans March 2019 through July 2020.

[b,c,d] Given the key characteristic and income poverty level under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[f] This analysis uses the longitudinal cohort.

[g,h,i] Given the key characteristic and income poverty level under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

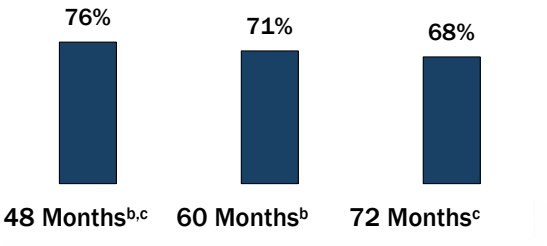
Pre-/Post-COVID ED Analysis. It is well-known that the pandemic response in the United States resulted in the loss of employment for many.[52] Though the Federal Government authorized emergency payments to support families in need, the rise in unemployment suggested that the distribution of household income reported pre-COVID ED might differ from the distribution reports post-COVID ED. There was not a significant association between household income and

[52] Source: https://www.census.gov/data/academy/webinars/2020/taking-the-pulse-of-american-households-during-covid-19.html.

whether the data were collected pre- or post-COVID ED based on chi-square test results. This may reflect the fact that the recall period, March through June 2020, was early in the pandemic.

Because 130 percent of FPG is a common income cutoff for participation in Federal assistance programs,[53] Figure 2-3 highlights the percentage of study families reporting income at or below 130 FPG each year since the study child was 4 years old (48 months). Based on pairwise t-tests, the decline since child age 48 months is statistically significant. Though the decline in the percentage of households with incomes at or below 130 FPG is noteworthy, it is important to recall that all children in this study were in households eligible for WIC at the time of study enrollment. By age 6 years, over two-thirds (68%) of these children are in households that are still quite income poor. Research by Min, Xue, and Wang (2018) finds that adverse eating behaviors and subsequent increased obesity risk are associated with recurrent household poverty.

Figure 2-3. Percentage of study participants reporting household income at or below 130 percent of the Federal Poverty Guidelines (FPG) by interview month[a]



[a] At 48 months, unweighted *n*=2,571 and weighted *n*=441,457. At 60 months, unweighted *n*=2,380 and weighted *n*=419,010. At 72 months, unweighted *n*=2,137 and weighted *n*=441,226. For 48-month data, 2017 FPG were used. Fore 60-month data, 2018 FPG were used. For 72-month data, 2019 FPG were used. Appendix Table B2a-3 offers additional detail.

[b.c] Pairwise differences between percentages are significantly different at $p \leq 0.05$ after Bonferroni adjustment for multiple comparisons.

2.5 Maternal Work and School Status

WIC ITFPS-2 also probed maternal[54] work and school status, including whether mothers were working full-time (FT), part-time (PT), or not working outside the home. Analyses included whether caregivers were attending school when the study child was 72 months old and whether there were caregivers who both worked and attended school.

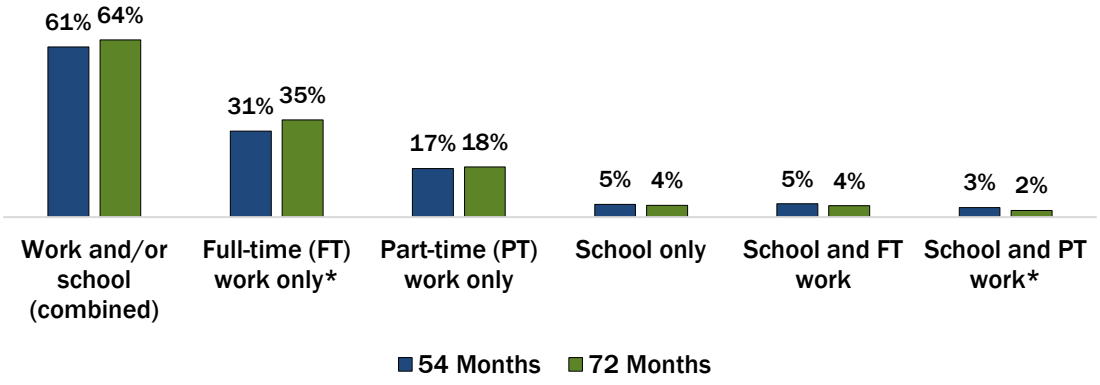
[53] The income cutoff for participation in WIC is typically higher, often 185 percent of FPG.

[54] Throughout this report, the terms "mothers" and "caregivers" are used interchangeably to refer to adult WIC ITFPS-2 participants. Maternal includes both mothers and non-mother caregivers as well.

2.5.1 Work and School at 72 Months

At the 72-month interview, 64 percent of study mothers were working, going to school, or doing both, which is not significantly different from 61 percent doing so at the 54-month interview (Figure 2-4). Thirty-five percent of study mothers reported working FT and not attending school. This was up 4 percentage points from the percentage reported at the 54-month interview, the most recent prior interview requesting the information. Eighteen percent of mothers reported working PT and not attending school at 72 months, which was very similar to the percentage at 54 months (17%). While the majority of mothers who reported working were not in school, just under 7 percent reported working and attending school when their study child was 72 months old, once rounded numbers in Figure 2-4 are summed. A small percentage (4%) of mothers reported attending school and not working for pay at 72 months. Research has shown that children whose mothers worked more consumed more unhealthy foods and watched more television, which may contribute to a positive association between maternal work hours and children's body mass index (BMI) (Datar, Nicosia, & Shier, 2014).

Figure 2-4. Percentage of WIC ITFPS-2 mothers working and going to school at 54[a] and 72[b] months



[a] Unweighted *n*=2,563; weighted *n*=441,244. Sample size used in analysis is three unweighted cases smaller due to missing data.

[b] Unweighted *n*=2,131; weighted *n*=440,454. Appendix Tables B2a-4a and B2a-4b offer additional detail.

* Percentages are significantly different at $p \leq 0.05$ after Bonferroni adjustment for multiple comparisons.

2.5.2 Characteristics of Those Working and/or Going to School at 72 Months

At 72 months, chi-square tests yielded statistically significant associations between working and/or going to school and several key sociodemographic characteristics: maternal ethnorace, parity, marital

status, maternal educational attainment at 54 months, income poverty, non-WIC benefit participation, and pattern of WIC participation for the study child. Table 2-4 presents the findings.

Table 2-4. Row percentage of key sociodemographic characteristics associated with caregivers working and/or going to school at 72 months

Key sociodemographic characteristics	Study mothers working and/or going to school at the 72-month interview % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	77.1 (1.6)[a,b]	615	89,505
Non-Hispanic White	63.6 (1.8)[a]	609	118,214
Non-Hispanic Other	72.3 (5.3)[c]	117	26,505
Hispanic	56.4 (2.7)[b,c]	790	206,229
Parity[d]			
Firstborn	67.4 (2.3)	866	187,339
Second born	62.0 (2.1)	586	118,784
Third or subsequent born	59.4 (3.3)	679	134,332
Marital status			
Married	57.6 (2.5)	866	189,473
Not married	67.9 (1.9)	1,265	250,981
Maternal educational attainment at 54 months[e]			
High school or less	53.3 (3.0)	1,128	235,375
More than high school	75.2 (1.9)	1,003	205,079
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	48.3[c,d] (2.4)	831	166,032
>75% of FPG and ≤130% of FPG	67.3[c] (2.9)	615	132,223
>130% of FPG	77.7[d] (1.7)	685	142,199
Participation in non-WIC benefit programs			
Does not participate in any other programs[f]	80.2[c,d] (2.2)	357	71,553
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[f]	53.2[c] (1.8)	902	181,328
Participates in other program(s) excluding SNAP[f]	67.1[d] (2.8)	872	187,573
Pattern of study child's WIC participation[g]			
1st year only	76.0[a] (5.5)	86	36,990
2nd or 3rd year only	68.9[b] (3.8)	181	75,735
4th or 5th year only	62.3 (5.1)	143	68,640
Consistently	51.8[a,b,c] (2.8)	423	198,657
Intermittently	70.7[c] (4.9)	128	58,969

[a,b,c] Given the key characteristic under analysis, pairs of matching letters indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] The chi-square test was significant at $p \leq 0.05$ but none of the t-tests indicated significant pairwise differences in percentages.

[e] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

[f] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[g] This analysis uses the longitudinal cohort.

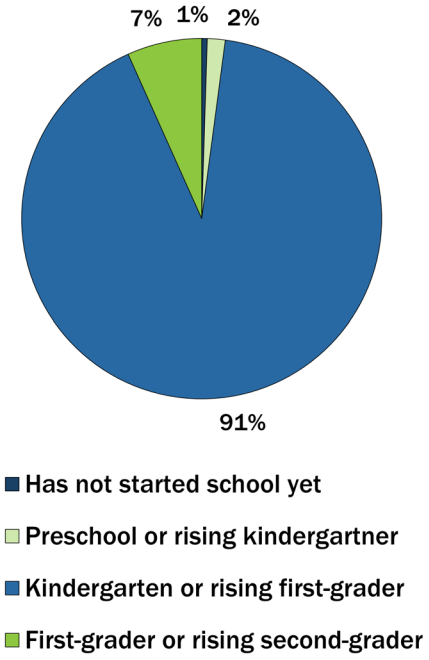
Pre-/Post-COVID ED Analysis. In addition to examining associations with key sociodemographic characteristics, the study found that working and/or going to school was significantly associated with whether the 72-month interview took place pre- or post-COVID ED. Nearly two-thirds (65%) of participants interviewed pre-COVID ED indicated that they were currently working and/or going to school, while 57 percent of participants interviewed post-COVID ED indicated that they were currently working and/or going to school. Pairwise t-test results indicated that the difference in the percentages currently working and/or going to school pre- and post-COVID ED was statistically significant. The change in the percentage working and/or going to school was driven by differences in the percentage of participants currently working. Pre-COVID ED, an estimated 61 percent were working; post-COVID ED, an estimated 53 percent were working. Full-time work was particularly hard-hit, as evidenced by a significant difference between the pre-COVID ED (40%) and post-COVID ED (34%) percentages. Conversely, 35 percent reported not currently working or going to school pre-COVID ED, and 43 percent reported not currently working or going to school post-COVID ED, which was also a statistically significant difference.

2.6 Child School Status, Childcare Participation, and Sources of Food

By the 72-month interview, almost all study children had started some form of formal schooling. Figure 2-5 presents the distribution of study children by grade level in school, including those who had not started school yet. Less than 1 percent had not started school, and 2 percent were in preschool or about to start kindergarten. The vast majority (91%) were either in kindergarten or were rising first-graders (i.e., they had completed kindergarten and were waiting to start first grade). Nearly 7 percent were in first grade or were rising second-graders (i.e., they had completed first grade and were waiting to start second grade).

Because the percentage of study children not in school was small (<1%), the study could not assess associations between this group and some key sociodemographic characteristics because some characteristics were not present among those not in school. For those key sociodemographic characteristics that had nonzero values in each cell of the distribution, there were statistically significant bivariate associations between the child's school status and employment status and household food security. Table 2-5 presents the findings based on bivariate chi-square analyses, with the results of pairwise t-tests indicated.

Figure 2-5. Percentage of study children by grade level in school at 72 months[a]



[a] Unweighted *n*=2,135; weighted *n*=441,023. Appendix Table B2a-5 offers additional detail.

Percentages may not sum to 100 percent due to rounding.

Table 2-5. Row percentages of key sociodemographic characteristics associated with child's school status at 72 months

Key sociodemographic characteristic	Study child's school status % (standard error)				Unweighted *n*	Weighted *n*
	Has not started school yet	In preschool or about to start kindergarten	In kindergarten or rising first-grader	In first grade or rising second-grader		
Employment status						
Full-time	0.2 (0.1)	1.1 (0.4)	89.9 (2.1)	8.8[a] (2.0)	843	171,855
Part-time	0.6 (0.5)	1.3 (0.6)	90.7 (1.9)	7.4 (2.0)	425	89,882
Not working	0.8 (0.3)	2.2 (0.6)	92.7 (1.1)	4.3[a] (1.0)	867	179,287
Household food security status						
High or marginal	0.6 (0.2)	1.4 (0.4)	90.8[a] (1.4)	7.2[a] (1.4)	1,658	351,606
Low	0.3 (0.4)	2.9 (1.1)	90.3[b] (2.1)	6.4 (1.9)	264	53,728
Very low	0.3 (0.3)	1.6 (0.8)	96.5[a,b] (1.1)	1.7[a] (0.8)	213	35,689

[a,b] Given the key characteristic and school status level (i.e., grade level) under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

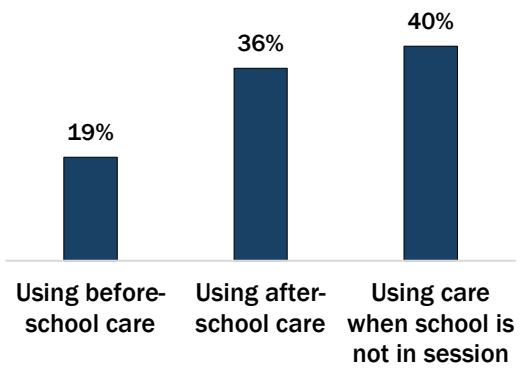
In addition to school status, WIC ITFPS-2 continued to explore the use of childcare when the child was 72 months old. The study defined regular childcare as an arrangement in which someone other than the child's primary caregiver or the other parent cares for the child on a regular basis. The regular childcare provider may, therefore, be a nonparental relative who lives in the home (e.g., grandparent, aunt, uncle, or older sibling).

Because most study children were in school, the 72-month interview inquired about types of childcare arrangement before and after school, as well as those used when school is not in session (e.g., in the summer or over school holidays). For childcare arrangements before or after school, response options included someone caring for the child in their home (provider's home), someone caring for the child in the child's home (child's home), before/after-school childcare program at the child's school, before/after-school childcare program that is not at the child's school, other (unspecified) types of childcare, and not currently using childcare. For childcare arrangements during school breaks or summer, response options included provider's home; child's home; childcare center; camp, academic, or activity program; other (unspecified) types of care; and not currently using childcare.

2.6.1 Childcare Use at 72 Months

Young children often spend significant time in childcare and may receive meals and snacks while in care. Research has found mixed results when exploring associations between type of childcare and child obesity (Swyden, Sisson, Lora, Castle, & Copeland, 2017). Figure 2-6 presents the percentage of study children in regular childcare by when care occurred relative to the school day (i.e., before school, after school, or when school is not in session). At 72 months, 19 percent used before-school care. Thirty-six percent used after-school care, and 40 percent used childcare when school was not in session. Table 2-6 presents the distribution of children by type of childcare. The most popular type of childcare was care in the child's home. Care in the provider's home was

Figure 2-6. Percentage of study children in regular childcare by when it occurs relative to school, reported at 72 months[a]



[a] Unweighted *n*=2,118; weighted *n*=438,036. Appendix Table B2a-6 offers additional detail.

second. A majority of study participants reported not using childcare before school (81%), after school (64%), or when school was not in session (60%).

Table 2-6. Distribution of study children by timing of childcare relative to the school day and when school is not in session at 72 months[a]

Type of childcare	Timing of childcare % (standard error)		
	Before school	After school	When school is not in session
Child's home	8.0 (0.8)	12.5 (0.8)	15.0 (0.8)
Provider's home	4.6 (0.5)	8.1 (0.9)	13.9 (1.0)
Program at school	2.5 (0.5)	8.4 (1.0)	NA[b]
Program not at school	3.6 (0.8)	6.2 (1.0)	NA[b]
Childcare center	NA[b]	NA[b]	5.1 (0.8)
Camp, academic, or activity program	NA[b]	NA[b]	5.2 (1.0)
Unspecified types of care	0.5 (0.2)	0.6 (0.2)	0.8 (0.2)
Not using childcare	80.7 (1.6)	64.1 (1.4)	60.0 (1.6)

[a] If school was not in session at the time of the interview, respondents were asked to think about the most recent school year. Unweighted *n*=2,118; weighted *n*=438,036.

[b] NA indicates that response option was not available.

Several key sociodemographic characteristics were associated with childcare use before school, after school, and when school is not in session. Tables 2-7a, 2-7b, and 2-7c present the findings.

Table 2-7a. Row percentages of key sociodemographic characteristics associated with type of childcare arrangement before school, reported at 72 months[a]

Key sociodemographic characteristic	Type of childcare used before school when school is in session % (standard error)						Weighted *n*	Unweighted *n*
	Child's home	Provider's home	A program at school	A program not at school	Nonspecified types of childcare	Not currently used		
Maternal ethnorace								
Non-Hispanic Black	10.0 (1.6)	5.9 (0.9)	5.8[b] (1.3)	6.2 (2.0)	0.7 (0.4)	71.5[b,c] (4.0)	616	89,641
Non-Hispanic White	5.4 (1.0)	4.8 (1.1)	2.0 (0.6)	3.2 (0.9)	0.4 (0.4)	84.2[b] (1.8)	605	117,535
Non-Hispanic Other	9.0 (3.0)	3.0 (1.6)	2.4 (1.0)	8.6 (3.1)	0.9 (0.7)	76.0 (4.0)	118	26,602
Hispanic	8.6 (1.3)	4.1 (0.7)	1.5[b] (0.4)	2.0 (0.6)	0.5 (0.3)	83.4[c] (1.8)	779	204,258
Parity								
Firstborn	8.4 (1.1)	5.9[b] (0.9)	3.6[b] (0.8)	3.2 (0.7)	0.9 (0.4)	78.0[b] (2.0)	861	186,094
Second born	7.0 (1.4)	4.6 (1.0)	2.5 (0.7)	3.6 (1.2)	0.2 (0.2)	82.0 (2.3)	584	118,402
Third or subsequent born	8.4 (1.3)	2.8[b] (0.6)	1.1[b] (0.4)	4.1 (1.0)	0.3 (0.2)	83.3[b] (1.9)	673	133,540
Marital status								
Married	5.9[b] (1.1)	3.2[b] (0.7)	1.4[b] (0.4)	1.7[b] (0.6)	0.4 (0.3)	87.2[b] (1.3)	864	189,233
Not married	9.6[b] (1.0)	5.6[b] (0.8)	3.4[b] (0.7)	5.0[b] (1.2)	0.6 (0.2)	75.8[b] (2.2)	1,254	248,802
Maternal educational attainment at 54 months								
High school or less	7.5 (1.0)	3.4[b] (0.7)	1.9[b] (0.5)	3.1 (0.8)	0.2 (0.1)	84.0[b] (1.5)	1,119	233,965
More than high school	8.7 (0.9)	6.0[b] (0.7)	3.3[b] (0.6)	4.2 (0.9)	1.0 (0.4)	76.9[b] (2.0)	999	204,071
Employment status								
Full-time	13.6[b] (1.4)	8.5[b,c] (1.2)	4.6[b] (0.9)	6.1[b,c] (1.4)	1.1 (0.5)	66.1[b,c] (2.4)	839	171,096
Part-time	9.5[c] (1.9)	3.7[b] (1.0)	2.1 (0.8)	3.1[b] (0.9)	0.1 (0.1)	81.5[b,d] (2.3)	422	89,180
Not employed	2.0[b,c] (0.6)	1.2[c] (0.4)	0.7[b] (0.3)	1.5[c] (0.5)	0.2 (0.2)	94.4[c,d] (1.1)	857	177,759
Income poverty								
≤75% of Federal Poverty Guidelines (FPG)	7.0 (1.0)	3.6 (0.7)	1.3[b] (0.4)	3.6 (1.3)	0.2 (0.2)	84.2[b] (2.0)	823	164,998
>75% of FPG and ≤130% of FPG	7.5 (1.5)	3.3 (0.9)	1.9 (0.6)	3.9 (1.1)	0.6 (0.5)	82.7[c] (2.3)	613	131,676
>130% of FPG	9.8 (1.6)	6.9 (1.3)	4.6[b] (1.0)	3.3 (0.8)	0.8 (0.4)	74.8[b,c] (2.3)	682	141,361

Table 2-7a. Row percentages of key sociodemographic characteristics associated with type of childcare arrangement before school, reported at 72 months[a] (continued)

Key sociodemographic characteristic	Type of childcare used before school when school is in session % (standard error)						Weighted *n*	Unweighted *n*
	Child's home	Provider's home	A program at school	A program not at school	Nonspecified types of childcare	Not currently used		
Participation in non-WIC benefit programs								
Does not participate in any other programs[e]	9.5 (2.2)	7.1 (1.7)	5.8 (1.6)	5.2[b] (1.2)	0.5 (0.4)	72.0[b,c] (3.2)	357	71,553
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[e]	6.2 (1.0)	3.5 (0.7)	1.8 (0.6)	4.9 (1.4)	0.3 (0.2)	83.3[b] (2.2)	897	180,535
Participates in other program(s) excluding SNAP[e]	9.3 (1.2)	4.7 (0.8)	2.0 (0.6)	1.8[b] (0.5)	0.7 (0.3)	81.5[c] (1.5)	864	185,948

[a] If school was not in session at the time of the interview, respondents were asked to think about the most recent school year.

[b,c,d] Given the key characteristic and childcare setting under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Table 2-7b. Row percentages of key sociodemographic characteristics associated with type of childcare arrangement after school, reported at 72 months[a]

Key sociodemographic characteristic	Type of childcare used after school when school is in session % (standard error)						Weighted *n*	Unweighted *n*
	Child's home	Provider's home	Program at school	Program not at school	Nonspecified types of childcare	Not currently used		
Maternal ethnorace								
Non-Hispanic Black	11.3 (1.4)	10.1 (1.2)	13.9[b,c] (1.6)	10.6 (2.6)	1.8[b] (0.6)	52.3[b,c] (3.5)	616	89,641
Non-Hispanic White	12.4 (1.4)	7.5 (1.3)	7.6[b] (1.5)	5.4 (1.0)	0.0[b] (0.0)	67.0[b] (1.8)	605	117,535
Non-Hispanic Other	9.1 (2.2)	10.1 (3.4)	5.4 (2.4)	11.8 (2.9)	0.6 (0.7)	63.0 (5.3)	118	26,602
Hispanic	13.6 (1.4)	7.4 (1.5)	6.9[c] (1.5)	4.0 (0.9)	0.4 (0.2)	67.7[c] (1.5)	779	204,258
Marital status								
Married	11.1 (1.5)	6.4[b] (0.9)	6.5[b] (0.9)	3.6[b] (0.8)	0.3 (0.2)	72.1[b] (1.7)	864	189,233
Not married	13.6 (1.0)	9.5[b] (1.2)	9.9[b] (1.4)	8.1[b] (1.5)	0.8 (0.2)	58.1[b] (1.9)	1,254	248,802
Maternal educational attainment at 54 months								
High school or less	11.1 (1.0)	6.5[b] (1.1)	6.7[b] (1.3)	4.3[b] (0.8)	0.7 (0.2)	70.7[b] (1.7)	1,119	233,965
More than high school	14.2 (1.6)	10.0[b] (1.1)	10.5[b] (1.4)	8.3[b] (1.4)	0.5 (0.2)	56.5[b] (2.0)	999	204,071
Employment status								
Full-time	19.3[b] (2.1)	13.6[b] (1.8)	14.1[b,c] (1.9)	10.6[b,c] (1.7)	1.0 (0.4)	41.3[b,c] (2.3)	839	171,096
Part-time	16.5[c] (2.6)	10.1[c] (1.7)	8.0[b,d] (1.3)	4.6[b] (1.1)	0.3 (0.2)	60.5[b,d] (2.7)	422	89,180
Not employed	4.0[b,c] (1.2)	1.9[b,c] (0.5)	3.2[c,d] (0.8)	2.6[c] (0.7)	0.4 (0.2)	87.9[c,d] (1.4)	857	177,759
Income poverty								
≤75% of Federal Poverty Guidelines (FPG)	10.6 (1.5)	6.4 (0.9)	5.2[b] (1.1)	5.2 (1.3)	0.7 (0.3)	71.9[b,c] (1.6)	823	164,998
>75% of FPG and ≤130% of FPG	12.2 (1.5)	8.7 (1.7)	8.3 (1.6)	6.1 (1.5)	0.7 (0.3)	64.0[b] (3.1)	613	131,676
>130% of FPG	15.2 (2.0)	9.7 (1.5)	12.3[b] (1.5)	7.3 (1.3)	0.4 (0.3)	55.1[c] (2.5)	682	141,361

[a] If school was not in session at the time of the interview, respondents were asked to think about the most recent school year.

[b,c,d] Given the key characteristic and childcare setting under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

Table 2-7c. Row percentages of key sociodemographic characteristics associated with type of childcare arrangement when school is not in session, reported at 72 months[a]

Key sociodemographic characteristic	Type of childcare used when school is not in session % (standard error)						Weighted *n*	Unweighted *n*
	Child's home	Provider's home	Childcare center	Camp, academic, or activity program	Nonspecified types of childcare	Not currently used		
Maternal ethnorace								
Non-Hispanic Black	15.6 (1.4)	14.9 (1.9)	8.4[b] (1.5)	10.2[b] (2.3)	0.8 (0.4)	50.2[b,c,d] (3.0)	616	89,641
Non-Hispanic White	15.1 (1.7)	12.4 (1.5)	5.6[c] (0.9)	5.1 (1.3)	0.5 (0.2)	61.4[b] (2.2)	605	117,535
Non-Hispanic Other	10.3 (2.2)	12.3 (3.3)	9.4 (2.5)	3.7 (2.2)	0.5 (0.5)	63.8[c] (4.2)	118	26,602
Hispanic	15.3 (1.4)	14.5 (1.1)	2.8[b,c] (0.7)	3.3[b] (0.7)	0.9 (0.4)	63.0[d] (1.7)	779	204,258
Parity								
Firstborn	14.1 (1.7)	15.9[b] (1.8)	6.4[b] (1.1)	5.7 (1.2)	1.1 (0.3)	56.8 (2.3)	861	186,094
Second born	13.7 (1.9)	15.0 (1.4)	4.1[b] (1.0)	5.6 (1.1)	0.5 (0.3)	61.2 (2.3)	584	118,402
Third or subsequent born	17.5 (1.8)	10.1[b] (1.3)	4.2 (0.9)	4.3 (1.3)	0.5 (0.3)	63.4 (2.8)	673	133,540
Reported weight status of mother								
Normal or underweight	12.5 (1.5)	12.7 (1.6)	6.5 (1.4)	7.7[b] (1.2)	0.8 (0.5)	59.7 (2.9)	566	124,587
Overweight	14.1 (1.6)	15.3 (1.7)	3.2 (0.8)	5.7 (1.5)	0.8 (0.4)	60.9 (2.9)	627	123,660
Obese	17.2 (1.5)	13.7 (1.3)	5.4 (1.0)	3.3[b] (0.9)	0.7 (0.3)	59.6 (2.2)	925	189,789
Marital status								
Married	12.6[b] (1.2)	10.5[b] (1.3)	2.4[b] (0.7)	4.3 (0.8)	0.3 (0.3)	70.0[b] (1.5)	864	189,233
Not married	16.8[b] (1.1)	16.5[b] (1.4)	7.2[b] (1.1)	6.0 (1.5)	1.1 (0.3)	52.4[b] (2.3)	1,254	248,802
Maternal educational attainment at 54 months								
High school or less	15.2 (1.1)	12.6 (1.2)	4.9 (1.2)	3.4[b] (0.9)	0.5 (0.2)	63.4[b] (2.2)	1,119	233,965
More than high school	14.8 (1.5)	15.3 (1.2)	5.4 (0.8)	7.3[b] (1.3)	1.1 (0.4)	56.1[b] (1.6)	999	204,071
Employment status								
Full-time	23.4[b] (2.0)	23.6[b,c] (1.9)	8.6[b,c] (1.3)	8.9[b] (1.8)	1.2 (0.4)	34.5[b,c] (2.4)	839	171,096
Part-time	19.7[c] (2.4)	16.4[b,d] (2.7)	4.7[b] (1.5)	5.5[c] (1.3)	0.8 (0.4)	53.0[b,d] (2.5)	422	89,180
Not employed	4.6[b,c] (0.9)	3.3[c,d] (0.9)	2.0[c] (0.6)	1.6[b,c] (0.6)	0.4 (0.3)	88.1[d,c] (1.2)	857	177,759

Table 2-7c. Row percentages of key sociodemographic characteristics associated with type of childcare arrangement when school is not in session, reported at 72 months[a] (continued)

Key sociodemographic characteristic	Type of childcare used when school is not in session % (standard error)						Weighted *n*	Unweighted *n*
	Child's home	Provider's home	Childcare center	Camp, academic, or activity program	Nonspecified types of childcare	Not currently used		
Timing of WIC enrollment								
1st trimester	16.1 (2.0)	13.9 (1.5)	4.1 (1.0)	2.6 (0.7)[b,c]	0.8 (0.4)	62.5 (2.3)	660	139,703
2nd trimester	14.4 (1.5)	13.8 (1.4)	5.8 (1.7)	3.9 (0.9)[d]	0.5 (0.3)	61.6 (2.6)	852	175,777
3rd trimester	14.0 (2.7)	14.2 (2.2)	4.7 (1.3)	7.6 (1.9)[b]	1.6 (1.0)	57.9 (3.9)	315	65,541
Postnatal	15.3 (2.3)	13.6 (2.3)	6.0 (1.5)	13.2 (2.8)[c,d]	0.5 (0.3)	51.5 (3.1)	291	57,015
Participation in non-WIC benefit programs								
Does not participate in any other programs[e]	15.4 (2.1)	14.3 (2.2)	6.7 (1.4)	9.8[b] (2.0)	0.2 (0.2)	53.6[b] (2.5)	357	71,553
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[e]	13.2 (1.2)	11.5[b] (1.1)	5.6 (1.1)	3.9[b] (0.8)	0.6 (0.2)	65.2[b] (2.0)	897	180,535
Participates in other program(s) excluding SNAP[e]	16.6 (1.5)	16.1[b] (1.7)	4.1 (1.0)	4.7 (1.6)	1.1 (0.3)	57.4 (2.9)	864	185,948

[a] The 72-month survey item specifically requests type of childcare when school is not in session; however, at the time of the 72-month interview, the child may have been in school, depending on the date of birth of the child.

[b,c,d] Given the key characteristic and childcare setting under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

2.6.2 Source of Foods Consumed during the School Week

Because children in school or in regular childcare may consume many of their meals and snacks in those settings, analyses examined who provides the food during the school week for children while they are in school or in childcare. Eating breakfast has been associated with better overall diet quality and nutrient and fiber intakes that are more likely to align with dietary recommendations (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005), and lunches consumed by NSLP participants are of higher diet quality than those for nonparticipants with similar characteristics (USDA, FNS, Office of Policy Support, 2019). Given this, the analyses focused on number of breakfasts and lunches provided during the school week. Given this focus and the limited numbers in preschool (2%), the analyses were limited to children in kindergarten or higher grades.

The survey asked respondents to indicate how many times during a typical Monday through Friday that the child gets food from different sources for breakfast, lunch, and dinner. Sources included home, childcare provider, school, and other sources. For any given eating occasion (breakfast or lunch), the sum of days across sources was allowed to differ from 5; however, in such cases, the interviewer reviewed the data with the respondent to confirm. As shown in Table 2-8, more than half (57%) of study children in kindergarten or higher grades received breakfast foods most school days (4-5 days) from home, and about 40 percent received breakfast foods most school days (4-5 days) from school. For lunch, slightly more than one-quarter (26%) of study children in kindergarten or higher grades received lunch foods from home, and about two-thirds (66%) received lunch foods from school. Some families rely heavily on the school meals programs and receive both breakfast and lunch from school nearly every day. This study found that about 37 percent of caregivers reported that their children received both breakfast and lunch foods from school on most school days (4-5 times per week).

Table 2-8. Among children in kindergarten or higher grades,[a] the sources of their breakfasts and lunches during the school week at 72 months

Meal by source	Days per week receiving meal from source % (standard error)		
	0-1 days	2-3 days	4-5 days
Breakfast			
Home	31.9 (2.2)	11.3 (0.9)	56.9 (2.1)
Childcare provider	97.5 (0.3)	0.7 (0.2)	1.8 (0.3)
School	49.8 (2.4)	9.9 (0.9)	40.3 (2.5)
Somewhere else	99.8 (0.1)	0.1 (0.1)	0.1 (0.1)
Lunch			
Home	61.5 (2.0)	12.2 (1.1)	26.3 (1.5)
Childcare provider	99.0 (0.2)	0.5 (0.2)	0.5 (0.2)
School	23.4 (1.6)	10.2 (0.9)	66.4 (2.0)
Somewhere else	99.9 (0.1)	0.1 (0.1)	0

[a] Unweighted *n*=2,079; weighted *n*=431,316.

Tables 2-9a and 2-9b present the key sociodemographic characteristics associated with sources for children's breakfasts during the school week, and Tables 2-10a and 2-10b present the associations with sources for children's lunches. As mentioned, the survey item used in these analyses asked the caregiver to report the number of times the child gets the food from the source during a typical Monday through Friday, so responses do not necessarily reflect what happened on any given day. Moreover, as discussed, the results indicate where at least some of the food comes from for the eating occasion but not necessarily all of it.

The associations with income poverty indicate that children in the poorest households (≤75% of FPG) are typically eating breakfast and lunch food from school more frequently than children in the wealthiest households in this cohort (>130% of FPG). Those families that participated consistently with WIC during the study child's first 5 years of life were more likely to report a higher number of lunch foods from school compared to those who participated less than 4 years or inconsistently with WIC during the study child's first 5 years.

Table 2-9a. Row percentages of key sociodemographic characteristics associated with the frequency of the provision of breakfast from home during a typical school week for children in kindergarten or higher grades at 72 months

Key sociodemographic characteristic	Days of the school week breakfast provided from home % (standard error) 0-1 days	2-3 days	4-5 days	Unweighted *n*	Weighted *n*
Maternal ethnorace					
Non-Hispanic Black	29.6 (2.7)	14.5[a] (1.2)	55.8 (2.7)	604	87,960
Non-Hispanic White	29.1 (2.9)	7.4[a] (1.1)	63.5[a] (3.2)	590	114,569
Non-Hispanic Other	23.1 (5.3)	12.6 (4.8)	64.3 (5.7)	115	26,035
Hispanic	35.5 (3.5)	11.9 (1.7)	52.6[a] (3.2)	770	202,752
Reported weight status of mother					
Normal or underweight	26.8[a] (2.7)	10.4 (1.6)	62.8[a] (2.2)	559	123,516
Overweight	29.8 (2.6)	11.1 (1.3)	59.1[b] (2.8)	617	122,204
Obese	36.6[a] (3.0)	12.0 (1.3)	51.4[a,b] (2.8)	903	185,596
Maternal educational attainment at 54 months					
High school or less	37.3[a] (2.5)	12.4 (1.3)	50.3[a] (2.3)	1,095	230,271
More than high school	25.6[a] (2.6)	10.1 (1.3)	64.3[a] (2.3)	984	201,045
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	37.7[a] (2.9)	11.2 (1.3)	51.0[a] (3.3)	806	162,040
>75% of FPG and ≤130% of FPG	30.2 (2.8)	15.4[a] (1.8)	54.4[b] (2.5)	601	129,564
>130% of FPG	26.5[a] (2.6)	7.6[a] (1.5)	65.9[a,b] (2.4)	672	139,713
Household food security status					
High or marginal	29.9[a] (2.0)	11.8[a] (1.0)	58.2 (1.9)	1,616	344,312
Low	37.1 (4.5)	11.6 (2.0)	51.2 (3.7)	255	51,989
Very low	42.9[a] (4.4)	5.5[a] (1.7)	51.6 (4.5)	208	35,014
Participation in non-WIC benefit programs					
Does not participate in any other programs[c]	18.8[a,b] (2.8)	5.3[a,b] (1.5)	75.8[a,b] (3.4)	348	69,750
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[c]	37.2[a] (2.2)	11.8[a] (1.4)	51.0[a] (2.3)	882	178,009
Participates in other program(s) excluding SNAP[c]	31.7[b] (3.2)	13.1[b] (1.4)	55.3[b] (2.9)	849	183,557

[a,b] Given the characteristic and number of breakfasts per week under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[c] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Table 2-9b. Row percentages of key sociodemographic characteristics associated with the frequency of the provision of breakfast from school during a typical school week for children in kindergarten or higher grades at 72 months

Key sociodemographic characteristic	Days of the school week breakfast provided from school % (standard error) 0-1 days	2-3 days	4-5 days	Unweighted *n*	Weighted *n*
Maternal ethnorace					
Non-Hispanic Black	42.8[a,b] (2.7)	13.1[a] (1.5)	44.1[a,b] (2.6)	604	87,960
Non-Hispanic White	60.2[a,c] (3.2)	6.7[a] (1.3)	33.1[a] (3.3)	590	114,569
Non-Hispanic Other	63.8[b] (5.7)	11.4 (4.5)	24.8[b,c] (5.1)	115	26,035
Hispanic	45.1[c] (3.6)	10.1 (1.5)	44.8[c] (3.9)	770	202,752
Parity					
Firstborn	54.7[a] (3.2)	8.8 (1.2)	36.5[a] (3.4)	848	184,099
Second born	50.6 (3.6)	11.8 (2.1)	37.6[b] (3.1)	570	116,096
Third or subsequent born	42.2[a] (2.6)	9.6 (1.5)	48.2[a,b] (2.9)	661	131,121
Reported weight status of mother					
Normal or underweight	52.9 (2.8)	9.9 (1.3)	37.1 (3.3)	559	123,516
Overweight	54.0[a] (2.9)	9.2 (1.1)	36.7[a] (2.8)	617	122,204
Obese	44.9[a] (3.4)	10.2 (1.4)	44.8[a] (3.4)	903	185,596
Maternal educational attainment at 54 months					
High school or less	41.5[a] (2.4)	10.3 (1.2)	48.2[a] (2.8)	1,095	230,271
More than high school	59.3[a] (2.9)	9.3 (1.3)	31.4[a] (2.8)	984	201,045
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	40.6[a] (3.4)	9.4 (1.3)	50.0[a,b] (3.4)	806	162,040
>75% of FPG and ≤130% of FPG	48.3[b] (3.2)	12.0 (1.8)	39.6[a,c] (3.4)	601	129,564
>130% of FPG	61.7[a,b] (2.7)	8.4 (1.5)	29.9[b,c] (2.8)	672	139,713
Household food security status					
High or marginal	51.6[a] (2.5)	10.0[a] (0.9)	38.5[a] (2.4)	1,616	344,312
Low	41.7[a] (3.9)	12.4 (3.2)	45.8 (4.9)	255	51,989
Very low	44.3 (4.4)	5.2[a] (1.7)	50.5[a] (4.6)	208	35,014
Participation in non-WIC benefit programs					
Does not participate in any other programs[d]	73.3[a,b] (3.8)	6.3 (1.7)	20.4[a,b] (3.3)	348	69,750
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	40.5[a,c] (2.6)	10.0 (1.4)	49.5[a,c] (2.5)	882	178,009
Participates in other program(s) excluding SNAP[d]	49.9[b,c] (3.1)	11.1 (1.4)	39.0[b,c] (3.5)	849	183,557

[a,b,c] Given the key characteristic and number of breakfasts per week under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Table 2-10a. Row percentages of key sociodemographic characteristics associated with the frequency of the provision of lunch from home during a typical school week for children in kindergarten or higher grades at 72 months

Key sociodemographic characteristic	Days of the school week lunch provided from home % (standard error) 0-1 days	2-3 days	4-5 days	Unweighted *n*	Weighted *n*
Maternal ethnorace					
Non-Hispanic Black	59.4[a,b] (2.7)	12.6 (1.5)	28.0[a] (2.1)	604	87,960
Non-Hispanic White	48.4[a,c] (3.3)	16.8[a] (1.8)	34.8[b] (3.0)	590	114,569
Non-Hispanic Other	54.1[b] (6.9)	16.3 (5.9)	29.6 (6.0)	115	26,035
Hispanic	70.6[c] (2.2)	8.9[a] (1.3)	20.4[a,b] (1.9)	770	202,752
Parity					
Firstborn	56.5[a] (2.8)	15.4[a] (1.9)	28.1 (2.2)	848	184,099
Second born	61.8 (3.1)	11.0 (1.3)	27.2 (2.5)	570	116,096
Third or subsequent born	68.0[a] (2.8)	8.9[a] (1.4)	23.1 (2.0)	661	131,121
Reported weight status of mother					
Normal or underweight	60.3 (2.8)	11.1 (1.6)	28.6 (2.6)	559	123,516
Overweight	54.4[a] (2.8)	14.8 (1.8)	30.9[a] (2.3)	617	122,204
Obese	66.9[a] (2.7)	11.3 (1.4)	21.8[a] (1.8)	903	185,596
Maternal educational attainment at 54 months					
High school or less	65.2[a] (1.8)	11.4 (1.1)	23.4[a] (1.7)	1,095	230,271
More than high school	57.2[a] (2.9)	13.2 (1.8)	29.6[a] (2.0)	984	201,045
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	71.2[a,b] (2.2)	9.5 (1.4)	19.3[a] (1.9)	806	162,040
>75% of FPG and ≤130% of FPG	61.5[a,c] (3.2)	13.9 (1.9)	24.6[b] (2.5)	601	129,564
>130% of FPG	50.1[b,c] (2.8)	13.8 (1.8)	36.0[a,b] (2.4)	672	139,713
Participation in non-WIC benefit programs					
Does not participate in any other programs[d]	39.7[a,b] (4.2)	10.4 (2.3)	49.9[a,b] (3.8)	348	69,750
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	69.9[a,c] (2.5)	11.6 (1.4)	18.5[a,c] (1.9)	882	178,009
Participates in other program(s) excluding SNAP[d]	61.6[b,c] (2.1)	13.5 (1.9)	24.9[b,c] (1.8)	849	183,557
Timing of WIC enrollment					
1st trimester	69.1[a,b,c] (2.9)	8.0[a] (1.2)	23.0[a] (2.4)	652	138,541
2nd trimester	60.0[a] (2.3)	15.5[a] (2.0)	24.4[b] (1.7)	839	173,399
3rd trimester	53.8[b] (3.1)	12.8 (2.7)	33.4[a,b] (2.9)	310	64,511
Postnatal	55.7[c] (3.2)	11.9 (2.0)	32.4 (3.0)	278	54,865
Pattern of study child's WIC participation					
1st year only	51.2 (7.1)	7.4 (3.0)	41.4 (8.2)	84	36,379
2nd or 3rd year only	59.5 (4.4)	12.7 (3.6)	27.7 (3.2)	179	75,266
4th or 5th year only	58.9 (4.9)	17.8 (3.4)	23.4 (4.7)	134	65,316
Consistently	68.8 (3.3)	11.0 (1.8)	20.2 (2.7)	418	197,655
Intermittently	49.0 (6.8)	14.1 (4.2)	37.0 (6.1)	124	57,027

[a,b,c] Given the key characteristic and number of lunches per week under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Table 2-10b. Row percentages of key sociodemographic characteristics associated with the frequency of the provision of lunch from school during a typical school week for children in kindergarten or higher grades at 72 months

Key sociodemographic characteristic	Days of the school week lunch provided from school % (standard error)			Unweighted *n*	Weighted *n*
	0-1 days	2-3 days	4-5 days		
Maternal ethnorace					
Non-Hispanic Black	23.4 (2.8)	9.8 (1.4)	66.7[a] (3.3)	604	87,960
Non-Hispanic White	34.6[a] (3.1)	14.9[a] (1.6)	50.5[a,b] (3.2)	590	114,569
Non-Hispanic Other	29.3 (6.2)	11.4 (4.5)	59.3 (6.6)	115	26,035
Hispanic	16.3[a] (1.4)	7.6[a] (1.2)	76.1[b] (1.9)	770	202,752
Parity					
Firstborn	25.4 (2.2)	12.8[a] (1.6)	61.8[a] (2.7)	848	184,099
Second born	22.8 (2.3)	9.9 (1.4)	67.3 (3.0)	570	116,096
Third or subsequent born	21.3 (2.1)	6.9[a] (1.1)	71.9[a] (2.7)	661	131,121
Reported weight status of mother					
Normal or underweight	25.8 (2.4)	10.3 (1.4)	63.9[a] (2.6)	559	123,516
Overweight	26.9[a] (2.7)	12.7 (1.6)	60.3[b] (3.0)	617	122,204
Obese	19.6[a] (2.0)	8.5 (1.1)	72.0[a,b] (2.4)	903	185,596
Marital status					
Married	28.2[a] (2.1)	11.1 (1.5)	60.7[a] (2.9)	849	186,141
Not married	19.8[a] (1.7)	9.6 (1.0)	70.7[a] (2.1)	1,230	245,175
Maternal educational attainment at 54 months					
High school or less	19.3[a] (1.9)	9.1 (1.1)	71.6[a] (1.9)	1,095	230,271
More than high school	28.2[a] (2.0)	11.4 (1.6)	60.4[a] (2.6)	984	201,045
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	15.0[a,b] (1.6)	7.1[a] (1.1)	78.0[a,c] (1.9)	806	162,040
>75% of FPG and ≤130% of FPG	22.0[a,c] (2.2)	11.6 (1.7)	66.5[a,c] (2.8)	601	129,564
>130% of FPG	34.6[b,c] (2.5)	12.6[a] (1.8)	52.9[b,c] (2.9)	672	139,713
Participation in non-WIC benefit programs					
Does not participate in any other programs[d]	50.5[a,b] (3.9)	8.9 (2.1)	40.6[a,b] (4.3)	348	69,750
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	14.1[a,c] (1.5)	9.2 (1.2)	76.7[a,c] (2.3)	882	178,009
Participates in other program(s) excluding SNAP[d]	22.1[b,c] (1.9)	11.7 (1.5)	66.2[b,c] (1.9)	849	183,557
Timing of WIC enrollment					
1st trimester	20.5[a,c] (2.4)	7.0[a] (1.1)	72.5[a,b] (2.9)	652	138,541
2nd trimester	21.1[b,e] (1.7)	12.6[a] (1.4)	66.3 (1.8)	839	173,399
3rd trimester	28.9[a,b] (2.7)	10.4 (2.4)	60.6[a] (3.1)	310	64,511
Postnatal	31.8[c,e] (3.0)	10.3 (1.7)	57.9[b] (3.2)	278	54,865
Pattern of study child's WIC participation					
1st year only	39.2[a] (6.8)	7.1 (2.9)	53.7[a] (6.0)	84	36,379
2nd or 3rd year only	28.8 (3.2)	10.8 (3.5)	60.5[b] (4.4)	179	75,266
4th or 5th year only	16.6 (3.7)	16.9 (3.6)	66.5 (4.8)	134	65,316
Consistently	17.7[a] (2.6)	7.7 (1.3)	74.6[a,b] (3.0)	418	197,655
Intermittently	30.6 (5.5)	14.5 (4.3)	54.9 (6.1)	124	57,027

[a,b,c] Given the key characteristic and number of lunches per week under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[e] Given the key characteristic and number of lunches per week under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

Pre-/Post-COVID ED Analysis. The frequency of the provision of breakfast and lunch foods from home and school was significantly associated with whether the 72-month interview occurred pre- or post-COVID ED. Table 2-11 presents the findings by temporal timing of the 72-month interview. Compared with the percentage of children who reported receiving breakfast or lunch from school before the pandemic, there was a significant increase in the percentage of children who reported receiving these meals from schools after the pandemic started. Post-COVID ED, approximately half of study families reported that their child was receiving breakfast foods 4-5 days a week from school, and nearly three-quarters of families reported that their study child was receiving lunch foods 4-5 days a week from school. It is important to note that in these analyses "from school" does not necessarily mean that the meal was eaten at school. After the COVID ED, the USDA provided waivers for schools to provide meals in socially distanced ways. When the school was closed for educational purposes, the family may have been able to collect food from a school and eat it at home or in another setting.

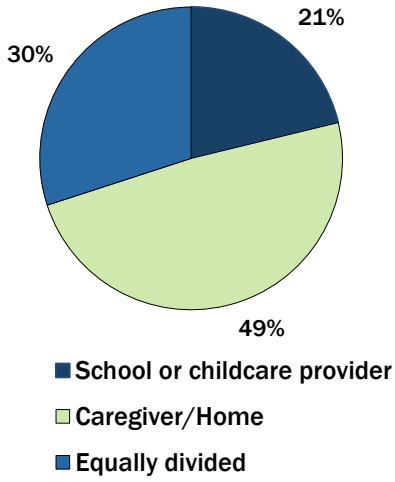
Table 2-11. The frequency of provision of breakfast and lunch from home and school for children in kindergarten or higher grades by whether the 72-month interview occurred prior to the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) on March 13, 2020, or after it

Meals by source and temporal timing of the 72-month interview	Days of the school week meals provided % (standard error)			Unweighted *n*	Weighted *n*
	0-1 days	2-3 days	4-5 days		
Breakfast from home					
Pre-COVID ED	29.2[a] (2.0)	11.5 (1.0)	59.3[a] (2.0)	1,582	345,813
Post-COVID ED	42.5[a] (3.5)	10.4 (1.5)	47.0[a] (3.4)	497	85,503
Breakfast from school					
Pre-COVID ED	51.7[a] (2.4)	10.3 (1.1)	38.0[a] (2.4)	1,582	345,813
Post-COVID ED	42.1[a] (3.6)	8.1 (1.4)	49.8[a] (3.6)	497	85,503
Lunch from home					
Pre-COVID ED	59.4[a] (2.0)	13.5[a] (1.2)	27.1 (1.5)	1,582	345,813
Post-COVID ED	69.8[a] (3.0)	7.3[a] (1.2)	23.0 (2.6)	497	85,503
Lunch from school					
Pre-COVID ED	24.3 (1.5)	11.4[a] (1.0)	64.3[a] (2.0)	1,582	345,813
Post-COVID ED	19.8 (2.6)	5.4[a] (1.1)	74.7[a] (2.8)	497	85,503

[a] Given the type/source of meal and the number of these meals under analysis, pairs of matching letters in a column indicate a statistically significant difference between pre- and post-COVID ED percentages at $p \leq 0.05$.

The study also inquired about the provision of snacks, asking who provides the majority of the child's snacks during the school week. Response options included the school or childcare provider, you (i.e., the mother/caregiver), or equally divided between these two sources. Figure 2-7 presents the distribution of children in kindergarten or higher grades by who provides the majority of their snacks during the typical school week. Nearly half of study children in kindergarten or higher grades (49%) received their snacks during the school week from their caregiver (i.e., home). An estimated 30 percent received equal portions of their snacks from home and school or their childcare provider. Twenty-one percent received the majority of their snacks from school or their childcare provider.

Figure 2-7. Percentage of children in kindergarten or higher grades at 72 months[a] by source of snacks during the school week



[a] Unweighted *n*=2,063; weighted *n*=428,004. Appendix Table B2a-7 offers additional detail.

Among children in kindergarten or higher grades, the source of their snacks during the school week was significantly associated with maternal educational attainment at 54 months, income poverty, and participation in non-WIC benefit programs. Table 2-12 presents the findings.

Table 2-12. Row percentages of key sociodemographic characteristics associated with provision of snacks among study children in kindergarten or higher grades at 72 months

Key sociodemographic characteristic	Snack provision during the school week % (standard error)			Unweighted *n*	Weighted *n*
	School or childcare provider	Caregiver	Equally divided		
Maternal educational attainment at 54 months					
High school or less	25.1[a] (2.2)	41.5[a] (2.3)	33.4[a] (1.6)	1,084	228,004
More than high school	16.8[a] (1.7)	57.1[a] (2.1)	26.1[a] (2.0)	979	200,000
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	25.7[a,b] (2.2)	44.7[a] (2.6)	29.6 (2.3)	797	159,948
>75% of FPG and ≤130% of FPG	19.2[a] (2.1)	48.5 (3.1)	32.3 (2.0)	599	129,306
>130% of FPG	17.9[b] (2.0)	53.8[a] (2.5)	28.3 (2.4)	667	138,750
Participation in non-WIC benefit programs					
Does not participate in any other programs[c]	15.8 (2.1)	58.4[a] (3.1)	25.8 (2.9)	344	69,022
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[c]	22.2 (1.9)	44.5[a] (2.6)	33.3 (2.2)	872	176,442
Participates in other program(s) excluding SNAP[c]	22.3 (2.5)	49.3 (2.8)	28.4 (1.7)	847	182,541

[a,b] Given the key characteristic and snack provider under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[c] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Pre-/Post-COVID ED Analysis. There was not a significant association, based on the chi-square test, between the provision of snacks and whether the interview occurred pre- or post-COVID ED. However, pairwise t-tests indicated that significantly different percentages of study children received the majority of their snacks from home pre- and post-COVID ED, 50 percent and 44 percent respectively. Similarly, significantly different percentages of students received the majority of their snacks from school or childcare pre- and post-COVID ED, 20 percent and 26 percent respectively.

Food Consumed At versus Away from Home. Because about two-thirds of study children get food from school for lunch, and schools typically offered meals in congregate settings,[55] analysis examined the percentage of total daily energy that is consumed at home and away from home. This

[55] With the declaration of the national health emergency, many school districts received waivers from USDA, allowing them to offer school meals in a socially distanced manner. During their closure, many schools transitioned to meal distribution programs that allowed for food to be distributed and eaten off-campus, typically at home.

analysis considered only where the food was eaten, not its source, and used a single day of dietary recall information, so outcomes reflect intakes on a given day.

On a given day at 72 months, study children consumed an average of about 81 percent of daily dietary energy (calories) at home and about 18 percent away from home. There were a small number of foods consumed for which the respondent did not report where it was eaten; hence, the percentages of daily dietary energy consumed at home and away from home do not sum to 100 percent.

Looking at the data by eating occasion, study children consumed an average of about 23 percent of their daily dietary energy at breakfast on a given day. About 87 percent of all calories consumed by study children for breakfast (breakfast calories) were consumed at home; about 13 percent were eaten away from home. Study children consumed an average of about 28 percent of their daily dietary energy at lunch on a given day. About 63 percent of all calories consumed for lunch (lunch calories) were consumed at home; about 36 percent were consumed away from home. Study children consumed an average of 28 percent of their daily dietary energy at dinner. About 90 percent of all calories consumed for dinner (dinner calories) were consumed at home, and nearly 10 percent were eaten away from home. At each of these eating occasions, less than 1 percent of daily energy was consumed in unknown settings.

The mean percentage of total energy consumed at home and the percentage consumed away from home on a given day differed significantly pre- and post-COVID ED. Pre-COVID ED, the mean percentage of total dietary energy consumed at home on a given day was 77 percent; post-COVID ED, the mean was 97 percent. Pre-COVID ED, the mean percentage of energy consumed away from home on a given day was 22 percent; post-COVID ED, it was 3 percent.

There were also statistically significant differences by eating occasion. Pre-COVID ED, an average of 84 percent of breakfast calories were eaten at home on a given day, 56 percent of lunch calories were, and 88 percent of dinner calories were. Post-COVID ED, an average of 98 percent of breakfast calories were eaten at home on a given day, 95 percent of lunch calories were, and 97 percent of dinner calories were. Given COVID-19 mitigation strategies, the shift toward home consumption—regardless of source—is not surprising.

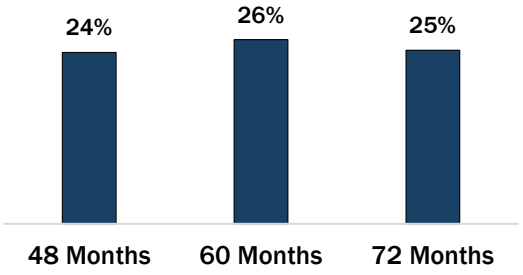
2.7 Participation in Federal Nutrition Programs at 72 Months

Given the percentage of families who reported low household incomes and a history of WIC participation, the analysis explored participation in Federal assistance programs such as WIC, SNAP, NSLP, SBP, and the Summer Food Service Program (SFSP). For school-based and summer nutrition assistance programs, respondents reported whether any children in the household participated in any of three programs: NSLP, SBP, and SFSP.

2.7.1 WIC Participation

Though study children were no longer age-eligible to continue participating with WIC after they turned 5 years old (60 months), families might have continued to participate with another eligible family member. Figure 2-8 shows the trend over time in study families reporting that they participated in WIC with a child other than the study child at select interview months. The percentage of families reporting that they had another child participating with WIC has been relatively stable since the study child was 4 years old, with about one-quarter of families indicating that they had at least one other non-study child participating with WIC.

Figure 2-8. Percentage of WIC ITFPS-2 families participating with WIC with a non-study child at select interview months[a]



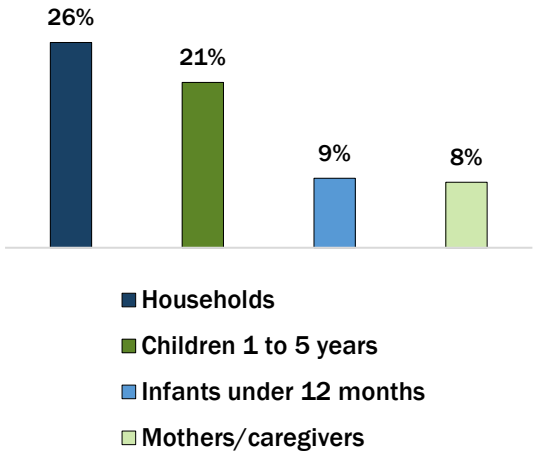
[a] At 48 months, unweighted *n*=2,568; weighted *n*=440,892. At 60 months, unweighted *n*=2,528; weighted *n*=441,124. At 72 months, unweighted *n*=2,136; weighted *n*=439,041. Appendix Table B2a-8 offers additional detail.

Historically, the survey has probed whether the family participated with a non-study child but has not asked whether the caregiver participated by herself. At the 72-month interview, the survey probed more deeply, inquiring about WIC participation by the mother, an infant, or a child between the ages of 1 and 5 years. Just over one-quarter (26%) of study families reported continued participation with WIC at the study child's 72-month interview (Figure 2-9). About 21 percent of study families reported that they participated with a child between the ages of 1 and 5 years old.

About 9 percent of study families reported that they participated with an infant under 12 months of age. Eight percent of mothers reported that they participated for themselves. Nearly 10 percent of families reported at least one family member in more than one of these categories of WIC participants (not shown).

Bivariate chi-square tests of association indicated significant associations between several key sociodemographic characteristics and WIC participation by a household member other than the study child. Table 2-13 presents significant associations by all categories analyzed: household, caregiver, infant under 12 months, and children ages 1 to 5 years. For this analysis, the structure of data collection differentially influenced the table presentation. Category of WIC participant was collected across three survey items, so associations with key sociodemographic characteristics in Table 2-13 were individually assessed for each type of participant. This format differs from previous and subsequent tables where the columns indicate different response options to a single survey item and a single chi-square test was used to assess the relationship. There were no reports of children ages 1 to 5 years receiving WIC or caregiver self-receiving WIC for study families that left WIC after the study child's first year of life; therefore, these associations could not be assessed.

Figure 2-9. Percentage of WIC ITFPS-2 mothers reporting family members received WIC when the study child is 72 months old by category of participant[a]



[a] Unweighted *n*=2,124; weighted *n*=439,039. Appendix Table B2a-9 offers additional detail.

Note: Percentages for specific types of participants may sum to more than the percentage of households participating because households may have more than one type of participant.

Table 2-13. Row percentages of key sociodemographic characteristics associated with participation in WIC when the study child is 72 months old

Key sociodemographic characteristic	Participates in WIC at 72 months[a] % (standard error) Household	Caregiver	Infant under 12 months	Children 1 to 5 years	Unweighted *n*	Weighted *n*
Maternal ethnorace[b]						
Non-Hispanic Black	25.3 (1.9)	6.3 (1.5)[c]	10.9 (1.5)[c]	21.5 (2.0)	619	90,005
Non-Hispanic White	21.0 (2.3)	7.1 (1.4)[c]	7.0 (1.2)[c]	16.3 (2.0)	610	118,390
Non-Hispanic Other	27.7 (4.2)	3.6 (2.4)[c]	8.9 (3.6)[c]	23.3 (3.5)	118	26,602
Hispanic	28.4 (2.1)	10.2 (1.4)[c]	8.7 (1.4)[c]	22.5 (1.7)	789	204,044
Maternal age at study child's birth						
16-19 years	40.2[d] (4.7)	13.7[d] (2.7)	15.7 (3.7)	35.5[d,e] (5.0)	196	46,495
20-25 years	28.7[e] (1.9)	10.5[e] (1.5)	9.8 (1.2)	22.5[d,f] (1.7)	868	178,978
26+ years	20.0[d,e] (1.6)	5.0[d,e] (0.8)	6.2 (1.1)	15.9[e,f] (1.5)	1,072	213,569
Parity						
Firstborn	30.6[d] (1.9)	9.6 (1.0)[c]	9.8 (1.5)[c]	25.2[d] (1.8)	866	185,329
Second born	25.4 (2.3)	8.4 (1.7)[c]	9.0 (1.2)[c]	20.0 (2.1)	588	119,010
Third or subsequent born	19.2[d] (2.0)	6.0 (1.2)[c]	6.9 (1.5)[c]	14.9[d] (1.4)	682	134,702
Marital status[g]						
Married	24.5 (2.0)[c]	6.4 (1.1)	6.2 (0.8)	20.6 (1.6)[c]	868	187,700
Not married	26.6 (1.8)[c]	9.5 (1.0)	10.7 (1.4)	20.7 (1.6)[c]	1,268	251,341
Maternal educational attainment at 54 months[g]						
High school or less	29.6 (2.1)	9.6 (1.0)	11.5 (1.2)	22.8 (1.7)	1,130	235,738
More than high school	21.2 (1.7)	6.4 (1.2)	5.5 (0.9)	18.2 (1.6)	1,006	203,303
Employment status						
Full-time	17.4[d] (1.8)	4.6[d] (1.0)	5.5[d] (1.1)	14.0[d] (1.5)	842	169,669
Part-time	22.8[e] (2.4)	7.8 (1.2)	8.3 (1.5)	17.6[e] (2.3)	426	89,927
Not employed	35.0[c,e] (2.4)	11.7[d] (1.4)	12.0[d] (1.4)	28.5[d,e] (2.2)	868	179,444
Income poverty						
≤75% of Federal Poverty Guidelines (FPG)	33.9[d] (2.2)	10.5[d] (1.3)	11.1[d] (1.5)	27.5[d] (2.3)	833	166,295
>75% of FPG and ≤130% of FPG	28.2[e] (2.6)	9.4 (2.2)	11.1[e] (1.8)	22.5[e] (2.5)	618	132,546
>130% of FPG	13.5[d,e] (1.6)	4.2[d] (1.0)	3.7[d,e] (0.9)	10.7[d,e] (1.6)	685	140,200
Participation in non-WIC benefit programs						
Does not participate in any other program[h]	8.5[d,e] (1.9)	1.8[d,e] (0.7)	2.3[d,e] (0.9)	6.6[d,e] (1.5)	358	71,611
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[h]	34.3[e,f] (2.5)	11.8[e,f] (1.3)	13.2[e,f] (1.6)	27.5[e,f] (2.4)	906	181,856
Participates in other program(s) excluding SNAP[h]	23.9[d,f] (1.6)	7.1[d,f] (1.3)	6.8[d,f] (1.2)	19.3[d,f] (1.3)	872	185,574

Table 2-13. Row percentages of key sociodemographic characteristics associated with participation in WIC when the study child is 72 months old (continued)

Key sociodemographic characteristic	Participates in WIC at 72 months[a] % (standard error) Household	Caregiver	Infant under 12 months	Children 1 to 5 years	Unweighted *n*	Weighted *n*
Timing of WIC enrollment						
1st trimester	30.8[d] (2.5)	9.6[d] (1.2)	10.1 (1.2)[c]	25.1[d,e] (2.1)	664	138,295
2nd trimester	27.0[e] (2.0)	8.9[e] (1.4)	9.2 (1.7)[c]	21.2 (1.7)	859	176,965
3rd trimester	20.2 (3.2)	7.6 (1.8)	8.1 (2.2)[c]	15.6[d] (2.5)	316	65,935
Postnatal	15.8[d,e] (2.2)	2.9[d,e] (0.9)	4.5 (1.0)[c]	14.1[e] (2.2)	297	57,847
Pattern of study child's WIC participation[i]						
1st year only	1.6[d,e,f] (1.5)	NT[j]	1.6 (1.5)[c]	NT[j]	86	36,990
2nd or 3rd year only	9.2[k,l,m] (2.6)	NT[j]	8.6 (2.6)[c]	NT[j]	182	76,172
4th or 5th year only	30.4[d,k] (6.4)	NT[j]	15.3 (2.7)[c]	NT[j]	143	68,640
Consistently	37.4[e,l] (2.7)	NT[j]	12.7 (2.1)[c]	NT[j]	423	198,657
Intermittently	29.7[f,m] (5.9)	NT[j]	12.2 (4.2)[c]	NT[j]	128	58,969

[a] Category of participant type was assessed through individual survey items. Respondents could mark more than one. Percentages across sources will not sum to 100 percent.

[b] The chi-square test was significant at $p \leq 0.05$ but none of the t-tests indicated significant pairwise differences in percentages.

[c] There was not a significant association. Data are presented for completeness.

[d,e,f] Given the key characteristic and category of WIC participant, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[g] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

[h] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[i] This analysis uses the longitudinal cohort.

[j] NT=Not tested. At least one cell was empty so the chi-square test was not run.

[k,l,m] Given the key sociodemographic characteristic and WIC participant, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

Pre-/Post-COVID ED Analysis. In addition to associations with key sociodemographic characteristics, there was a significant association between WIC participation and whether the interview took place pre- or post-COVID ED. Table 2-14 presents the findings.

Table 2-14. Row percentages of types of WIC participants by whether the 72-month interview occurred prior to the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) on March 13, 2020, or after it

Temporal timing of 72-month interview[a]	Participates in WIC at 72 months % (standard error)				Unweighted *n*	Weighted *n*
	Household	Caregiver	Infant under 12 months	Children 1 to 5 years		
Pre-COVID ED	24.4 (1.5)	6.9 (1.0)	8.0 (1.0)[b]	19.6 (1.2)	1,627	353,794
Post-COVID ED	30.9 (2.8)	13.3 (2.0)	11.6 (1.7)[b]	24.9 (2.5)	509	85,247

[a] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

[b] There was not a significant association. Data are presented for completeness.

2.7.2 SNAP Participation

At 72 months, 41 percent of study families participated in SNAP. Though not significantly different than the percentage participating at 60 months (43%), this is significantly different than the percentage participating at 48 months (46%).

Bivariate chi-square analyses indicated significant associations between SNAP participation at 72 months and several key sociodemographic characteristics. Table 2-15 presents the findings.

Pre-/Post-COVID ED Analysis. There was not a significant association between SNAP participation and whether the interview was administered pre- or post-COVID ED.

Table 2-15. Row percentages of key sociodemographic characteristics associated with participation in the Supplemental Nutrition Assistance Program (SNAP) when the study child is 72 months old

Key sociodemographic characteristics	Households reporting SNAP participation at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	49.6[a] (2.7)	619	90,005
Non-Hispanic White	41.2 (3.1)	610	118,390
Non-Hispanic Other	28.6[a] (4.7)	118	26,602
Hispanic	39.3 (2.3)	789	204,044
Parity			
Firstborn	34.5[a] (2.3)	866	185,329
Second born	42.6 (3.0)	588	119,010
Third or subsequent born	49.3[a] (2.2)	682	134,702
Marital status[b]			
Married	24.2 (1.6)	868	187,700
Not married	54.1 (1.9)	1,268	251,341
Maternal educational attainment at 54 months[b]			
High school or less	50.6 (2.0)	1,130	235,738
More than high school	30.4 (1.9)	1,006	203,303
Employment status			
Full-time	28.0[a,c] (1.9)	842	169,669
Part-time	44.5[a] (3.0)	426	89,927
Not employed	52.3[c] (2.4)	868	179,444
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	67.0[a,c] (1.8)	833	166,295
>75% of FPG and ≤130% of FPG	38.0[a,d] (2.8)	618	132,546
>130% of FPG	14.2[c,d] (1.5)	685	140,200
Household food security status			
High or marginal	37.8[a] (1.7)	1,658	349,579
Low	47.9[c] (3.6)	264	53,728
Very low	65.0[a,c] (3.7)	214	35,735
Timing of WIC enrollment			
1st trimester	41.7[a] (2.2)	664	138,295
2nd trimester	46.0[c] (2.5)	859	176,965
3rd trimester	37.7 (3.0)	316	65,935
Postnatal	29.7[a,c] (2.5)	297	57,847
Pattern of study child's WIC participation[e]			
1st year only	21.7[a,c] (5.7)	86	36,990
2nd or 3rd year only	31.3[d] (4.6)	182	76,172
4th or 5th year only	49.8[a] (5.3)	143	68640
Consistently	48.6[c,d] (3.7)	423	198,657
Intermittently	30.9 (4.7)	128	58,969

[a] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[b] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

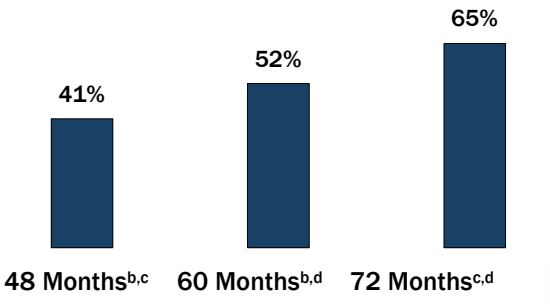
[c,d] Given the key sociodemographic characteristic under analysis, pairs of matching letters within a sociodemographic category indicate statistically significant differences at $p \leq 0.05$.

[e] This analysis uses the longitudinal cohort.

2.7.3 Household Participation in School and Summer Food Programs

Since the beginning of the study, select interviews have probed whether *any* children in the household participated in school and summer nutrition assistance programs, specifically NSLP, SBP, or SFSP. Figure 2-10 presents the percentage of families participating in these programs at select interview months. Consistent with the increasing numbers of study children becoming age-eligible for formal schooling, the percentage of study participants reporting participation by someone in the household increased significantly between study child age 48 months and 60 months (from 41% to 52%) and, again, between study child age 60 and 72 months (from 52% to 65%).

Figure 2-10. Percentage of study participants reporting that someone in the household participates in the National School Lunch Program (NSLP), the School Breakfast Program (SBP), or the Summer Food Service Program (SFSP)[a]



[a] At 48 months, unweighted *n*=2,559; weighted *n*=439,680. At 60 months, unweighted *n*=2,503; weighted *n*=437,645. At 72 months, unweighted *n*=2,136; weighted *n*=439,041. Appendix Table B2a-10 offers additional detail.

[b,c,d] Pairwise differences between percentages are significantly different at $p \leq 0.05$ after Bonferroni adjustment for multiple comparisons.

The key sociodemographic characteristics significantly associated with school and summer food program participation at 72 months were the same as those significantly associated with participation in SNAP. Table 2-16 presents the findings for participation in NSLP, SBP, or SFSP.

Table 2-16. Row percentages of key sociodemographic characteristics associated with participation in the National School Lunch Program (NSLP), the School Breakfast Program (SBP), or the Summer Food Service Program (SFSP) when the study child is 72 months old

Key sociodemographic characteristics	Households reporting NSLP, SBP, or SFSP participation at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	72.6[a] (2.0)	619	90,005
Non-Hispanic White	57.9[a] (2.8)	610	118,390
Non-Hispanic Other	59.6 (5.0)	118	26,602
Hispanic	65.5 (3.8)	789	204,044
Parity			
Firstborn	51.5[a,b] (3.3)	866	185,329
Second born	69.9[a,c] (2.2)	588	119,010
Third or subsequent born	78.1[b,c] (2.0)	682	134,702
Marital status[d]			
Married	59.9 (3.2)	868	187,700
Not married	68.0 (2.5)	1,268	251,341
Maternal educational attainment at 54 months[d]			
High school or less	70.7 (2.1)	1,130	235,738
More than high school	57.6 (3.1)	1,006	203,303
Employment status			
Full-time	59.2[a] (2.7)	842	169,669
Part-time	66.7 (3.5)	426	89,927
Not employed	68.6[a] (2.6)	868	179,444
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	73.3[a] (3.3)	833	166,295
>75% of FPG and ≤130% of FPG	70.7[b] (3.2)	618	132,546
>130% of FPG	48.6[a,b] (2.7)	685	140,200
Household food security status			
High or marginal	61.9[a,b] (2.3)	1,658	349,579
Low	72.6[a] (3.6)	264	53,728
Very low	78.8[b] (4.1)	214	35,735
Timing of WIC enrollment			
1st trimester	68.1[a] (3.9)	664	138,295
2nd trimester	68.4[b,c] (2.5)	859	176,965
3rd trimester	58.4[b] (2.9)	316	65,935
Postnatal	51.2[a,c] (3.0)	297	57,847
Pattern of study child's WIC participation			
1st year only	44.7[a,b] (5.8)	86	36,990
2nd or 3rd year only	54.6[c] (4.8)	182	76,172
4th or 5th year only	75.5[a,e] (5.1)	143	68,640
Consistently	76.4[b,c,f] (3.6)	423	198,657
Intermittently	53.8[e,f] (4.9)	128	58,969

[a,b,c] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

[e,f] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

2.8 Purchasing WIC Foods and Referrals for Other Services

While participating with WIC, study participants received either paper vouchers or an electronic benefit transfer (EBT) card to purchase nutritious supplemental foods at authorized retailers. Additionally, WIC participants may have received referrals that connected participants with other organizations to help with social services including housing, healthcare, childcare, or legal services, for example. The study explored continued purchasing of WIC foods and the continued use of referrals.

2.8.1 Purchasing WIC Foods

At the 72-month interview, a time when the study children are no longer age-eligible for WIC, WIC ITFPS-2 probed for the first time whether study families continued to purchase select "WIC foods" (i.e., foods that may be eligible for purchase as part of the WIC food packages). Specifically, the instrument asked whether the participant continued to purchase the following items:

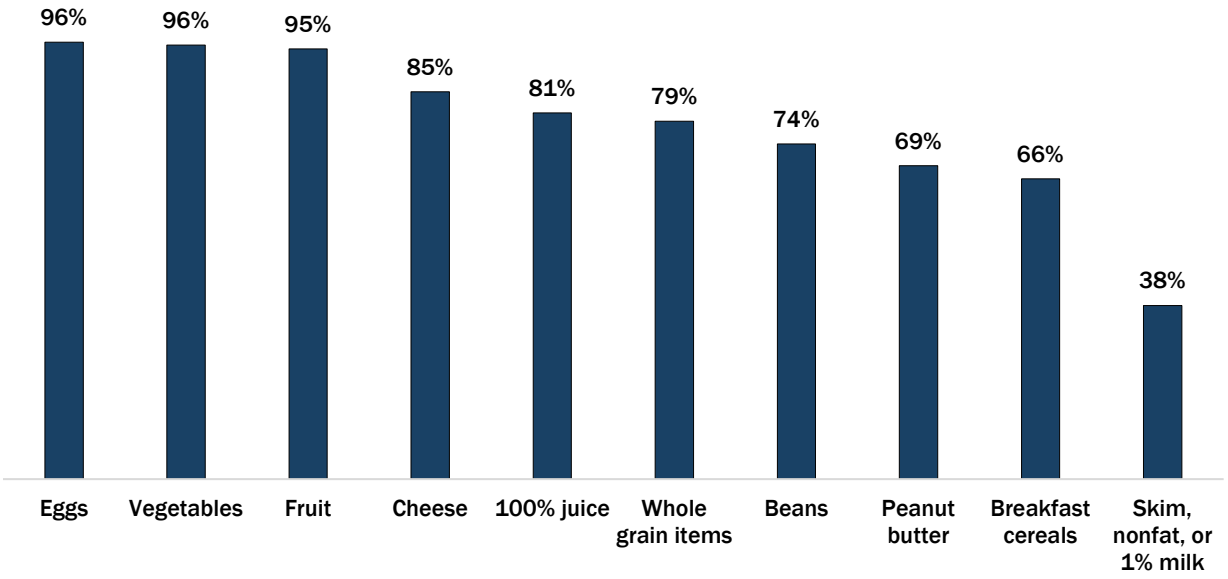
- Hot or cold breakfast cereals;
- Cheese, not including processed cheese spreads or dips;
- Eggs;
- 100 percent juice;
- Fruit, including fresh, frozen, dried, or canned;
- Skim, nonfat, or 1 percent milk;
- Peanut butter;
- Beans, including dried or canned whole beans;
- Vegetables, including fresh, frozen, or canned; and/or
- Whole grain bread, including whole wheat or corn tortillas or brown rice.

Previous analysis of WIC ITFPS-2 data when study children were age 5 years old indicated that nearly all participants purchased items from the WIC food package, whether the families continued with WIC or not (Borger et al., 2022). To explore whether healthy food purchasing patterns

continued without the ongoing influence of WIC, the analysis in this study was limited to those no longer participating with WIC.

Among families with no household members participating with WIC, more than 9 out of 10 indicated that they continued to purchase eggs (96%), fruit (95%), and vegetables (96%) at the 72-month interview. Almost 7 in 10 study families no longer participating with WIC indicated that they continued to purchase peanut butter (69%) or breakfast cereals (66%). Slightly less than 4 in 10 study families indicated that they continued to purchase skim, nonfat, or 1 percent milk (38%). Figure 2-11 presents the percentage of study participants indicating that they continued to purchase WIC foods among those who are no longer participating in WIC.

Figure 2-11. Among those households no longer participating with WIC, the percentage of study mothers reporting at 72 months that they continued to purchase select foods that may be eligible for purchase as part of the WIC food packages[a]



[a] Unweighted *n*=1,628 and weighted *n*=325,911. Appendix Table B2a-11 offers additional detail.

Though there are many associations between key characteristics and the individual foods examined, the focus of the reported analyses is on the four least popular foods or beverages: beans; peanut butter; breakfast cereals; and skim, nonfat, or 1 percent milk. Tables 2-17a through 2-17d present the findings for each type of food. Families who consistently participated with WIC during the study child's first 5 years of life more frequently reported purchasing skim, nonfat, or 1 percent milk when the study child was 6 years old than those who participated with WIC for shorter spans of time

(Table 2-17d). This bivariate association does not control for other factors, so it should be interpreted with caution.

Table 2-17a. Among those no longer participating with WIC, row percentages of key sociodemographic characteristics associated with purchasing beans when the study child is 72 months old

Key sociodemographic characteristics	Percentage of households purchasing beans at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	66.2[a] (4.2)	473	67,275
Non-Hispanic White	63.2[b] (3.4)	486	93,456
Non-Hispanic Other	69.8 (5.9)	89	19,230
Hispanic	84.7[a,b] (2.7)	580	145,951
Maternal age at study child's birth			
16-19 years	57.7[a] (7.2)	123	27,801
20-25 years	70.8[b] (2.9)	623	127,329
26+ years	78.7[a,b] (2.4)	882	170,781
Parity			
Firstborn	68.1[a] (3.1)	621	128,423
Second born	72.2 (3.6)	451	88,705
Third or subsequent born	82.0[a] (2.5)	556	108,782
Marital status[c]			
Married	78.8 (2.2)	669	141,706
Not married	70.0 (3.1)	959	184,205
Employment status[d]			
Full-time	69.9 (2.8)	709	140,147
Part-time	76.9 (2.8)	325	69,437
Not employed	76.7 (2.8)	594	116,327

[a,b] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[c] Follow-up pairwise t-tests were not run because the chi-square test was sufficient.

[d] The chi-square test was significant at $p \leq 0.05$ but none of the t-tests indicated significant pairwise differences in percentages.

Table 2-17b. Among those no longer participating with WIC, row percentages of key sociodemographic characteristics associated with purchasing peanut butter when the study child is 72 months old

Key sociodemographic characteristics	Percentage of households purchasing peanut butter at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	69.5[a] (3.5)	473	67,275
Non-Hispanic White	85.1[a,b] (2.2)	486	93,456
Non-Hispanic Other	72.0 (5.5)	89	19,230
Hispanic	58.1[a] (3.0)	580	145,951
Parity			
Firstborn	64.1[a] (4.0)	621	128,423
Second born	69.3 (3.1)	451	88,705
Third or subsequent born	74.7[a] (2.4)	556	108,782
Household food security status			
High or marginal	67.0[a,b] (2.6)	1,266	261,309
Low	77.8[a] (4.3)	197	37,949
Very low	76.5[b] (3.5)	165	26,652
Timing of WIC enrollment			
1st trimester	69.9 (3.8)	475	95,580
2nd trimester	68.4 (3.4)	651	129,035
3rd trimester	60.9[a] (3.5)	252	52,586
Postnatal	77.8[a] (3.8)	250	48,710

[a,b] Given the key characteristic, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

Table 2-17c. Among those no longer participating with WIC, row percentages of key sociodemographic characteristics associated with purchasing hot or cold breakfast cereals when the study child is 72 months old

Key sociodemographic characteristics	Percentage of households purchasing hot or cold breakfast cereals at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	65.0 (4.1)	473	67,275
Non-Hispanic White	57.1[a] (2.8)	486	93,456
Non-Hispanic Other	58.3 (6.8)	89	19,230
Hispanic	73.3[a] (3.2)	580	145,951
Parity			
Firstborn	59.3[a] (3.0)	621	128,423
Second born	67.8 (3.5)	451	88,705
Third or subsequent born	72.6[a] (2.0)	556	108,782
Employment status[b]			
Full-time	61.7 (2.6)	709	140,147
Part-time	68.4 (3.2)	325	69,437
Not employed	69.9 (2.8)	594	116,327
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	72.2[a] (2.6)	569	109,673
>75% of FPG and ≤130% of FPG	69.0[c] (2.6)	459	95,026
>130% of FPG	58.1[a,c] (2.3)	600	121,211
Participation in non-WIC benefit programs			
Does not participate in any other programs[d]	52.4[a,c] (3.0)	326	65,326
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	71.0[a] (2.1)	616	119,382
Participates in other program(s) excluding SNAP[d]	68.2[c] (2.9)	686	141,203
Timing of WIC enrollment			
1st trimester	75.6[a,c] (3.2)	475	95,580
2nd trimester	65.7[a,e] (2.8)	651	129,035
3rd trimester	50.4[c,e,f] (3.0)	252	52,586
Postnatal	65.1[f] (3.6)	250	48,710
Pattern of study child's WIC participation[g]			
1st year only	52.5 (7.1)	85	36,406
2nd or 3rd year only	56.8 (5.4)	166	68,977
4th or 5th year only	71.5[a] (5.1)	107	47,800
Consistently	74.7[c] (3.8)	280	124,317
Intermittently	44.1[a,c] (6.3)	95	41,463

[a] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[b] The chi-square test was significant at $p \leq 0.05$ but none of the t-tests indicated significant pairwise differences in percentages.

[c] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[e,f] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[g] This analysis uses the longitudinal cohort.

Table 2-17d. Among those no longer participating with WIC, row percentages of key sociodemographic characteristics associated with purchasing skim, nonfat, or 1 percent milk when the study child is 72 months old

Key sociodemographic characteristics	Percentage of households purchasing skim, nonfat, or 1% milk at 72 months % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	27.8[a] (2.1)	473	67,275
Non-Hispanic White	28.2[b] (2.4)	486	93,456
Non-Hispanic Other	33.5[c] (4.8)	89	19,230
Hispanic	50.1[a,b,c] (2.6)	580	145,951
Pattern of study child's WIC participation[d]			
1st year only	35.2 (5.6)	85	36,406
2nd or 3rd year only	24.4[a] (4.0)	166	68,977
4th or 5th year only	37.4 (6.6)	107	47,800
Consistently	52.4[a,b] (3.6)	280	124,317
Intermittently	30.2[b] (6.5)	95	41,463

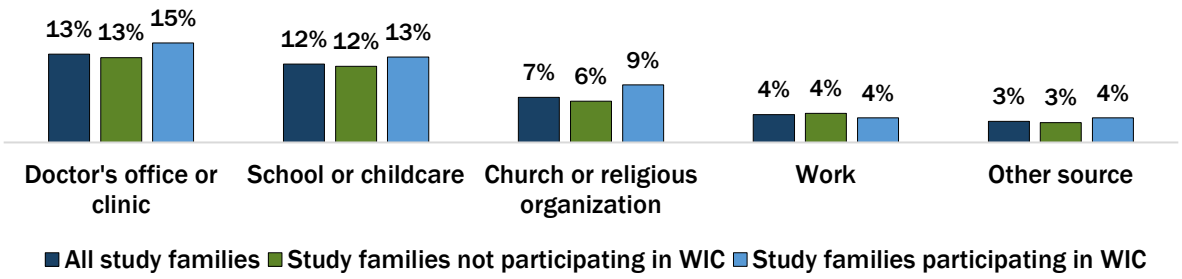
[a,b,c] Given the key sociodemographic characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[d] This analysis uses the longitudinal cohort.

2.8.2 Referrals for Other Services

At the 72-month interview, about 13 percent of all study participants indicated that they received referrals to other entities for non-WIC social services from their WIC site when the study child was receiving WIC benefits. At this same interview, about 23 percent of all study participants indicated that they received referrals *from non-WIC sources* during the study child's sixth year (i.e., after the study child was no longer eligible for WIC). Figure 2-12 presents non-WIC sources of referrals during the study child's sixth year for all study participants and for those study families by WIC participation status at 72 months. Survey respondents were asked to indicate all sources used.

Figure 2-12. Non-WIC sources of referrals for services during the study child's sixth year for all study families[a] and for study families by WIC participation status at 72 months[b]



[a] Unweighted *n*=2,133; weighted *n*=439,795. Appendix Table B2a-12 offers additional detail.

[b] Study families not participating in WIC: unweighted *n*=1,626; weighted *n*=324,769. Study families participating in WIC: unweighted *n*=506; weighted *n*=112,840.

Among all participants, receipt of referrals for services was associated with maternal ethnorace, marital status, maternal educational attainment at 54 months, employment status, household food security, participation in non-WIC benefit programs, and pattern of WIC participation. Table 2-18 presents significant associations by all service sources analyzed: work, school or childcare, church or religious organization, doctor's office or clinic, or other (unspecified). Because source information was collected across multiple survey items, the associations with key sociodemographic characteristics in Table 2-18 were individually assessed for each source. The format of Table 2-18 represents a departure from the majority of tables presented in this chapter where the columns indicate different response options to a single survey item and a single chi-square test was used to assess the relationship.

Pre-/Post-COVID ED Analysis. There was not a significant association between using any non-WIC source for referrals and whether the interview was administered pre- or post-COVID ED. However, among all study participants, there was a significant association between seeking referrals from WIC when the study child was receiving WIC benefits. Among families who took their 72-month interview pre-COVID ED, 12 percent reported seeking referrals while participating with WIC for the study child; among those who took their 72-month interview post-COVID ED, 16 percent sought referrals from WIC during the child's tenure with the program. The difference was statistically significant.

Table 2-18. Row percentages of key sociodemographic characteristics associated with non-WIC sources of referrals among all study participants, reported at 72 months

Key sociodemographic characteristics	Non-WIC source of referral[a] % (standard error)					Unweighted *n*	Weighted *n*
	Work	School or childcare	Church or religious organization	Doctor's office or clinic	Other source		
Maternal ethnorace							
Non-Hispanic Black	5.5[b] (1.1)	13.3[b] (1.7)	11.0[c,d] (1.4)	15.6 (1.8)	3.0[b] (0.6)	618	89,946
Non-Hispanic White	3.7[b] (0.9)	11.4[b] (1.4)	7.4 (1.5)	12.8 (1.5)	4.1[b] (1.2)	609	118,294
Non-Hispanic Other	6.5[b] (3.0)	15.6[b] (5.1)	4.0[d] (1.7)	26.7[c] (5.4)	3.6[b] (2.3)	117	25,934
Hispanic	3.6[b] (0.9)	10.9[b] (1.6)	5.1[c] (0.8)	10.8[c] (1.3)	2.7[b] (0.6)	789	205,620
Maternal age at study child's birth							
16-19 years	3.9[b] (1.6)	11.1[b] (2.8)	3.5[c] (1.3)	13.2[b] (2.7)	2.0[b] (0.8)	196	48,012
20-25 years	4.5[b] (0.8)	12.6[b] (1.2)	8.2[c] (1.0)	14.9[b] (1.9)	3.1[b] (0.8)	867	178,369
26+ years	4.0[b] (0.8)	11.2[b] (1.3)	6.5 (0.9)	11.9[b] (1.4)	3.5[b] (0.8)	1,070	213,414
Self-reported weight status of mother							
Normal or underweight	4.3[b] (1.2)	12.3[b] (1.7)	6.4[b] (1.3)	12.3[b] (1.6)	2.8 (0.8)	571	125,743
Overweight	3.6[b] (0.9)	12.3[b] (1.7)	7.6[b] (1.1)	14.3[b] (1.9)	1.9[c] (0.6)	631	123,290
Obese	4.5[b] (0.8)	11.0[b] (1.3)	6.6[b] (0.8)	13.3[b] (1.4)	4.2[c] (0.7)	931	190,761
Marital status[e]							
Married	3.3[b] (0.8)	9.4[c] (1.4)	5.3[c] (0.7)	11.8[b] (1.4)	2.4[b] (0.5)	866	188,550
Not married	4.8[b] (0.8)	13.6[c] (1.2)	8.0[c] (1.0)	14.4[b] (1.1)	3.7[b] (0.7)	1,267	251,245
Maternal educational attainment at 54 months[e]							
High school or less	3.5[b] (0.7)	10.3 (1.2)	5.9[b] (0.9)	10.5 (0.9)	2.9[b] (0.5)	1,128	235,032
More than high school	4.9[b] (0.9)	13.5, (1.5)	7.9[b] (0.8)	16.5 (1.5)	3.5[b] (0.9)	1,005	204,762
Income poverty							
≤75% of Federal Poverty Guidelines (FPG)	3.8[b] (0.7)	14.1[b] (1.6)	9.7[c] (1.4)	15.6[b] (1.6)	3.9[b] (0.9)	833	166,295
>75% of FPG and ≤130% of FPG	4.4[b] (1.0)	10.8[b] (1.7)	6.1 (1.1)	10.4[b] (1.6)	3.3[b] (0.9)	615	131,782
>130% of FPG	4.4[b] (0.9)	9.9[b] (1.5)	4.2[c] (0.8)	13.3[b] (1.6)	2.3[b] (0.6)	685	141,718
Household food security status							
High or marginal	4.0[b] (0.6)	10.7[c] (1.1)	5.1[c] (0.6)	12.3[b] (1.0)	2.6[b] (0.4)	1,656	350,428
Low	6.0[b] (1.9)	13.3 (2.2)	12.5 (3.5)	14.9[b] (2.4)	4.8[b] (1.8)	264	53,728
Very low	3.4[b] (1.4)	20.2[c] (3.4)	15.5[c] (3.1)	20.4[b] (4.6)	5.9[b] (2.2)	213	35,639

Table 2-18. Row percentages of key sociodemographic characteristics associated with non-WIC sources of referrals among all study participants, reported at 72 months (continued)

Key sociodemographic characteristics	Non-WIC source of referral[a] % (standard error)					Unweighted *n*	Weighted *n*
	Work	School or childcare	Church or religious organization	Doctor's office or clinic	Other source		
Participation in non-WIC benefit programs							
Does not participate in any other programs[f]	4.8[b] (1.3)	7.0[c] (1.7)	4.4[c] (1.0)	14.0[b] (1.8)	0.9[c] (0.9)	356	70,885
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[f]	5.3[b] (1.0)	14.5[c] (1.3)	9.1[c] (1.3)	15.4[b] (1.5)	5.0[c,d] (1.0)	905	181,760
Participates in other program(s) excluding SNAP[f]	2.9[b] (0.6)	10.9 (1.6)	5.6 (1.0)	11.0[b] (1.5)	2.2[d] (0.4)	872	187,150
Pattern of study child's WIC participation[g]							
1st year only	1.4[b] (0.8)	8.5[b] (3.3)	5.3 (2.8)	7.7[b] (3.1)	2.3[b] (2.0)	86	36,990
2nd or 3rd year only	4.6[b] (1.9)	10.2[b] (2.0)	4.3[c] (1.6)	13.6[b] (3.0)	1.6[b] (0.7)	182	76,172
4th or 5th year only	3.8[b] (1.7)	16.8[b] (3.7)	12.3[c,d] (2.0)	21.1[b] (5.1)	3.1[b] (1.5)	143	68,640
Consistently	3.8[b] (1.1)	10.3[b] (1.9)	7.1 (1.3)	12.8[b] (2.2)	2.7[b] (0.8)	422	198,444
Intermittently	2.0[b] (1.5)	9.1[b] (2.6)	4.1[d] (1.8)	12.2[b] (3.4)	2.7[b] (2.3)	128	58,969

[a] Sources were assessed through individual survey items. Respondents could mark more than one. Percentages across sources will not sum to 100 percent.

[b] There was not a significant association. Data are presented for completeness.

[c,d] Given the key characteristic and source of referral, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[e] The chi-square test was sufficient.

[f] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[g] This analysis uses the longitudinal cohort.

Differences in the groups' referral-seeking behaviors may have endured after the study child aged out of WIC, as pre-/post-COVID ED there was a statistically significant difference in the percentages of families seeking referrals from schools. Pre-COVID ED, about 11 percent of study families reported school or childcare as a source of referrals; post-COVID ED, about 16 percent of study families reported using this source. The statistically significant difference may reflect multiple factors: new challenges facing families as the health emergency escalated, closure of WIC sites, and proactive behavior by schools.

2.9 Household Food Security at 72 Months

The USDA six-item household food security module asks participants to recall the extent to which they experienced difficulty in providing enough food for all their household members over the past 12 months. This timeframe encompassed the period during which about three-quarters (74%) of study families reported that their households were no longer participating with WIC.

The analyses of household food security status[56] took two approaches. First, bivariate chi-square analyses assessed associations with key sociodemographic characteristics (excluding household food security status). Second, multivariable regression assessed factors associated with low or very low household food security status at 72 months.

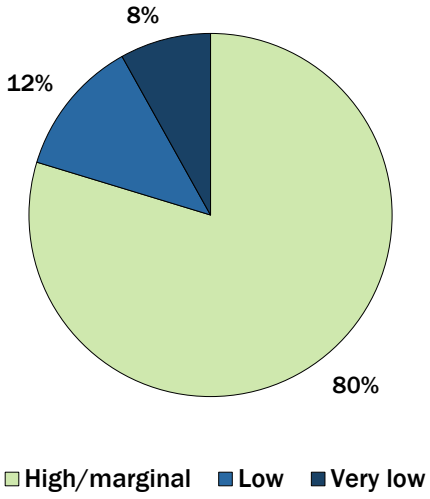
[56] To avoid any artificial associations between imputed values of household food security status and key sociodemographic characteristics, the unimputed version of food security status was used for this analysis.

2.9.1 Bivariate Analysis of Household Food Security Status at 72 Months

At 72 months, nearly 80 percent of study respondents reported high or marginal household food security (Figure 2-13; Appendix Table B2a-13 offers additional detail). About 12 percent indicated low food security and about 8 percent of respondents indicated very low food security.

Food security status at 72 months was associated with maternal ethnorace, marital status, income poverty, and participation in non-WIC benefit programs. Table 2-19 presents the findings.

Figure 2-13. Food security status of WIC ITFPS-2 households reported when the study child was 72 months old[a]



[a] Unweighted *n*=2,137; weighted *n*=441,226.

Pre-/Post-COVID ED Analysis. There was not a significant bivariate association between household food security status and the temporal timing of the 72-month interview (i.e., whether it took place pre- or post-COVID ED). Pre-COVID ED, about 79 percent of study participants reported high/marginal household food security; post-COVID ED, about 82 percent of study families reported high/marginal household food security. The difference was not statistically significant. In this context, it is important to note that the recall period for the USDA six-item instrument includes the past 12 months, which spans much of the pre-COVID ED period. Also, it is well-established that traumatic events may get telescoped into a survey timeframe even though they occurred outside of it (Gaskell, Wright, & O'Muircheartaigh, 2000). It is also important to note that the post-COVID ED reports of food security status took place in the context of reduced full-time employment (Section 2.4.2).

Table 2-19. Household food security status reported when the study child is 72 months old

Key sociodemographic characteristic	Household food security status % (standard error)			Unweighted *n*	Weighted *n*
	High/marginal	Low	Very low		
Maternal ethnorace					
Non-Hispanic Black	78.9 (2.0)	15.2 (1.7)	5.8[a] (1.4)	619	90,005
Non-Hispanic White	74.7[a] (2.1)	12.3 (1.7)	13.0[a,b] (1.6)	610	118,390
Non-Hispanic Other	77.8 (3.2)	11.8 (3.0)	10.3 (3.1)	118	26,602
Hispanic	83.2[a] (1.4)	10.8 (1.1)	6.0[b] (0.7)	790	206,229
Marital status					
Married	84.1[a] (1.4)	10.3[a] (1.2)	5.6[a] (0.7)	869	189,886
Not married	76.4[a] (1.5)	13.6[a] (1.1)	10.0[a] (1.0)	1,268	251,341
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	73.8[a] (2.0)	14.6[a] (1.4)	11.6[a] (1.3)	833	166,295
>75% of FPG and ≤130% of FPG	80.0 (2.2)	12.7 (1.6)	7.3 (1.3)	618	132,546
>130% of FPG	86.4[a] (1.6)	8.9[a] (1.3)	4.8[a] (0.7)	686	142,385
Participation in non-WIC benefit programs					
Does not participate in any other programs	90.1[a,b] (1.7)	6.9[a,b] (1.4)	3.0[a] (0.8)	358	71,611
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[c]	73.1[a,d] (2.0)	14.2[a] (1.4)	12.8[a,b] (1.2)	906	181,856
Participates in other program(s) excluding SNAP[c]	82.2[b,d] (1.5)	12.3[b] (1.3)	5.5[b] (0.7)	873	187,759

[a,b] Given the key characteristic and level of food security status, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

[c] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[d] Given the key characteristic and level of food security status, pairs of matching letters in a column indicate a statistically significant difference between sociodemographic subgroups at $p \leq 0.05$.

2.9.2 Multivariable Analysis of Factors Associated with Household Food Security Status

Multivariable analysis assessed the factors associated with household food security status based on reports from the 72-month survey, which covered the prior 12 preceding months. Using multinomial logistic regression with the study's 72-month cross-sectional weights, this analysis examined whether participation in Federal nutrition programs was associated with household food security status at 72 months. The odds[57] of two possible outcomes—very low food security or low food security—were assessed relative to those who reported high/marginal food security, so all subsequent comparisons are relative to those who reported high/marginal food security. The independent variables included sociodemographic characteristics such as maternal ethnorace, marital status at 72 months, maternal educational attainment at 54 months,[58] household size (up to 4 people compared to more than 4 people), and self-reported household income at 72 months. Federal nutrition assistance program participation included historical WIC participation of the study participant (whether the family participated consistently with the study child or not); household WIC participation status (for the caregiver or another child in the household) at 72 months; participation by household members in NSLP, SBP, or SFSP at 72 months; and participation in SNAP at 72 months. Household income was reported for the month prior to the survey, so the period spanned approximately March 2019 through June 2020. In an effort to assess association with SNAP participation independent of income requirements, SNAP participation was crossed with whether income was less than or equal to 130 percent of FPG or greater than this amount. Because of the far-ranging implications of the COVID-19 emergency and response measures to it, the regression included whether the data were collected pre- or post-COVID ED. Results of the regression are reported in Table 2-20.

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[57] The odds ratio is a measure of association between a characteristic (or exposure) and an outcome. For example, the odds ratio of very low food security for Hispanics is the ratio of the odds of very low food security for Hispanic persons to the odds of very low food security for non-Hispanic persons. An odds ratio of 1 indicates no relationship between the characteristic (in this case, Hispanic origin) and the outcome (in this case, very low food security). An odds ratio less than 1 indicates a decreased occurrence of the outcome among those with the characteristic (relative to those without the characteristic). An odds ratio greater than 1 indicates an increased occurrence of the outcome among those with the characteristic (relative to those without the characteristic).

[58] Maternal educational attainment was not asked at the 72-month interview. The 54-month values represent the most recent information.

Table 2-20. Results from multinomial logistic regression of household food security status at 72 months on sociodemographic characteristics and participation in Federal nutrition assistance programs[a]

Covariate	Odds ratio (95% confidence limits)	
	Very low food security	Low food security
Hispanic vs. Non-Hispanic White	0.429* (0.254-0.723)	0.723 (0.418-1.249)
Non-Hispanic Black vs. Non-Hispanic White	0.355* (0.186-0.679)	0.949 (0.648-1.391)
Non-Hispanic Other vs. Non-Hispanic White	0.613 (0.190-1.979)	0.757 (0.307-1.865)
Married vs. Not married	0.532* (0.297-0.952)	0.717 (0.495-1.039)
More than high school vs. High school or less	2.301* (1.388-3.815)	1.196 (0.825-1.734)
More than 4 people in household vs. Up to 4 people in household	1.485 (0.938-2.351)	1.132 (0.759-1.687)
Participating in National School Lunch Program (NSLP)/School Breakfast Program (SBP)/SFSP (Summer Food Service Program) vs. Not participating in NSLP/SBP/SFSP	1.451 (0.744-2.83)	1.231 (0.83-1.827)
Not participating in Supplemental Nutrition Assistance Program (SNAP) and income ≤130% Federal Poverty Guidelines (FPG) vs. Not participating in SNAP and income >130% FPG	2.754* (1.357-5.591)	1.886 (0.948-3.753)
Participating in SNAP and income ≤130% FPG vs. Not participating in SNAP and income >130% FPG	5.691* (3.008-10.767)	2.090* (1.047-4.172)
Participating in SNAP and income >130% FPG vs. Not participating in SNAP and income >130% FPG	7.202* (1.799-28.834)	1.140 (0.394-3.295)
On WIC consistently throughout the first 5 years vs. Not on WIC consistently	0.974 (0.623-1.523)	0.789 (0.459-1.356)
Not participating in WIC and does not have a child 0-4 vs. Currently participating in WIC	1.325 (0.746-2.352)	1.053 (0.636-1.743)
Not participating in WIC but has child 0-4 vs. Currently participating in WIC	1.156 (0.547-2.440)	0.496 (0.233-1.058)
Post-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) vs. Pre-COVID ED	0.834 (0.522-1.331)	0.812 (0.493-1.336)

[a] Programs assessed include the NSLP, SBP, SFSP, SNAP, and WIC.

* Indicates coefficient is statistically significant at $p \leq 0.05$.

Among the sociodemographic characteristics assessed, maternal ethnorace, marital status, and maternal educational attainment at 54 months were statistically significant predictors of very low food security when compared with high/marginal food security. Compared to those who reported high or marginal household food security, Hispanic and non-Hispanic Black caregivers were less likely to report very low household food security than non-Hispanic White caregivers. Similarly, compared to those who reported high or marginal food security, married caregivers were also less likely to report very low household food security. Contrastingly, compared to those who reported high or marginal food security, caregivers with higher educational attainment at 54 months were more likely to report very low household food security than those with less education.

Assessment of participation in NSLP, SBP, and SFSP (together); SNAP; and WIC indicated significant associations between report of very low food security status relative to high/marginal food security and participation in SNAP, accounting for income. Compared to families with high or marginal household food security, participating in SNAP was positively associated with increased likelihood of reporting very low household food security regardless of income.

3. Meals and Snacks, Food Intake, and Diet Quality

Key Findings at 72 Months:

- On a given day, almost all study children ate breakfast, lunch, and dinner, and 88 percent consumed at least one snack.
- 2020-2025 *Dietary Guidelines for Americans* (DGA) recommendations for major food group intake were met by the following percentage of study children based on usual intake:
  - 51 percent for fruits intake;
  - 1 percent for vegetables intake;
  - 18 percent for dairy intake;
  - 22 percent for protein foods intake; and
  - 62 percent for grains intake.
- Eighty-five percent of study children consumed sugar-sweetened beverages (SSBs), desserts, candy, or other sweets on a given day. An estimated 59 percent consumed desserts or candy on a given day, and 38 percent consumed SSBs.
- Among children who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) consistently during the first 5 years of life, an average of about 17 percent of their dairy intake came from drinking plain skim or 1 percent milk on a given day, which was higher than the average of 4 percent among children who left WIC after their first year of life.
- The average Healthy Eating Index-2015 (HEI-2015) total score based on usual intake of study children was 56, which was significantly lower than the total score at 60 months (59). Like the national average of 53 for 6- to 11-year-old children, a total score of 56 is in the range indicating a need to improve overall diet quality.
- Findings from multivariable regression analysis of cup equivalent of vegetable intake per 1,000 calories (vegetable density) on a given day revealed that more calories from SSBs were associated with less vegetable density in the child's diet, and so was eating less than five meals together as a family per week compared to children in families who ate with their families five or more times per week.

3.1 Overview

Using dietary intake data collected from study children at age 72 months (i.e., 6 years), this chapter focuses on food intake and meal and snack patterns. Where applicable, the chapter includes data from study children at younger ages to provide context. The findings inform the following research questions:

- What are the meal and snack patterns, both overall and by subgroups of interest?
- How many 6-year-olds exhibit unhealthy eating patterns, and what characteristics are associated with these habits?

- How do dietary intake patterns change once a child ages out of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)? How do changes in these patterns vary across subgroups?

- What is the relationship, if any, between (1) cumulative years of participation in the WIC, (2) ages during WIC participation, and (3) continuity of WIC benefit receipt (e.g., constant vs. intermittent) and dietary behaviors and energy and nutrient intake after aging out of WIC?

  - 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])?

  - 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?

  - Do early feeding practices, meal/snack patterns, or food and nutrient intakes between ages 0 and 24 months relate to feeding practices, meal/snack patterns, and food and nutrient intakes at age 6 years? How do these vary based on characteristics of WIC participation of the child/household?

- 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 sixth year of life?

- What are the food/beverage (including water), energy, and nutrient intakes of the study children both overall and by subgroups of interest?

- How many 5-6-year-olds exhibit unhealthy eating patterns, and what characteristics, including weight-for-height status, are associated with these habits?

3.2 Background

As discussed in previous reports for the WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2), fruits, vegetables, and whole grains are excellent sources of nutrients, yet most children in the United States do not consume sufficient amounts of these food groups (National Cancer Institute [NCI], 2018; Kim et al., 2014; U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [HHS], 2020). Research indicates that household income and participation in Federal nutrition programs are positively associated with consumption of fruits and vegetables and promote equitable improvements in children's diet quality (USDA & HHS, 2020; Lorson, Melgar-Quinonez, & Taylor, 2009; Liu, Micha, Li, & Mozaffarian, 2021). This chapter

reports on associations between food group intakes and current participation in Federal nutrition assistance programs as well as prior participation in the WIC program.

Though consumption of nutrient-dense foods can be improved at all eating occasions, snacks are of particular interest. Studies of nationally representative samples highlight substantial increases in childhood snacking from 1977 to 2014, with children ages 2 to 6 years having, on average, three snacks per day around age 6 years (Dunford & Popkin, 2018; Piernas & Popkin, 2010). Snacks contribute nearly one-third of daily total calories, over one-third of added sugars, and nearly 20 percent of sodium to the diets of young children (Shriver et al., 2018).

The 2020-2025 *Dietary Guidelines for Americans* (DGA) recommendations encourage children age 2 years and above consume less than 10 percent of total calories from saturated fats (USDA & HHS, 2020). Most children ages 5 to 8 years old in the United States have average intakes above this recommendation for saturated fat: 84 percent of males and 82 percent of females exceed the recommendation on a given day based on 2013-2016 data from the National Health and Nutrition Examination Survey (USDA & HHS, 2020).

The 2020-2025 DGA also recommends limiting intake of added sugars to no more than 10 percent of total daily calories (USDA & HHS, 2020). However, 80 percent of males and 77 percent of females fail to meet the added sugars recommendation (2020-2025 DGA). A major source of added sugars in children's diets is sugar-sweetened beverages (SSBs), with consumption of SSBs typically starting during the preschool years and increasing through adolescence (Wang, Bleich, & Gortmaker, 2008). An analysis of data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES) revealed that 18 percent of the total sugar consumed by children ages 6 to 11 years in the United States comes from SSBs (Marriott, Hunt, Malek, & Newman, 2019). Recent research indicates that consumption of added sugars may be inversely associated with duration of WIC participation (Borger, Paolicelli, & Sun, 2022).

SSB intake has been associated with increased weight gain in young children (Luger et al., 2017) and with obesity, metabolic syndrome, and cardiovascular disease in older children and adults (Twarog et al., 2020; Collin, Judd, Safford, Vaccarino, & Welsh, 2019; Rodríguez, Madsen, Cotterman, & Lustig, 2016; Yang et al., 2014). Although SSB consumption by children ages 2 to 19 has declined in recent years in the United States, intakes remain high (Vercammen, Moran, Soto, Kennedy-Shaffer, &

Bleich, 2020). Moreover, children living in lower income neighborhoods, and from lower income or food insecure households, tend to drink more SSBs than their higher income peers (Twarog et al., 2020; Koma, Vercammen, Jarlenski, Frelier, & Bleich, 2020; Eicher-Miller, Boushey, Bailey, & Yang, 2020; Palakshappa et al., 2020). Conversely, plain water intake, which can have positive health impacts if substituted for SSBs, is not adequate among many children, particularly by those from lower income families (Patel, Hecht, Cradock, Edwards, & Ritchie, 2020; Vieux, Maillot, Rehm, Barrios, & Drewnowski, 2020). Because of the adverse health effects related to SSB intake, and because SSBs are a top contributor of added sugars in children's diets (Reedy & Krebs-Smith, 2010), this chapter examines factors associated with consumption of added sugars when children are 6 years old; however, added sugars are also discussed in Chapter 4, which focuses on nutrient intakes.

By assessing alignment with the 2015-2020 DGA, Healthy Eating Index-2015 (HEI-2015) total scores provide a comprehensive measure of diet quality beyond assessing individual food groups or nutrients (Thomson, Tussing-Humphreys, Goodman, & Landry, 2019).[59] Average HEI-2015 scores for children tend to decrease as children get older. For example, scores averaged 61 for children ages 2-4 years old, 55 for children ages 5-8 years old, and 52 for children ages 9-13 years old in the United States (2020-2025 DGA). The diet quality of study children in their sixth year of life may decrease as a result of no longer being on WIC or increase as a result of access to school meals which tend to be healthier than meals children eat elsewhere (Liu et al., 2021).

3.3 Sample and Analysis Approach

3.3.1 Sample

The analyses in this chapter primarily used 24-hour dietary recall information from the 60- and 72-month interviews; however, other survey information was used where applicable. Both the core and supplemental samples of the WIC ITFPS-2 were eligible for the 60- and 72-month interviews. Table 3-1 shows the unweighted number of respondents by sample and type of interview (survey or dietary recall). In analyses, the responses to each interview were weighted so that findings reflect the study-eligible WIC population as described in Chapter 1.

[59] HEI-2015 is the most current version of the Healthy Eating Index available from the USDA.

Table 3-1. Unweighted number of respondents by interview month, survey interview and dietary recall

Sample structure	60-month interview		72-month interview		
	Survey interview	Dietary recall	Survey interview	First dietary recall	Second dietary recall
Core prenatal sample	1,766	1,742	1,458	1,449	151
Core postnatal sample	223	220	201	199	22
Supplemental prenatal sample	437	434	377	373	41
Supplemental postnatal sample	103	102	101	100	11
Total	2,529	2,498	2,137	2,121[a]	225

[a] A total of 2,120 participants completed both the survey and the first dietary recall at 72 months.

3.3.2 Analysis

Analyses in this chapter examined energy consumed at eating occasions (i.e., breakfast, lunch, dinner, snack) to describe meal and snack patterns and consumption of specific food groups. Because the children were school-age, the majority of food group analyses used the DGA food groups, with amounts based on the Healthy U.S.-Style Dietary Pattern included in the DGA.[60]

The discussion of major food group intakes presents findings using DGA food groups and references published findings from NHANES. Findings from NHANES reflect a national sample of 6-to-11-year-old children in the United States—that is, children from all income brackets. The references to NHANES are intended to contextualize findings from this study. Statistical comparisons between NHANES and WIC ITFPS-2 findings are not made because the age groups do not perfectly align.

For consistency across years of WIC ITFPS-2, a subset of analyses of foods and beverages consumed used the food group classifications in the Feeding Infants and Toddler Study (FITS) 2016 (Anater et al., 2018; Welker, Jacquier, Catellier, Anater, & Story, 2018), which were originally developed for FITS 2008 (Fox, Pac, Devaney, & Jankowski, 2004). These classifications, based on the Continuing Survey of Food Intakes by Individuals, the U.S. dietary surveillance system which preceded NHANES (Wilson et al., 1997), may not always be an exact match to the DGA food groups. One significant difference between the FITS and DGA foods groups is that the FITS groups do not reflect the contributions of foods in mixed dishes to individual food groups; rather, mixed dishes are in separate groups. Thus, for example, dark-green vegetables consumed in a mixed

[60] The meal patterns are in Appendix 3 of the 2020-2025 DGA.

vegetable soup are not included in the FITS dark-green vegetable group, but they are included in the DGA dark-green vegetable food group. Analyses that used FITS food groups appear in Sections 3.5.8 and 3.5.9.[61]

HEI-2015 scores were used to assess diet quality. HEI-2015 is the current version of the Healthy Eating Index (HEI) and can be used to evaluate the diet quality of children ages 2 years and older. Scores are discussed in more detail in Section 3.6. Mean HEI-2015 scores were estimated using the population ratio method (NCI, 2017).

Dietary Data. In WIC ITFPS-2, all post-birth interviews through 24 months, as well as the interviews at 36, 48, 60, and 72 months, included a 24-hour dietary recall using the USDA's Automated Multiple Pass Method (AMPM) (Raper, Perloff, Ingwersen, Steinfeldt, & Anand, 2004). When conducting the 24-hour dietary recall, an interviewer guided the caregiver through the prior day's intake, and asked the caregiver to report all foods, beverages, and dietary supplements the child consumed for each eating occasion during the 24-hour period. Within 10 days of the initial dietary intake interview, the study collected a second, replicate recall on a randomly selected 10 percent subsample of children at 13, 15, 18, 24, 36, 48, 60, and 72 months. The dietary data were coded and analyzed by trained dietary coders and then analyzed for nutrient and food group content and snack and meal frequency, using version 5.0 (2009-2010) of the USDA Food and Nutrient Database for Dietary Studies.

It is important to note that research has found that single 24-hour dietary recalls on very young children, collected by proxy, may be subject to error, particularly overestimation of energy intake (Fisher et al., 2008). Additional research has found that two recalls provide much better estimates of energy intake for preschool-age children on a group level (Börnhorst et al., 2014). WIC ITFPS-2 conducted second recalls on a 10 percent subset of the study sample and used the replicate recalls to estimate usual intake, but the proxy intakes themselves may still be subject to reporting error.

In this chapter, 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

[61] Appendix B3 offers additional information on dietary coding procedures used in this study.

are referred to as *usual intake* estimates because the 2 days of dietary data were used to adjust for day-to-day variation in dietary intakes using methods offered by the NCI.

The NCI recommends different methods for estimating usual dietary intake depending on the type of dietary component under analysis.[62] In this chapter, NCI's univariate model was used to estimate usual intakes within DGA food groups unless the food was infrequently (episodically) consumed. Estimates of intakes for episodically consumed foods used 1 day of recall information, so they are estimates of intakes on a given day. NCI's multivariate Markov Chain Monte Carlo (MCMC) method was used to estimate usual intake underlying HEI-2015 scores and the percentages of children meeting the DGA recommendations for added sugars and saturated fat. NCI's MCMC method is the preferred approach for estimating HEI scores because it accounts for the correlations between all dietary components, including total dietary energy.[63] Two days of dietary recall information were used in both the univariate and MCMC models. The models generated estimates for a pseudo-population. The usual intake estimates presented were derived from the pseudo-populations that the models generated. In both the univariate and MCMC models, usual intake estimates were adjusted for child sex,[64] the 12 key sociodemographic characteristics described in Chapter 1, Section 1.8.2, and the timing of the 72-month interview (i.e., whether it took place before or after March 13, 2020). March 13, 2020, was the date of the Federal coronavirus disease 2019 (COVID-19) public health emergency declaration (COVID ED).

Bivariate Analyses. Bivariate analyses explored key sociodemographic characteristics associated with meal patterns and patterns of food intake, foods consumed, and HEI-2015 scores. Chapter 1, Section 1.8.2 presented the 12 key sociodemographic characteristics used. Nonmodifiable key sociodemographic characteristics were measured at the time of the baseline interview and only updated if the caregiver changed. Modifiable key characteristics may change over time and included household food security status and income relative to Federal Poverty Guidelines (FPG). The bivariate analyses assessed modifiable key sociodemographic characteristics measured at 72 months.[65] The cross-sectional 72-month cross-sectional sample weights were used in all analyses

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[62] See https://epi.grants.cancer.gov/diet/usualintakes/method.html.

[63] See https://epi.grants.cancer.gov/hei/hei-methods-and-calculations.html.

[64] Child sex was determined from the baseline interview from the survey item, "Is your [CHILD's NAME] a boy or a girl?"

[65] The exception is maternal educational attainment which is not assessed during the 72-month interview, so attainment reported during the 54-month interview is used.

except when assessing associations with (prior) pattern of WIC program participation for the study child. For the latter, the 1- or 3- through 72-month longitudinal core sample weights were used, as the patterns represent program participation over time.

Analyses in this chapter include chi-square tests to examine whether outcomes of interest are associated with key sociodemographic characteristics. If a significant association was found, typically, two-tailed t-tests were used to determine which pairwise subgroup differences are statistically significant. Bonferroni correction was used to adjust for multiple comparisons.

Subgroup differences discussed in the chapter were typically limited to those that form a pattern over time or across items and were noteworthy in magnitude.[66] The latter criterion is applied in order to avoid focusing on findings that, while statistically significant, may have little practical importance. Statistical significance, when indicated, is at the level of $p \leq 0.05$. Because they do not account for confounding factors, the bivariate analyses do not identify characteristics independently associated with the outcome and should be interpreted with caution.

Multivariable Regression Analysis. Multivariable regression analysis isolates the unique association between a model variable and an outcome while holding the influence of other variables constant. For this chapter, multivariable linear regression was used to assess factors independently associated with vegetable intake on a given day at 72 months.[67] In the model, participation at 72 months in Federal nutrition assistance programs, including SNAP, NSLP, SBP, and SFSP, was included. The model also incorporated the child's prior pattern of WIC participation between birth and age 5 years to determine whether length of participation in the programs had an enduring effect on dietary intake. Because *duration* of participation is of interest, the regression analysis used the core sample longitudinal weights associated with the longitudinal subsample of study children discussed in Chapter 1.

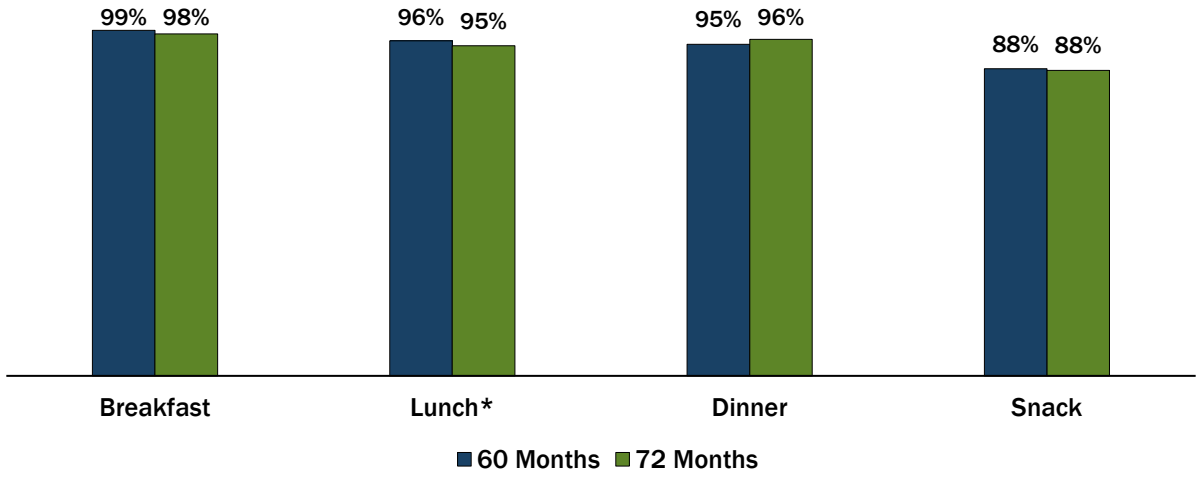
[66] Differences in percentages are typically discussed if they are more than 3 percentage points. Significant differences in means may be discussed regardless of the magnitudes of the differences.

[67] Data are weighted in all regression analyses.

3.4 Meal and Snack Patterns on a Given Day at 72 Months

As a part of the AMPM protocol, WIC ITFPS-2 caregivers identified each eating occasion when completing their child's 24-hour dietary recall. Eating occasions included meals as well as events in between meals (i.e., snacks). At 72 months, almost all children were eating breakfast (98%), lunch (95%), and dinner (96%) on a given day (Figure 3-1; Appendix Table B2b-1 offers additional detail). Despite a statistically significant difference in the percentage of dietary energy consumed at lunch, the percentages at 72 months were essentially the same as those at 60 months.

Figure 3-1. Percentage of study children consuming foods/beverages by eating occasion on a given day at 60 and 72 months[a]



[a] At 60 months, unweighted *n*=2,496 and weighted *n*=436,443. At 72 months, unweighted *n*=2,120 and weighted *n*=438,408.

* Indicates that the 60- and 72-month estimates are significantly different at $p \leq 0.05$.

The percentage of children consuming at least one snack on a given day varied with maternal ethnorace and pattern of WIC participation for the study child. Table 3-2 presents the findings.

Table 3-2. Row percentage of key sociodemographic characteristics associated with the percentage of children consuming snacks on a given day at 72 months

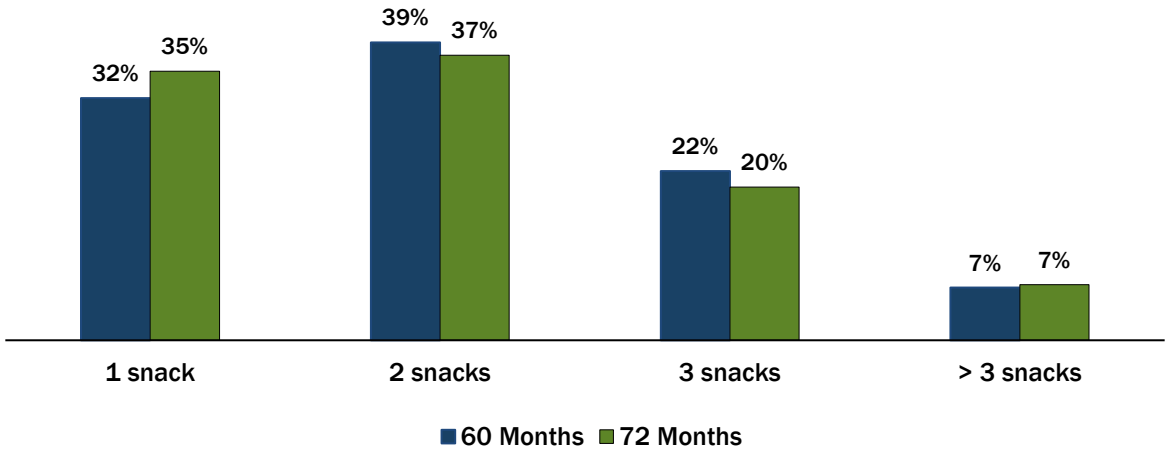
Key sociodemographic characteristics	Consuming snacks % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	88.0[a] (1.4)	614	89,192
Non-Hispanic White	89.8 (1.4)	606	117,893
Non-Hispanic Other	96.4[a,b] (1.8)	118	26,602
Hispanic	84.9[b] (1.2)	782	204,722
Pattern of study child's WIC participation[c]			
1st year only	90.8[a] (3.1)	77	33,572
2nd or 3rd year only	88.8[b] (2.3)	161	67,671
4th or 5th year only	88.1 (3.7)	124	59,347
Consistently	78.8[a,b] (2.2)	347	155,897
Intermittently	82.5 (5.1)	109	48,214

[a,b] Given the key characteristic, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, the percentage of children with non-Hispanic Black caregivers who eat snacks (88.0%) significantly differs from the percentage of children with non-Hispanic caregivers of Other races (96.4%). In other words, the comparisons are between percentages within a column for a key sociodemographic characteristic.

[c] This analysis uses the longitudinal weight.

Among children who consumed at least 1 snack on a typical day, the average number of daily snacks at 72 months was 2.0 snacks. Figure 3-2 presents the distribution of the number of snacks consumed on a given day among those who ate snacks.

Figure 3-2. Among study children who consumed at least one snack, the distribution of the number of snacks consumed at 60 and 72 months[a]



[a] At 60 months, unweighted *n*=2,189 and weighted *n*=382,390. At 72 months, unweighted *n*=1,853 and weighted *n*=383,730. Appendix Table B2b-2 offers additional detail.

3.5 Food and Beverage Intake at 72 Months

Knowing which foods and beverages children typically consume can inform recommendations for dietary improvements. Furthermore, this information can be leveraged to evaluate associations between diet and health outcomes. Using DGA food groups, this section presents information on mean and median intakes of fruits, vegetables, dairy, protein foods, total grains, and oils. The DGA recommendations for intake of most food groups assessed in this section are activity-level dependent; however, activity levels were not directly assessed as part of WIC ITFPS-2. Consequently, direct statistical comparisons of mean and median intakes with DGA guidance are not discussed. The DGA recommendations summarized in Table 3-3 provide context for interpreting findings.

Table 3-3. Recommended amounts of food from each food group at respective calorie levels for 72-month-old males and females[a]

	Males			Females		
Food group	Sedentary (1,400 calories per day)	Moderately Active (1,600 calories per day)	Active (1,800 calories per day)	Sedentary (1,200 calories per day)	Moderately Active (1,400 calories per day)	Active (1,600 calories per day)
Fruits	1.5 cup eq.[b]	1.5 cup eq.	1.5 cup eq.	1 cup eq.	1.5 cup eq.	1.5 cup eq.
Vegetables	1.5 cup eq.	2.0 cup eq.	2.5 cup eq.	1.5 cup eq.	1.5 cup eq.	2.0 cup eq.
Dairy	2.5 cup eq.	3.0 cup eq.	3.0 cup eq.	2.5 cup eq.	2.5 cup eq.	3.0 cup eq.
Protein	4 oz. eq.[c]	5 oz. eq.	5 oz. eq.	3 oz. eq.	4 oz. eq.	5 oz. eq.
Grains	5 oz. eq.	5 oz. eq.	6 oz. eq.	4 oz. eq.	5 oz. eq.	5 oz. eq.
Oils	17 g/d[d]	22 g/d	24 g/d	17 g/d	17 g/d	22 g/d

[a] From the 2020-2025 *Dietary Guidelines for Americans* (DGA).

[b] cup eq.=cup equivalents.

[c] oz. eq.=ounce equivalents.

[d] g/d=grams per day.

Within some of the food groups reported, there were episodically consumed foods that are of interest. These foods were not consumed every day by nearly all children and were, therefore, often reported as zero on a given day. For this report, they included dark-green vegetables; red and orange vegetables; beans, peas, and lentils; starchy vegetables and other (miscellaneous) vegetables; seafood; nuts, seeds, and soy products; and whole grains. Because these foods were infrequently consumed by study children, usual intake estimates were not developed for the sample, and intake on a given day is reported. In addition to presenting mean and median intakes of food groups aligned with the

DGA, Sections 3.5.8 and 3.5.9 present analyses of select foods and beverages (e.g., sugar-sweetened beverages) using the FITS food groups.

3.5.1 Fruits

The DGA recommends that 6-year-old children consume 1.0 to 2.5 cup equivalents (cup eq.) of fruits per day (inclusive of fruit juice), depending on the child's sex and activity level. Study children consumed an average of 1.8 cup eq. (standard error [SE]<0.01) of fruit at 72 months. Median consumption was 1.6 cup eq. of fruit (SE<0.01). These estimates suggest that the typical study child regularly consumed sufficient fruit. Assuming that the child's calorie intake was appropriate for his or her activity level, 51 percent (SE=3.0) of study children met the DGA recommendation for fruits intake. Data from the 2015-2016 NHANES indicated that children ages 6 to 11 years consumed an average of about 0.9 cup eq. of fruit on a given day.[68]

Estimates of mean and median usual fruit intake by male and female study children were the same as those for the entire study population (mean=1.8 cup eq. and median=1.6 cup eq.); consequently, there were no statistically significant differences in mean or median usual fruit intakes by child sex. Table 3-4 presents mean and median intakes for all three groups (all study children, male study children, and female study children) by the key sociodemographic characteristics used in this study. There were no statistically significant differences in mean or median usual intakes of fruit for all study children, male study children, or female study children by the key sociodemographic characteristics.

[68] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

Table 3-4. Mean and median usual total fruit intake[a] at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Maternal ethnorace					
Non-Hispanic Black	1.64 (0.07) / 1.47 (0.08)	1.63 (0.08) / 1.46 (0.09)	1.65 (0.08) / 1.48 (0.09)	614	89,192
Non-Hispanic White	1.75 (0.06) / 1.58 (0.06)	1.76 (0.07) / 1.58 (0.07)	1.75 (0.07) / 1.59 (0.07)	606	117,893
Non-Hispanic Other	1.88 (0.13) / 1.71 (0.12)	1.86 (0.13) / 1.69 (0.12)	1.89 (0.16) / 1.72 (0.15)	118	26,602
Hispanic	1.79 (0.05) / 1.63 (0.05)	1.80 (0.06) / 1.64 (0.06)	1.78 (0.06) / 1.61 (0.06)	782	204,722
Maternal age at study child's birth					
16-19 years	1.98 (0.15) / 1.82 (0.15)	1.99 (0.14) / 1.83 (0.15)	1.97 (0.17) / 1.80 (0.17)	194	48,151
20-25 years	1.67 (0.04) / 1.51 (0.05)	1.67 (0.04) / 1.51 (0.06)	1.67 (0.06) / 1.51 (0.06)	861	177,892
26+ years	1.77 (0.05) / 1.61 (0.05)	1.78 (0.06) / 1.61 (0.06)	1.77 (0.07) / 1.60 (0.06)	1,065	212,365
Parity					
Firstborn	1.74 (0.05) / 1.57 (0.06)	1.74 (0.07) / 1.58 (0.08)	1.73 (0.07) / 1.56 (0.07)	858	186,023
Second born	1.78 (0.06) / 1.61 (0.06)	1.75 (0.06) / 1.58 (0.06)	1.80 (0.08) / 1.64 (0.08)	585	118,551
Third or subsequent born	1.76 (0.08) / 1.59 (0.07)	1.78 (0.08) / 1.61 (0.08)	1.75 (0.08) / 1.58 (0.08)	677	133,835
Reported weight status of mother					
Normal or underweight	1.80 (0.07) / 1.63 (0.07)	1.79 (0.07) / 1.62 (0.07)	1.80 (0.09) / 1.63 (0.09)	566	124,698
Overweight	1.84 (0.07) / 1.67 (0.06)	1.84 (0.06) / 1.67 (0.06)	1.83 (0.09) / 1.66 (0.08)	627	123,401
Obese	1.68 (0.06) / 1.51 (0.07)	1.68 (0.07) / 1.52 (0.08)	1.67 (0.06) / 1.50 (0.06)	927	190,309
Marital status					
Married	1.76 (0.07) / 1.59 (0.06)	1.76 (0.07) / 1.59 (0.08)	1.76 (0.08) / 1.59 (0.07)	863	189,002
Not married	1.75 (0.05) / 1.58 (0.05)	1.75 (0.05) / 1.58 (0.06)	1.75 (0.06) / 1.58 (0.06)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	1.74 (0.05) / 1.57 (0.05)	1.74 (0.05) / 1.57 (0.06)	1.74 (0.07) / 1.57 (0.06)	1,120	233,978
More than high school	1.78 (0.04) / 1.61 (0.05)	1.77 (0.05) / 1.61 (0.06)	1.78 (0.06) / 1.61 (0.06)	1,000	204,430
Employment status					
Full-time	1.74 (0.05) / 1.58 (0.06)	1.75 (0.06) / 1.59 (0.07)	1.73 (0.07) / 1.56 (0.07)	839	171,202
Part-time	1.88 (0.08) / 1.71 (0.09)	1.87 (0.10) / 1.70 (0.11)	1.89 (0.08) / 1.73 (0.09)	423	89,381
Not employed	1.71 (0.05) / 1.54 (0.05)	1.70 (0.05) / 1.53 (0.05)	1.72 (0.07) / 1.55 (0.07)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	1.79 (0.05) / 1.62 (0.06)	1.79 (0.06) / 1.62 (0.07)	1.79 (0.06) / 1.63 (0.06)	821	164,397
>75% of FPG and ≤130% of FPG	1.71 (0.07) / 1.54 (0.07)	1.71 (0.08) / 1.54 (0.07)	1.70 (0.09) / 1.54 (0.08)	615	131,923
>130% of FPG	1.76 (0.06) / 1.59 (0.07)	1.78 (0.06) / 1.61 (0.08)	1.75 (0.07) / 1.58 (0.08)	684	142,087

Table 3-4. Mean and median usual total fruit intake[a] at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Household food security status					
High or marginal	1.76 (0.04) / 1.59 (0.04)	1.77 (0.05) / 1.60 (0.05)	1.76 (0.06) / 1.59 (0.06)	1,649	349,680
Low	1.70 (0.12) / 1.53 (0.12)	1.68 (0.12) / 1.50 (0.13)	1.72 (0.13) / 1.55 (0.13)	258	53,048
Very low	1.78 (0.12) / 1.62 (0.12)	1.79 (0.12) / 1.62 (0.12)	1.78 (0.12) / 1.61 (0.13)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[c]	1.66 (0.09) / 1.49 (0.08)	1.64 (0.10) / 1.47 (0.10)	1.68 (0.09) / 1.51 (0.09)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[c]	1.74 (0.05) / 1.58 (0.05)	1.74 (0.06) / 1.58 (0.06)	1.74 (0.07) / 1.58 (0.06)	898	180,440
Participates in other program(s) excluding SNAP[c]	1.80 (0.05) / 1.63 (0.06)	1.81 (0.05) / 1.64 (0.07)	1.80 (0.07) / 1.63 (0.07)	867	186,850
Timing of WIC enrollment					
1st trimester	1.77 (0.05) / 1.61 (0.06)	1.77 (0.06) / 1.60 (0.07)	1.78 (0.07) / 1.61 (0.07)	659	139,420
2nd trimester	1.70 (0.05) / 1.53 (0.05)	1.70 (0.06) / 1.53 (0.07)	1.70 (0.07) / 1.54 (0.06)	856	176,586
3rd trimester	1.72 (0.09) / 1.56 (0.08)	1.72 (0.09) / 1.56 (0.09)	1.72 (0.09) / 1.55 (0.09)	311	65,126
Postnatal	1.92 (0.10) / 1.75 (0.10)	1.93 (0.10) / 1.75 (0.10)	1.91 (0.12) / 1.74 (0.12)	294	57,276
Pattern of study child's WIC participation[d]					
1st year only	1.48 (0.14) / 1.33 (0.15)	1.39 (0.15) / 1.25 (0.16)	1.57 (0.19) / 1.43 (0.19)	86	36,990
2nd or 3rd year only	1.68 (0.11) / 1.54 (0.14)	1.63 (0.12) / 1.49 (0.14)	1.74 (0.16) / 1.59 (0.18)	182	76,172
4th or 5th year only	1.67 (0.16) / 1.53 (0.18)	1.54 (0.18) / 1.39 (0.20)	1.82 (0.15) / 1.67 (0.16)	141	67,355
Consistently	1.64 (0.07) / 1.49 (0.10)	1.56 (0.10) / 1.41 (0.12)	1.74 (0.09) / 1.58 (0.11)	421	197,720
Intermittently	1.49 (0.12) / 1.34 (0.14)	1.39 (0.16) / 1.24 (0.18)	1.55 (0.13) / 1.41 (0.14)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[d] This analysis uses the longitudinal cohort.

3.5.2 Vegetables

The DGA recommends that 6-year-old children consume 1.5 to 2.5 cup eq. of total vegetables per day, depending on the child's sex and activity level. Study children consumed an average of 0.9 cup eq. (SE=0.0) of vegetables at 72 months. Median consumption was 0.8 cup eq. of vegetables (SE=0.0). These estimates suggest that the typical 6-year-old study child did not usually consume the recommended amount of vegetables, regardless of activity level. Analysis assuming that the child's calorie intake was appropriate for his or her activity level indicated that about 1 percent (SE=0.8) of study children met the DGA recommendation for vegetables. Findings of insufficient vegetable intake are consistent with national findings based on data from the 2015-2016 NHANES showing that 6- to 11-year-old children consumed about 0.9 cup eq. of vegetables on a given day.[69]

Estimates of mean and median usual vegetable intake by male and female study children were the same as the estimates for the entire study population (mean=0.9 cup eq. [SE=0.0] and median=0.8 cup eq. [SE=0.0]); consequently, there were no statistically significant differences in mean or median usual vegetable intakes by child sex. Table 3-5 presents mean and median intake for the three groups by the key sociodemographic characteristics used in this study. Only maternal ethnorace subgroups exhibited statistically significant differences.

[69] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

Table 3-5. Mean and median usual total vegetable intake[a] at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Maternal ethnorace					
Non-Hispanic Black	1.01[c] (0.04) / 0.92[d] (0.04)	1.02[c] (0.05) / 0.93[d] (0.05)	1.00[c] (0.04) / 0.92[d] (0.04)	614	89,192
Non-Hispanic White	0.91[e] (0.03) / 0.83[f] (0.03)	0.91[e] (0.04) / 0.83[f] (0.04)	0.91[e] (0.03) / 0.83[f] (0.04)	606	117,893
Non-Hispanic Other	0.93[g] (0.06) / 0.85 (0.06)	0.93 (0.06) / 0.85 (0.06)	0.93[g] (0.06) / 0.85 (0.06)	118	26,602
Hispanic	0.74[c,e,g] (0.03) / 0.67[d,f] (0.03)	0.75[c,e] (0.04) / 0.67[d,f] (0.04)	0.74[c,e,g] (0.03) / 0.66[d,f] (0.03)	782	204,722
Maternal age at study child's birth					
16-19 years	0.78 (0.06) / 0.69 (0.07)	0.75 (0.07) / 0.67 (0.08)	0.80 (0.06) / 0.72 (0.06)	194	48,151
20-25 years	0.88 (0.04) / 0.79 (0.04)	0.88 (0.05) / 0.79 (0.05)	0.88 (0.03) / 0.79 (0.03)	861	177,892
26+ years	0.85 (0.03) / 0.76 (0.03)	0.86 (0.03) / 0.77 (0.03)	0.84 (0.03) / 0.76 (0.03)	1,065	212,365
Parity					
Firstborn	0.84 (0.04) / 0.75 (0.04)	0.84 (0.05) / 0.75 (0.05)	0.84 (0.04) / 0.76 (0.04)	858	186,023
Second born	0.85 (0.03) / 0.76 (0.04)	0.85 (0.04) / 0.77 (0.05)	0.84 (0.03) / 0.75 (0.03)	585	118,551
Third or subsequent born	0.88 (0.03) / 0.79 (0.03)	0.88 (0.03) / 0.79 (0.03)	0.88 (0.03) / 0.79 (0.03)	677	133,835
Reported weight status of mother					
Normal or underweight	0.85 (0.05) / 0.77 (0.05)	0.86 (0.06) / 0.77 (0.06)	0.85 (0.05) / 0.77 (0.05)	566	124,698
Overweight	0.85 (0.04) / 0.77 (0.04)	0.86 (0.04) / 0.77 (0.04)	0.85 (0.05) / 0.76 (0.04)	627	123,401
Obese	0.85 (0.03) / 0.77 (0.04)	0.85 (0.04) / 0.76 (0.05)	0.86 (0.03) / 0.77 (0.04)	927	190,309
Marital status					
Married	0.84 (0.03) / 0.76 (0.04)	0.84 (0.04) / 0.75 (0.04)	0.85 (0.03) / 0.76 (0.03)	863	189,002
Not married	0.86 (0.03) / 0.78 (0.04)	0.87 (0.04) / 0.78 (0.04)	0.86 (0.03) / 0.77 (0.03)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	0.85 (0.02) / 0.76 (0.03)	0.85 (0.03) / 0.76 (0.03)	0.85 (0.03) / 0.76 (0.03)	1,120	233,978
More than high school	0.86 (0.04) / 0.77 (0.04)	0.86 (0.05) / 0.77 (0.05)	0.86 (0.04) / 0.77 (0.04)	1,000	204,430
Employment status					
Full-time	0.88 (0.04) / 0.79 (0.04)	0.88 (0.04) / 0.79 (0.05)	0.88 (0.04) / 0.79 (0.04)	839	171,202
Part-time	0.84 (0.04) / 0.75 (0.04)	0.83 (0.05) / 0.75 (0.05)	0.84 (0.04) / 0.76 (0.04)	423	89,381
Not employed	0.84 (0.03) / 0.75 (0.04)	0.84 (0.04) / 0.75 (0.04)	0.83 (0.03) / 0.75 (0.04)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	0.82 (0.03) / 0.74 (0.04)	0.82 (0.04) / 0.74 (0.04)	0.82 (0.03) / 0.74 (0.04)	821	164,397
>75% of FPG and ≤130% of FPG	0.84 (0.05) / 0.75 (0.05)	0.84 (0.05) / 0.75 (0.05)	0.83 (0.05) / 0.74 (0.05)	615	131,923
>130% of FPG	0.91 (0.04) / 0.82 (0.04)	0.91 (0.05) / 0.82 (0.05)	0.91 (0.04) / 0.83 (0.04)	684	142,087

Table 3-5. Mean and median usual total vegetable intake[a] at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Household food security status					
High or marginal	0.83 (0.02) / 0.75 (0.03)	0.83 (0.03) / 0.75 (0.04)	0.84 (0.02) / 0.75 (0.03)	1,649	349,680
Low	0.95 (0.06) / 0.86 (0.06)	0.95 (0.07) / 0.86 (0.07)	0.95 (0.06) / 0.86 (0.06)	258	53,048
Very low	0.90 (0.06) / 0.82 (0.06)	0.90 (0.06) / 0.82 (0.06)	0.90 (0.05) / 0.82 (0.06)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[h]	0.89 (0.05) / 0.80 (0.05)	0.88 (0.06) / 0.80 (0.05)	0.89 (0.05) / 0.81 (0.05)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[h]	0.86 (0.03) / 0.77 (0.04)	0.86 (0.04) / 0.78 (0.05)	0.85 (0.04) / 0.76 (0.04)	898	180,440
Participates in other program(s) excluding SNAP[h]	0.84 (0.04) / 0.75 (0.04)	0.84 (0.04) / 0.75 (0.04)	0.84 (0.03) / 0.75 (0.04)	867	186,850
Timing of WIC enrollment					
1st trimester	0.79 (0.03) / 0.70 (0.04)	0.79 (0.04) / 0.70 (0.04)	0.79 (0.04) / 0.70 (0.04)	659	139,420
2nd trimester	0.89 (0.05) / 0.80 (0.05)	0.90 (0.06) / 0.81 (0.06)	0.88 (0.05) / 0.79 (0.05)	856	176,586
3rd trimester	0.88 (0.05) / 0.79 (0.05)	0.88 (0.05) / 0.79 (0.05)	0.88 (0.05) / 0.79 (0.05)	311	65,126
Postnatal	0.89 (0.05) / 0.81 (0.05)	0.89 (0.06) / 0.80 (0.06)	0.90 (0.05) / 0.81 (0.05)	294	57,276
Pattern of study child's WIC participation[i]					
1st year only	1.07 (0.11) / 0.99 (0.11)	1.07 (0.11) / 0.99 (0.11)	1.06 (0.13) / 0.99 (0.13)	86	36,990
2nd or 3rd year only	0.88 (0.08) / 0.81 (0.07)	0.91 (0.09) / 0.83 (0.08)	0.86 (0.08) / 0.79 (0.08)	182	76,172
4th or 5th year only	0.96 (0.08) / 0.89 (0.07)	0.97 (0.09) / 0.90 (0.08)	0.96 (0.09) / 0.89 (0.08)	141	67,355
Consistently	0.80 (0.03) / 0.73 (0.04)	0.81 (0.05) / 0.74 (0.05)	0.80 (0.05) / 0.73 (0.05)	421	197,720
Intermittently	1.02 (0.08) / 0.95 (0.09)	1.07 (0.10) / 1.00 (0.11)	0.98 (0.08) / 0.91 (0.09)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c,d,e,f,g] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with Hispanic caregivers is statistically significant. In all cases, the comparisons are between means (or medians) within a column for a key sociodemographic characteristic, not across columns.

[h] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[i] This analysis uses the longitudinal cohort.

One of the recommendations recently put forward by National Academies of Sciences, Engineering, and Medicine (NASEM) when considering revisions to the WIC food package was increasing the fruit and vegetable allotment (NASEM, 2017). Though study children were no longer age-eligible for WIC, episodically consumed vegetables may be of interest in light of their past participation. Episodically consumed vegetables included dark-green vegetables; red and orange vegetables; beans, peas, and lentils; starchy vegetables; and other (miscellaneous) vegetables. Because these vegetables were eaten by very few study children, estimates of intakes were based on a single day of dietary recall information. Given the limited nature of consumption, mean and median estimates of intake on a given day by all study children, male study children, and female study are reported in Table 3-6, but not by key sociodemographic subgroups. Because the DGA recommendation differs by child sex, the table includes mean and median intakes by sex, but statistical comparisons were not made.

Table 3-6. Mean and median intake on a given day at 72 months of episodically consumed vegetables[a]

Episodically consumed vegetables	Mean (standard error [SE])/Median (SE) cup equivalents		
	All study children	Male study children	Female study children
Dark-green vegetables	0.1 (0.0) / 0.0 (0.2)	0.1 (0.0) / 0.0 (0.2)	0.1 (0.0) / 0.0 (0.1)
Red and orange vegetables	0.3 (0.0) / 0.1 (0.0)	0.3 (0.0) / 0.2 (0.0)	0.3 (0.0) / 0.1 (0.0)
Beans, peas, and lentils	0.1 (0.0) / 0.0 (0.1)	0.1 (0.0) / 0.0 (0.1)	0.1 (0.0) / 0.0 (0.2)
Starchy vegetables	0.3 (0.0) / 0.1 (0.0)	0.3 (0.0) / 0.1 (0.0)	0.3 (0.0) / 0.1 (0.0)
Other (miscellaneous) vegetables	0.2 (0.0) / 0.0 (0.0)	0.2 (0.0) / 0.0 (0.0)	0.2 (0.0) / 0.0 (0.0)

[a] The unweighted *n*=2,120 and the weighted *n*=438,408.

3.5.3 Dairy

The DGA recommends that 6-year-old children consume between 2.5 to 3.0 cup eq. of dairy per day, depending on the child's sex and activity level. Study children consumed an average of 2.1 cup eq. (SE=0.0) of dairy foods at 72 months. Median consumption was 2.0 cup eq. (SE=0.0). These findings suggest that the typical study child did not consume enough dairy at age 6 years. Analysis assuming that the child's calorie intake was appropriate for his or her activity level indicated that about 18 percent (SE=2.6) of study children met the DGA recommendation for dairy intake. WIC

ITFPS-2 findings are consistent with the findings from the 2015-2016 NHANES for children ages 6 to 11 years, 2.0 cup eq. on a given day.[70]

Estimates of mean and median usual dairy intake by male and female study children were very similar to the estimates for the entire study population (male mean=2.2 cup eq. [SE=0.1], male median=2.1 cup eq. [SE=0.1], female mean=2.1 cup eq. [SE=0.0], female median=2.0 cup eq. [SE=0.0]). The small differences in usual dairy intake by child sex were not statistically significant. Table 3-7 presents mean and median intake for the three groups of children by the key sociodemographic characteristics used in this study. Maternal ethnorace and marital status subgroups exhibited statistically significant differences.

[70] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

Table 3-7. Mean and median usual dairy intake[a] at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted *n*[b]	Weighted *n*[b]
	All study children	Male study children	Female study children		
Maternal ethnorace					
Non-Hispanic Black	1.93[c] (0.07) / 1.82[b] (0.07)	1.95[c] (0.09) / 1.84[d] (0.09)	1.91[c] (0.08) / 1.79[d] (0.08)	614	89,192
Non-Hispanic White	2.29[c] (0.06) / 2.17[b] (0.06)	2.33[c] (0.08) / 2.21[d] (0.08)	2.24[c] (0.08) / 2.13[d] (0.08)	606	117,893
Non-Hispanic Other	2.08 (0.13) / 1.96 (0.13)	2.10 (0.14) / 1.98 (0.15)	2.07 (0.14) / 1.95 (0.13)	118	26,602
Hispanic	2.16 (0.06) / 2.04 (0.07)	2.18 (0.08) / 2.07 (0.08)	2.13 (0.08) / 2.01 (0.08)	782	204,722
Maternal age at study child's birth					
16-19 years	2.17 (0.13) / 2.06 (0.14)	2.21 (0.17) / 2.10 (0.17)	2.14 (0.11) / 2.02 (0.12)	194	48,151
20-25 years	2.07 (0.06) / 1.95 (0.06)	2.10 (0.08) / 1.98 (0.09)	2.04 (0.07) / 1.92 (0.07)	861	177,892
26+ years	2.19 (0.06) / 2.07 (0.06)	2.23 (0.07) / 2.10 (0.07)	2.16 (0.07) / 2.04 (0.06)	1,065	212,365
Parity					
Firstborn	2.10 (0.06) / 1.98 (0.06)	2.12 (0.09) / 2.01 (0.09)	2.07 (0.06) / 1.95 (0.05)	858	186,023
Second born	2.09 (0.06) / 1.97 (0.06)	2.13 (0.08) / 2.01 (0.08)	2.04 (0.08) / 1.92 (0.07)	585	118,551
Third or subsequent born	2.25 (0.07) / 2.13 (0.07)	2.27 (0.08) / 2.15 (0.08)	2.23 (0.08) / 2.11 (0.07)	677	133,835
Reported weight status of mother					
Normal or underweight	2.14 (0.07) / 2.02 (0.07)	2.17 (0.09) / 2.05 (0.09)	2.10 (0.07) / 1.99 (0.06)	566	124,698
Overweight	2.12 (0.05) / 2.00 (0.05)	2.16 (0.06) / 2.04 (0.07)	2.08 (0.07) / 1.96 (0.07)	627	123,401
Obese	2.16 (0.06) / 2.04 (0.06)	2.19 (0.08) / 2.07 (0.09)	2.13 (0.07) / 2.01 (0.07)	927	190,309
Marital status					
Married	2.27[c] (0.06) / 2.15[d] (0.06)	2.30[c] (0.07) / 2.19[d] (0.08)	2.23[c] (0.07) / 2.11[d] (0.06)	863	189,002
Not married	2.05[c] (0.05) / 1.93[d] (0.05)	2.07[c] (0.07) / 1.95[d] (0.08)	2.02[c] (0.06) / 1.90[d] (0.06)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	2.15 (0.04) / 2.03 (0.04)	2.17 (0.05) / 2.05 (0.06)	2.12 (0.06) / 2.00 (0.06)	1,120	233,978
More than high school	2.14 (0.06) / 2.02 (0.07)	2.17 (0.09) / 2.06 (0.09)	2.10 (0.06) / 1.98 (0.06)	1,000	204,430
Employment status					
Full-time	2.07 (0.06) / 1.95 (0.07)	2.10 (0.09) / 1.98 (0.09)	2.03 (0.06) / 1.92 (0.06)	839	171,202
Part-time	2.17 (0.07) / 2.05 (0.07)	2.20 (0.09) / 2.08 (0.09)	2.12 (0.09) / 2.01 (0.08)	423	89,381
Not employed	2.20 (0.06) / 2.08 (0.06)	2.23 (0.07) / 2.11 (0.07)	2.17 (0.07) / 2.05 (0.07)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	2.20 (0.05) / 2.08 (0.05)	2.23 (0.08) / 2.10 (0.08)	2.17 (0.06) / 2.05 (0.05)	821	164,397
>75% of FPG and ≤130% of FPG	2.10 (0.07) / 1.98 (0.08)	2.13 (0.08) / 2.01 (0.09)	2.06 (0.08) / 1.94 (0.08)	615	131,923
>130% of FPG	2.12 (0.08) / 2.00 (0.08)	2.16 (0.10) / 2.04 (0.10)	2.08 (0.09) / 1.96 (0.09)	684	142,087

Table 3-7. Mean and median usual dairy intake[a] at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) cup equivalents			Unweighted *n*[b]	Weighted *n*[b]
	All study children	Male study children	Female study children		
Household food security status					
High or marginal	2.11 (0.05) / 1.99 (0.04)	2.15 (0.06) / 2.03 (0.07)	2.08 (0.06) / 1.96 (0.06)	1,649	349,680
Low	2.20 (0.11) / 2.07 (0.12)	2.21 (0.13) / 2.08 (0.14)	2.18 (0.11) / 2.06 (0.12)	258	53,048
Very low	2.34 (0.11) / 2.22 (0.12)	2.38 (0.13) / 2.26 (0.13)	2.29 (0.11) / 2.19 (0.11)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[e]	2.11 (0.09) / 1.99 (0.09)	2.15 (0.10) / 2.03 (0.10)	2.07 (0.11) / 1.95 (0.10)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[e]	2.13 (0.05) / 2.01 (0.06)	2.16 (0.08) / 2.04 (0.08)	2.10 (0.06) / 1.99 (0.05)	898	180,440
Participates in other program(s) excluding SNAP[e]	2.16 (0.06) / 2.05 (0.07)	2.19 (0.09) / 2.08 (0.09)	2.13 (0.06) / 2.01 (0.06)	867	186,850
Timing of WIC enrollment					
1st trimester	2.16 (0.08) / 2.04 (0.08)	2.18 (0.09) / 2.07 (0.10)	2.12 (0.09) / 2.00 (0.09)	659	139,420
2nd trimester	2.15 (0.06) / 2.04 (0.06)	2.20 (0.08) / 2.08 (0.09)	2.12 (0.07) / 2.00 (0.06)	856	176,586
3rd trimester	2.23 (0.09) / 2.11 (0.09)	2.27 (0.11) / 2.15 (0.11)	2.20 (0.09) / 2.08 (0.08)	311	65,126
Postnatal	1.96 (0.09) / 1.84 (0.10)	1.99 (0.11) / 1.87 (0.11)	1.93 (0.09) / 1.81 (0.10)	294	57,276
Pattern of study child's WIC participation[f]					
1st year only	1.85 (0.19) / 1.77 (0.18)	1.92 (0.18) / 1.83 (0.18)	1.78 (0.21) / 1.71 (0.20)	86	36,990
2nd or 3rd year only	2.24 (0.11) / 2.16 (0.12)	2.31 (0.14) / 2.23 (0.15)	2.17 (0.12) / 2.09 (0.12)	182	76,172
4th or 5th year only	1.90 (0.10) / 1.82 (0.11)	1.92 (0.13) / 1.85 (0.14)	1.87 (0.08) / 1.79 (0.09)	141	67,355
Consistently	2.01 (0.10) / 1.93 (0.10)	2.02 (0.12) / 1.93 (0.13)	2.01 (0.12) / 1.93 (0.11)	421	197,720
Intermittently	2.03 (0.13) / 1.95 (0.14)	2.12 (0.17) / 2.04 (0.18)	1.96 (0.13) / 1.88 (0.13)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c,d] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with non-Hispanic White caregivers is statistically significant. In all cases, the comparisons are between means or medians within a column for a key sociodemographic characteristic, not across columns.

[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[f] This analysis uses the longitudinal cohort.

3.5.4 Protein Foods

The DGA recommends that 6-year-old children consume 3.0 to 5.0 ounce equivalents (oz. eq.) of protein foods per day, depending on the child's sex and activity level. Study children consumed an average of 3.9 oz. eq. (SE=0.1) of protein foods at 72 months. Median consumption was 3.8 oz. eq. (SE=0.1). Assuming that the child's calorie intake was appropriate for his or her activity level, about 22 percent (SE=2.9) of study children met the DGA recommendation for protein foods intake. WIC ITFPS-2 findings are consistent with the findings from the 2015-2016 NHANES: Children ages 6- to 11-years-old consumed 3.2 oz. eq. of meat, poultry, and seafood on a given day.[71]

Estimates of mean and median usual protein foods intake by male and female study children were as follows: male mean=4.0 oz. eq. (SE=0.1), male median=3.9 oz. eq. (SE=0.1), female mean=3.7 oz. eq. (SE=0.1), and female median=3.6 oz. eq. (SE=0.0). The differences in usual protein intake by child sex were not statistically significant. Table 3-8 presents mean and median intake for the three groups of children by the key sociodemographic characteristics used in this study. There were statistically significant differences in mean and median intakes by several key sociodemographic characteristics: maternal ethnorace, maternal age, marital status, maternal educational attainment at 54 months, and employment status.

[71] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

Table 3-8. Mean and median usual protein foods intake[a] at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) ounce equivalents			Unweighted *n*[b]	Weighted *n*[b]
	All study children	Male study children	Female study children		
Maternal ethnorace					
Non-Hispanic Black	4.18[c] (0.09) / 4.07[d] (0.10)	4.33 (0.12) / 4.22 (0.13)	4.03[c] (0.12) / 3.92[d] (0.12)	614	89,192
Non-Hispanic White	4.01 (0.11) / 3.90 (0.11)	4.15 (0.14) / 4.04 (0.14)	3.85 (0.13) / 3.75 (0.14)	606	117,893
Non-Hispanic Other	4.36 (0.21) / 4.24 (0.23)	4.54 (0.22) / 4.43 (0.24)	4.24[e] (0.23) / 4.13 (0.25)	118	26,602
Hispanic	3.65[c] (0.15) / 3.53[d] (0.15)	3.81 (0.21) / 3.70 (0.20)	3.47[c,e] (0.12) / 3.36[d] (0.13)	782	204,722
Maternal age at study child's birth					
16-19 years	4.32 (0.34) / 4.21 (0.34)	4.50 (0.46) / 4.40 (0.45)	4.14 (0.27) / 4.04 (0.26)	194	48,151
20-25 years	4.03[c] (0.08) / 3.92 (0.10)	4.18 (0.11) / 4.07 (0.12)	3.87 (0.12) / 3.76 (0.13)	861	177,892
26+ years	3.69[c] (0.11) / 3.57 (0.12)	3.82 (0.15) / 3.71 (0.16)	3.55 (0.10) / 3.43 (0.11)	1,065	212,365
Parity					
Firstborn	4.06 (0.14) / 3.95 (0.14)	4.24 (0.20) / 4.14 (0.20)	3.88 (0.14) / 3.77 (0.14)	858	186,023
Second born	3.94 (0.10) / 3.83 (0.11)	4.04 (0.13) / 3.93 (0.14)	3.83 (0.11) / 3.73 (0.12)	585	118,551
Third or subsequent born	3.63 (0.14) / 3.51 (0.15)	3.78 (0.16) / 3.67 (0.17)	3.46 (0.15) / 3.34 (0.16)	677	133,835
Reported weight status of mother					
Normal or underweight	3.86 (0.12) / 3.75 (0.13)	3.99 (0.14) / 3.89 (0.15)	3.73 (0.14) / 3.62 (0.15)	566	124,698
Overweight	3.89 (0.10) / 3.78 (0.10)	4.01 (0.12) / 3.89 (0.13)	3.77 (0.13) / 3.66 (0.13)	627	123,401
Obese	3.92 (0.14) / 3.80 (0.15)	4.10 (0.21) / 3.98 (0.21)	3.73 (0.11) / 3.61 (0.12)	927	190,309
Marital status					
Married	3.62[c] (0.15) / 3.51[d] (0.16)	3.75[c] (0.19) / 3.64[d] (0.20)	3.48[c] (0.14) / 3.37[d] (0.15)	863	189,002
Not married	4.11[c] (0.11) / 3.99[d] (0.11)	4.26[c] (0.15) / 4.15[d] (0.14)	3.94[c] (0.13) / 3.83[d] (0.13)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	3.71[c] (0.09) / 3.59[d] (0.11)	3.85[c] (0.12) / 3.74[d] (0.13)	3.56[c] (0.11) / 3.45[d] (0.12)	1,120	233,978
More than high school	4.11[c] (0.13) / 4.00[d] (0.13)	4.26[c] (0.19) / 4.15[d] (0.19)	3.96[c] (0.11) / 3.84[d] (0.11)	1,000	204,430
Employment status					
Full-time	4.18[c] (0.14) / 4.07[d] (0.15)	4.34 (0.20) / 4.24 (0.21)	4.00[c] (0.13) / 3.89[d] (0.14)	839	171,202
Part-time	3.80 (0.12) / 3.69 (0.13)	3.91 (0.15) / 3.80 (0.16)	3.66 (0.14) / 3.56 (0.15)	423	89,381
Not employed	3.68[c] (0.11) / 3.56[d] (0.12)	3.82 (0.14) / 3.71 (0.15)	3.54[c] (0.11) / 3.42[d] (0.12)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	3.85 (0.09) / 3.74 (0.10)	4.01 (0.11) / 3.89 (0.12)	3.70 (0.12) / 3.59 (0.13)	821	164,397
>75% of FPG and ≤130% of FPG	3.88 (0.14) / 3.76 (0.14)	4.05 (0.19) / 3.93 (0.19)	3.68 (0.14) / 3.56 (0.14)	615	131,923
>130% of FPG	3.96 (0.16) / 3.85 (0.17)	4.07 (0.20) / 3.97 (0.21)	3.84 (0.15) / 3.73 (0.16)	684	142,087

Table 3-8. Mean and median usual protein foods intake[a] at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) ounce equivalents			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Household food security status					
High or marginal	3.84 (0.10) / 3.73 (0.11)	3.98 (0.15) / 3.87 (0.15)	3.70 (0.10) / 3.59 (0.11)	1,649	349,680
Low	4.13 (0.21) / 4.01 (0.22)	4.31 (0.24) / 4.20 (0.25)	3.92 (0.19) / 3.80 (0.19)	258	53,048
Very low	4.06 (0.21) / 3.94 (0.22)	4.18 (0.21) / 4.06 (0.21)	3.91 (0.26) / 3.80 (0.26)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[f]	4.02 (0.16) / 3.91 (0.16)	4.11 (0.20) / 3.99 (0.20)	3.94 (0.17) / 3.83 (0.17)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[f]	3.84 (0.09) / 3.73 (0.11)	4.02 (0.12) / 3.91 (0.13)	3.66 (0.12) / 3.55 (0.13)	898	180,440
Participates in other program(s) excluding SNAP[f]	3.90 (0.16) / 3.78 (0.16)	4.04 (0.20) / 3.93 (0.21)	3.74 (0.13) / 3.63 (0.14)	867	186,850
Timing of WIC enrollment					
1st trimester	3.86 (0.16) / 3.74 (0.15)	4.02 (0.22) / 3.90 (0.22)	3.67 (0.12) / 3.55 (0.12)	659	139,420
2nd trimester	3.85 (0.09) / 3.74 (0.12)	4.02 (0.12) / 3.91 (0.14)	3.69 (0.11) / 3.58 (0.13)	856	176,586
3rd trimester	3.88 (0.20) / 3.76 (0.19)	3.99 (0.23) / 3.88 (0.22)	3.77 (0.21) / 3.66 (0.20)	311	65,126
Postnatal	4.14 (0.17) / 4.03 (0.18)	4.22 (0.22) / 4.11 (0.24)	4.05 (0.16) / 3.94 (0.17)	294	57,276
Pattern of study child's WIC participation[g]					
1st year only	3.84 (0.33) / 3.75 (0.31)	4.10 (0.38) / 4.01 (0.38)	3.52 (0.31) / 3.43 (0.30)	86	36,990
2nd or 3rd year only	4.16 (0.20) / 4.05 (0.21)	4.33 (0.23) / 4.22 (0.23)	3.99 (0.29) / 3.89 (0.27)	182	76,172
4th or 5th year only	4.31 (0.24) / 4.21 (0.25)	4.56 (0.24) / 4.47 (0.24)	4.03 (0.28) / 3.94 (0.29)	141	67,355
Consistently	3.76 (0.15) / 3.66 (0.16)	4.02 (0.21) / 3.92 (0.21)	3.47 (0.19) / 3.37 (0.20)	421	197,720
Intermittently	3.85 (0.25) / 3.75 (0.26)	3.97 (0.32) / 3.87 (0.34)	3.76 (0.27) / 3.65 (0.28)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c,d,e] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with Hispanic caregivers is statistically significant. In all cases, the comparisons are between means or medians within a column for a key sociodemographic characteristic, not across columns.

[f] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[g] This analysis uses the longitudinal cohort.

Increasing the amount of seafood in the WIC food package was a recent NASEM recommendation (NASEM, 2017). Although study children are no longer age-eligible for WIC, their consumption of seafood may be of particular interest. Episodically consumed protein foods included seafood and nuts, seeds, and soy products. Food within these groups were eaten infrequently or by very few children, so estimates of intake were based on a single day of dietary recall information to produce estimates of intake on a given day. Given the limited nature of consumption, mean and median estimates of intake on a given day by all study children, male study children, and female study children are reported in Table 3-9, but not by key sociodemographic subgroups. Because the DGA recommendation differs by child sex, the table includes mean and median intakes by sex, but statistical comparisons were not made.

Table 3-9. Mean and median intake on a given day at 72 months of episodically consumed protein foods[a]

Episodically consumed protein foods	Mean (standard error [SE])/Median (SE) ounce equivalents		
	All study children	Male study children	Female study children
Seafood	0.1 (0.0) / 0.0 (3.9)	0.1 (0.0) / 0.0 (6.2)	0.1 (0.0) / 0.0 (5.0)
Nuts, seeds, and soy products	0.4 (0.0) / 0.0 (0.0)	0.3 (0.0) / 0.0 (0.0)	0.4 (0.1) / 0.0 (0.0)

[a] The unweighted *n*=2,120 and the weighted *n*=438,408.

3.5.5 Grains

The DGA recommends that 6-year-old children consume from 4.0 to 6.0 oz. eq. of total grains per day, depending on the child's sex and activity level. Study children consumed an average of 6.0 oz. eq. (SE=0.1) of total grains at 72 months. Median consumption was 5.9 oz. eq. (SE=0.1). Assuming that the child's calorie intake was appropriate for his or her activity level, about 62 percent (SE=2.9) of study children met the DGA recommendation for grains intake. Though the typical study child's regular intake of total grains met the DGA recommendation, WIC ITFPS-2 findings appear somewhat lower than the national average for 6- to 11-year-old children, 7.2 oz. eq. based on 2015-2016 NHANES data.[72]

Estimates of mean and median usual total grains intake by male and female study children were as follows: male mean=6.4 oz. eq. (SE=0.2), male median=6.3 oz. eq. (SE=0.2), female mean=5.6 oz. eq. (SE=0.2), and female median=5.5 oz. eq. (SE=0.2). Pairwise comparisons of mean and median

[72] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

intakes by child sex indicated that the differences in consumption of total grains were statistically significant. Table 3-10 presents mean and median intakes for the three groups of children by the key sociodemographic characteristics used in this study. Maternal ethnorace subgroups were the only ones to exhibit statistically significant differences in mean and median intakes of total grains.

Study children consumed whole grains episodically. This subgroup of total grains is of particular interest, however, because the 2009 revisions to the WIC food packages sought to encourage whole grain consumption by including whole grain breads, breakfast cereals, and other whole grain foods. Given the limited nature of consumption, mean and median estimates of intake on a given day are reported in Table 3-11, but not by key sociodemographic subgroups. Further, because the DGA recommendation differs by child sex, the table includes mean and median intakes by sex, but statistical comparisons were not made. The mean and median levels of intake indicate that study children are not meeting the DGA recommendation that 50 percent of total grains be whole grains. Moreover, the typical study child may have consumed slightly less whole grains on a regular basis than 6- to 11-year-old children nationally, as data from the 2015-2016 NHANES showed intake of 1.0 cup eq. on a given day.

Table 3-10. Mean and median usual total grains intake[a] at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) ounce equivalents			Unweighted *n*[b]	Weighted *n*[b]
	All study children	Male study children	Female study children		
Maternal ethnorace					
Non-Hispanic Black	6.50[c] (0.19) / 6.32[d] (0.19)	6.74[c] (0.20) / 6.56[d] (0.20)	6.24[c] (0.23) / 6.07[d] (0.23)	614	89,192
Non-Hispanic White	6.34[e] (0.15) / 6.17[f] (0.14)	6.58 (0.18) / 6.41 (0.17)	6.07 (0.16) / 5.90[e] (0.15)	606	117,893
Non-Hispanic Other	6.25 (0.27) / 6.07 (0.27)	6.53 (0.28) / 6.36 (0.28)	6.07 (0.28) / 5.91 (0.28)	118	26,602
Hispanic	5.72[c,e] (0.14) / 5.55[d,f] (0.14)	5.98[c] (0.15) / 5.81[d] (0.15)	5.43[c] (0.17) / 5.27[d,e] (0.16)	782	204,722
Maternal age at study child's birth					
16-19 years	6.45 (0.25) / 6.28 (0.25)	6.63 (0.29) / 6.47 (0.29)	6.28 (0.26) / 6.11 (0.26)	194	48,151
20-25 years	6.18 (0.16) / 6.01 (0.15)	6.43 (0.16) / 6.25 (0.15)	5.91 (0.19) / 5.73 (0.18)	861	177,892
26+ years	5.90 (0.12) / 5.72 (0.11)	6.17 (0.13) / 5.99 (0.12)	5.62 (0.15) / 5.46 (0.15)	1,065	212,365
Parity					
Firstborn	6.05 (0.13) / 5.88 (0.12)	6.28 (0.14) / 6.11 (0.12)	5.82 (0.16) / 5.65 (0.16)	858	186,023
Second born	5.94 (0.12) / 5.76 (0.12)	6.20 (0.15) / 6.02 (0.14)	5.66 (0.14) / 5.49 (0.14)	585	118,551
Third or subsequent born	6.23 (0.13) / 6.04 (0.14)	6.49 (0.15) / 6.31 (0.15)	5.93 (0.18) / 5.76 (0.18)	677	133,835
Reported weight status of mother					
Normal or underweight	6.37 (0.16) / 6.19 (0.15)	6.62 (0.18) / 6.44 (0.17)	6.12 (0.18) / 5.94 (0.17)	566	124,698
Overweight	6.00 (0.13) / 5.83 (0.13)	6.29 (0.13) / 6.11 (0.13)	5.71 (0.16) / 5.54 (0.17)	627	123,401
Obese	5.93 (0.14) / 5.76 (0.14)	6.17 (0.16) / 5.99 (0.15)	5.67 (0.18) / 5.50 (0.18)	927	190,309
Marital status					
Married	6.08 (0.11) / 5.91 (0.10)	6.33 (0.12) / 6.16 (0.11)	5.83 (0.14) / 5.65 (0.14)	863	189,002
Not married	6.07 (0.12) / 5.89 (0.12)	6.32 (0.13) / 6.14 (0.12)	5.80 (0.16) / 5.63 (0.16)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	5.95 (0.13) / 5.77 (0.13)	6.19 (0.14) / 6.01 (0.13)	5.71 (0.17) / 5.53 (0.17)	1,120	233,978
More than high school	6.22 (0.13) / 6.04 (0.12)	6.47 (0.14) / 6.30 (0.13)	5.93 (0.16) / 5.77 (0.16)	1,000	204,430
Employment status					
Full-time	6.06 (0.14) / 5.88 (0.13)	6.31 (0.14) / 6.14 (0.13)	5.78 (0.18) / 5.61 (0.17)	839	171,202
Part-time	6.23 (0.17) / 6.06 (0.16)	6.45 (0.20) / 6.28 (0.19)	5.96 (0.18) / 5.80 (0.18)	423	89,381
Not employed	6.02 (0.16) / 5.83 (0.16)	6.27 (0.17) / 6.08 (0.16)	5.77 (0.18) / 5.59 (0.18)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	6.16 (0.14) / 5.97 (0.13)	6.42 (0.17) / 6.23 (0.15)	5.90 (0.17) / 5.73 (0.16)	821	164,397
>75% of FPG and ≤130% of FPG	5.91 (0.17) / 5.73 (0.17)	6.17 (0.16) / 5.99 (0.15)	5.58 (0.21) / 5.42 (0.21)	615	131,923
>130% of FPG	6.14 (0.14) / 5.97 (0.14)	6.38 (0.16) / 6.21 (0.15)	5.89 (0.18) / 5.72 (0.18)	684	142,087

Table 3-10. Mean and median usual total grains intake[a] at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) ounce equivalents			Unweighted *n*[b]	Weighted *n*[b]
	All study children	Male study children	Female study children		
Household food security status					
High or marginal	6.04 (0.10) / 5.86[c] (0.09)	6.29 (0.10) / 6.11 (0.09)	5.78 (0.14) / 5.61 (0.14)	1,649	349,680
Low	5.90 (0.32) / 5.72 (0.32)	6.11 (0.31) / 5.93 (0.31)	5.66 (0.32) / 5.48 (0.32)	258	53,048
Very low	6.70 (0.25) / 6.53[c] (0.25)	6.96 (0.30) / 6.79 (0.30)	6.39 (0.26) / 6.23 (0.25)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[g]	6.13 (0.18) / 5.96 (0.18)	6.39 (0.21) / 6.22 (0.20)	5.89 (0.20) / 5.73 (0.20)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[g]	6.15 (0.14) / 5.97 (0.14)	6.41 (0.16) / 6.22 (0.15)	5.88 (0.17) / 5.71 (0.17)	898	180,440
Participates in other program(s) excluding SNAP[g]	5.98 (0.15) / 5.81 (0.14)	6.23 (0.15) / 6.05 (0.15)	5.70 (0.19) / 5.53 (0.19)	867	186,850
Timing of WIC enrollment					
1st trimester	6.00 (0.14) / 5.82 (0.13)	6.23 (0.16) / 6.05 (0.15)	5.72 (0.16) / 5.55 (0.16)	659	139,420
2nd trimester	6.07 (0.16) / 5.90 (0.15)	6.35 (0.16) / 6.17 (0.15)	5.81 (0.19) / 5.64 (0.19)	856	176,586
3rd trimester	6.09 (0.20) / 5.92 (0.19)	6.37 (0.22) / 6.19 (0.21)	5.84 (0.23) / 5.68 (0.23)	311	65,126
Postnatal	6.24 (0.20) / 6.06 (0.19)	6.46 (0.23) / 6.27 (0.23)	5.98 (0.20) / 5.81 (0.20)	294	57,276
Pattern of study child's WIC participation[h]					
1st year only	6.49 (0.36) / 6.39 (0.36)	6.94 (0.39) / 6.86 (0.39)	5.93 (0.35) / 5.86 (0.36)	86	36,990
2nd or 3rd year only	6.39 (0.27) / 6.30 (0.27)	6.77 (0.35) / 6.69 (0.33)	6.03 (0.27) / 5.96 (0.27)	182	76,172
4th or 5th year only	6.05 (0.34) / 5.98 (0.34)	6.42 (0.39) / 6.35 (0.38)	5.67 (0.36) / 5.60 (0.38)	141	67,355
Consistently	5.75 (0.17) / 5.67 (0.17)	6.09 (0.21) / 6.03 (0.20)	5.36 (0.23) / 5.30 (0.23)	421	197,720
Intermittently	5.87 (0.36) / 5.79 (0.37)	6.39 (0.38) / 6.32 (0.39)	5.49 (0.37) / 5.42 (0.39)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c,d,e,f] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with Hispanic caregivers is statistically significant. In all cases, the comparisons are between means or medians within a column for a key sociodemographic characteristic, not across columns.

[g] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[h] This analysis uses the longitudinal cohort.

Table 3-11. Mean and median intake on a given day at 72 months of episodically consumed grains[a]

Episodically consumed grains	Mean (standard error [SE])/Median (SE) cup equivalents		
	All study children	Male study children	Female study children
Whole grains	0.7 (0.0) / 0.5 (0.0)	0.7 (0.1) / 0.5 (0.0)	0.6 (0.0) / 0.5 (0.1)

[a] The unweighted *n*=2,120 and the weighted *n*=438,408.

3.5.6 Oils

The DGA recommends that 6-year-old children consume between 17 and 24 grams per day (g/d) of oils, depending on the child's sex and activity level. Study children consumed an average of 16.6 g/d (SE=0.4) of oils at 72 months. Median consumption was 15.7 g/d (SE=0.4). These findings indicate that the typical study child's consumption of oils was near the lower end of the DGA recommendation and was below the mean of 23 g/d for 6- to 11-year-old children nationally, based on 2015-2016 NHANES data.[73]

Estimates of mean and median usual oils intake by male and female study children were as follows: male mean=17.8 g/d (SE=0.7), male median=16.5 g/d (SE=0.8), female mean=15.7 g/d (SE=0.6), and female median=14.4 g/d (SE=0.7). The differences in mean and median intakes by child sex were not statistically significant. Table 3-12 presents mean and median intakes for the three groups of children by the key sociodemographic characteristics used in this study. There were statistically significant differences in mean and median intakes by maternal ethnorace, maternal educational attainment at 54 months, employment, and pattern of WIC participation for the study child.

[73] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

Table 3-12. Mean and median usual intake[a] of oils at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) grams per day			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Maternal ethnorace					
Non-Hispanic Black	18.35[c] (0.64) / 17.47[d] (0.60)	18.71[c] (0.81) / 17.84[d] (0.79)	17.97[c] (0.66) / 17.10[d] (0.61)	614	89,192
Non-Hispanic White	17.96[e] (0.64) / 17.06[f] (0.62)	18.29[e] (0.77) / 17.41[f] (0.75)	17.57[e] (0.68) / 16.68[f] (0.66)	606	117,893
Non-Hispanic Other	17.56 (1.03) / 16.67 (1.04)	18.09 (1.04) / 17.15 (1.10)	17.24 (1.12) / 16.37 (1.11)	118	26,602
Hispanic	15.02[c,e] (0.45) / 14.17[d,f] (0.50)	15.39[c,e] (0.63) / 14.54[d,f] (0.67)	14.62[c,e] (0.51) / 13.77[d,f] (0.56)	782	204,722
Maternal age at study child's birth					
16-19 years	17.11 (1.36) / 16.19 (1.34)	17.40 (1.75) / 16.50 (1.74)	16.83 (1.14) / 15.93 (1.13)	194	48,151
20-25 years	16.76 (0.65) / 15.85 (0.69)	17.02 (0.84) / 16.11 (0.87)	16.46 (0.66) / 15.55 (0.68)	861	177,892
26+ years	16.43 (0.50) / 15.51 (0.51)	16.87 (0.60) / 15.95 (0.60)	15.99 (0.61) / 15.06 (0.60)	1,065	212,365
Parity					
Firstborn	16.73 (0.57) / 15.82 (0.60)	17.08 (0.78) / 16.17 (0.81)	16.37 (0.57) / 15.46 (0.59)	858	186,023
Second born	16.24 (0.59) / 15.32 (0.65)	16.60 (0.82) / 15.68 (0.86)	15.85 (0.54) / 14.96 (0.59)	585	118,551
Third or subsequent born	16.87 (0.67) / 15.94 (0.62)	17.21 (0.71) / 16.27 (0.68)	16.49 (0.82) / 15.57 (0.77)	677	133,835
Reported weight status of mother					
Normal or underweight	17.00 (0.65) / 16.08 (0.67)	17.30 (0.72) / 16.40 (0.75)	16.70 (0.75) / 15.78 (0.76)	566	124,698
Overweight	16.00 (0.55) / 15.08 (0.61)	16.39 (0.71) / 15.49 (0.76)	15.59 (0.60) / 14.68 (0.64)	627	123,401
Obese	16.82 (0.62) / 15.90 (0.60)	17.17 (0.87) / 16.25 (0.85)	16.43 (0.58) / 15.53 (0.56)	927	190,309
Marital status					
Married	16.42 (0.66) / 15.50 (0.65)	16.75 (0.78) / 15.83 (0.76)	16.08 (0.70) / 15.16 (0.68)	863	189,002
Not married	16.80 (0.45) / 15.89 (0.51)	17.17 (0.67) / 16.25 (0.72)	16.41 (0.47) / 15.50 (0.51)	1,257	249,406
Maternal educational attainment at 54 months					
High school or less	15.69[c] (0.53) / 14.79[d] (0.59)	15.98[c] (0.68) / 15.07[d] (0.73)	15.40[c] (0.57) / 14.51[d] (0.62)	1,120	233,978
More than high school	17.72[c] (0.61) / 16.83[d] (0.57)	18.10[c] (0.78) / 17.22[d] (0.75)	17.31[c] (0.62) / 16.41[d] (0.57)	1,000	204,430
Employment status					
Full-time	17.58 (0.76) / 16.68 (0.75)	17.99 (0.95) / 17.11 (0.93)	17.14 (0.74) / 16.24 (0.73)	839	171,202
Part-time	16.43 (0.61) / 15.52 (0.69)	16.65 (0.70) / 15.73 (0.77)	16.17 (0.70) / 15.28 (0.77)	423	89,381
Not employed	15.84 (0.53) / 14.93 (0.56)	16.18 (0.67) / 15.26 (0.71)	15.51 (0.59) / 14.61 (0.59)	858	177,825
Income poverty					
≤75% of Federal Poverty Guidelines (FPG)	15.30[c] (0.56) / 14.42[d] (0.57)	15.60[c] (0.77) / 14.69[d] (0.78)	15.02[c] (0.55) / 14.16[d] (0.55)	821	164,397
>75% of FPG and ≤130% of FPG	16.79 (0.57) / 15.88 (0.62)	17.24 (0.66) / 16.33 (0.69)	16.24 (0.71) / 15.34 (0.76)	615	131,923
>130% of FPG	18.05[c] (0.58) / 17.17[d] (0.59)	18.30[c] (0.73) / 17.43[d] (0.74)	17.79[c] (0.66) / 16.89[d] (0.65)	684	142,087

Table 3-12. Mean and median usual intake[a] of oils at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/Median (SE) grams per day			Unweighted	Weighted
	All study children	Male study children	Female study children	*n*[b]	*n*[b]
Household food security status					
High or marginal	16.33 (0.39) / 15.43 (0.45)	16.67 (0.58) / 15.77 (0.62)	15.97 (0.45) / 15.08 (0.49)	1,649	349,680
Low	17.53 (1.46) / 16.60 (1.40)	17.85 (1.64) / 16.92 (1.58)	17.17 (1.33) / 16.23 (1.28)	258	53,048
Very low	18.36 (1.26) / 17.48 (1.24)	18.61 (1.29) / 17.72 (1.28)	18.06 (1.39) / 17.18 (1.33)	213	35,680
Participation in non-WIC benefit programs					
Does not participate in any other programs[g]	17.70 (0.84) / 16.82 (0.82)	17.86 (1.00) / 16.99 (0.97)	17.56 (0.86) / 16.68 (0.84)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[g]	16.70 (0.50) / 15.79 (0.50)	17.16 (0.73) / 16.24 (0.73)	16.22 (0.51) / 15.32 (0.49)	898	180,440
Participates in other program(s) excluding SNAP[g]	16.17 (0.55) / 15.26 (0.61)	16.53 (0.70) / 15.62 (0.75)	15.76 (0.59) / 14.86 (0.63)	867	186,850
Timing of WIC enrollment					
1st trimester	16.22 (0.54) / 15.28 (0.49)	16.56 (0.75) / 15.63 (0.71)	15.81 (0.56) / 14.87 (0.51)	659	139,420
2nd trimester	16.41 (0.63) / 15.51 (0.68)	16.87 (0.80) / 15.97 (0.84)	15.97 (0.61) / 15.07 (0.65)	856	176,586
3rd trimester	16.87 (0.83) / 16.00 (0.86)	17.10 (0.91) / 16.25 (0.96)	16.66 (0.91) / 15.78 (0.93)	311	65,126
Postnatal	18.08 (0.93) / 17.17 (0.94)	18.25 (1.10) / 17.33 (1.10)	17.87 (0.90) / 16.98 (0.89)	294	57,276
Pattern of study child's WIC participation[h]					
1st year only	22.13[c] (1.56) / 20.75[d] (1.49)	23.03[c] (1.72) / 21.62[d] (1.62)	21.05[c] (1.72) / 19.87[d] (1.71)	86	36,990
2nd or 3rd year only	16.64 (1.02) / 15.44 (1.08)	17.99 (1.15) / 16.79 (1.20)	15.36 (1.20) / 14.22 (1.24)	182	76,172
4th or 5th year only	16.92 (1.11) / 15.71 (1.13)	17.89 (1.46) / 16.70 (1.46)	15.89 (1.06) / 14.76 (1.10)	141	67,355
Consistently	15.11[c] (0.52) / 13.92[d] (0.60)	16.08[c] (0.72) / 14.85[d] (0.75)	14.04[c] (0.77) / 12.94[d] (0.81)	421	197,720
Intermittently	18.81 (1.37) / 17.55 (1.36)	20.39 (1.77) / 19.09 (1.74)	17.68 (1.28) / 16.51 (1.32)	126	58,433

[a] These estimates used the National Cancer Institute (NCI) univariate model.

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data were used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c,d,e,f] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with Hispanic caregivers is statistically significant. In all cases, the comparisons are between means or medians within a column for a key sociodemographic characteristic, not across columns.

[g] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[h] This analysis uses the longitudinal cohort.

3.5.7 Water

The 2020-2025 DGA recommendations highlight water as a calorie-free beverage that should be among those primarily consumed. For the first time in this series of reports, analyses focused on children's intake of water as a beverage on a given day. For this report, "water as a beverage" included tap water, unsweetened carbonated water, bottled water (with or without added sweeteners or flavorings), Propel or Glaceau water, and bottled baby water. Eighty-nine percent of study children drank water on a given day at 72 months. Based on 2017-2018 NHANES data, 86 percent of U.S. children ages 6 to 11 years drank water on a given day. Among study children who drank water, mean consumption was 20.8 fluid ounces (fl. oz.) (SE=0.5) and median consumption was 16.5 fl. oz. (SE=0.5). Nationally, among children who drank water, children ages 6 to 11 drank an average of 24 fl. oz. of water on a given day, based on 2017-2018 NHANES data.[74]

Because the DGA recommends water as a beverage for all children, and the recommendation does not differ by sex, the analyses focused on all study children. At 72 months, WIC ITFPS-2 study children drank an average of 18.5 fl. oz. (SE=0.4) of water as a beverage on a given day. Median intake of water as a beverage was 15.3 fl. oz. (SE=0.3) on a given day. Table 3-13 reports the findings by key sociodemographic characteristics. Mean intakes differed significantly by maternal ethnorace, marital status, maternal educational attainment at 54 months, household food security status, participation in non-WIC benefit programs, and timing of WIC enrollment (for the study child).

[74] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/32_Beverage_children_1718.pdf.

Table 3-13. Mean and median intake[a] of water as a beverage on a given day at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Mean (standard error [SE])/ Median (SE) fluid ounces per day All study children	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	15.1[b,c,d] (0.8) / 11.8 (1.7)	614	89,192
Non-Hispanic White	20.6[b] (0.7) / 16.4 (0.7)	606	117,893
Non-Hispanic Other	22.8[c] (2.7) / 16.8 (1.9)	118	26,602
Hispanic	18.2[d] (0.5) / 15.2 (0.6)	782	204,722
Maternal age at study child's birth			
16-19 years	18.4 (1.4) / 15.3 (1.8)	194	48,151
20-25 years	18.7 (0.7) / 15.1 (0.8)	861	177,892
26+ years	18.4 (0.7) / 15.4 (0.6)	1,065	212,365
Parity			
Firstborn	18.8 (0.6) / 15.3 (0.7)	858	186,023
Second born	17.7 (0.7) / 15.2 (1.0)	585	118,551
Third or subsequent born	18.8 (0.8) / 15.3 (0.9)	677	133,835
Reported weight status of mother			
Normal or underweight	17.6 (0.6) / 15.1 (0.7)	566	124,698
Overweight	18.0 (0.8) / 14.9 (0.8)	627	123,401
Obese	19.4 (0.8) / 15.6 (0.8)	927	190,309
Marital status			
Married	19.5[b] (0.6) / 15.7 (0.3)	863	189,002
Not married	17.7[b] (0.6) / 15.0 (0.8)	1,257	249,406
Maternal educational attainment at 54 months			
High school or less	17.2[b] (0.6) / 14.8 (0.6)	1,120	233,978
More than high school	20.0[b] (0.6) / 15.7 (0.6)	1,000	204,430
Employment status			
Full-time	18.0 (0.6) / 15.2 (0.8)	839	171,202
Part-time	19.7 (0.8) / 16.2 (0.5)	423	89,381
Not employed	18.4 (0.5) / 15.0 (0.5)	858	177,825
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	17.7 (0.7) / 14.7 (0.7)	821	164,397
>75% of FPG and ≤130% of FPG	17.9 (0.7) / 15.3 (0.8)	615	131,923
>130% of FPG	20.0 (0.7) / 16.3 (0.7)	684	142,087
Household food security status			
High or marginal	18.2[b] (0.4) / 15.3 (0.5)	1,649	349,680
Low	17.4[c] (1.3) / 14.9 (0.9)	258	53,048
Very low	23.0[b,c] (1.8) / 15.8 (2.0)	213	35,680
Participation in non-WIC benefit programs			
Does not participate in any other programs[e]	21.2[b] (1.3) / 16.7 (1.2)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[e]	16.7[b,c] (0.6) / 13.8 (1.0)	898	180,440
Participates in other program(s) excluding SNAP[e]	19.2[c] (0.6) / 15.6 (0.6)	867	186,850

Table 3-13. Mean and median intake[a] of water as a beverage on a given day at 72 months by key sociodemographic characteristics (continued)

Key sociodemographic characteristics	Mean (standard error [SE])/ Median (SE) fluid ounces per day All study children	Unweighted *n*	Weighted *n*
Timing of WIC enrollment			
1st trimester	19.8[b] (0.7) / 15.8 (0.6)	659	139,420
2nd trimester	17.1[b] (0.7) / 14.2 (0.9)	856	176,586
3rd trimester	18.1 (1.0) / 14.9 (1.2)	311	65,126
Postnatal	20.0 (0.9) / 15.8 (0.7)	294	57,276
Pattern of study child's WIC participation[f]			
1st year only	17.0 (2.0) / 15.0 (1.2)	86	36,990
2nd or 3rd year only	19.7 (1.6) / 14.9 (1.9)	182	76,172
4th or 5th year only	17.4 (1.5) / 14.5 (1.3)	141	67,355
Consistently	17.3 (0.8) / 13.6 (1.0)	421	197,720
Intermittently	18.0 (1.9) / 15.1 (1.1)	126	58,433

[a] These estimates are based on 1 day of dietary recall information.

[b,c,d] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, footnote c indicates that the difference in mean intakes of all children with non-Hispanic Black caregivers and children with non-Hispanic caregivers of Other races is statistically significant.

[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[f] This analysis uses the longitudinal cohort.

3.5.8 Foods and Beverages of Specific Interest

As mentioned, previous WIC ITFPS-2 reports present dietary intakes using the FITS food groups, which, though similar to the DGA food groups, differ in important ways. This section reports on study children's intakes on a given day using select food groups adapted from the FITS. Foods and beverages promoted in the WIC food package motivated the selection of foods presented and are not intended to represent all FITS groups. The analysis examined how much select foods contributed to DGA food group intake on a given day at 72 months. Because FITS groups separate mixed dishes from individual components (such as vegetables and grains), the findings reflect patterns in the approach to eating foods.

Table 3-14 presents the contribution of select FITS food groups to DGA food group intake, reporting the percentage that each FITS group contributes. The numerator in each calculation is the cup or ounce equivalent of the FITS food or beverage group, and the denominator is the cup or ounce equivalent of the relevant DGA food group. So, for example, on average, whole fruit

contributed over half (54%) of the DGA total fruit group, while 100 percent fruit juice contributed about 40 percent. The subsequent bivariate analyses in Table 3-15 highlight statistically significant differences by pattern of WIC participation by the study child.

Table 3-14. Contribution of select foods consumed on a given day at 72 months to the *Dietary Guidelines for Americans* (DGA) food groups

Food or beverage[a]	Contribution to DGA food group[b] percentage (standard error)
Total fruit (cup equivalent/day)	
Whole fruit	54.3 (1.4)
100% fruit juices	39.6 (1.5)
Fruits in mixed dishes[c]	0.2 (0.1)
Total vegetables (cup equivalent/day)	
Any vegetable	60.4 (1.5)
Dark-green vegetables	7.9 (0.8)
Deep-yellow vegetables	6.2 (0.5)
French fries and other fried potatoes	10.6 (0.6)
White potatoes and other starchy vegetables	16.2 (1.0)
Other vegetables	20.7 (1.1)
Vegetables in mixed dishes	29.2 (1.6)
Dairy (cup equivalent/day)	
Cow's milk	54.2 (1.0)
All skim and 1% milk, plain	10.8 (0.8)
All skim and 1% milk, flavored	2.8 (0.4)
2% milk, plain	16.0 (0.9)
2% milk, flavored	2.9 (0.4)
Soy-based beverages[d]	0.3 (0.1)
Yogurt	4.0 (0.3)
Low-fat and nonfat yogurt	2.8 (0.3)
Cheese	17.6 (0.6)
Dairy in mixed dishes	14.9 (1.0)
Protein foods (ounce equivalent/day)	
Meat and poultry	68.2 (1.2)
Beans, peas, legumes	0.5 (0.1)
Nuts and seeds	8.2 (0.8)
Seafood	3.8 (0.4)
High in N-3 fatty acids	1.4 (0.3)
Eggs	9.8 (0.6)
Protein source in mixed dishes	16.1 (0.9)
Grains (ounce equivalent/day)	
All whole grains	7.2 (0.3)
Whole grain breads[e]	0.9 (0.2)
Whole grain cereals[f]	6.4 (0.3)
Not presweetened whole grain cereals[g]	2.3 (0.2)
Presweetened whole grain cereals	4.1 (0.3)
Grains in mixed dishes	25.7 (1.0)
Unweighted *n*	2,120
Weighted *n*	438,408

[a] Adapted from food groups used in the Feeding Infants and Toddlers Study (FITS).

[b] Percentages are not expected to sum to 100 percent because not all foods within a DGA group are assessed. The mean percentage is calculated using the population ratio method.

[c] Does not include intakes from desserts, pastries, and pies.

[d] Soy beverages include all soy beverages and does not distinguish whether the soy beverage meets WIC requirements.

[e] Includes whole grain tortillas. The Food Pattern Equivalent Database (FPED) counts only whole wheat tortillas as whole grain.

[f] Includes hot and cold cereals.

[g] Not presweetened cereals contain no more than 21.2 grams of sucrose and other sugars per 100 grams of dry cereal (i.e., not more than 6 grams of sucrose and other sugars per 1 dry ounce).

Because inclusion in the food package motivated the selection of many of the foods and beverages presented in Table 3-14 (above), Table 3-15 (below) presents results by pattern of WIC participation. Only three of the foods analyzed in Table 3-14 (above) exhibited statistically significant differences in their contribution to DGA food groups by pattern of WIC participation of the study child: any vegetable, plain 1 percent milk, and flavored 1 percent milk.

Though mean and median intake of total vegetables did not significantly differ by pattern of WIC participation when assessed using the DGA food group (see Table 3-5), the way in which children consumed their vegetables differed significantly by pattern of participation (Table 3-15). Compared with children who participated with WIC into their fourth or fifth years of life, consistently or intermittently, children who participated with WIC in the first year of life only were more likely to consume vegetables that were not in mixed dishes (Table 3-15). In addition, though mean and median intakes of dairy did not differ significantly by pattern of WIC participation when assessed using the DGA dairy food group (see Table 3-7), the types of dairy foods children consumed did differ (Table 3-15). Children who participated consistently with WIC into their fifth year were more likely to consume plain skim or 1 percent milk than children who left WIC after their first year (Table 3-15). The nutrient implications of differences in the types of food eaten are explored in Chapter 4.

Table 3-15. Contribution of select foods and beverages consumed on a given day at 72 months to the *Dietary Guidelines for Americans* (DGA) food groups by pattern of WIC participation

Pattern of study child's WIC participation	Contribution of Feeding Infants and Toddlers Study (FITS) group to the DGA food group percentage (standard error)			Unweighted *n*	Weighted *n*
	Any vegetable[a] to total vegetables	Plain skim and 1% cow's milk[a] to total dairy	Flavored skim and 1% cow's milk[a] to total dairy		
1st year only	80.1[b,c,d] (3.6)	4.3[b] (1.9)	0.3[b,c] (0.3)	86	36,990
2nd or 3rd year only	59.8 (6.0)	10.9 (2.4)	3.2[b] (0.9)	182	76,172
4th or 5th year only	58.9[b] (5.3)	8.8 (2.3)	2.3 (1.2)	141	67,355
Consistently	53.2[c] (2.6)	16.5[b] (1.8)	4.9[c] (1.2)	421	197,720
Intermittently	61.2[d] (4.1)	9.3 (1.9)	2.0 (0.9)	126	58,433

[a] Adapted from food groups used in the Feeding Infants and Toddlers Study (FITS). FITS groups do not include foods from mixed dishes.

[b,c,d] Given the key characteristic and group of children under analysis, pairs of matching letters in a column indicate a statistically significant difference between subgroups at $p \leq 0.05$.

Though intakes did not differ by pattern of WIC participation, fruit juice consumption is also of interest because the American Academy of Pediatrics (AAP) recently issued new guidance on fruit juice consumption for young children. Intakes by toddlers should be limited to no more than 4 fl. oz. of fruit juice per day. Intakes by children ages 4 to 6 years should be limited to 4 to 6 fl. oz. per day.[75] Because the DGA recommendations do not prescribe the consumption of fruit juice to meet the total fruit recommendation, the analysis of fruit juice consumption focused on those who chose to consume fruit juice on a given day at 72 months.

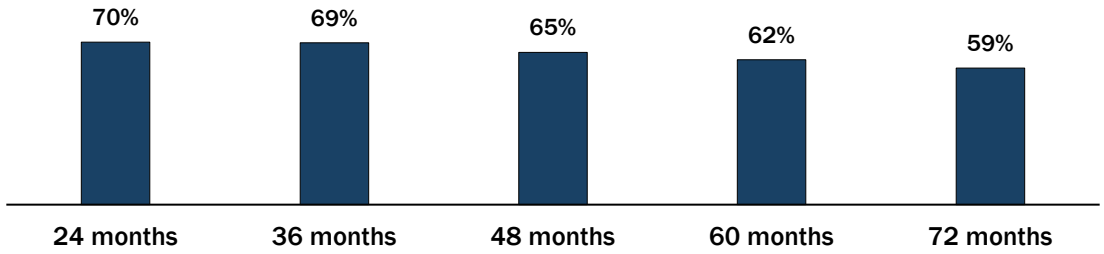
At 6 years of age, 59 percent of study children consumed 100 percent fruit juice on a given day at 72 months (Figure 3-3). Among those consuming 100 percent fruit juice, study children consumed an average of 9.5 fl. oz. (SE=0.2) on a given day. Median consumption was 7.9 fl. oz. (SE=0.3) on a given day (Figure 3-4). These findings suggest that among those children who chose to consume 100 percent fruit juice, the typical child consumed more than the AAP-recommended limit. These findings appear consistent with the national average for children ages 6 to 11 years based on 2017-2018 NHANES data, which found that an average of 8 fl. oz. was consumed on a given day.[76] To place the current findings in context, Figure 3-3 presents the trend in the percentage of children

[75] Source: https://publications.aap.org/pediatrics/article/139/6/e20170967/38754/Fruit-Juice-in-Infants-Children-and-Adolescents.

[76] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

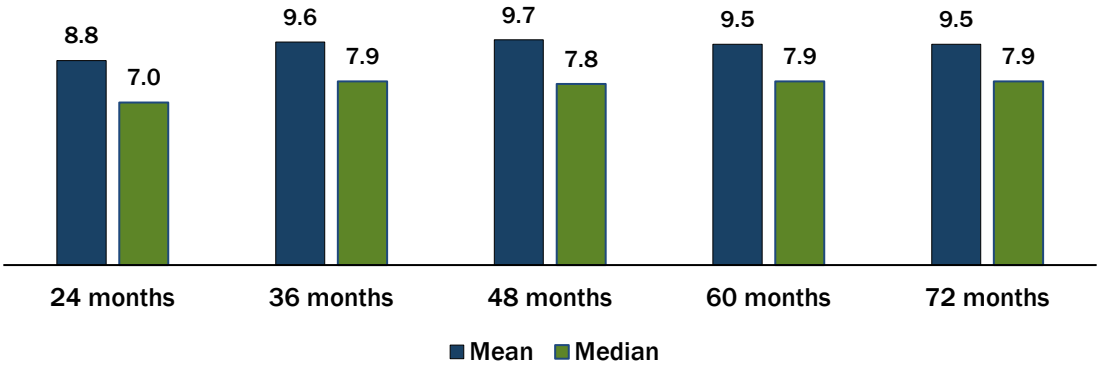
consuming fruit juice, and Figure 3-4 presents mean and median intakes at 24-, 36-, 48-, 60-, and 72-month interviews.

Figure 3-3. Percentage of study children consuming 100 percent fruit juice on a given day at 24, 36, 48, 60, and 72 months[a]



[a] At 24 months, unweighted *n*=2,437 and weighted *n*=438,859. At 36 months, unweighted *n*=2,584 and weighted *n*=437,901. At 48 months, unweighted *n*=2,561 and weighted *n*=439,572. At 60 months, unweighted *n*=2,496 and weighted *n*=436,443. At 72 months, unweighted *n*=2,120 and weighted *n*=438,408. Appendix Table B2b-3 offers additional detail.

Figure 3-4. Among study children consuming 100 percent fruit juice, mean and median fluid ounces consumed on a given day at 24, 36, 48, 60, and 72 months[a]



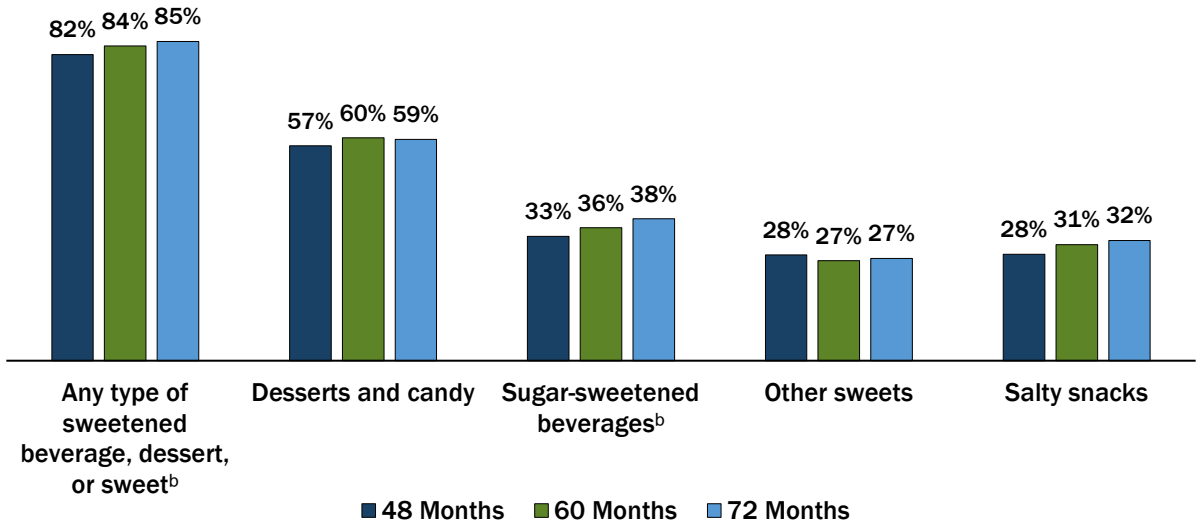
[a] At 24 months, unweighted *n*=1,709 and weighted *n*=305,541. At 36 months, unweighted *n*=1,760 and weighted *n*=303,470. At 48 months, unweighted *n*=1,653 and weighted *n*=286,693. At 60 months, unweighted *n*=1,514 and weighted *n*=270,985. At 72 months, unweighted *n*=1,245 and weighted *n*=256,603. Appendix Table B2b-4 offers additional detail.

3.5.9 Desserts and Sweets, Sugar-Sweetened Beverages, and Salty Snacks

As children age, their consumption of sweets, sugar-sweetened beverages (SSBs), and salty snacks is of interest because of the adverse health effects associated with excessive intakes of added sugars and sodium. The FITS food groups were used to examine intakes of sugar-sweetened foods and beverages and salty snacks on a given day at 72 months. Most WIC ITFPS-2 children (85%)

consumed some type of dessert, candy, SSB, or other sweets[77] on a given day at 72 months. About one-third (32%) of study children consumed a salty snack (e.g., potato chips, popcorn, cheese curls/puffs, tortilla chips, and other types of chips and salty snacks) on a given day at 72 months. Figure 3-5 shows the pattern in consumption over time by presenting the findings from the 48-, 60-, and 72-month interviews. The increase in the percentages of study children consuming any type of sweetened beverage, dessert, or sweet between 48 and 72 months was driven by an increase in consumption of SSBs. Between 48 and 72 months, there were no statistically significant differences in the percentages of children consuming desserts and candy or other sweets.

Figure 3-5. Percentage of study children consuming desserts and candy, sugar-sweetened beverages (SSBs), and salty snacks on a given day at 48, 60, and 72 months[a]



[a] At 48 months, unweighted *n*=2,561 and weighted *n*=439,572. At 60 months, unweighted *n*=2,496 and weighted *n*=436,443. At 72 months, unweighted *n*=2,120 and weighted *n*=438,408. Appendix Table B2b-5 offers additional detail.

[b] Difference between percentages at 48 and 72 months is statistically significant at $p \leq 0.05$.

Note: Consistent with the Feeding Infants and Toddlers Study (FITS) 2008, SSBs include all fruit drinks and -ades, carbonated beverages, instant tea and coffee mixes with sweetener, and sweetened water. Excluded are beverages with artificial sweetener, unsweetened tea, coffee, and water.

[77] "Any type of dessert, sweet, or sweetened beverage" is a FITS food group which includes sugar, sugar substitutes, syrups, honey, sweet toppings, frostings, sweet sauces, jellies, jams, preserves, fruit butters, marmalades, gelatin desserts, ices, fruit bars, popsicles, candy (including dietetic sweets), and chewing gum. Excludes sugars that were ingredients in food mixtures coded as a single item and tabulated under another food group. For example, sugar in baked goods is tabulated under Grain Products. In this report, "other sweets" is used to be inclusive of the wide variety of sweet foods included.

As at previous interview months, within the desserts and candy food group, cakes, pies, cookies, and pastries were the most commonly consumed dessert items (31%). Candy was consumed by 20 percent of study children on a given day at 72 months. Fruit-flavored drinks were consumed by 24 percent of study children, which made them the most frequently consumed SSB. Consumption of carbonated soda was second at 11 percent. The percentage consuming carbonated soda increased significantly at each interview between 48 months (7%) and 72 months (11%).

Maternal ethnorace was the only key sociodemographic characteristic associated with consumption of desserts, candy, SSBs, or other sweets at 72 months. Among children with non-Hispanic Black caregivers, 91 percent consumed SSBs, desserts, candy, or sweets on a given day. Among children with non-Hispanic White caregivers, 86 percent consumed them on a given day. Among children with non-Hispanic caregivers of Other races, 87 percent consumed them on a given day, and 82 percent of children with Hispanic caregivers consumed them. Pairwise comparisons of subgroups who consumed SSBs, desserts, candy, or sweets on a given day indicated that the difference in the percentages of children with non-Hispanic Black caregivers and those with Hispanic caregivers was statistically significant.

Consumption of salty snacks remained largely unchanged between the 60- and 72-month interviews (31% and 32%, respectively). Consumption of salty snacks was significantly associated with maternal ethnorace. Among children with non-Hispanic Black caregivers, 44 percent consumed salty snacks on a given day at 72 months. Among children with non-Hispanic White caregivers, 36 percent consumed from this food group on a given day. Among children with non-Hispanic caregivers of all Other races, 27 percent consumed these foods on a given day, while 25 percent of children with Hispanic caregivers consumed them. Pairwise comparisons of these key sociodemographic subgroups of children who consumed salty snacks on a given day at 72 months indicated that the difference in the percentage of children with non-Hispanic Black caregivers and non-Hispanic caregivers of all Other races was statistically significant, as were the differences between the percentages of children with Hispanic caregivers and children with either non-Hispanic Black or non-Hispanic White caregivers.

Added Sugars as a Percentage of Total Calories. Unlike the DGA recommendations discussed in previous subsections, the DGA recommendation for added sugars intake is not dependent on the child's activity level. The recommendation is to limit added sugars intake to no more than 10 percent

of total calories. The analysis, therefore, examined usual intake of added sugars as a percentage of total calories. At 72 months, an average of nearly 11 percent of children's calories came from added sugars, and slightly less than half (48%) of study children met the DGA recommendation for added sugars intake.[78,79]

Children's intakes of added sugars as a percentage of total calories differed by maternal ethnorace characteristics of caregivers. Table 3-16 presents the findings for the mean contribution of added sugars to total calories, and Table 3-17 presents the percentages of study children meeting the DGA recommendation by maternal ethnorace.

Table 3-16. Usual intake of added sugars as a percentage of total energy at 72 months[a] by maternal ethnorace subgroups

Key sociodemographic characteristics	Percentage (standard error) All study children	Unweighted *n*[b]	Weighted *n*[b]
Maternal ethnorace			
Non-Hispanic Black	11.3[c] (0.3)	614	89,192
Non-Hispanic White	11.1 (0.3)	606	117,893
Non-Hispanic Other	9.6 (0.5)	118	26,602
Hispanic	9.9[c] (0.3)	782	204,722

[a] These estimates used the National Cancer Institute (NCI) univariate model. Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

[b] Two days of dietary recall information data are used in the NCI's univariate model to generate the pseudo-population underlying the estimates presented. The percentages reported are the means of the percentages for the pseudo-population. The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM).

[c] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, the difference in the mean percentage for children with non-Hispanic Black caregivers and Hispanic caregivers is statistically significant. In other words, the comparisons are between means or medians within a column for a key sociodemographic characteristic, not across columns.

[78] Source: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf.

[79] Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

Table 3-17. Percentage of study children meeting the *Dietary Guidelines for Americans* (DGA) recommendation for added sugars at 72 months[a] by maternal ethnorace subgroups based on usual intake estimates

Key sociodemographic characteristic	Met DGA percentage (standard error)	Unweighted *n*[b]	Weighted *n*[b]
Maternal ethnorace			
Non-Hispanic Black	37.7[c] (4.5)	614	89,192
Non-Hispanic White	40.1 (5.0)	606	117,893
Non-Hispanic Other	59.1 (7.0)	118	26,602
Hispanic	55.4[c] (4.0)	782	204,722

[a] These estimates used the National Cancer Institute (NCI) multivariable Markov Chain Monte Carlo (MCMC) method. Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

[b] The unweighted and weighted sample sizes (*n*'s) reported were collected as part of the 72-month survey using the Automated Multiple Pass Method (AMPM). Two days of dietary recall information data are used in the NCI univariate model to generate the pseudo-population underlying the estimates presented.

[c] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$. For example, the difference in the mean percentage for children with non-Hispanic Black caregivers and Hispanic caregivers is statistically significant.

3.6 Diet Quality at 72 Months

Knowing which foods and beverages children consume is informative; however, it is important to quantify diet quality in order to determine if overall intake is appropriate for a healthy diet. To evaluate the overall quality of children's diets in WIC ITFPS-2, analyses explored dietary intake using the HEI-2015. The intakes underlying HEI-2015 scores used the 2 days of dietary recall information, with the second day collected from a 10 percent subsample, to adjust intakes for day-to-day variation; therefore, the estimates are referred to as estimates of usual intake.

The HEI-2015 is a standard measure of diet quality for children ages 2 years and older that measures adherence to the 2015-2020 DGA recommendations, accounting for total dietary energy (Krebs-Smith et al., 2018). The HEI-2015 scores 13 individual dietary components, as well as total diet. The total HEI-2015 score ranges from 0 to 100, with higher scores indicating better alignment with the 2015-2020 DGA (Krebs-Smith et al., 2018). HEI-2015 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 fats range from 0 to 10. The 13 individual components are subdivided into two groups: "adequacy," which are evaluated based on consuming above a minimum amount; and "moderation," which are evaluated based on consumption below a maximum amount.

The average HEI-2015 total score for study children at 72 months was 56.2, which is in the range indicating a need for improvement. Based on 2013-2014 NHANES data, the national average HEI-2015 total score for children ages 6 to 11 years was 53.[80] Table 3-18 shows the mean HEI-2015 score for WIC ITFPS-2 children from ages 2 through 6 years. It is important to note that the methodology for estimating HEI-2015 scores changed between estimates at 48 and 60 months; this report continues with the methodology used for the 60-month estimate. Nonetheless, as study children age, there is a noteworthy downward trend in overall scores. This trend is also evident in the refined grain, sodium, and added sugars component scores.

Table 3-18. Average Healthy Eating Index-2015 (HEI-2015) scores for study children at 24, 36, 48, 60, and 72 months[a]

HEI component	Maximum score	Standard for maximum score[b]	24-month mean score	36-month mean score	48-month mean score	60-month mean score	72-month mean score
Adequacy							
Total fruits	5	≥0.8 cup equiv. per 1,000 kcal	4.7	4.8	4.6	4.6	4.3
Whole fruits	5	≥0.4 cup equiv. per 1,000 kcal	3.6	4.2	3.7	4.6	4.0
Total vegetables	5	≥1.1 cup equiv. per 1,000 kcal	2.5	2.6	2.3	2.5	2.5
Greens and beans	5	≥0.2 cup equiv. per 1,000 kcal	2.2	1.9	1.3	1.8	2.0
Whole grains	10	≥1.5 oz. equiv. per 1,000 kcal	3.5	3.5	3.6	3.2[c]	2.8[c]
Total dairy	10	≥1.3 cup equiv. per 1,000 kcal	9.5	9.1	8.6	8.6	8.5
Total protein foods	5	≥2.5 oz. equiv. per 1,000 kcal	4.3	4.5	4.6	4.3	4.2
Seafood and plant proteins	5	≥0.8 oz. equiv. per 1,000 kcal	1.7	1.6	1.0	2.1	1.8
Fatty acids[d]	10	(PUFAs + MUFAs)/ SFAs ≥2.5	1.7	2.9	3.8	3.3	3.0
Moderation							
Refined grains	10	≤1.8 oz. equiv. per 1,000 kcal	7.5	6.5	5.9	5.6[c]	5.0[c]
Sodium	10	≤1.1 gram per 1,000 kcal	5.6	5.0	4.6	4.4	4.3

[80] Source: https://www.fns.usda.gov/hei-scores-americans.

Table 3-18. Average Healthy Eating Index-2015 (HEI-2015) scores for study children at 24, 36, 48, 60, and 72 months[a] (continued)

HEI component	Maximum score	Standard for maximum score[b]	24-month mean score	36-month mean score	48-month mean score	60-month mean score	72-month mean score
Moderation							
Added sugars	10	≤6.5% of energy	9.1	8.7	8.3	8.0	7.9
Saturated fats	10	≤8% of energy	6.2	6.2	6.5	6.2	5.9
Total HEI-2015 score	100		60.5	61.4	58.7	59.1[e]	56.2[e]
Unweighted *n*[f]			2,199	2,586	2,562	2,496	2,120
Weighted *n*[f]			371,245	438,319	439,736	436,443	438,408

[a] In this report, the National Cancer Institute (NCI) Markov Chain Monte Carlo (MCMC) method was used to estimate HEI-2015 scores at study child ages 60 and 72 months, so scores from prior years are not directly comparable with the 60- and 72-month scores. Prior years' estimates are included for informational purposes only.

[b] Scoring criteria for HEI-2015 can be found at https://epi.grants.cancer.gov/hei/developing.html. Retrieved on: September 10, 2020.

[c] Indicates that the component scores at 60 and 72 months are significantly different at $p \leq 0.05$. The usual-intake adjusted scores are not linked to the individual so the correlation between 60- and 72-month observations is not accounted for; thus, the standard error of the difference in the denominator of the t-statistic is likely too large. The independent t-test performed is likely conservative, meaning that findings of significant difference are likely reliable (subject to the Type 1 error rate), but findings of no difference are not as reliable.

[d] Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

[e] Indicates that the total scores at 60 and 72 months are significantly different at $p \leq 0.05$. The usual-intake adjusted scores are not linked to the individual so the correlation between 60- and 72-month observations is not accounted for; thus, the standard error of the difference in the denominator of the t-statistic is likely too large. The independent t-test performed is likely conservative, meaning that findings of significant difference are likely reliable (subject to the Type 1 error rate), but findings of no difference are not as reliable.

[f] Sample sizes reported represent the size of the unweighted and weighted size on the sample that reported dietary information; however, estimation methods recommended by NCI generate a pseudo-population from these data. Therefore, the sample sizes are not necessarily the number of cases used in the estimation process.

Bivariate analysis of HEI-2015 scores at 72 months found statistically significant differences in several component scores for the key sociodemographic subgroups, but there were no significant differences in total scores. Table 3-19 presents the findings for scores that exhibited significant differences by key sociodemographic characteristics.

Table 3-19. Mean Healthy Eating Index-2015 (HEI-2015) scores by key sociodemographic characteristics[a]

HEI-2015 component and key sociodemographic characteristics	HEI-2015 score Mean (standard error)
Greens and Beans	
Maternal ethnorace	
Non-Hispanic Black	2.01[b] (0.19)
Non-Hispanic White	1.16[b,c] (0.12)
Non-Hispanic Other	1.89 (0.29)
Hispanic	2.62[c] (0.16)
Participation in non-WIC benefit programs	
Does not participate in any other programs[d]	2.07 (0.20)
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	1.72[b] (0.15)
Participates in other program(s) excluding SNAP[d]	2.34[b] (0.17)
Whole Grains	
Household food security status	
High or marginal	2.87[b] (0.10)
Low	2.17[c] (0.24)
Very low	2.80 (0.23)
Total Dairy	
Maternal ethnorace	
Non-Hispanic Black	7.68[b,c] (0.20)
Non-Hispanic White	8.68[b] (0.19)
Non-Hispanic Other	8.27 (0.32)
Hispanic	8.74[c] (0.18)
Marital status	
Married	8.83[b] (0.18)
Not married	8.20[b] (0.17)
Total Protein Foods	
Marital status	
Married	4.00[b] (0.13)
Not married	4.33[b] (0.07)
Sodium	
Maternal ethnorace	
Non-Hispanic Black	3.69[b] (0.18)
Non-Hispanic White	4.33 (0.15)
Non-Hispanic Other	4.11 (0.36)
Hispanic	4.68[b] (0.19)
Added Sugars	
Maternal ethnorace	
Non-Hispanic Black	7.55[b,c] (0.15)
Non-Hispanic White	7.64 (0.14)
Non-Hispanic Other	8.33[c] (0.23)
Hispanic	8.19[b] (0.14)
Reported weight status of mother	
Normal or underweight	7.73[b] (0.16)
Overweight	8.23[b] (0.11)
Obese	7.83 (0.14)

Table 3-19. Mean Healthy Eating Index-2015 (HEI-2015) scores by key sociodemographic characteristics[a] (continued)

HEI-2015 component and key sociodemographic characteristics	HEI-2015 score Mean (standard error)
Saturated Fats	
Maternal ethnorace	
Non-Hispanic Black	6.03 (0.20)
Non-Hispanic White	5.28[b] (0.19)
Non-Hispanic Other	5.80 (0.36)
Hispanic	6.24[b] (0.19)

[a] In this report, the National Cancer Institute (NCI) Markov Chain Monte Carlo (MCMC) method was used to estimate HEI-2015 scores at study child age 72 months. Two days of dietary recall information (unweighted *n*=2,120 and weighted *n*=438,408) were used in the MCMC.

[b,c] Given the key characteristic and group of children under analysis, matching letters within a column indicate a statistically significant difference between subgroups at $p \leq 0.05$

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

3.7 Factors Independently Associated with Vegetable Intake

This section reports on findings from multivariable analyses of factors independently associated with vegetable intake on a given day at 72 months. Originally, associations between early feeding practices and vegetable intake were of interest; however, preliminary analyses did not find independent associations between these and vegetable density (i.e., cup eq. of vegetables per 1,000 calories of dietary energy). Focus, therefore, shifted to contemporary influences. The independent variables included in the regression were maternal ethnorace; household food security status; calories from salty, non-vegetable snacks[81] as a percentage of dietary energy; fruit density of the child's diet (i.e., cup eq. of fruit per 1,000 calories of dietary energy); calories from SSBs as a percentage of dietary energy; participation in SNAP; and household participation in NSLP, SBP, or SFSP. In addition, the analysis included two measures of the home environment in which children eat: the frequency of television viewing during meals and the frequency of eating meals together as a family. Respondents to the 72-month interview indicated their frequency of television viewing during meals using a scale: *never*, *rarely*, *sometimes*, or *most of the time*. For the regression analysis, responses of *never* and *rarely* were combined, as were *sometimes* and *most of the time*. Respondents to the 72-month interview also indicated how often they ate together as a family in the past week: *never, 1-2 times*, *3-4 times*, *5-6 times*, or *7 or more times*. For the regression analysis, these responses were collapsed into two categories: 0 to

[81] Vegetables were removed from the FITS salty snack food group.

4 times, and 5 or more times. These measures of the child's food environment are discussed in more detail in Chapter 5. All independent variables in the regression except maternal ethnorace were assessed during the 72-month interview.[82]

Table 3-20 presents the model results. Calories from SSBs were inversely associated with vegetable density given the factors in the model. The effect was very small; however, the accumulative detrimental influence on the child's health over the course of years may be noteworthy. Additionally, the frequency of family meals together was associated with reduced vegetable density: Children in families that ate 5 or more meals together in a week had higher vegetable density than children in families who ate 0 to 4 meals together in the past week. The other covariates were not statistically significant.

Table 3-20. Results of multivariable regression of vegetable density on covariates[a]

Covariate	Coefficient	*p*-value
Maternal ethnorace: reference category is Non-Hispanic White		
Hispanic	-0.08	0.15
Non-Hispanic All Other	0.15	0.25
Non-Hispanic Black	0.08	0.19
Household food security status: reference is high or marginal		
Low food security	0.06	0.19
Very low food security	0.04	0.52
Energy from non-vegetable salty snacks as a percentage of total energy	<-0.01	0.09
Fruit density (cup eq. per 1,000 calories)	-0.03	0.11
Energy from sugar-sweetened beverages as a percentage of total	<-0.01	0.04*
Pattern of WIC participation: reference is consistently through 5 years		
1st year only	0.08	0.26
2nd and 3rd years only	0.01	0.81
4th and 5th years only	0.02	0.71
Intermittently	0.09	0.15
Receiving Supplemental Nutrition Assistance Program (SNAP) benefits	0.02	0.57
Someone in household participates in the National School Lunch Program, School Breakfast Program, or the Summer Food Service Program	0.04	0.25
Television viewing during meals: reference is rarely or never		
Most of the time or sometimes	-0.05	0.27
Meals eaten together: reference is 5 or more times during the week		
Less than 5 times during the week	-0.13	<0.01*
Timing of 72-month interview: reference is after the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) on March 13, 2020		
On or prior to the COVID ED	0.04	0.26

[a] Findings are weighted. Unweighted n=950 and weighted n=433,353.

* Indicates statistically significant difference at $p \leq 0.05$.

[82] Between enrollment and the 72-month interview, maternal ethnorace was refreshed if the caregiver changed.

4. Energy and Nutrient Intake

Key Findings at 72 Months:

- Median daily usual intake of energy was 1,780 kcal/day and 1,640 kcal/day for male and female study children, respectively. These levels were higher than at age 60 months (1,660 kcal/day for males and 1,539 kcal/day for females).
- With the exception of dietary fiber, median macronutrient intakes met or exceeded recommended levels and were within acceptable levels as percentages of daily energy intake. Study children typically had lower intakes of total fat and higher intakes of protein as percentages of energy than a nationally representative sample of children based on data from the 2015-2018 National Health and Nutrition Examination Survey (NHANES).
- While intakes of total fat and protein as percentages of energy were within recommended ranges for both groups, study children who consistently participated with the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) during the first 5 years of life had lower total fat intake and higher protein intake than children who left WIC after their first year of life.
- An estimated 71 percent of study children had inadequate intake of vitamin D. About 36 percent had inadequate intake of vitamin E, which is an improvement from 45 percent of children exhibiting inadequate intakes at 60 months. The prevalence of inadequate calcium intake was 24 percent, which did not significantly differ from the prevalence at 60 months (25%).
- Median usual intake of sodium (2,737 mg/d) exceeded the Chronic Disease Risk Reduction (CDRR) level (1,500 mg/d). Approximately 97 percent of study children had sodium intakes above the level recommended to reduce risk of chronic disease.
- Compared with children who consistently participated with WIC over the first 5 years of life, children who left WIC after their first year or left after the second or third years had significantly higher saturated fat intake as a percentage of energy on a given day when they were 6 years old.

4.1 Overview

This chapter focuses on children's energy and nutrient intake at 72 months, one of several interviews during which the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) collected 24-hour dietary recall data on study children. Throughout the chapter, findings from earlier interviews are included, where applicable, to provide context. Research questions addressed in this chapter include:

- What are the food/beverage (including water), energy, and nutrient intakes of the study children both overall and by subgroups of interest?
- How do dietary intake patterns change once a child ages out of WIC? How do changes in these patterns vary across subgroups?
- How many 5-6-year-olds exhibit unhealthy eating patterns, and what characteristics, including weight-for-height status, are associated with these habits?

- What is the relationship, if any, between (1) cumulative years of participation in WIC, (2) ages during WIC participation, and (3) continuity of WIC benefit receipt (e.g., constant vs. intermittent) and dietary behaviors and energy and nutrient intake after aging out of WIC?
  - 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])?
  - 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?
  - Do early feeding practices, meal/snack patterns, or food and nutrient intakes between ages 0 and 24 months relate to feeding practices, meal/snack patterns, and food and nutrient intakes at age 6 years? How do these vary based on characteristics of WIC participation of the child/household?
- 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 sixth year of life?

4.2 Background

Children need sufficient amounts of energy, macronutrients, and micronutrients for healthy growth and development. The nutrient intakes of groups of children at age 72 months can be evaluated using Dietary Reference Intakes (DRIs). DRIs are nutrient standards (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019) that can be used as a point of comparison to estimate the prevalence of adequate, inadequate, or excessive intakes. The 2020-2025 *Dietary Guidelines for Americans* (DGA) can also be used as standards for a healthy, nutritionally adequate diet (U.S. Department of Agriculture [USDA] & U.S. Department of Health and Human Services [HHS], 2020).

4.2.1 Energy and Nutrient Intake

To examine dietary intake comprehensively, the total energy (as measured in kilocalories, or kcal), macronutrient, and micronutrient contents of individuals' diets were estimated and, when appropriate, compared to existing standards or references. The comparisons speak directly to the nutrition security of the study population when study children are 6 years old. Nutrition security, as

opposed to food security, addresses whether intakes of important nutrients are appropriate to maintain optimal health.

For total energy, comparisons with the Estimated Energy Requirement (EER) are often made. EER is the average estimated amount of energy necessary to promote adequate and appropriate growth among various age groups. The EER for children (Institute of Medicine, 2005), which is based on both total energy expenditure and energy deposition during growth, requires obtaining an accurate body weight and height for the child at the same time point as the dietary intake. Although the current study collected data on weight and height around the time of the sixth birthday (i.e., between 67 and 77 months of age), measurements were not obtained on the same day that the dietary recall was conducted. In addition, the study did not collect sufficiently detailed information on physical activity to determine children's actual energy needs. As such, individual-level EERs could not be determined for each study child, and evaluation of energy intake of WIC ITFPS-2 participants by comparisons to EERs is not appropriate.[83]

Comprehensive dietary evaluations also examine the macronutrient and micronutrient content of individuals' diets. Essential macronutrients (i.e., protein, carbohydrate, and fat) are needed in relatively large quantities to provide energy and promote growth, whereas micronutrients (i.e., vitamins and minerals) are needed in smaller amounts but are still essential for various physiological and metabolic processes. Insufficient consumption of the necessary micronutrients can increase risk of disease and can impede growth and development.

The DRIs for essential nutrients[84] include Recommended Dietary Allowances (RDAs), Estimated Average Requirements (EARs), Adequate Intakes (AIs), and Tolerable Upper Intake Levels (ULs). 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

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[83] A similar determination regarding energy intake for children and EER comparisons was made for the Feeding Infants and Toddlers Study 2008 (FITS 2008) (Butte et al., 2010).

[84] DRIs for phosphorous, magnesium, and fluoride (1997); DRIs for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline (1998); DRIs for vitamin C, vitamin E, selenium, and carotenoids (2000); DRIs for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc (2001); DRIs for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (2002/2005); DRIs for calcium and vitamin D (2011); and DRIs for sodium and potassium (2019). Available at: http://nationalacademies.org/HMD/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx. Retrieved on: February 14, 2022.

individual-level dietary intakes. RDAs are dependent on the establishment of an EAR. 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. EARs can be used as a cut point for most nutrients; the prevalence of inadequate intakes is estimated as the proportion of the population with intakes below the EAR (Murphy, Guenther, & Kretsch, 2006). In the absence of sufficient data to produce EARs, AIs are estimated. 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, while the exact prevalence of low intakes cannot be determined, a low prevalence of inadequate intake is assumed (Murphy et al., 2006). Nutrient intake levels may also be compared to the UL, the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects. If a sizable proportion of a group has intakes above the UL, it may be appropriate to reduce intakes (Murphy et al., 2006). In 2017, the NASEM recommended expanding the DRIs to include a new category based on chronic disease, called the Chronic Disease Risk Reduction intakes (CDRRs). To date, a CDRR has been established for sodium only.

In addition to DRIs, macronutrients can also be expressed as absolute amounts or as percentages of daily energy intake. The latter is then compared with a range known as the Acceptable Macronutrient Distribution Range (AMDR). Like other DRIs, the AMDR is based on the ideal range necessary to promote health and growth while reducing chronic disease risk.

When evaluating nutrient intakes of children, it is important to consider the intake of several micronutrients that are essential for growth and development and are nutrients of public health concern, including vitamin D, calcium, sodium, and potassium. Inadequate vitamin D in childhood can impair calcium absorption, decrease bone mineralization and growth, and cause rickets in children (Del Valle, Yaktine, Taylor, & Ross, 2011; Holick, 2006). Similarly, inadequate calcium intake contributes to poor bone health (Del Valle et al., 2011; Stallings & Yaktine, 2007). Compared with older children and adults, children ages 4-8 years in the United States are more likely to meet recommended intakes of dairy, the main dietary sources of vitamin D and calcium (Wallace, Reider, & Fulgoni, 2013). Nevertheless, average intakes of vitamin D remain below recommended amounts by children of all ages (Moore, Radcliffe, & Liu, 2014).

Adequate intakes of sodium and potassium are critical for the maintenance of cellular function and fluid balance (World Health Organization, 2012). However, excessive sodium intake is associated with increased risk of cardiovascular disease and hypertension (NASEM, 2019). The 2020-2025 DGA recommends reducing the intake of sodium (USDA & HHS, 2020). For children ages 4 to 8 years, the CDRR for sodium recommends reducing intakes above 1,500 mg/day, whereas the former Tolerable Upper Intake Level (UL) for sodium was 1,900 mg/day. While sodium intakes by children in the United States have decreased in recent years, in 2011-2016 less than one-quarter of children 4-8 years old met the prior target of 1,900 mg/d or less (Brouillard, Deych, Canter, & Rich, 2020). An analysis of the 2011-2014 National Health and Nutrition Examination Survey (NHANES) data found that the average sodium intake of children residing in households receiving WIC benefits exceeded both the UL and CDRR recommendations (Zimmer, Rubio, Kintziger, & Barroso, 2019).

Another dietary component of public health concern is fiber (USDA & HHS, 2020). Higher dietary fiber intakes are associated with reduced cardiovascular disease risk and weight among children (Brauchla, Juan, Story, & Kranz, 2012; Fulgoni, Brauchla, Fleige, & Chu, 2020). The recommendation for dietary fiber intake is 14 grams (g) per 1,000 kilocalories (kcal), which translates to 17-20 g/day for children 4-8 years old (USDA & HHS, 2020). However, children in the United States average approximately 13 g/day of dietary fiber (Fulgoni et al., 2020).

4.3 Sample and Analysis Approach

4.3.1 Sample

The analyses in this chapter primarily used data from dietary intake interviews when the child was 72 months old. The 72-month interview included both the core and supplemental samples. Table 3-1 in Chapter 3 of this report presents the unweighted number of respondents by sample and type of interview (i.e., survey interview or dietary recall). The responses were weighted so that findings reflect the study-eligible population as described in Chapter 1—that is, all mother-child dyads who were 16 years or older at the time of the study child's birth, spoke English or Spanish, and were enrolling in WIC for their current pregnancy or child less than 3 months old in the fall of 2013.

Findings from previous WIC ITFPS-2 interviews, particularly the 60-month interview, are presented, as appropriate, to show progression as children age and provide context. The samples for

earlier interviews are discussed in prior WIC reports. These can be found at https://www.fns.usda.gov/wic/infant-and-toddler-feeding-practices-study-2-fourth-year-report.

4.3.2 Analysis

Results from assessing median and mean intakes for energy, macronutrients, and micronutrients are presented in this chapter. This chapter includes an overview of the nutrients important to the WIC food package; however, because study children are no longer age-eligible for WIC, the emphasis is on dietary components of public health concern. The 2020-2025 DGA mention that calcium, potassium, dietary fiber, and vitamin D are typically underconsumed by Americans, while added sugars and sodium are overconsumed. This report analyzed intakes of these nutrients of public health concern and also included saturated fat, which is also typically overconsumed by American children. WIC ITFPS-2 findings for the seven nutrients were compared to DRIs or DGA recommendations, as appropriate. The prevalence of inadequate intakes of relevant nutrients was assessed using the cut-point method described previously, by examining the distribution of intakes to determine the proportion that falls below the EAR (Murphy et al., 2006).

The analyses also included an assessment of the contributions of select foods to nutrients of public health concern. Foods available in the WIC food package motivated the selection of foods which were categorized using food groups from the 2016 Feeding Infants and Toddlers Study (FITS) (Anater et al., 2018; Welker, Jacquier, Catellier, Anater, & Story, 2018). The FITS food groups were based on the Continuing Survey of Food Intakes by Individuals (Wilson et al., 1997), the predecessor to NHANES.

As mentioned in Chapter 3, one significant difference between the FITS and DGA food groups is that the FITS groups do not reflect the contributions of foods in mixed dishes to individual food groups; rather, mixed dishes are in separate groups. Thus, for example, dark-green vegetables consumed in a mixed vegetable soup are not included in the FITS dark-green vegetable group, but they are included in the DGA dark-green vegetable food group. The differences in these two approaches to food groups reflect that the FITS groups predate the Food Patterns Equivalent Database (FPED) used for the current DGA. For many years, the FITS food groups were the food groups available for very young children. Moreover, the 2015-2020 DGA did not include specific recommendations for feeding very young children.

Dietary Data. All post-birth WIC ITFPS-2 interviews through 24 months, as well as the interviews at 36, 48, 60, and 72 months, included a 24-hour dietary recall using the USDA's Automated Multiple Pass Method (AMPM) (Raper, Perloff, Ingwersen, Steinfeldt, & Anand, 2004). Using the computer-assisted interview protocol, an interviewer guided the caregiver through the prior day's intake and asked the caregiver to report all foods, beverages, and dietary supplements the child consumed for each eating occasion during the 24-hour period. The interviewer recorded all information and trained coders then coded and analyzed the data for nutrient content.[85]

About 73 percent of initial dietary recalls were collected on a weekday (i.e., Monday through Friday), and 27 percent were collected on weekend days (i.e., Saturday or Sunday). About 85 percent of the initial dietary recalls were collected in months traditionally associated with the school year, September through May. About 15 percent were collected in months traditionally associated with summer vacation from school, June through August. However, many schools closed for in-person instruction around the time of the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED), March 13, 2020. The final initial dietary recall collected as part of the 72-month interview was collected in June 2020.

Within 10 days of the initial dietary intake interview, the study collected a second, replicate intake on a randomly selected 10 percent subsample of children at 13, 15, 18, 24, 36, 48, 60, and 72 months. The second day of recall information was used in conjunction with the first to statistically adjust intakes for day-to-day variation in order to estimate "usual" intake.

Research has found that single 24-hour dietary recalls on very young children, collected by proxy, may be subject to error, particularly overestimation of energy intake (Fisher et al., 2008). However, additional research found that two recalls provide much better estimates of energy intake for preschool-age children on a group level (Börnhorst et al., 2014). Though WIC ITFPS-2 conducted second recalls on a 10 percent subset of the study sample and used the second recall to estimate usual intake, the proxy reports of intakes may still be subject to reporting error.

In this chapter, 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

[85] Appendix B3 offers additional information on dietary coding.

day-to-day variation in dietary intakes using methods developed by the National Cancer Institute (NCI).

NCI recommends different methods for estimating usual dietary intake depending on the type of dietary component under analysis.[86] In this chapter, NCI's univariate model was used to estimate usual intakes of single nutrients. NCI's multivariate Markov Chain Monte Carlo (MCMC) method was used to estimate usual intake underlying estimates of the percentages of children meeting the DGA recommendations for added sugars and saturated fat. NCI's MCMC method accounts for the correlations between all dietary components, including energy.[87] Two days of dietary recall information were used in both the univariate and MCMC models. The models generated estimates for a pseudo-population from which the usual intake estimates presented were derived. In both the univariate and MCMC models, usual intake estimates were adjusted for child sex,[88] the 12 key sociodemographic characteristics described in Chapter 1, Section 1.8.2, and the timing of the 72-month interview (i.e., whether it took place before or after March 13, 2020). March 13, 2020, is the date of the Federal COVID ED. The 72-month cross-sectional combined sample weights were used in the NCI models except when adjusting for pattern of WIC participation by the study child. The patterns were derived longitudinally, meaning the 1- or 3-month through 72-month longitudinal core sample weights were used.

When estimates from the NCI univariate model were used to estimate ratios of intakes, the ratios of usual intake were estimated using the population ratio method (NCI, 2017). In other words, the means of intake for the numerator and denominator were calculated separately and, subsequently, divided for ratio estimation. This approach does not reflect the correlation among components of an individual child's intake. Accordingly, when ratios of intakes are discussed, the mean ratio, instead of the median ratio, is presented.

Bivariate Analyses. These analyses explored key sociodemographic characteristics associated with energy and other nutrient intakes. Chapter 1, Section 1.8.2 presented the 12 key sociodemographic characteristics used. Nonmodifiable key sociodemographic characteristics were measured at the time

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[86] See https://epi.grants.cancer.gov/diet/usualintakes/method.html.

[87] See https://epi.grants.cancer.gov/hei/hei-methods-and-calculations.html.

[88] Child sex was determined from the baseline interview from the survey item "Is your [CHILD's NAME] a boy or a girl?"

of the baseline interview, and only refreshed if the caregiver changed. Modifiable key characteristics may change over time and included household food security status and income relative to Federal Poverty Guidelines (FPG). The bivariate analyses included modifiable key sociodemographic characteristics assessed at 72 months.[89] The cross-sectional 72-month weights were used in all analyses except when assessing associations with the pattern of WIC program participation for the study child. For the latter, the longitudinal weights were used, as the patterns incorporated program participation over time.

In addition to the key sociodemographic characteristics, select outcomes were analyzed by the timing of the 72-month interview. More specifically, the analysis examined whether the interview was administered pre- or post-COVID ED. The incorporation of this timing of the 72-month interview into the NCI usual intake models facilitated analyses of the pre-/post-COVID ED subgroups.

Two-tailed t-tests, with Bonferroni adjustment for multiple tests,[90] were used to determine which pairwise key sociodemographic subgroup differences are statistically significant. There is an important caveat to this approach to determining statistically significant differences in findings across interview months (as opposed to within an interview month). The standard error of the difference in the denominator of the independent t-test is likely too large because it does not account for the correlation resulting from the fact that, in many cases, the usual-intake adjusted values for individual nutrients at 72 months and the usual-intake adjusted values for the individual nutrients at 60 months were for the same child.in reported intakes at these interviews. That is, many of the observations at 72 months were from the same children as the observations at 60 months. This means that the test is likely conservative; some statistically significant differences may not be identified by the test. Statistical significance, when indicated, is at the level of $p \leq 0.05$.

Multivariable Analysis. Informed by the bivariate analyses, multivariable regression was used to explore how specific behaviors and characteristics were associated with an outcome. This approach isolated the unique effects of individual variables on the outcome, while holding the influence of

[89] The exception is maternal educational attainment, which is not assessed during the 72-month interview, so attainment reported during the 54-month interview is used.

[90] Bonferroni adjustment was typically applied when comparing outcomes across key sociodemographic characteristics with more than two subgroups.

other variables constant. In this chapter, multivariable linear regression was used to assess factors independently associated with calories from saturated fat as a percentage of energy on a given day at 72 months.

Reported Sample Size. As mentioned, the NCI methods used in this chapter computed a large number[91] of pseudo-individual intakes—a distribution of estimated intakes around each original observed intake. Given this, reported actual sample size for any key sociodemographic characteristic may be misleading. The sample sizes in tables provide information on the number of *original* unweighted and weighted observations that were used in the NCI models, not the actual number of total observations involved in calculating the estimates.

4.4 Energy and Nutrient Intake at 72 Months

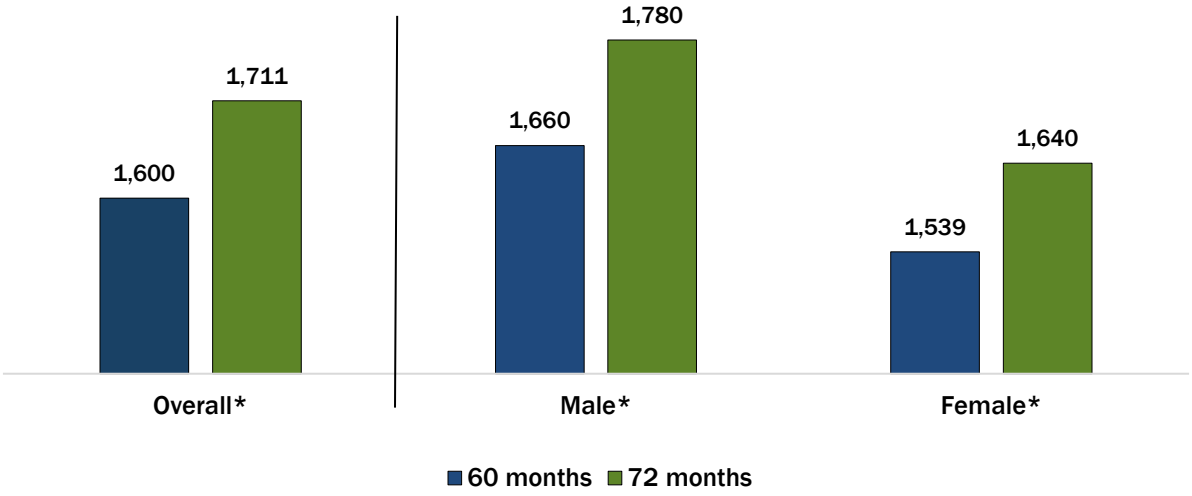
4.4.1 Energy Intake

At 72 months, median energy intake of study children was 1,711 kcal/day (standard error [SE]=20.4), up from 1,600 kcal/day (SE=23.0) at 60 months (Figure 4-1). Median intake for male children was 1,780 kcal/day (SE=24.5), and median intake for female children was 1,640 kcal/day (SE=23.2). The change in median energy intakes, between 60 and 72 months, for both male and female children was statistically significant (Figure 4-1). For context, the 2020-2025 DGA-recommended level for energy intake is 1,400-1,800 kcal/day and 1,200-1,600 kcal/day for 6-year-old males and females, respectively.[92]

[91] The models generate 500 pseudo-individuals for each observed intake.

[92] The DGA-recommended energy intakes are presented as ranges because the absolute amount is dependent on children's physical activity levels, which are defined as sedentary, moderately active, and active.

Figure 4-1. Median usual energy intake by study child sex at 60 and 72 months[a]



[a] The sample underlying these estimates is reported in Chapter 3, Table 3-1. The National Cancer Institute method employed generated a distribution of 500 pseudo-individual intakes around each observation, so weighted and unweighted *n*'s do not accurately reflect the number of observations used in these estimates. Appendix Table B2c-1 offers additional detail.

* Percentages within the designated category are significantly different at $p \leq 0.05$.

Table 4-1 presents statistically significant differences in median usual energy intake at 72 months by key sociodemographic characteristics for male and female study children. For both sexes, median energy intakes differed by maternal ethnoracial characteristics, with median energy intake lower—though well within the DGA-recommended range—for children with Hispanic caregivers than for children with non-Hispanic Black or non-Hispanic White caregivers; for female children, median intakes also differed by age of the caregiver at the study child's birth.

Table 4-1. Sex-specific median usual energy intakes at 72 months by select key sociodemographic characteristics

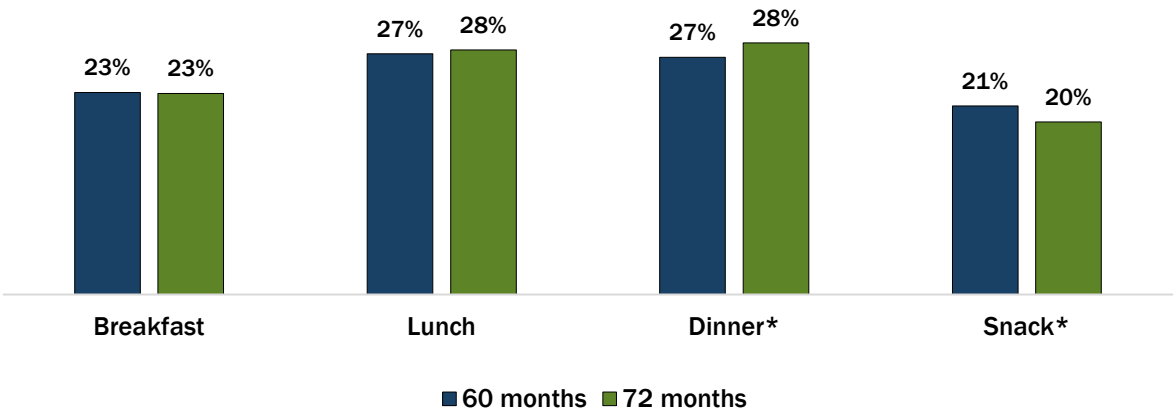
Sociodemographic characteristics	Median usual energy intake at 72 months kcal/day (standard error)		Unweighted *n*	Weighted *n*
	Male children	Female children		
Maternal ethnorace				
Non-Hispanic Black	1869.0[a] (34.4)	1735.5[a] (37.7)	614	89,192
Non-Hispanic White	1841.7[b] (35.2)	1706.5[b] (26.3)	606	117,893
Non-Hispanic Other	1815.7 (52.1)	1687.2 (57.8)	118	26,602
Hispanic	1703.3[a,b] (33.7)	1553.4[a,b] (31.5)	782	204,722
Age of mother or caregiver at child's birth				
16-19 years	1917.1 (70.8)	1784.1[a] (46.9)	194	48,151
20-25 years	1795.4 (29.1)	1659.4 (34.4)	861	177,892
26 years or older	1737.5 (32.2)	1591.3[a] (27.3)	1,065	212,365

[a,b] For the characteristic under analysis, matching superscripts on the medians indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

Energy Intake by Eating Occasion. Another way to examine energy intake is to look at the average percentage of daily energy intake contributed by each eating occasion. For these analyses, only 1 day of dietary recall information was used, so they are estimates of intake on a given day.

As presented in Figure 4-2, breakfast contributed slightly less than one-quarter (23%) of total energy intake on a given day. Lunch and dinner each contributed slightly over one-quarter (28%) of energy intake. Snacks contributed about one-fifth (20%) of energy intake. Though the mean percentage of energy contributed by dinner and snacks on a given day differed significantly between the 60- and 72-month interviews, the differences were very small.

Figure 4-2. Energy intake at each eating occasion[a] as a percentage of total energy intake on a given day at 60 and 72 months[b]



[a] The percentage of energy by eating occasion = (mean of energy for foods reported at the eating occasion on a given day for all study children)/(mean of total energy on a given day for all study children) times 100. Because a few records in the dietary recall data cannot be classified into one of the four eating occasions, the sum of percentages across eating occasions may not sum to 100 percent.

[b] At 60 months, unweighted *n*=2,456 and weighted *n*=430,709 for breakfast. At 60 months, unweighted *n*=2,384 and weighted *n*=419,377 for lunch. At 60 months, unweighted *n*=2,394 and weighted *n*=415,533 for dinner. At 60 months, unweighted *n*=2,189 and weighted *n*=382,390 for snack. At 72 months, unweighted *n*=2,080 and weighted *n*=429,966 for breakfast. At 72 months, unweighted *n*=1,998 and weighted *n*=414,819 for lunch. At 72 months, unweighted *n*=2,050 and weighted *n*=422,592 for dinner. At 72 months, unweighted *n*=1,853 and weighted *n*=383,730 for snack. Appendix Table B2c-2 offers additional detail.

* Percentages within the designated category are significantly different at $p \leq 0.05$.

For breakfast, lunch, and dinner, the mean percentage of total energy at each eating occasion differed significantly by race (Table 4-2). The mean percentages at dinner also differed significantly by timing of WIC enrollment (for the study child) and timing of the 72-month interview. The mean percentages for snack also differed by whether the interview was administered pre- or post-COVID ED, with the mean percentage energy from snacks increasing significantly post-COVID ED.

Table 4-2. Energy intake at each eating occasion as a percentage of total energy intake[a] on a given day at 72 months by select key sociodemographic characteristics

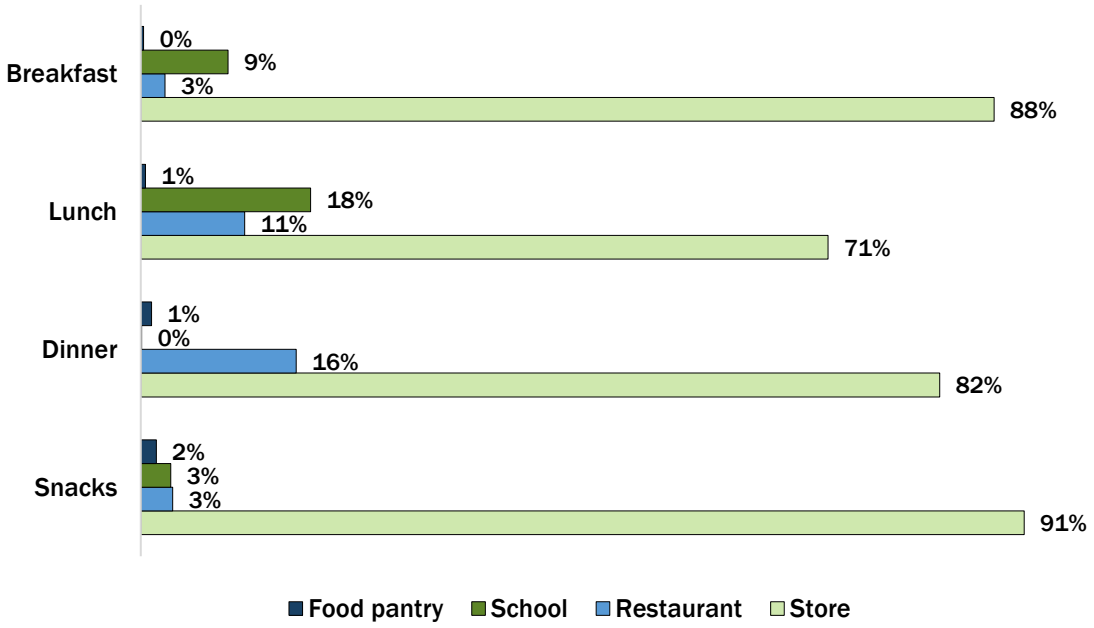
Eating occasion and key sociodemographic characteristics	Percentage of total energy on a given day % (standard error)	Unweighted *n*	Weighted *n*
Breakfast			
Maternal ethnorace			
Non-Hispanic Black	21.8 (0.5)	614	89,192
Non-Hispanic White	21.4[b] (0.4)	606	117,893
Non-Hispanic Other	21.9 (1.0)	118	26,602
Hispanic	24.1[b] (0.7)	782	204,722
Lunch			
Maternal ethnorace			
Non-Hispanic Black	26.2 (0.6)	614	89,192
Non-Hispanic White	27.4 (0.5)	606	117,893
Non-Hispanic Other	24.3[b] (1.4)	118	26,602
Hispanic	28.8[b] (0.8)	782	204,722
Dinner			
Maternal ethnorace			
Non-Hispanic Black	30.5[b] (0.9)	614	89,192
Non-Hispanic White	30.4[c] (0.7)	606	117,893
Non-Hispanic Other	31.3 (2.3)	118	26,602
Hispanic	25.7[b,c] (0.5)	782	204,722
Timing of WIC enrollment			
1st trimester	26.7[b] (0.7)	659	139,420
2nd trimester	28.6 (0.8)	856	176,586
3rd trimester	30.4[b] (0.8)	311	65,126
Postnatal	29.6 (1.0)	294	57,276
Pre-/Post-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED)			
Pre-COVID ED	28.9[b] (0.5)	1,612	351,224
Post-COVID ED	26.4[b] (0.7)	508	87,184
Snack			
Pre-/Post-COVID ED			
Pre-COVID ED	18.8[b] (0.5)	1,612	351,224
Post-COVID ED	22.3[b] (0.9)	508	87,184

[a] Percentages presented are the means for the subpopulations.

[b,c] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

Sources of Foods. For the first time in the series of WIC ITFPS-2 reports, the analysis examined sources of foods reported in the dietary interview. Developed from a list of 26 specified options, sources reported included stores, restaurants, schools, childcare, food pantry, and unknown sources. These sources represent where the food was obtained, not where it was eaten. Thus, for example, food purchased from a restaurant but eaten at home was categorized as being from a restaurant. For each eating occasion, the mean percentage of energy from the four largest sources is presented in Figure 4-3.

Figure 4-3. Energy intake by food source as a percentage of energy at each eating occasion[a] on a given day at 72 months[b]



[a] The percentage of energy by source at an eating occasion= (mean of energy for foods from a given source reported at an eating occasion on a given day for all study children)/(mean of total energy at the eating occasion on a given day for all study children) times 100. Because a few records in the dietary recall data cannot be classified into one of the four eating occasions and because numbers were rounded for presentation, the sum of percentages of energy by source may not sum to 100 percent.

[b] At 72 months, unweighted *n*=2,120 and weighted *n*=438,408 at each eating occasion.

Regardless of eating occasion, the vast majority of children's foods, and also energy, came from stores. However, schools were a noteworthy source of energy for breakfasts (9%) and lunches (18%). It is important to remember that many schools and restaurants were likely closed during the latter months of data collection for the 72-month interview due to COVID-19 pandemic mitigation measures and the window for data collection stretching into the summer months. Closures altered how foods from schools were provided and may have altered how respondents reported sources of food.

The bivariate analyses focused on statistically significant differences in mean intakes from school. Because there were widespread closures of schools and the USDA offered waivers[93] for socially distanced distributions of food from schools after the COVID ED, the timing of the 72-month

[93] More information is available at https://www.fns.usda.gov/fns-disaster-assistance/fns-responds-covid-19/child-nutrition-covid-19-waivers.

interview is included in the presentation of findings. There were no significant differences among the key sociodemographic subgroups[94] or by timing of the 72-month interview for mean intakes from schools at dinner, so only findings from breakfast and lunch are reported in Table 4-3. The data indicated a dramatic drop in energy from schools after the COVID ED; however, caution is warranted when interpreting these findings because many school districts shifted to distributing uncooked food for preparation at home, and respondents may have had trouble distinguishing these foods from those purchased at stores once both were in their homes.

Table 4-3. Energy from schools at breakfast and at lunch as a percentage of total energy intake[a] on a given day at 72 months by select key sociodemographic characteristics

Eating occasion and key sociodemographic characteristics	Percentage of energy from schools on a given day % (standard error)	Unweighted *n*	Weighted *n*
Breakfast			
Reported weight status of mother			
Normal or underweight	6.3[b] (1.1)	566	124,698
Overweight	7.6 (1.6)	627	123,401
Obese	11.8[b] (1.8)	927	190,309
Timing of WIC enrollment			
1st trimester	10.5[b] (2.0)	659	139,420
2nd trimester	8.7[c] (1.0)	856	176,586
3rd trimester	11.3 (2.7)	311	65,126
Postnatal	3.4[b,c] (1.4)	294	57,276
Pre-/Post-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED)			
Pre-COVID ED	11.1[b] (1.2)	1,612	351,224
Post-COVID ED	1.2[b] (0.4)	508	87,184
Lunch			
Maternal ethnorace			
Non-Hispanic Black	22.3[b] (1.9)	614	89,192
Non-Hispanic White	15.2[b] (1.2)	606	117,893
Non-Hispanic Other	23.3 (5.9)	118	26,602
Hispanic	16.1 (1.8)	782	204,722
Timing of WIC enrollment			
1st trimester	13.2[b,c] (2.1)	659	139,420
2nd trimester	22.1[b,d] (1.7)	856	176,586
3rd trimester	24.2[c,e] (3.3)	311	65,126
Postnatal	6.7[d,e] (1.7)	294	57,276
Pre-/Post-COVID ED			
Pre-COVID ED	21.3[b] (1.4)	1,612	351,224
Post-COVID ED	2.0[b] (0.7)	508	87,184

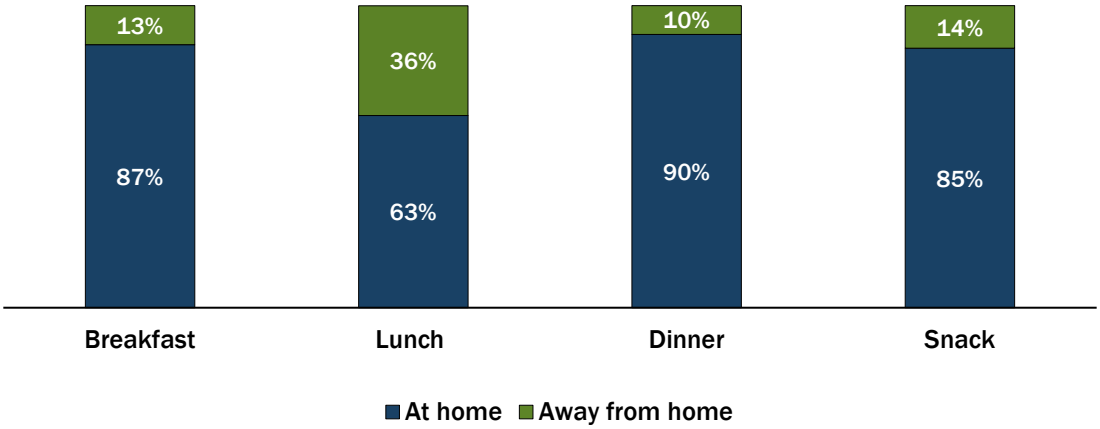
[a] Percentages presented are the means for the subpopulations.

[b,c,d,e] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

[94] Some pairwise comparisons could not be assessed because cells were empty. There were empty cells for subgroups within maternal age at the study child's birth and within pattern of WIC participation.

Where Food Was Eaten. In addition to collecting information on the sources of food, the dietary data include information on where food was eaten. The analysis examined where food was eaten—at home or away from home—by eating occasion. Figure 4-4 presents the findings.

Figure 4-4. Energy by place consumed as a percentage of energy intake[a] at each eating occasion on a given day at 72 months[b]



[a] The percentage of energy for an eating occasion = (mean of energy for foods eaten either at home or away from home at an eating occasion on a given day for all study children)/(mean of total energy at the eating occasion on a given day for all study children) times 100. The sum of the mean percentages may not sum to 100 percent. Because a few records in the dietary recall data cannot be classified into one of the four eating occasions, the sum of percentages of energy by place may not sum to 100 percent.

[b] At 72 months, unweighted *n*=2,080 and weighted *n*=429,966 for breakfast. At 72 months, unweighted *n*=1,998 and weighted *n*=414,819 for lunch. At 72 months, unweighted *n*=2,050 and weighted *n*=422,592 for dinner. At 72 months, unweighted *n*=1,853 and weighted *n*=383,730 for snack.

Regardless of eating occasion, the vast majority of energy was consumed at home. However, on average, more than a third (36%) of energy consumed for lunch was consumed away from home. Subsequent analysis of the sources of the 36 percent of energy consumed away from home for lunch revealed that schools were the source of nearly half (47%) of that energy. Subsequent analysis of the 13 percent of breakfast energy consumed away from home revealed that schools were the source of about two-thirds (67%) of that energy. Given the age of the children (6 years) and that participation

in NSLP is high among elementary students,[95] prior to the COVID ED, much of this food was likely consumed at schools prior to their closures in the effort to curb the spread of COVID-19.[96]

The bivariate analyses focused on food eaten away from home (Table 4-4). Because many restaurants and schools closed during the early months of the pandemic, the timing of the 72-month interview was included in the analyses with the key sociodemographic characteristics. The drop in food eaten away from home pre-/post-COVID ED was statistically significant at each eating occasion.

Table 4-4. Energy eaten away from home as a percentage of energy intake[a] at each eating occasion on a given day at 72 months by select key sociodemographic characteristics

Eating occasion and key sociodemographic characteristics	Percentage of energy eaten away from home % (standard error)	Unweighted *n*	Weighted *n*
Breakfast			
Reported weight status of mother			
Normal or underweight	9.7[b] (1.3)	566	124,698
Overweight	11.4 (1.7)	627	123,401
Obese	15.9[b] (1.8)	927	190,309
Employment status			
Full-time	15.5[b] (1.4)	839	171,202
Part-time	8.1[b] (1.7)	423	89,381
Not employed	12.4 (2.0)	858	177,825
Timing of WIC enrollment			
1st trimester	12.9 (2.1)	659	139,420
2nd trimester	12.6 (1.1)	856	176,586
3rd trimester	18.0[b] (2.9)	311	65,126
Postnatal	7.3[b] (1.6)	294	57,276
Pre-/Post-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED)			
Pre-COVID ED	15.6[b] (1.3)	1,612	351,224
Post-COVID ED	2.0[b] (0.7)	508	87,184
Lunch			
Maternal educational attainment at 54 months			
High school or less	32.6[b] (1.9)	1,120	233,978
More than high school	40.0[b] (2.5)	1,000	204,430
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	32.0[b] (2.0)	821	164,397
>75% of FPG and ≤130% of FPG	36.0 (3.1)	615	131,923
>130% of FPG	40.8[b] (2.4)	684	142,087

[95] Source: https://www.fns.usda.gov/school-nutrition-and-meal-cost-study.

[96] Pre-COVID ED, 16 percent of energy eaten for breakfast was consumed away from home. Of this, 69 percent was from schools. Pre-COVID ED, 44 percent of energy eaten for lunch was consumed away from home. Of this, 48 percent was from schools. These analyses include all initial dietary recalls regardless of the day of the week they were collected.

Table 4-4. Energy eaten away from home as a percentage of energy intake[a] at each eating occasion on a given day at 72 months by select key sociodemographic characteristics (continued)

Eating occasion and key sociodemographic characteristics	Percentage of energy eaten away from home % (standard error)	Unweighted *n*	Weighted *n*
Lumch			
Timing of WIC enrollment			
1st trimester	23.1[b,c] (2.8)	659	139,420
2nd trimester	43.3[b,d] (2.1)	856	176,586
3rd trimester	48.7[c,e] (4.0)	311	65,126
Postnatal	31.4[d,e] (3.6)	294	57,276
Pre-/Post-COVID ED			
Pre-COVID ED	43.8[b] (1.7)	1,612	351,224
Post-COVID ED	4.3[b] (1.4)	508	87,184
Dinner			
Maternal educational attainment at 54 months			
High school or less	7.0[b] (1.2)	1,120	233,978
More than high school	12.2[b] (2.3)	1,000	204,430
Income poverty			
≤75% of FPG	5.7[b] (1.3)	821	164,397
>75% of FPG and ≤130% of FPG	11.5 (2.9)	615	131,923
>130% of FPG	11.9[b] (2.1)	684	142,087
Pre-/Post-COVID ED			
Pre-COVID ED	11.1[b] (1.6)	1,612	351,224
Post-COVID ED	2.6[b] (0.9)	508	87,184
Snacks			
Maternal educational attainment at 54 months			
High school or less	11.2[b] (1.1)	1,120	233,978
More than high school	16.9[b] (1.3)	1,000	204,430
Employment status			
Full-time	16.6[b] (1.6)	839	171,202
Part-time	15.6 (1.9)	423	89,381
Not employed	10.6[b] (1.4)	858	177,825
Income poverty			
≤75% of FPG	10.6[b,c] (1.3)	821	164,397
>75% of FPG and ≤130% of FPG	16.3[b] (1.5)	615	131,923
>130% of FPG	15.8[c] (1.5)	684	142,087
Timing of WIC enrollment			
1st trimester	8.2[b,c] (1.6)	659	139,420
2nd trimester	15.2[b] (1.5)	856	176,586
3rd trimester	23.7[c] (3.0)	311	65,126
Postnatal	14.4 (2.3)	294	57,276
Pre-/Post-COVID ED			
Pre-COVID ED	17.3[b] (1.2)	1,612	351,224
Post-COVID ED	2.9[b] (0.7)	508	87,184

[a] Percentages presented are the means for the subpopulations.

[b,c,d,e] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

4.4.2 Macronutrient Intake

WIC ITFPS-2 examined median macronutrient intakes of carbohydrate, protein, fat, and fiber using the AIs/RDAs, EARs, and AMDRs as points of comparison when available. The findings for all study children at 60 and 72 months are presented in Table 4-5a. Though median levels of macronutrient intakes differed significantly between 60 and 72 months, the differences in intakes as a percentage of energy were not significantly different between the two periods. More specifically, less than 1 percent (0.4%) of study children had inadequate carbohydrate intake at 72 months. For protein, prevalence of inadequate intakes cannot be estimated because the EAR for protein is based on body weight and WIC ITFPS-2 did not obtain a body weight at the same time that dietary intake was recorded. However, median protein intakes exceeded the RDA[97] at both 60 and 72 months. The DRIs do not include an EAR or AI for fat for 4- to 8-year-old children, so prevalence of inadequate intakes cannot be estimated; however, estimates of the mean percentages of energy intake from carbohydrate, protein, and fat were within their respective AMDRs. The DRIs include an AI for fiber. Median intake of fiber was 14.2 g/d at 72 months, which was below the AI of 25 g/d for 4- to 8-year-old children.

[97] Although the RDA is the intake level sufficient to meet the nutrient requirements of nearly all healthy individuals in a group, comparisons to the RDA are not reliable indicators of inadequate intakes.

Table 4-5a. Median usual macronutrient and fiber intake of study children at 60 and 72 months[a] and Dietary Reference Intakes (DRIs)

Macronutrients	Usual intake	
	60 months	72 months
Median intake	Median (standard error [SE])	Median (SE)
Fat (g/d)	55.3[b] (1.2)	60.3[b] (1.1)
AI[c]	*ND*[d]	*ND*[d]
Carbohydrate (g/d)	218.1[b] (2.8)	231.0[b] (2.5)
EAR[e]	*100*	*100*
Protein (g/d)	60.7[b] (0.7)	64.3[b] (0.8)
RDA[f]	*19*	*19*
Fiber (g/d)	13.4[b] (0.2)	14.2[b] (0.2)
AI[c]	*25*	*25*
Percentage of energy[g]	% (SE)	% (SE)
Fat	31.9 (0.3)	32.2 (0.3)
AMDR[h]	*25-35*	*25-35*
Carbohydrate	54.1 (0.3)	54.0 (0.3)
AMDR[h]	*45-65*	*45-65*
Protein	15.2 (0.1)	15.0 (0.1)
AMDR[h]	*10-30*	*10-30*
Unweighted *n*	2,496	2,120
Weighted *n*	436,443	438,408

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The 60-month usual intake adjustments included the key sociodemographic characteristics used in the *Fifth Year Report* with the 60-month cross-sectional weights; the 72-month usual intake adjustments included the key sociodemographic characteristics used in this report with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Difference between WIC ITFPS-2 usual intake estimates at 60 months and 72 months for this macronutrient is statistically significant at $p \leq 0.05$.

[c] Adequate Intake (AI).

[d] Not determined (ND).

[e] Estimated Average Requirement (EAR).

[f] Recommended Dietary Allowance (RDA). 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 to EAR could not be made.

[g] The population ratio method is used to estimate the means for these ratios. The percentages reported are the means for the population.

[h] Acceptable Macronutrient Distribution Range (AMDR) is measured as calories from macronutrient as a percentage of energy.

Table 4-5b presents 60- and 72-month usual intake findings alongside the national estimates for 4- to 8-year-old children from the 2015-2018 NHANES. In both studies, estimated average intakes as percentages of energy (Table 4-5b, bottom) were within recommended ranges for both sexes. However, as a percentage of energy, the subpopulations of male and female WIC ITFPS-2 children consumed, on average, significantly less fat and more protein at child age 72 months than male and female 4- to 8-year-old children nationally, based on 2015-2018 NHANES data. Though median

fiber intake of WIC ITFPS-2 children exceeded median intake of 4- to 8-year-old children nationally (Table 4-5b, top), regardless of sex, median intake was less than recommended.

Table 4-5b. Usual macronutrient and fiber intake of study children at 60 and 72 months[a] by child sex and of 4- to 8-year-old children nationally by sex with Dietary Reference Intakes (DRIs)

	Usual Intake		
	WIC ITFPS-2[b]		NHANES 4- to 8-year-olds[c]
Macronutrients	60 months	72 months	National
Median intake	Median (standard error [SE])	Median (SE)	Median (SE)
Fat (g/d)			
Male	57.3[d] (1.4)	63.0[e] (1.4)	69.8[d,e] (1.2)
Female	53.2[f] (1.2)	57.5[g] (1.2)	60.7[f,g] (0.9)
AI[h]	*ND*[i]	*ND*[i]	*ND*[i]
Carbohydrate (g/d)			
Male	226 (3.2)	240 (2.8)	236 (4)
Female	210 (3.2)	222[g] (3.1)	212[g] (2)
EAR[j]	*100*	*100*	*100*
Protein (g/d)			
Male	62.8 (1.0)	66.6[e] (1.0)	62.3[e] (1.0)
Female	58.6[f] (0.9)	61.9[g] (1.0)	54.8[f,g] (0.7)
RDA[k]	*19*	*19*	*19*
Fiber (g/d)			
Male	13.7 (0.2)	14.6[e] (0.3)	13.5[e] (0.4)
Female	13.1 (0.2)	13.8[g] (0.2)	12.4[g] (0.3)
AI[h]	*25*	*25*	*25*
Percentage of energy[l]	% (SE)	% (SE)	% (SE)
Fat			
Male	31.9[d] (0.4)	32.3[e] (0.3)	34.5[d,e] (0.3)
Female	31.9[f] (0.3)	32.0[g] (0.3)	33.9[f,g] (0.3)
AMDR[m]	*25-35*	*25-35*	*25-35*
Carbohydrate			
Male	54.1[d] (0.4)	53.9[e] (0.3)	52.7[d,e] (0.3)
Female	54.2 (0.3)	54.2 (0.3)	53.5 (0.4)
AMDR[m]	*45-65*	*45-65*	*45-65*
Protein			
Male	15.2[d] (0.2)	15.0[e] (0.2)	14.1[d,e] (0.2)
Female	15.3[f] (0.2)	15.1[g] (0.2)	14.0[f,g] (0.1)
AMDR[m]	*10-30*	*10-30*	*10-30*
Unweighted *n*	2,496	2,120	
Weighted *n*	436,443	438,408	

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The 60-month usual intake adjustments included the key sociodemographic characteristics used in the *Fifth Year Report* with the 60-month cross-sectional weights; the 72-month usual intake adjustments included the key sociodemographic characteristics used in this report with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).

[c] National Health and Nutrition Examination Survey (NHANES). U.S. Department of Agriculture, Agricultural Research Service (2021). *Usual nutrient intake from food and beverages, by gender and age, what we eat in America, NHANES 2015-2018, Table A*. Available at: https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

[d] WIC ITFPS-2 60-month estimates for males are significantly different, at $p \leq 0.05$, from national sex-specific estimate for 4- to 8-year-old children reported in https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

[e] WIC ITFPS-2 72-month estimates for males are significantly different, at $p \leq 0.05$, from national sex-specific estimate for 4- to 8-year-old children reported in https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

[f] WIC ITFPS-2 60-month estimates for females are significantly different, at $p \leq 0.05$, from national sex-specific estimate for 4- to 8-year-old children reported in https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

[g] WIC ITFPS-2 72-month estimates for females are significantly different, at $p \leq 0.05$, from national sex-specific estimate for 4- to 8-year-old children reported in https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

[h] Adequate Intake (AI).

[i] Not determined (ND).

[j] Estimated Average Requirement (EAR).

[k] Recommended Dietary Allowance (RDA). 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 to EAR could not be made.

[l] The population ratio method is used to estimate the means for these ratios. The percentages reported are the means for the subpopulations.

[m] Acceptable Macronutrient Distribution Range (AMDR) is measured as calories from macronutrient as a percentage of energy.

At 72 months, self-reported household income for approximately two-thirds of WIC ITFPS-2 families was at or below 130 percent of the FPG. Table 4-5c presents WIC ITFPS-2 usual intake estimates among these families and 2015-2018 NHANES findings for 4- to 8-year-old children in families with incomes below 131 percent of the poverty level.[98] In both studies, estimated average intakes as percentages of energy (Table 4-5b, bottom) were within recommended ranges for both sexes. However, as a percentage of energy, the low-income subpopulation of WIC ITFPS-2 children consumed significantly less fat and more protein and carbohydrate, on average, at child age 72 months than the nationally representative sample of 4- to 8-year-old children in low-income families. Though median fiber intake of WIC ITFPS-2 children in low-income families exceeded median intake of 4- to 8-year-old children in low-income families nationally (Table 4-5c, top), based on 2015-2018 NHANES data, median intake was less than recommended.

[98] In this study, families self-reporting 130 percent of FPG or less were chosen as the relevant comparison group. This income cutoff is commonly understood as relevant for participation in SNAP.

Table 4-5c. Usual macronutrient and fiber intake of study children in low-income families at 60 and 72 months[a] and of 4- to 8-year-old children in low-income families nationally with Dietary Reference Intakes (DRIs)

	Usual intake		
	WIC ITFPS-2[b] children in families under 130% of the Federal Poverty Guidelines		NHANES 4- to 8-year-olds in families under 131% of poverty level[c]
Macronutrients	60 months	72 months	
Median intake	Median (standard error [SE])	Median (SE)	Median (SE)
Fat (g/d)	54.7[d] (1.3)	59.2[e] (1.3)	64.5[d,e] (1.1)
AI[f]	*ND*[g]	*ND*[g]	*ND*[g]
Carbohydrate (g/d)	219 (3.1)	230 (3.2)	221 (5.0)
EAR[h]	*100*	*100*	*100*
Protein (g/d)	60.6 (0.8)	64.0[e] (1.0)	58.4[e] (0.9)
RDA[i]	*19*	*19*	*19*
Fiber (g/d)	13.5[d] (0.2)	14.1[e] (0.2)	12.1[d,e] (0.3)
AI[f]	*25*	*25*	*25*
Percentage of energy[j]	% (SE)	% (SE)	% (SE)
Fat	31.6[d] (0.3)	31.9[e] (0.3)	34.1[d,e] (0.2)
AMDR[k]	*25-35*	*25-35*	*25-35*
Carbohydrate	54.4[d] (0.3)	54.2[e] (0.3)	52.9[e] (0.3)
AMDR[k]	*45-65*	*45-65*	*45-65*
Protein	15.2[d] (0.2)	15.1[e] (0.1)	14.1[d,e] (0.2)
AMDR[k]	*10-30*	*10-30*	*10-30*
Unweighted *n*	1,871	1,436	
Weighted *n*	335,062	296,320	

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The 60-month usual intake adjustments included the key sociodemographic characteristics used in the *Fifth Year Report* with the 60-month cross-sectional weights; the 72-month usual intake adjustments included the key sociodemographic characteristics used in this report with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).

[c] National Health and Nutrition Examination Survey (NHANES). U.S. Department of Agriculture, Agricultural Research Service (2021). *Usual nutrient intake from food and beverages, among individuals under 131% of poverty level, what we eat in America, NHANES 2015-2018, Table F.* Available at: https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Under_131_WWEIA_2015_2018.pdf.

[d] Difference between WIC ITFPS-2 60-month estimate and NHANES low-income sample estimate for this macronutrient is significantly different at $p \leq 0.05$.

[e] Difference between WIC ITFPS-2 72-month estimate and NHANES low-income sample estimate for this macronutrient is significantly different at $p \leq 0.05$.

[f] Adequate Intake (AI).

[g] Not determined (ND).

[h] Estimated Average Requirement (EAR).

[i] Recommended Dietary Allowance (RDA). 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 to EAR could not be made.

[j] The population ratio method is used to estimate the means for these ratios.

[k] Acceptable Macronutrient Distribution Range (AMDR) is measured as calories from the macronutrient as a percentage of energy.

Findings from bivariate analyses of mean percentages of energy from total fat, carbohydrate, and protein are presented in Table 4-6. Compared with children who left WIC after their first year, children who participated with WIC consistently through the first 5 years of life had lower fat intakes both as a percentage of energy and in absolute level (not shown). This is consistent with the finding presented in Chapter 3 that study children who consistently participated in WIC consumed more skim or 1 percent fat milk than children who participated for the first year only. Consistent exposure to these milks through the supplemental food package may have fostered lasting acceptance.

Table 4-6. Usual intake of total fat, carbohydrate, and protein as percentages of energy intake[a] at 72 months by select key sociodemographic characteristics

Macronutrient and key sociodemographic characteristic	Percentage of energy % (standard error)	Unweighted *n*	Weighted *n*
Total fat			
Maternal ethnorace			
Non-Hispanic Black	32.9[b] (0.3)	614	89,192
Non-Hispanic White	33.3[c] (0.3)	606	117,893
Non-Hispanic Other	32.9 (0.6)	118	26,602
Hispanic	31.0[b,c] (0.3)	782	204,722
Maternal educational attainment at 54 months			
High school or less	31.5[b] (0.3)	1,120	233,978
More than high school	32.9[b] (0.3)	1,000	204,430
Pattern of study child's WIC participation[c]			
1st year only	35.3[b] (0.8)	86	36,990
2nd or 3rd year only	32.9 (0.7)	182	76,172
4th or 5th year only	32.2 (0.7)	141	67,355
Consistently	31.2[b] (0.5)	421	197,720
Intermittently	32.9 (0.8)	126	58,433
Carbohydrate			
Maternal educational attainment at 54 months			
High school or less	54.7[b] (0.3)	1,120	233,978
More than high school	53.4[b] (0.3)	1,000	204,430
Protein			
Maternal ethnorace			
Non-Hispanic Black	14.4[b] (0.1)	614	89,192
Non-Hispanic White	14.5[c] (0.2)	606	117,893
Non-Hispanic Other	15.1 (0.4)	118	26,602
Hispanic	15.6[b,c] (0.2)	782	204,722
Household food security status			
High or marginal	15.1[b] (0.2)	1,649	349,680
Low	15.1 (0.3)	258	53,048
Very low	14.3[b] (0.2)	213	35,680
Participation in non-WIC benefit programs			
Does not participate in any other programs[d]	14.9 (0.3)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	14.6[b] (0.2)	898	180,440
Participates in other program(s) excluding SNAP[d]	15.4[b] (0.2)	867	186,850

Table 4-6. Usual intake of total fat, carbohydrate, and protein as percentages of energy intake[a] at 72 months by select key sociodemographic characteristics (continued)

Macronutrient and key sociodemographic characteristic	Percentage of energy % (standard error)	Unweighted *n*	Weighted *n*
Protein			
Pattern of study child's WIC participation[e]			
1st year only	13.9[b] (0.5)	86	36,990
2nd or 3rd year only	15.0 (0.3)	182	76,172
4th or 5th year only	15.0 (0.3)	141	67,355
Consistently	15.5[b] (0.2)	421	197,720
Intermittently	14.8 (0.3)	126	58,433

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The adjustments included child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights for all but the pattern of WIC participation analyses which used the 72-month longitudinal weights. The population ratio was used to estimate means for the ratios. Percentages presented are the means for the subpopulations. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b,c] For the characteristic under analysis, matching superscripts on the subgroups indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[e] This analysis uses the longitudinal cohort.

4.4.3 Micronutrient Intake

WIC ITFPS-2 reports have focused on intakes of select nutrients associated with the WIC food package. Though study children were no longer age-eligible for WIC at the 72-month interview, these nutrients continue to be of interest. Table 4-7a displays median usual intakes of select micronutrients at 60 and 72 months. The AIs and EARs are offered for comparisons.

Between 60 and 72 months, there were statistically significant changes in median intakes of several micronutrients: thiamin, riboflavin, niacin, folate, phosphorus, magnesium, zinc, sodium, potassium, and choline. Given the 2019 changes in Dietary Reference Intakes for Sodium and Potassium (NASEM, 2019), intakes of sodium and potassium are discussed in more detail subsequently. Though median intakes appear higher at 72 months than they were at 60 months for some nutrients of public health concern that are typically underconsumed, differences in calcium and vitamin D intakes between the two periods were not statistically significant.

Table 4-7a. Dietary Reference Intakes (DRIs) and median usual intake of study children at 60 and 72 months,[a] select micronutrients

Micronutrients	DRIs for children 4-8 years		Usual intake Median (standard error)	
	AI[b]/EAR[c]	RDA[d]	60 months	72 months
Antioxidants				
Vitamin C (mg/d)	22[c]	25	96.3 (2.9)	99.0 (2.4)
Vitamin E (mg/d)	6[c]	7	6.9 (0.2)	7.3 (0.2)
B vitamins				
Thiamin (mg/d)	0.5[c]	0.6	1.6[e] (<0.1)	1.7[e] (<0.1)
Riboflavin (mg/d)	0.5[c]	0.6	2.0[e] (<0.1)	2.1[e] (<0.1)
Niacin (mg/d)	6[c]	8	21.4[e] (0.4)	22.6[e] (0.4)
Vitamin B-6 (mg/d)	0.5[c]	0.6	2.0 (<0.1)	2.0 (<0.1)
Folate (µg/d)	160[c]	200	419.9[e] (8.0)	453[e] (8.2)
Vitamin B-12 (µg/d)	1.0[c]	1.2	5.3 (0.1)	5.5 (0.1)
Bone-related nutrients				
Calcium (mg/d)	800[c]	1,000	995 (12.5)	1,035 (16.5)
Phosphorus (mg/d)	405[c]	500	1,157[e] (12.7)	1,212[e] (13.0)
Magnesium (mg/d)	110[c]	130	222[e] (2.4)	231[e] (2.4)
Vitamin D (µg/d)	10[c]	15	7.6 (0.2)	7.6 (0.2)
Other micronutrients				
Vitamin A (µg RAE/d)	275[c]	400	713 (13.4)	772 (63.8)
Vitamin K (µg/d)	55[b]	NA[f]	49.1 (1.4)	49.4 (1.7)
Iron (mg/d)	4.1[c]	10	14.7 (0.3)	15.2 (0.4)
Zinc (mg/d)	4.0[c]	5	9.8[e] (0.1)	10.4[e] (0.2)
Sodium (mg/d)	1,000[b]	NA[f]	2,584[e] (46.7)	2,737[e] (39.7)
Potassium (mg/d)	2,300[b]	NA[f]	2,165[e] (24.0)	2,250[e] (22.7)
Choline (mg/d)	250[b]	NA[f]	240.5[e] (3.5)	252[e] (3.8)
Unweighted *n*			2,496	2,120
Weighted *n*			436,443	438,408

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The usual intake adjustments included child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Adequate Intake (AI).

[c] Estimated Average Requirement (EAR).

[d] Recommended Dietary Allowance (RDA).

[e] Difference between usual intake estimates at 60 months and 72 months for this macronutrient is statistically significant at $p \leq 0.05$.

[f] NA indicates that an estimate is not available.

Table 4-7b presents findings for study children by child sex and findings from the 2015-2018 NHANES for 4- to 8-year-old children nationally by sex. With the exception of folate, median usual intakes from this study are similar to or exceed median intake estimates from NHANES. Despite comparing favorably with the NHANES, median usual intake of vitamin D by both male and female study children was below the EAR.

Table 4-7b. Dietary Reference Intakes (DRIs) and median usual intake of study children at 72 months[a] by sex and of 4- to 8-year-old children nationally by sex, select micronutrients

Micronutrients	DRIs for children 4-8 years		Usual intake Median (standard error)			
			WIC ITFPS-2[e] at 72 months		NHANES 4-8 years, national[f]	
	AI[b]/EAR[c]	RDA[d]	Male	Female	Male	Female
Antioxidants						
Vitamin C (mg/d)	22[c]	25	98.6[g] (2.9)	99.4[h] (3.1)	76.5[g] (5.2)	73.4[h] (3.3)
Vitamin E (mg/d)	6[c]	7	7.5 (0.3)	7.2 (0.2)	NA[i]	NA[i]
B vitamins						
Thiamin (mg/d)	0.5[c]	0.6	1.8[g] (<0.1)	1.6[h] (<0.1)	1.5[g] (<0.1)	1.3[h] (<0.1)
Riboflavin (mg/d)	0.5[c]	0.6	2.2[g] (<0.1)	2.1[h] (<0.1)	1.9[g] (<0.1)	1.7[h] (<0.1)
Niacin (mg/d)	6[c]	8	23.4[g] (0.6)	21.8[h] (0.4)	20.2[g] (0.5)	17.8[h] (0.5)
Vitamin B-6 (mg/d)	0.5[c]	0.6	2.1[g] (0.1)	2.0[h] (<0.1)	1.8[g] (<0.1)	1.6[h] (<0.1)
Folate (µg/d)	160[c]	200	470[g] (14.3)	436[h] (8.6)	532[g] (11.0)	486[h] (17.0)
Vitamin B-12 (µg/d)	1.0[c]	1.2	5.5 (0.2)	5.5[h] (0.1)	4.9 (0.2)	4.4[h] (0.2)
Bone-related nutrients						
Calcium (mg/d)	800[c]	1,000	1,055 (23.4)	1,015[h] (19.6)	1,012 (24)	875[h] (25)
Phosphorus (mg/d)	405[c]	500	1,249 (16.3)	1,175 (15.5)	NA[i]	NA[i]
Magnesium (mg/d)	110[c]	130	238 (3.1)	224 (2.7)	NA[i]	NA[i]
Vitamin D (µg/d)	10[c]	15	7.7[g] (0.3)	7.6[h] (0.2)	6.7[g] (0.3)	6.0[h] (0.3)
Other micronutrients						
Vitamin A (µg RAE/d)	275[c]	400	771.1 (65.0)	772 (65.8)	NA[i]	NA[i]
Vitamin K (µg/d)	55[b]	NA[i]	50.2 (2.1)	48.5 (1.9)	NA[i]	NA[i]
Iron (mg/d)	4.1[c]	10	15.7[g] (0.5)	14.6[h] (0.4)	13.1[g] (0.2)	11.9[h] (0.3)
Zinc (mg/d)	4.0[c]	5	10.9[g] (0.2)	9.9[h] (0.2)	9.7[g] (0.2)	8.6[h] (0.1)
Sodium (mg/d)	1,000[b,j]	NA[i]	2,839 (44.7)	2,633[h] (54.4)	2,736 (61)	2,385[h] (61)
Potassium (mg/d)	2,300[b,j]	NA[i]	2,321 (30.3)	2,176 (25.1)	NA[i]	NA[i]
Choline (mg/d)	250[b]	NA[i]	259[g] (4.1)	244[h] (4.9)	227[g] (6)	209[h] (7)
Unweighted *n*			1,085	1,035		
Weighted *n*			225,118	213,290		

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The usual intake adjustments included child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Adequate Intake (AI).

[c] Estimated Average Requirement (EAR).

[d] Recommended Dietary Allowance (RDA).

[e] WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).

[f] National Health and Nutrition Examination Survey (NHANES). U.S. Department of Agriculture, Agricultural Research Service (2021). *Total usual nutrient intake from food, beverages, and dietary supplements, by age and gender, what we eat in America, NHANES 2015-2018, Table TA*. Available at: https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Gender_WWEIA_2015_2018_Tables_TA.pdf.

[g] Estimates for WIC ITFPS-2 male children and NHANES male children are significantly different at $p \leq 0.05$.

[h] Estimates for WIC ITFPS-2 female children and NHANES female children are significantly different at $p \leq 0.05$.

[i] NA indicates that an estimate is not available.

[j] AIs for sodium and potassium were revised in 2019. Previous values for sodium were 1,000 mg (ages 1-3 years) and 1,200 mg (ages 4-8 years); previous values for potassium were 3,000 mg (ages 1-3 years) and 3,800 mg (ages 4-8 years).

As mentioned, many WIC ITFPS-2 families self-reported household income below 130 percent FPG. Table 4-7c presents median usual intakes of select micronutrients of study children in these low-income families at 60 and 72 months, with findings from the 2015-2018 NHANES sample of 4- to 8-year-old children in low-income families for comparisons. In this low-income subpopulation of WIC ITFPS-2 study children, median usual intakes are similar to or exceed median intake estimates for 4- to 8-year-old children in low-income families nationally, based on findings from NHANES. Despite comparing favorably with the NHANES, median usual intake of vitamin D by WIC ITFPS-2 children in families that self-reported household income below 130 percent FPG was below the EAR.

Table 4-7c. Dietary Reference Intakes (DRIs) and median usual intake of study children in low-income families at 72 months[a] and of 4- to 8-year-old children in low-income families nationally, select micronutrients

	DRIs for children 4-8 years		Usual intake Median (standard error)		
			WIC ITFPS-2[e] children in families under 130% of the Federal Poverty Guidelines		NHANES 4- to 8-year-old children in families under 131% of poverty level[f]
Micronutrients	AI[b]/ EAR[c]	RDA[d]	60 months	72 months	
Antioxidants					
Vitamin C (mg/d)	22[c]	25	96.4[g] (3.0)	98.8[h] (2.6)	73.3[g,h] (4.1)
Vitamin E (mg/d)	6[c]	7	6.7 (0.2)	7.0 (0.2)	NA[i]
B vitamins					
Thiamin (mg/d)	0.5[c]	0.6	1.6[g] (<0.1)	1.7[h] (<0.1)	1.5[g,h] (<0.1)
Riboflavin (mg/d)	0.5[c]	0.6	2.0[g] (<0.1)	2.1[h] (<0.1)	1.8[g,h] (<0.1)
Niacin (mg/d)	6[c]	8	21.3[g] (0.4)	22.4[h] (0.4)	19.4[g,h] (0.5)
Vitamin B-6 (mg/d)	0.5[c]	0.6	2.0[g] (<0.1)	2.0[h] (<0.1)	1.7[g,h] (<0.1)
Folate (µg/d)	160[c]	200	421[g] (8.4)	448[h] (8.0)	501[g,h] (16)
Vitamin B-12 (µg/d)	1.0[c]	1.2	5.2[g] (0.1)	5.4[h] (0.2)	4.5[g,h] (0.2)
Bone-related nutrients					
Calcium (mg/d)	800[c]	1,000	996[g] (14.0)	1,207[h] (16.6)	913[g,h] (28)
Phosphorus (mg/d)	405[c]	500	1,155 (14.3)	1,203 (14.4)	NA[i]
Magnesium (mg/d)	110[c]	130	222 (2.7)	230 (2.8)	NA[i]
Vitamin D (µg/d)	10[c]	15	7.5[g] (0.2)	7.5[h] (0.2)	5.8[g,h] (0.2)
Other micronutrients					
Vitamin A (µg RAE/d)	275[c]	400	706 (13.5)	756 (60.0)	NA[i]
Vitamin K (µg/d)	55[b]	NA[i]	48.6 (1.5)	46.7 (2.0)	NA[i]
Iron (mg/d)	4.1[c]	10	14.8[g] (0.3)	15.2[h] (0.4)	12.9[g,h] (0.4)
Zinc (mg/d)	4.0[c]	5	9.7[g] (0.2)	10.3[h] (0.2)	8.9[g,h] (0.2)
Sodium (mg/d)	1,000[b,j]	NA[i]	2,583 (49.9)	2,695 (48.3)	2,593 (75)

Table 4-7c. Dietary Reference Intakes (DRIs) and median usual intake of study children in low-income families at 72 months[a] and of 4- to 8-year-old children in low-income families nationally, select micronutrients (continued)

Micronutrients	DRIs for children 4-8 years		Usual intake Median (standard error)		
			WIC ITFPS-2[e] children in families under 130% of the Federal Poverty Guidelines		NHANES 4- to 8-year-old children in families under 131% of poverty level[f]
	AI[b]/ EAR[c]	RDA[d]	60 months	72 months	
Other micronutrients					
Potassium (mg/d)	2,300[b,j]	NA[i]	2,181 (27.2)	2,247 (27.5)	NA[i]
Choline (mg/d)	250[b]	NA[i]	241[g] (3.7)	251[h] (4.3)	221[g,h] (6)
Unweighted *n*			1,871	1,436	
Weighted *n*			335,062	296,320	

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The usual intake adjustments included child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Adequate Intake (AI).

[c] Estimated Average Requirement (EAR).

[d] Recommended Dietary Allowance (RDA).

[e] WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).

[f] National Health and Nutrition Examination Survey (NHANES). U.S. Department of Agriculture, Agricultural Research Service (2021). *Total usual nutrient intake from food, beverages, and dietary supplements, among individuals under 131% of poverty level, what we eat in America, NHANES 2015-2018, Table TF*. Available at: https:/www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Under_131_WWEIA_2015_2018_Table_TF.pdf.

[g] Estimates for WIC ITFPS-2 children at 60 months and NHANES low-income sample of children are significantly different at $p \leq 0.05$.

[h] Estimates for WIC ITFPS-2 children at 72 months and NHANES low-income sample of children are significantly different at $p \leq 0.05$.

[i] NA indicates that an estimate is not available.

[j] AIs for sodium and potassium were revised in 2019. Previous values for sodium were 1,000 mg (ages 1-3 years) and 1,200 mg (ages 4-8 years); previous values for potassium were 3,000 mg (ages 1-3 years) and 3,800 mg (ages 4-8 years).

Inadequacy of Nutrient Intakes. The prevalence of inadequate intakes was estimated as the percentage of usual intakes below the EAR. In general, there was low prevalence of inadequacy of the nutrients assessed, with the exception of vitamin E, calcium, and vitamin D (Table 4-8). Changes between 60 and 72 months in the estimated prevalence of inadequacy for vitamin D and calcium were not statistically significant; however, the drop in the estimated prevalence of inadequacy for vitamins C and E was statistically significant.

Table 4-8. Median usual micronutrient intake and percentage of inadequate intakes of study children at 60 and 72 months,[a] select micronutrients

Micronutrients	AI[b]/EAR[c] for children 4-8 years	Usual intake of WIC ITFPS-2[d] children Median (standard error [SE])		Percentage of inadequate intakes[e] % (SE)	
		60 months	72 months	60 months	72 months
Antioxidants					
Vitamin C (mg/d)	22[c]	96.3 (2.9)	99.0 (2.4)	4.5[f] (1.3)	0.8[f] (0.6)
Vitamin E (mg/d)	6[c]	6.9 (0.2)	7.3 (0.2)	44.9[f] (2.1)	36.1[f] (2.9)
B vitamins					
Thiamin (mg/d)	0.5[c]	1.6[g] (<0.1)	1.7[g] (<0.1)	0.0 (0.1)	0.0 (<0.1)
Riboflavin (mg/d)	0.5[c]	2.0[g] (<0.1)	2.1[g] (<0.1)	0.0 (<0.1)	0.0 (<0.1)
Niacin (mg/d)	6[c]	21.4[g] (0.4)	22.6[g] (0.4)	0.0 (0.1)	0.0 (<0.1)
Vitamin B-6 (mg/d)	0.5[c]	2.0 (<0.1)	2.0 (<0.1)	0.1 (0.1)	0.1 (0.1)
Folate (µg/d)	160[c]	419.9[g] (8.0)	453.3[g] (8.2)	0.4 (0.5)	0.6 (0.4)
Vitamin B-12 (µg/d)	1.0[c]	5.3 (0.1)	5.5 (0.1)	0.0 (0.1)	0.2 (0.2)
Bone-related nutrients					
Calcium (mg/d)	800[c]	995.1 (12.5)	1,035.4 (16.5)	25.3 (3.3)	23.5 (2.7)
Phosphorus (mg/d)	405[c]	1,157.1[g] (12.7)	1,212.2[g] (13.0)	0.1 (0.1)	0.1 (0.1)
Magnesium (mg/d)	110[c]	221.7[g] (2.4)	231.1[g] (2.4)	0.4 0.4)	0.7 (0.4)
Vitamin D (µg/d)	10[c]	7.6 (0.2)	7.6 (0.2)	68.4 (2.3)	70.6 (1.8)
Other micronutrients					
Vitamin A (µg RAE/d)	275[c]	713.4 (13.4)	771.6 (63.8)	1.3 (1.3)	0.0 (5.4)
Vitamin K (µg/d)	55[b]	49.1 (1.4)	49.4 (1.7)	NA[h]	NA[h]
Iron (mg/d)	4.1[c]	14.7 (0.3)	15.2 (0.4)	0.1 (0.1)	0.0 (<0.1)
Zinc (mg/d)	4.0[c]	9.8[g] (0.1)	10.4[g] (0.2)	0.4 (0.4)	0.3 (0.4)
Sodium (mg/d)	1,000[b,i]	2,583.6[g] (46.7)	2,737.4[g] (39.7)	NA[h]	NA[h]
Potassium (mg/d)	2,300[b,i]	2,165.3[g] (24.0)	2,250.1[g] (22.7)	NA[h]	NA[h]
Choline (mg/d)	250[b]	240.5[g] (3.5)	251.8[g] (3.8)	NA[h]	NA[h]
Unweighted *n*		2,496	2,120	2,496	2,120
Weighted *n*		436,443	438,408	436,443	438,408

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The 60-month estimates were adjusted for the key sociodemographic characteristics used in the *Fifth Year Report* with the 60-month cross-sectional weights; the 72-month usual intake adjustments included child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Adequate Intake (AI).

[c] Estimated Average Requirement (EAR).

[d] WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2).

[e] Prevalence of inadequate intakes was estimated as the percentage of the intakes below the EAR.

[f] Difference between mean percentage inadequate intakes at 60 months and 72 months is statistically significant at $p \leq 0.05$.

[g] Difference between median usual intake estimates at 60 months and 72 months for the micronutrient is statistically significant at $p \leq 0.05$.

[h] NA indicates no EAR is available.

[i] AIs for sodium and potassium were revised in 2019. Previous values for sodium were 1,000 mg (ages 1-3 years) and 1,200 mg (ages 4-8 years); previous values for potassium were 3,000 mg (ages 1-3 years) and 3,800 mg (ages 4-8 years).

Bivariate analyses focused on nutrients with an EAR (i.e., those for which the prevalence of inadequacy was determined) and found statistically significant differences between key

sociodemographic subgroups and by timing of the 72-month interview for vitamins E and D. Table 4-9 presents the findings.

Table 4-9. Percentage of inadequate intakes for usual intake of select nutrients at 72 months by select key sociodemographic characteristics[a]

Macronutrient and key sociodemographic characteristic	Percentage of inadequate intake[b] % (standard error)	Unweighted *n*	Weighted *n*
Vitamin E (g/d)			
Maternal ethnorace			
Non-Hispanic Black	32.8 (2.6)	614	89,192
Non-Hispanic White	26.6[c] (3.0)	606	117,893
Non-Hispanic Other	29.5 (5.5)	118	26,602
Hispanic	43.8[c] (3.4)	782	204,722
Maternal educational attainment at 54 months			
High school or less	42.4[c] (3.6)	1,120	233,978
More than high school	28.8[c] (2.8)	1,000	204,430
Pre-/Post-coronavirus disease 2019 (COVID-19) emergency declaration (ED)			
Pre-COVID ED	38.1[c] (3.2)	1,627	353,794
Post-COVID ED	28.0[c] (2.9)	509	85,247
Vitamin D (µg/d)			
Maternal ethnorace			
Non-Hispanic Black	78.9[c] (2.9)	614	89,192
Non-Hispanic White	63.4[c] (2.7)	606	117,893
Non-Hispanic Other	64.3 (4.7)	118	26,602
Hispanic	71.9 (2.5)	782	204,722
Pre-/Post-COVID ED			
Pre-COVID ED	72.6[c] (1.9)	1,612	351,224
Post-COVID ED	62.6[c] (2.7)	508	87,184

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The estimates were adjusted for child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Prevalence of inadequate intakes is estimated as the percentage of the group falling below the Estimated Average Requirement (EAR).

[c] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

For sodium and potassium, the 2019 release of new DRI values included the removal of the UL for sodium and the addition of the CDRR (Table 4-10), a level above which intake reduction is expected to reduce chronic disease risk within a healthy population (NASEM, 2019). However, it should be noted that the risk previously captured in the UL of the 2005 DRIs is now captured in the CDRR. For potassium, the 2019 DRIs included a downward revision of adequate intake to 2,300 (mg/d) from 3,800 (mg/d)

Median intake of sodium by study children was 2,737 mg/d at 72 months (Table 4-10), about 1.5 times the previous UL (1,900 mg/day) and 1.9 times the current CDRR (1,500 mg/day). Median intake of potassium was 2,250 mg/d, which was below the new AI. For both nutrients, median intakes at 72 months were significantly different from median intakes at 60 months.

Table 4-10. Old and new Dietary Reference Intakes (DRIs) and median usual sodium and potassium intake of study children at 60 and 72 months[a]

	2005 DRIs		2019 DRIs		Median usual intake of WIC ITFPS-2 children	
	AI[b]	UL[c]	AI[b]	CDRR[d]		
Micronutrients	Children ages 4-8 years				60 months	72 months
Sodium (mg/d)	1,200	1,900	1,000	<1,500 mg/day	2,584[e]	2,737[e]
Potassium (mg/d)	3,800	ND[f]	2,300	ND[f]	2,165[e]	2,250[e]
Unweighted *n*					2,496	2,120
Weighted *n*					436,443	438,408

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The estimates were adjusted for child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population.

[b] Adequate Intake (AI).

[c] Tolerable Upper Intake Level (UL).

[d] Chronic Disease Risk Reduction (CDRR) intakes.

[e] Difference between median usual intake estimates at 60 months and 72 months for the micronutrient is statistically significant at $p \leq 0.05$.

[f] Not determined (ND).

Nutrients of Public Health Concern. As mentioned, for this study, intakes of nutrients of public health concern were focal. There is overlap between nutrients that WIC ITFPS-2 reports have analyzed over time (i.e., those in Tables 4-7a through 4-7c) and nutrients of public health concern. However, for completeness, all of the nutrients of public health concern analyzed in this report are presented together here. These include calcium, saturated fat, dietary fiber, potassium, sodium, vitamin D, and added sugars. After examining mean levels of intakes, bivariate relationships between these nutrients and key sociodemographic characteristics and the timing of the 72-month interview are presented.

The 2020-2025 DGA recommendations for saturated fat and added sugars are as a percentage of energy. Consequently, the remainder of this section discusses mean intakes, as opposed to median intakes. Table 4-11 presents the findings for mean intakes, which may differ from medians for nutrients previously presented.

At 72 months, estimated mean intake of calcium was significantly higher than the recommended level; however, 23.5 percent of study children had inadequate calcium intake (see Table 4-8). Estimated mean intakes for saturated fats and added sugars as a percentage of energy were not significantly different from their recommended limits. Mean intake of dietary fiber was well below the AI. At 72 months, mean intake of potassium was similar to the recommended level (2,300 mg/d), but sodium intake far exceeded the new CDRR level (1,500 mg/d) and adequate intake (1,000 mg/d). Mean intake of vitamin D at 72 months was below the EAR, and 70.6 percent of study children had inadequate vitamin D intake (see Table 4-8).

Table 4-11. Mean usual intake of nutrients of public health concern at 60 and 72 months[a]

Nutrients of public health concern	Recommended level	Usual intake Mean (standard error)	
		60 months	72 months
Calcium (mg/d)	800[b]	1,033.1[c] (13.1)	1,075.5[c,d] (15.5)
Saturated fat (g/d)	Not available	20.1[c] (0.4)	21.9[c] (0.4)
Saturated fat (% kcal)	<10%[e]	11.0 (0.1)	11.3[f] (0.1)
Dietary fiber (g/d)	25[g]	13.9 (0.2)	14.8[f] (0.2)
Potassium (mg/d)	2,300[g]	2,223.7[c] (19.2)	2,298.1[c,f] (19.9)
Sodium (mg/d)	1,000[g] -1,500[h]	2,649.5[c] (43.7)	2,830.1[c,f] (40.1)
Vitamin D (µg/d)	10[b]	8.6 (0.2)	8.3[f] (0.2)
Added sugars (g/d)	Not available	43.8 (1.0)	48.0 (1.1)
Added sugars (% kcal)	<10%[e]	10.2 (0.2)	10.5[f] (0.2)
Unweighted *n*		2,496	2,120
Weighted *n*		436,443	438,408

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The estimates were adjusted for child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The population ratio was used to estimate means for ratios of intakes. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population. Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

[b] Estimated Average Requirement (EAR).

[c] The estimates at 60 months and 72 months are significantly different at $p \leq 0.05$.

[d] Mean estimate at 72 months meets or exceeds the dietary recommendation.

[e] 2020-2025 *Dietary Guidelines for Americans*.

[f] Mean estimate at 72 months did not meet the recommendation.

[g] Adequate Intake (AI).

[h] Chronic Disease Risk Reduction (CDRR).

Table 4-12 presents the statistically significant findings from comparisons of mean intakes by key sociodemographic subgroups and timing of the 72-month interview. There were no statistically significant differences between key sociodemographic subgroups for potassium or fiber, so they do not appear in the table.

Table 4-12. Mean usual intake of nutrients of public health concern at 72 months by select key sociodemographic subgroups[a]

Micronutrient and key sociodemographic characteristic	Usual intake Mean (standard error)	Unweighted *n*	Weighted *n*
Calcium (mg/d)			
Marital status			
Married	1,121.7[b] (22.5)	863	189,002
Not married	1,040.5[b] (19.2)	1,257	249,406
Saturated fat (g/d)			
Maternal ethnorace			
Non-Hispanic Black	22.8[b] (0.6)	614	89,192
Non-Hispanic White	23.7[c] (0.5)	606	117,893
Non-Hispanic Other	22.5 (1.0)	118	26,602
Hispanic	20.3[b,c] (0.5)	782	204,722
Mother's educational attainment at 54 months			
High school or less	21.2[b] (0.4)	1,120	233,978
More than high school	22.6[b] (0.5)	1,000	204,430
Household food security status			
High or marginal	21.5[b] (0.4)	1,649	349,680
Low	22.3 (0.8)	258	53,048
Very low	25.1[b] (1.0)	213	35,680
Pattern of study child's WIC participation[d]			
1st year only	23.1 (1.5)	86	36,990
2nd or 3rd year only	23.4[b] (0.9)	182	76,172
4th or 5th year only	21.2 (0.9)	141	67,355
Consistently	19.6[b] (0.6)	421	197,720
Intermittently	20.9 (1.2)	126	58,433
Saturated fat (mean percentage of energy)			
Maternal ethnorace			
Non-Hispanic Black	11.2 (0.2)	614	89,192
Non-Hispanic White	11.8[b] (0.2)	606	117,893
Non-Hispanic Other	11.4 (0.3)	118	26,602
Hispanic	11.0[b] (0.2)	782	204,722
Sodium (mg/d)			
Maternal ethnorace			
Non-Hispanic Black	3,092.6[b] (62.8)	614	89,192
Non-Hispanic White	2,937.8[c] (43.6)	606	117,893
Non-Hispanic Other	2,903.9 (88.1)	118	26,602
Hispanic	2,644.2[b,c] (46.6)	782	204,722
Maternal age at study child's birth			
16-19 years	3,034.4[b] (82.2)	194	48,151
20-25 years	2,908.2 (58.7)	861	177,892
26+ years	2,718.4[b] (55.4)	1,065	212,365
Mother's educational attainment at 54 months			
High school or less	2,761.2[b] (48.6)	1,120	233,978
More than high school	2,909.1[b] (47.8)	1,000	204,430
Vitamin D (µg/d)			
Maternal ethnorace			
Non-Hispanic Black	7.3[b] (0.3)	614	89,192
Non-Hispanic White	9.1[b] (0.3)	606	117,893
Non-Hispanic Other	9.0 (0.5)	118	26,602
Hispanic	8.2 (0.3)	782	204,722
Marital status			
Married	8.7[b] (0.3)	863	189,002
Not married	8.0[b] (0.2)	1,257	249,406

Table 4-12. Mean usual intake of nutrients of public health concern at 72 months by select key sociodemographic subgroups[a] (continued)

Micronutrient and key sociodemographic characteristic	Usual intake Mean (standard error)	Unweighted *n*	Weighted *n*
Calcium (mg/d)			
Pre-/Post-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED)			
Pre-COVID ED	8.1[b] (0.2)	1,612	351,224
Post-COVID ED	9.2[b] (0.3)	508	87,184
Added sugars (g/d)			
Maternal ethnorace			
Non-Hispanic Black	54.2[b,c] (1.5)	614	89,192
Non-Hispanic White	52.4[e] (1.6)	606	117,893
Non-Hispanic Other	44.7[b] (3.0)	118	26,602
Hispanic	43.2[c,e] (1.5)	782	204,722
Reported weight status of mother			
Normal or underweight	51.1[b] (2.0)	566	124,698
Overweight	44.1[b] (1.6)	627	123,401
Obese	48.6 (1.5)	927	190,309
Household food security status			
High or marginal	47.0[b] (1.3)	1,649	349,680
Low	50.5 (2.1)	258	53,048
Very low	54.4[b] (2.2)	213	35,680
Added sugars (mean percentage of energy)			
Maternal ethnorace			
Non-Hispanic Black	54.2[b,c] (1.5)	614	89,192
Non-Hispanic White	52.4 (1.6)	606	117,893
Non-Hispanic Other	44.7[b] (3.0)	118	26,602
Hispanic	43.2[c] (1.5)	782	204,722

[a] Usual intakes were estimated using the univariate model offered by the National Cancer Institute. The estimates were adjusted for child sex, the key sociodemographic characteristics used in this report, and the timing of the 72-month interview with the 72-month cross-sectional weights. The population ratio was used to estimate means for ratios of intakes. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population. Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

[b,c] For the micronutrient and characteristic under analysis, matching superscripts on the means indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

[d] This analysis uses the longitudinal cohort.

[e] For the micronutrient and characteristic under analysis, matching superscripts on the means indicate that the difference between the two subgroups within the sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

Because the DGA recommends upper limits on the consumption of saturated fat, added sugars, and sodium, the study was able to estimate the percentage of children who met the recommended limits. Thirty-one percent (SE=3.0) of study children met the DGA recommendation for saturated fat (i.e., less than 10 percent of energy comes from saturated fats), and 48 percent (SE=2.9) met the DGA recommendation that less than 10 percent of energy comes from added sugars. Only 3 percent (SE=0.7) of study children met the new CDRR recommendation for sodium (i.e., less than 1,500 mg/d). Bivariate analysis indicated that there were not any statistically significant differences by key

socioeconomic subgroups or by timing of the 72-month interview in the percentage of study children who met the DGA recommendation for saturated fats. There were statistically significant differences in the percentages of children meeting the DGA recommendation for added sugars and percentage of children meeting the CDRR recommendation for sodium by maternal ethnoracial characteristics. These findings require further research to confirm and explain the differences observed. Table 4-13 presents the findings.

Table 4-13. Percentage of usual intakes meeting recommendations for added sugars and sodium on a given day at 72 months by maternal ethnorace[a]

Micronutrient and key sociodemographic characteristic	Met recommendation % (standard error)	Unweighted *n*	Weighted *n*
Added sugars (<10% energy)			
Maternal ethnorace			
Non-Hispanic Black	37.7[b] (4.5)	614	89,192
Non-Hispanic White	40.1 (5.0)	606	117,893
Non-Hispanic Other	59.1 (7.0)	118	26,602
Hispanic	55.4[b] (4.0)	782	204,722
Sodium (<1,500 m/d)			
Maternal ethnorace			
Non-Hispanic Black	1.3[b] (0.5)	614	89,192
Non-Hispanic White	2.0 (0.6)	606	117,893
Non-Hispanic Other	2.2 (0.8)	118	26,602
Hispanic	4.7[b] (1.0)	782	204,722

[a] Usual intakes were estimated using the Markov Chain Monte Carlo (MCMC) model offered by the National Cancer Institute. The usual intake adjustments included the key sociodemographic characteristics used in this report with the 72-month cross-sectional weights. The percentage meeting the recommendation is estimated as the percentage of the group falling below the recommendation. The unweighted and weighted *n*'s presented are for informational purposes, as estimates were derived from a larger pseudo-population. Calories from added sugar calculated as teaspoons of added sugars x (4 g/teaspoon) x (4 kcal/g).

[b] For the micronutrient and characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

4.5 Contributions of Select Foods to Adequate Intake

This section includes findings from analyses examining how select foods contributed to the child's nutrition security when the study child was 72 months old (i.e., 6 years old). Intakes of nutrients of public health concern and protein were focal outcomes. Because many foods contributed to these outcomes, the information presented was limited to select contributors, using FITS food groups. The FITS food groups chosen aligned well with items available in the WIC food package, or they ranked highly in preliminary analysis of foods contributing to the nutrient of focus. The analyses used 1 day of dietary recall information, so intakes are for a given day.

4.5.1 Select FITS Food Group Contributors to Nutrients of Public Health Concern on a Given Day at 72 Months

Among the foods analyzed, cheese was, on average, the largest contributor to children's dairy intake, with plain whole milk and 2 percent milk closely following (Table 4-14). Cheese was also the largest contributor to children's saturated fat intake. Whole fruits were the largest contributor to children's fiber intake, but vegetables also made a notable contribution. Whole fruits were also the largest contributor to children's potassium intake, with 100 percent fruit juice a close second among the foods examined. Chicken or turkey was the largest contributor to the children's sodium intake. Plain whole milk consumption was the largest contributor to vitamin D intakes, with plain 2 percent milk a close second. Though cakes, pies, and cookies were consumed by a greater percentage of study children than sugar-sweetened beverages (SSBs) were (see Chapter 3, Section 3.5.9), on average, fruit-flavored drinks were the largest contributor among the foods considered for added sugar intake on a given day at 72 months.

Table 4-14. Contribution of select foods[a] consumed on a given day at 72 months to intakes of nutrients of public health concern

Nutrient of public health concern and select food	Contribution % (standard error)
Calcium	
Cheese[b]	11.6 (0.4)
2% milk, plain	9.3 (0.6)
Whole milk, plain	9.1 (0.5)
Skim and 1% fat milk, plain	6.5 (0.5)
Low-fat and nonfat yogurt	2.5 (0.2)
Whole milk, flavored	2.2 (0.5)
Saturated fat	
Cheese	11.8 (0.7)
Pizza[c]	7.6 (0.5)
Whole milk, plain	7.4 (0.4)
Chicken or turkey[b]	6.4 (0.3)
2% milk, plain	4.8 (0.3)
Hot dogs, sausages, and cold cuts	4.6 (0.3)
Fiber	
Whole fruits	18.9 (0.5)
Vegetables	12.2 (0.6)
Beans, peas, legumes	5.8 (0.8)
Presweetened whole grain cereal	5.4 (0.4)
Not presweetened whole grain cereal	2.9 (0.2)
100% fruit juice	2.7 (0.1)

Table 4-14. Contribution of select foods[a] consumed on a given day at 72 months to intakes of nutrients of public health concern (continued)

Nutrient of public health concern and select food	Contribution % (standard error)
Potassium	
Whole fruits	10.6 (0.3)
100% fruit juice	9.3 (0.4)
Chicken or turkey	6.8 (0.4)
2% milk, plain	5.1 (0.3)
Whole milk, plain	5.0 (0.2)
Skim and 1% fat milk, plain	3.7 (0.3)
Sodium	
Chicken or turkey[b]	11.1 (0.4)
Protein sources in mixed dishes (e.g., chili, stew)	7.8 (0.6)
Bread and rolls	7.7 (0.3)
Pizza	7.5 (0.5)
Hot dogs, sausages, and cold cuts	7.0 (0.4)
Spaghetti, ravioli, lasagna	3.9 (0.3)
Vitamin D	
Whole milk, plain	13.6 (0.7)
2% milk, plain	12.1 (0.7)
Skim and 1% fat milk, plain	8.1 (0.7)
Cereal, sweetened	7.1 (0.4)
Cereal, unsweetened	3.9 (0.4)
Whole milk, flavored	2.9 (0.5)
Added sugars	
Fruit-flavored drinks	13.4 (0.8)
Cakes, pies, cookies, and pastries	11.3 (0.6)
Presweetened not whole grain cereal	7.1 (0.4)
Candy	4.6 (0.4)
Presweetened whole grain cereal	0.8 (0.1)
Unweighted *n*	2,120
Weighted *n*	438,408

[a] Adapted from Feeding Infants and Toddlers Study (FITS) food groups. Only select groups are presented.

[b] Does not include this food in mixed dishes.

[c] Categorized among grains in mixed dishes.

The bivariate analyses focused on statistically significant differences in intakes of select foods from Table 4-14 (above). The three focal foods were chosen because of their prominence in the WIC food package: skim or 1 percent fat milk, which contributed notably to calcium intakes of study children; whole fruit, which contributed meaningfully to potassium and fiber intake; and vegetables, which also contributed to fiber intake.

Table 4-15a presents the findings for the mean percentage of calcium from skim or 1 percent fat milk by key sociodemographic characteristics that exhibited significant differences between subgroups. The findings for calcium by pattern of WIC participation reflect those presented in

Chapter 3 where, compared with children who leave WIC after their first year, children who stay on WIC consistently consumed more skim and 1 percent fat milk as a proportion of their dairy foods. This pattern of consumption translated into more calcium from skim and 1 percent fat milk on a given day at 72 months for those who participated in WIC consistently than those who left WIC after their first year.

Table 4-15a. Contribution of plain skim or 1 percent fat milk to calcium intake on a given day at 72 months by select key sociodemographic characteristics

Key sociodemographic characteristics	Contribution of plain skim or 1% fat milk to calcium intake % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	3.7[a] (0.5)	614	89,192
Non-Hispanic White	4.5[b] (0.6)	606	117,893
Non-Hispanic Other	7.6 (1.7)	118	26,602
Hispanic	8.8[a,b] (0.8)	782	204,722
Maternal educational attainment at 54 months			
High school or less	7.9[a] (0.9)	1,120	233,978
More than high school	5.1[a] (0.5)	1,000	204,430
Employment status			
Full-time	5.2[a] (0.7)	839	171,202
Part-time	5.2[b] (0.7)	423	89,381
Not employed	8.5[a,b] (0.9)	858	177,825
Income poverty			
≤75% of Federal Poverty Guidelines (FPG)	8.1[a] (0.8)	821	164,397
>75% of FPG and ≤130% of FPG	6.7 (1.0)	615	131,923
>130% of FPG	4.7[a] (0.6)	684	142,087
Timing of WIC enrollment			
1st trimester	7.9[a] (1.0)	659	139,420
2nd trimester	7.1[b] (0.7)	856	176,586
3rd trimester	3.2[a,b] (0.6)	311	65,126
Postnatal	5.3 (1.1)	294	57,276
Pattern of study child's WIC participation[c]			
1st year only	2.5[a] (1.1)	86	36,990
2nd or 3rd year only	6.6 (1.4)	182	76,172
4th or 5th year only	5.3 (1.4)	141	67,355
Consistently	9.9[a] (1.1)	421	197,720
Intermittently	5.9 (1.2)	126	58,433

[a,b] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within a sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

[c] This analysis uses the longitudinal cohort.

Table 4-15b presents the mean percentage contribution to children's fiber intake from whole fruit consumption on a given day at 72 months by key sociodemographic characteristics that exhibited statistically significant differences between subgroups.

Table 4-15b. Contribution of whole fruit to fiber intake on a given day at 72 months by select key sociodemographic characteristics

Key sociodemographic characteristics	Contribution of whole fruit to fiber intake % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	15.6[a] (0.9)	614	89,192
Non-Hispanic White	18.8 (0.8)	606	117,893
Non-Hispanic Other	18.8 (1.6)	118	26,602
Hispanic	20.5[a] (0.9)	782	204,722
Maternal age at study child's birth			
16-19 years	20.7 (1.5)	194	48,151
20-25 years	17.2[a] (0.7)	861	177,892
26+ years	19.9[a] (0.6)	1,065	212,365
Marital status			
Married	20.2[a] (0.7)	863	189,002
Not married	18.0[a] (0.6)	1,257	249,406

[a] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within a sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

Table 4-15c presents mean percentage contribution to children's fiber from consumption of vegetables on a given day at 72 months. The findings by pattern of WIC participation by the study child clearly reflect findings in Chapter 3 that children who leave WIC after their first year have more vegetables that are not in mixed dishes contributing to their intake of total vegetables as assessed by the DGA food groups.

Table 4-15c. Contribution of vegetables to fiber intake on a given day at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Contribution of vegetables to fiber intake % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	15.9[a] (0.9)	614	89,192
Non-Hispanic White	12.4[b] (0.9)	606	117,893
Non-Hispanic Other	16.8 (1.9)	118	26,602
Hispanic	9.7[a,b] (0.6)	782	204,722
Pattern of study child's WIC participation[c]			
1st year only	23.6[a,b,c] (2.4)	86	36,990
2nd or 3rd year only	12.2[a] (2.0)	182	76,172
4th or 5th year only	13.6[b] (2.2)	141	67,355
Consistently	10.5[c] (0.7)	421	197,720
Intermittently	15.0 (1.9)	126	58,433
Pre-/Post-coronavirus 2019 disease (COVID-19) emergency declaration (COVID ED)			
Pre-COVID ED	12.9[a] (0.6)	1,612	351,224
Post-COVID ED	9.7[a] (1.1)	508	87,184

[a,b,c] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within a sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

Table 4-15d presents the mean percentage contribution to children's potassium intake from whole fruit on a given day at 72 months.

Table 4-15d. Percentage contribution of whole fruit to potassium intake on a given day at 72 months by key sociodemographic characteristics

Key sociodemographic characteristics	Contribution of whole fruit to potassium intake % (standard error)	Unweighted *n*	Weighted *n*
Marital status			
Married	11.6[a] (0.5)	863	189,002
Not married	9.9[a] (0.4)	1,257	249,406
Participation in non-WIC benefit programs			
Does not participate in any other programs[b]	11.2 (0.9)	355	71,118
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[b]	9.5[a](0.4)	898	180,440
Participates in other program(s) excluding SNAP[b]	11.5[a] (0.6)	867	186,850

[a] For the characteristic under analysis, matching superscripts on the percentages indicate that the difference between the two subgroups within a sociodemographic category is statistically significant at $p \leq 0.05$. Bonferroni correction was applied when more than two subgroups within a key characteristic were compared.

[b] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

4.5.2 Select FITS Food Group Contributors to Protein Intake

Though not a nutrient of concern, *per se*, protein sources were of interest, as there are several represented in the WIC food package. Moreover, increasing the amount of seafood in the WIC food package was included among the recommendations made by NASEM in their review of the current food packages (NASEM, 2017). Table 4-16 presents the mean percentage contribution to children's protein intake from select protein foods consumed on a given day at 72 months. There were no significant associations between intakes of these protein foods and the key sociodemographic characteristics or timing of the 72-month interview.

Table 4-16. Percentage contribution of select foods to protein intake on a given day at 72 months

Protein food	Contribution to protein intake % (standard error)
Eggs	4.1 (0.2)
Beans, peas, legumes	1.9 (0.3)
Nuts and seeds	1.8 (0.2)
Seafood	1.3 (0.2)
High in N-3 fatty acids	0.5 (0.1)
Unweighted *n*	2,120
Weighted *n*	438,408

4.6 Factors Independently Associated with Saturated Fat Intake on a Given Day at 72 Months

This section reports on findings from multivariable analyses of factors independently associated with saturated fat intake as a percentage of energy on a given day at 72 months. The independent variables included in the regression were: maternal ethnorace; maternal educational attainment (assessed at 54 months); household food security status; pattern of WIC participation by the study child; household participation in SNAP at 72 months; and household participation in NSLP, SBP, or SFSP at 72 months. In addition, the analysis included two measures of the home environment in which children eat: the frequency of television viewing during meals and the frequency of eating meals together as a family. Respondents to the 72-month interview indicated their frequency of television (TV) viewing during meals using a scale: *never*, *rarely*, *sometimes*, or *most of the time*. For the regression analysis, responses of *never* and *rarely* were combined, as were *sometimes* and *most of the time*. Respondents to the 72-month interview also indicated how often they ate together as a family in the past week: *never, 1-2 times*, *3-4 times*, *5-6 times*, or *7 or more times*. For the regression analysis, these responses were collapsed into two categories: 0 to 4 times and 5 or more times. These measures of the child's food environment are discussed in more detail in Chapter 5. All independent regression variables except maternal ethnorace and maternal educational attainment at 54 months were assessed during the 72-month interview.

Table 4-17 presents the model results. Children with non-Hispanic Black caregivers had lower intakes of saturated fat as a percentage of energy on a given day at 72 months than children with non-Hispanic White caregivers. Duration of WIC participation was also independently associated with saturated fat intake: Compared with those who consistently received WIC through the first

5 years of the study child's life, children who left WIC after the first year and children who left WIC after either the second or third year had higher intakes on a given day at 72 months. Children in families that watched TV *most of the time* or *sometimes* during meals had higher intakes of saturated fat than children who *never* or *rarely* watched TV during meals at 72 months.

Table 4-17. Results of multivariable regression of saturated fat as a percentage of energy on a given day at 72 months on covariates[a]

Covariate	Coefficient	*p*-value
Maternal ethnorace: reference category is Non-Hispanic White		
Hispanic	-0.57	0.18
Non-Hispanic All Other	0.66	0.23
Non-Hispanic Black	-1.00	<0.01*
Maternal educational attainment at 54 months: high school or less compared with more than high school	0.40	0.13
Household food security status: reference is high or marginal		
Low food security	0.13	0.71
Very low food security	0.77	0.19
Pattern of WIC participation: reference is consistently through 5 years		
1st year only	1.21	0.01*
2nd or 3rd year only	0.84	0.04*
4th or 5th year only	0.39	0.24
Intermittently	0.20	0.59
Receiving Supplemental Nutrition Assistance Program (SNAP) benefits at 72 months compared with not receiving these benefits	-0.10	0.73
Someone in household participates in the National School Lunch Program, School Breakfast Program, or the Summer Food Service Program at 72 months compared with not participating in any of these programs	-0.02	0.95
Television was on most of the time or sometimes during meals compared with rarely or never on during meals	0.70	0.01*
Family ate together 5 or more times in the past week compared with less than 5 times during the week	0.30	0.32
Timing of 72-month interview: On or prior to the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) on March 13, 2020, compared with after the COVID ED	-0.25	0.25

[a] Unweighted n=950 and weighted n=433,353. Adjusted R-square=0.05. Appendix Table B2c-3 offers additional detail.

* Indicates statistical significance at $p \leq 0.05$.

The finding that shorter durations of WIC participation were associated with higher intakes of saturated fat intake on a given day at 72 months may, in part, reflect earlier findings that children who left WIC after the first year are less likely to drink skim or 1 percent fat milk (see Chapter 3) than children who stayed on consistently over the first 5 years of life. Additional work on purchasing patterns is needed to tie exposure to these types of milk through the WIC food package to these saturated fat intake patterns. Age-appropriate nutrition education offered by WIC staff may also have played a role.

5. Feeding Practices

Key Findings at 72 Months:

- Thirty-six percent of study mothers indicated that they *always* used at least one pressuring (36%) feeding practice, and 39 percent indicated that they *always* used at least one restrictive (39%) feeding practice. Pressuring and restrictive feeding practices have been associated with unhealthy weight gain in children. None of the feeding practices examined in this chapter were associated with the household's WIC status at the 72-month interview based on bivariate analysis.
- Caregivers who had left WIC prior to the study child's 54-month interview because they believed that they no longer qualified for the program were less likely to *always* or *usually* try to get their study children to eat even if they did not seem hungry—a pressuring feeding practice—than caregivers who had not left WIC by the study child's 54-month interview.
- About two-thirds (67%) of study families indicated that they ate together as a family at least five times a week, and for 77 percent of study families, this practice was adopted when the child was 15 months old. This practice was positively associated with diet quality as assessed by Healthy Eating Index-2015 (HEI-2015) total scores on a given day based on univariate regression.
- Just under one-third (31%) of study mothers reported that the television (TV) was *never* on during meals, and many caregivers adopted this practice between child age 18 and 54 months (i.e., as the child grew older). Compared to those who reported that they *never* had the TV on during meals, children in families that had it on *most of the time* had lower HEI-2015 total scores on a given day at 72 months based on univariate regression.
- Compared with children who consistently participated with WIC over the first 5 years of life, children who left WIC after the first year had HEI-2015 total scores that were 3.4 points lower, on average, on a given day based on multivariable regression analysis.

5.1 Overview

This chapter focuses on sources of nutrition information sought by caregivers and other factors that may influence child feeding during the study child's sixth year (i.e., after the child is no longer age-eligible for the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]). Influences explored include caregiver feeding practices, the child's home eating environment, and caregiver exposure to WIC services and use of other sources of nutrition information. Associations between these factors and the child's diet quality are examined. The data in this chapter are primarily drawn from the 72-month interview, though other interviews may be referenced to provide context. This chapter addresses the following research questions:[99]

- 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, Supplemental Nutrition Assistance Program [SNAP], etc.), and childcare/preschool/school circumstances?

[99] A complete list of research questions appears in Appendix A.

- In what food environments (home, school, childcare, etc.) do children consume meals and snacks during the sixth year of life? How do these environments vary by subgroups of interest?

- What is the relationship, if any, between (1) cumulative years of participation in WIC, (2) ages during WIC participation, and (3) continuity of WIC benefit receipt (e.g., constant vs. intermittent) and dietary behaviors and energy and nutrient intake after aging out of WIC?

- 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?

- To what extent do feeding practices during the sixth year of life vary by the 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?

- To what extent do feeding practices during the sixth year of life vary by cumulative years of participation in WIC, and by reasons for exiting the WIC program?

5.2 Background

Once they turn 5 years old, children are no longer eligible for WIC, a trusted source of feeding information for many caregivers (Borger et al., 2022). It is important to understand where families turn for guidance on feeding their child once they are no longer receiving nutrition education from WIC. Information sought may address challenges, such as picky eating and healthy weight and development, and may influence the child's diet and dietary outcomes.

A caregiver's feeding style may also influence the child's diet and dietary outcomes such as excessive weight gain. A "responsive" feeding style that balances structure and flexibility is associated with improved child dietary intake and weight status (Vollmer & Mobley, 2013; Matvienko-Sikar et al., 2018; Wilson et al., 2019). Parents who employ a responsive feeding style tend to respond appropriately to children's signals of hunger and satiety.

Feeding styles incorporate several feeding practices describing the behaviors caregivers exhibit in feeding their child. Restrictive and pressuring feeding practices have been associated with increased children's body mass index (BMI) (Shloim, Edelson, Martin, & Hetherington, 2015). The restrictive and pressuring feeding practices probed in the 72-month interview were drawn from a questionnaire specifically developed for use with low-income families (Thompson et al., 2009); however, the entire

battery of questions necessary to determine a caregiver's feeding style was not asked. In general, practices that allow children to regulate their own portion sizes and how much they eat are associated with healthier child diet quality and weight status (Vaughn, Martin, & Ward, 2018; Hughes & Papaioannou, 2018; Haines et al., 2019). It is also recommended that parents of young children be responsible for providing healthy foods at predictable times and allow children to respond to their internal hunger and satiety signals in determining how much and whether to eat the foods provided (Pérez-Escamilla, Segura-Pérez, & Lott, 2017).

In addition to caregiver feeding practices, broader aspects of the child's home food environment, including regularly eating family meals together and limiting television (TV) at meals, may influence children's diets. In this chapter, television time during meals was the primary metric used to assess media exposure, as the study did not collect detailed data on programming or commercials viewed. Research associates family meals together and limiting TV at meals with better self-regulation of eating and diet quality and lower obesity in young children (Anderson & Whitaker, 2010; Frankel, Powell, & Jansen, 2018; Montaño, Smith, Dishion, Shaw, & Wilson, 2015; Avery, Anderson, & McCullough, 2017; Trofholz, Tate, Loth, Neumark-Sztainer, & Berge, 2019; Robson, McCullough, Rex, Munafò, & Taylor, 2020; Bassul, Corish, & Kearney, 2020) and potentially into adulthood (Tahir, Willett, & Forman, 2019).

5.3 Sample and Analysis Approach

5.3.1 Sample

Table 3-1 in Chapter 3 presented the unweighted number of respondents to the 72-month interview by type of interview (survey and dietary recall). Both the core and supplemental samples were eligible for the 72-month interview.

5.3.2 Analysis

Both survey data and dietary recall information from 72 months were used in analyses presented in this chapter. Responses were weighted so that findings in this chapter reflect the WIC population as described in Chapter 1. The 72-month cross-sectional sample weights were used for weighted findings at a point in time, and the 1- or 3-month through 72-month core sample longitudinal

weights were used to assess associations with characteristics realized over time (e.g., pattern of WIC participation by the study child).

The dietary data, collected using the Automated Multiple Pass Method (AMPM), were described in Chapter 3, Section 3.3.2. Herein, a single day of dietary recall information was used to assess diet quality on a given day at 72 months using the Healthy Eating Index-2015 (HEI-2015) total scores. This comprehensive measure of diet quality accounts for total dietary energy intake.

Bivariate analyses included the set of 12 key sociodemographic characteristics discussed in Chapter 1, Section 1.8.2. Nonmodifiable sociodemographic characteristics, assessed at the time of the first interview, were refreshed as needed (i.e., if the caregiver changed). However, for characteristics that may change over time, such as household food security status or income relative to Federal Poverty Guidelines (FPG), bivariate analyses typically used values reported at the 72-month interview.[100]

For categorical variables, chi-square tests of association were used to examine associations between key sociodemographic characteristics and feeding practices and broader aspects of the child's food environment. If a significant association was found, two-tailed t-tests, with Bonferroni correction for multiple tests, were typically used subsequently to determine which pairwise subgroup differences were statistically significant.[101] For continuous outcomes (e.g., HEI-2015 scores), univariate regression was used to assess bivariate relationship. For both types of analyses, statistical significance, when indicated, was at the level of $p \leq 0.05$.

As noted in Chapter 1, select outcomes were analyzed by whether the 72-month data were collected prior to or on March 13, 2020, or after March 13, 2020, the day on which a national public health emergency was declared. For ease of presentation, data gathered from 72-month interviews that took place prior to or on March 13, 2020, are referred to herein as having occurred pre-coronavirus disease 2019 (COVID-19) emergency declaration (pre-COVID ED) and outcomes that occurred

[100] Education level was not collected during the 72-month interview, so reports from the 54-month interview, the most recent information, were used.

[101] If the outcome and sociodemographic characteristic under analysis were both binary, then the follow-up pairwise tests were not performed, as the chi-square was sufficient to determine a significant difference.

post March 13, 2020, are referred to as having occurred post-COVID-19 emergency declaration (post-COVID ED).[102]

This chapter begins by exploring whether study participants sought non-WIC sources for nutrition classes or individual counseling on child feeding during the study child's sixth year, as these may influence feeding practices. It subsequently moves to describe caregiver feeding practices at 72 months, including examination of the broader eating environment in the household. Univariate regression results of significant associations between these factors and HEI-2015 total scores on a given day are presented.

Several factors influence a child's diet quality, so bivariate analyses are not sufficient to assess the independent contribution of different variables associated with this outcome. The chapter concludes with multivariable analyses of factors associated with children's HEI-2015 scores on a given day at child age 72 months. Of particular interest is whether feeding practices identified in bivariate analyses and pattern of WIC participation by the study child are significantly associated with diet quality when other factors are included in the model.

5.4 Sources of Non-WIC Nutrition Education

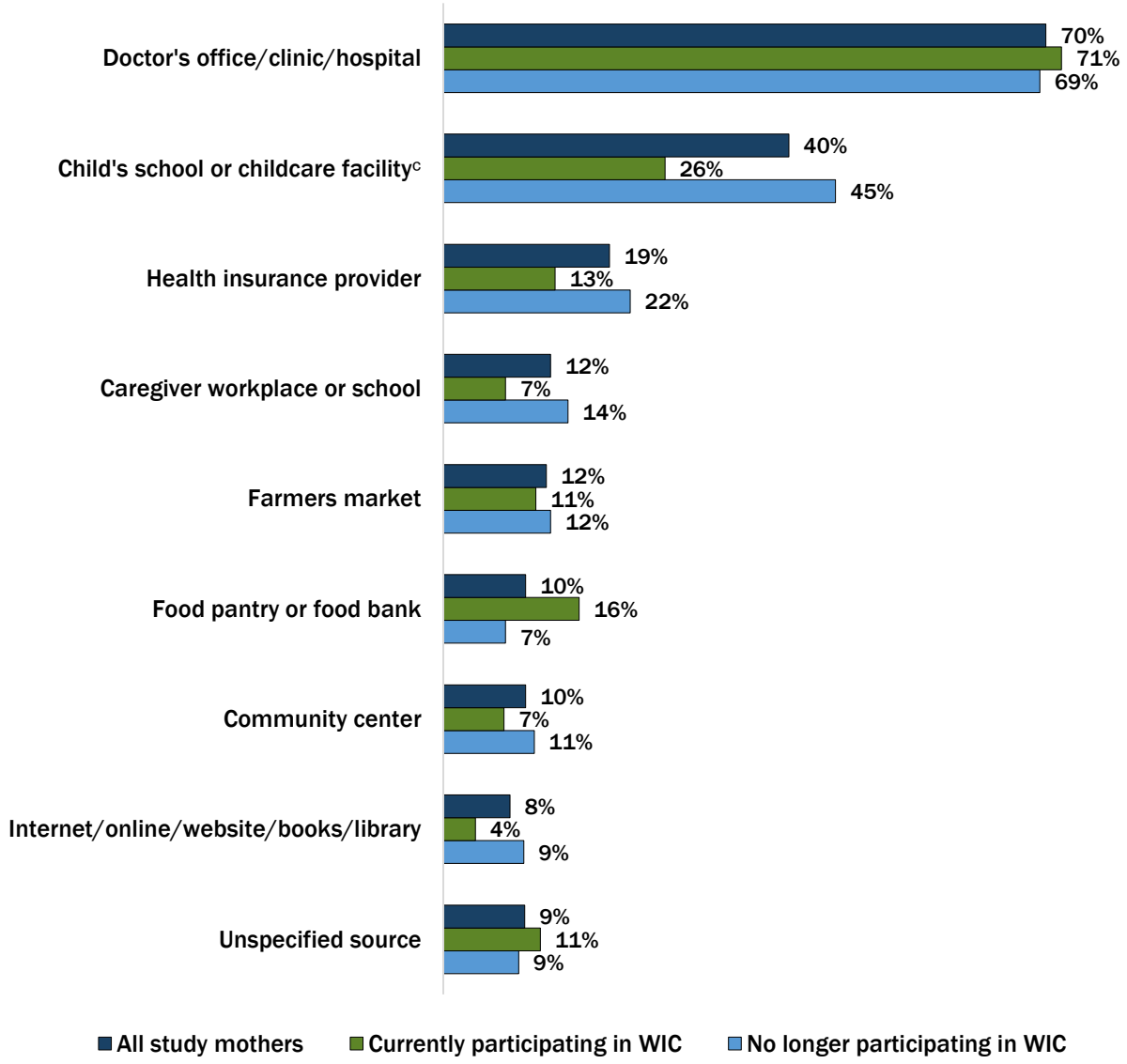
WIC provides nutrition education tailored to the nutritional needs of the WIC participant. The 72-month interview probed whether study mothers had sought nutrition classes or individual counseling on child feeding from non-WIC sources since the study child stopped receiving WIC benefits.

About 11 percent of study mothers indicated that they had sought classes or counseling since the study child stopped going to WIC. This estimate did not vary notably by whether the family was participating with WIC (for the mother or for a non-study child) at 72 months.

[102] The study was not designed to analyze interviews by their temporal timing; therefore, preliminary research was undertaken to determine feasibility. Statistical analysis of select key sociodemographic characteristics indicated that the approach was feasible. Based on chi-square analysis of key sociodemographic characteristics of the two temporal groups analyzed, there was no reason to suspect that the two temporal groups differed systematically.

Figure 5-1 presents the findings for those who sought nutrition classes or individual counseling on child feeding by source and by WIC participation status. Among participants who reported seeking out these forms of nutrition education, the most frequently reported source was a medical professional (70%). The percentages were essentially the same for those currently participating and those not currently participating with WIC. The child's school or childcare facility was the second most commonly reported source, and there was a statistically significant difference in the percentages of mothers using this source by current WIC participation status. Among those who sought nutrition classes or counseling, 26 percent of those currently participating with WIC cited the child's school or childcare facility, while 45 percent of those not currently participating with WIC cited this source. Health insurance providers were third among all caregivers, but the difference by WIC participation status was not statistically significant. All other sources were cited by 12 percent or less of all study mothers.

Figure 5-1. Among study mothers who sought nutrition classes or individual counseling on child feeding from sources other than WIC since the study child stopped receiving WIC benefits from WIC, the percentage of mothers by source of information and by household WIC participation status[a,b]



[a] WIC participation is for the caregiver (self) or another (non-study) child.

[b] Unweighted *n*=218 and weighted *n*=47,856 for study mothers who sought non-WIC sources. Unweighted *n*=51 and weighted *n*=13,245 for study mothers who sought non-WIC sources while still participating with WIC. Unweighted *n*=167 and weighted *n*=34,611 for study mothers who were not participating in WIC and sought non-WIC sources. Appendix Table B2d-1 offers additional detail.

[c] Percentages by WIC participation status are significantly different at $p \leq 0.05$.

The bivariate analyses first focused on associations between key sociodemographic characteristics and seeking out non-WIC sources for nutrition classes or individual counseling regardless of source.

Among all study mothers, there were statistically significant associations with three sociodemographic characteristics: maternal educational attainment at 54 months, maternal employment status, and participation in non-WIC benefit programs. Table 5-1 presents the findings.

Table 5-1. Key sociodemographic characteristics associated with study mothers who sought out nutrition classes or individual counseling from sources other than WIC since the study child stopped receiving WIC services, reported at 72 months

Key sociodemographic characteristics	Study mothers who indicated that they sought out non-WIC nutrition classes or individual counseling % (standard error)	Unweighted *n*	Weighted *n*
Maternal educational attainment at 54 months[a]			
High school or less	7.5 (1.0)	2,135	440,953
More than high school	14.7 (1.3)	2,135	440,953
Employment status			
Full-time	8.7[b] (1.1)	843	171,855
Part-time	15.5[b] (1.6)	426	89,927
Not working	10.6 (1.2)	866	179,171
Participation in non-WIC benefit programs[c]			
Does not participate in any other programs	7.7 (1.7)	358	71,611
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	9.1 (1.0)	904	181,582
Participates in other program(s) excluding SNAP[d]	13.8 (1.6)	873	187,759

[a] Follow-up pairwise t-tests were not run because the chi-square test was sufficient to determine difference.

[b] Given the key sociodemographic characteristic under analysis, pairs of matching letters indicate statistically significant differences at $p \leq 0.05$.

[c] The chi-square test statistic was significant at $p \leq 0.05$ but none of the t-tests indicated significant pairwise differences in percentages.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Pre-/Post-COVID ED Analysis. There was not a statistically significant association between the timing of the 72-month interview and whether caregivers sought nutrition classes or individual counseling from non-WIC sources. However, among those who sought these types of nutrition education, there was a significant drop in use of farmers markets: pre-COVID ED, 14 percent indicated they had sought information from a farmers market, and post-COVID ED, 5 percent did. It is possible that many farmers markets closed during the early months of the pandemic, as part of a broader mitigation strategy that kept people from gathering in crowds. Among those who sought nutrition classes or individual counseling and were currently participating in WIC for themselves or another (non-study) child, there was a significant uptick in the doctors' offices and clinics as a

source: pre-COVID ED, 63 percent indicated that they had sought information from a doctor's office or clinic, and post-COVID ED, 95 percent did so. The widespread transition of WIC clinics to remote service delivery post-COVID ED may have prompted participants to seek out medical professionals.

The analysis also examined whether there was an association between seeking nutrition information since the study child stopped receiving WIC services and diet quality.[103] Diet quality was assessed using HEI-2015 total scores on a given day at 72 months. Because HEI-2015 total scores are continuous, univariate regression was used to assess the bivariate relationship. Based on univariate regression results, there was a significant positive association between seeking nutrition classes or individual counseling since the study child stopped receiving WIC benefits and diet quality. Compared with children whose caregivers did not seek out information, children whose caregivers sought out nutrition information had HEI-2015 total scores that were about 3 points higher (p=0.02). Though multivariable analysis is needed, this finding suggests the possibility of nutrition education addressing feeding challenges in healthy ways. Because WIC offers nutrition education for eligible children from birth through age 5 years, the finding may indirectly provide evidence for the positive associations found thus far in the study between duration of WIC participation and HEI-2105 total scores (Borger, Paolicelli, & Sun, 2022; Anderson et al., 2022 [manuscript submitted for publication]).

5.5 Feeding Practices at 72 Months

In the literature on parental feeding styles, restrictive feeding practices attempt to decrease the amount of food the child consumes, such as controlling how much the child eats and being careful not to feed the child too much (Thompson, Adair, & Bentley, 2013). Pressuring feeding practices attempt to increase the amount of food the child consumes, such as having the child finish all of his or her food on the plate or eating even when the child is not hungry. Both restrictive and pressuring feeding practices have been associated with child size and, therefore, may be important environmental contributors to obesity.

[103] The study child may have been receiving WIC services at any point during the first 5 years of his or her life.

Table 5-2 indicates whether a particular feeding practice probed in the 72-month interview is restrictive or pressuring or neither. To assess the frequency of the practices assessed, study caregivers indicated how often they engage in each particular practice using a 5-point scale ranging from 1 (*always*) to 5 (*never*). The first three feeding practices listed aimed at encouraging the child to eat novel or healthy foods. These include using mealtimes to teach about healthy eating, asking the child to help prepare foods, and telling the child that he or she needs to eat a couple of bites of new foods but does not need to finish them. These practices are intended to encourage better nutrition and have been associated with better diet quality (Haines et al., 2019; Yee, Lwin, & Ho, 2017). It is recommended that caregivers keep track of what children eat; this recommended practice is included among those that are neither pressuring nor restrictive. The remainder are either pressuring or restrictive practices.

Table 5-2. Interview items probing feeding practices at 72 months

Feeding practice items	Pressuring (P) or Restricting (R) or Neither (N)	Author Thompson (T) or O'Connor (O)[a]
I use mealtimes to teach {CHILD} about healthy eating.	N	O
I ask {CHILD} to help me prepare food.	N	O
I tell {CHILD} he or she has to try at least a couple of bites of new foods, but doesn't have to eat it all.	N	O
I keep track of *what* food {CHILD} eats.	N	T
I try to get {CHILD} to finish his or her food.	P	T
I try to get {CHILD} to eat even if he or she seems not hungry.	P	T
I carefully control how much {CHILD} eats.	R	T
I am very careful not to feed {CHILD} too much.	R	T

[a] Thompson et al. (2009) or O'Connor et al. (2010).

Among the feeding practices designed to encourage consumption of novel foods, about 43 percent of study mothers indicated they *always* try to get the child to try a few bites of new foods without requiring the child to finish all of the new foods. Thirty-one percent of study mothers indicated they *always* use mealtimes to teach their children about healthy eating, and 13 percent indicated that they *always* ask the child to help prepare food. In addition, a majority of study mothers indicated that they *always* (34%) or *usually* (39%) keep track of what their child eats, a recommended practice for child feeding.

Thirty-six percent of study mothers indicated they *always* used at least one pressuring feeding practice, and 6 percent indicated that they *never* used one of the pressuring feeding practices assessed. About one-third (34%) of study mothers indicated that they *always* try to get the child to finish his or

her food, and about 11 percent indicated that they *always* try to get the child to eat even when he or she does not seem hungry. Among those who *always* try to get their child to eat even if he or she is not hungry, about 5 percent of children were underweight, 59 percent were healthy weight, 19 percent were overweight, and 16 percent were obese.[104] Thirty-nine percent of study mothers indicated that they *always* used and 14 percent indicated that they *never* used one of the restrictive feeding practices. About one-third (34%) were *always* very careful not to feed the child too much (Table 5-3).

Table 5-3. Percentage of study mothers reporting how often they follow select feeding practices at 72 months[a]

Feeding practice	Response options % (standard error)				
	Always=1	Usually=2	About half the time=3	Occasionally=4	Never=5
Practices that encourage consumption of novel foods					
Use mealtimes to teach child about healthy eating	30.6 (1.2)	31.4 (1.1)	16.0 (1.0)	18.2 (1.0)	3.8 (0.4)
Ask child to help me prepare food	12.6 (0.9)	19.3 (0.9)	17.1 (1.2)	36.0 (1.4)	15.1 (1.2)
Tell child he or she has to try at least a couple of bites of new foods, but doesn't have to eat it all	42.7 (1.7)	29.9 (1.3)	8.0 (0.9)	15.9 (1.2)	3.5 (0.4)
Other recommended practice					
Keep track of what the child eats	33.9 (1.4)	38.9 (1.7)	11.6 (0.9)	12.0 (0.9)	3.6 (0.6)
Pressuring or restrictive practices that control consumption					
Try to get the child to finish his or her food	33.9 (1.3)	33.5 (1.5)	11.5 (0.8)	13.1 (0.9)	7.9 (0.6)
Try to get the child to eat even if he or she does not seem hungry	11.4 (0.9)	18.2 (1.3)	9.3 (0.8)	20.0 (1.1)	41.0 (1.4)
Carefully control how much the child eats	24.9 (1.3)	26.5 (1.3)	9.9 (0.7)	15.7 (1.2)	23.0 (1.0)
Very careful not to feed child too much	33.9 (1.4)	26.6 (1.1)	5.6 (0.6)	9.8 (0.8)	24.1 (1.3)

[a] Unweighted *n*=2,134 and weighted *n*=440,513, where *n* is the number of mothers who completed items CF51a-h on the 72-month interview.

Note: Percentages may not sum to 100 percent due to rounding.

For bivariate analyses, the frequencies with which feeding practices are employed were combined into three categories: *always* or *usually*, *about half the time* or *occasionally,* and *never*. This categorization facilitated identification of trends and minimized the number of pairwise comparisons for follow-up t-tests.

[104] Chapter 6 discusses weight and growth outcomes more directly.

After categorizing the response options, only three feeding practices were associated with the key sociodemographic characteristics used in this study. Of these three, two practices—carefully controlling how much the child eats and being very careful not to feed the child too much—were associated with maternal ethnorace only. The practice of trying to get the child to finish food was associated with five key sociodemographic characteristics; Table 5-4 presents characteristics associated with this feeding practice.

Table 5-4. Key sociodemographic characteristics associated with the feeding practice of trying to get the child to finish his or her food, reported at 72 months

Key sociodemographic characteristic	Frequency with which the caregiver tries to get the child to finish his or her food % (standard error)			Unweighted *n*	Weighted *n*
	Usually/Always	About half the time/Occasionally	Never		
Maternal ethnorace					
Non-Hispanic Black	70.7 (2.0)	20.3[a] (1.9)	9.0[a] (1.2)	619	90,005
Non-Hispanic White	64.1 (2.4)	30.8[a,b] (2.3)	5.1[a] (0.9)	609	118,324
Non-Hispanic All Other	64.5 (4.9)	25.9 (3.9)	9.6 (2.7)	118	26,602
Hispanic	68.2 (2.0)	22.9[b] (1.8)	8.9 (1.2)	790	206,229
Maternal age at study child's birth					
16-19 years	78.4[a,b] (3.2)	14.9[a] (2.8)	6.7 (1.9)	197	48,680
20-25 years	68.6[a] (1.9)	24.4 (2.1)	7.0 (1.0)	868	178,978
26+ years	63.9[b] (1.7)	27.1[a] (1.3)	9.0 (1.0)	1,071	213,503
Parity					
Firstborn	72.1[a] (1.9)	21.8 (1.8)	6.0[a] (1.0)	866	187,449
Second born	66.9 (2.3)	25.2 (2.0)	7.9 (1.2)	588	119,010
Third or subsequent born	61.3[a] (2.2)	28.1 (2.0)	10.6[a] (1.2)	682	134,702
Reported weight status of mother					
Normal or underweight	70.5 (2.0)	24.2 (1.9)	5.2[a] (1.1)	570	125,678
Overweight	69.3 (1.9)	22.7 (1.6)	8.0 (1.2)	634	124,626
Obese	64.2 (2.0)	26.2 (1.9)	9.7[a] (1.0)	932	190,857
Marital status					
Married	63.8[a] (1.7)	28.0[a] (1.5)	8.2 (1.3)	869	189,886
Not married	70.2[a] (1.4)	22.1[a] (1.4)	7.7 (0.8)	1,267	251,275

[a,b] Given the key sociodemographic characteristic under analysis, pairs of matching letters in each column indicate statistically significant differences at $p \leq 0.05$.

Pre-/Post-COVID ED Analysis. The only feeding practice that varied by timing of the 72-month interview was being careful not to feed the child too much. Table 5-5 presents the finding.

Table 5-5. The frequency with which the caregiver is very careful not to feed the child too much by whether the 72-month interview occurred prior to the coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) on March 13, 2020, or after it

Temporal timing of 72-month interview	Frequency with which the caregiver is very careful not to feed the child too much % (standard error)			Unweighted *n*	Weighted *n*
	Usually/Always	About half the time/Occasionally	Never		
Pre-COVID ED	61.6 (1.9)	15.8 (1.3)	22.6[a] (1.4)	1,626	353,728
Post-COVID ED	55.6 (3.1)	14.2 (1.8)	30.2[a] (3.0)	510	87,432

[a] Given the key sociodemographic characteristic under analysis, pairs of matching letters in each column indicate statistically significant differences at $p \leq 0.05$.

Chi-square analysis did not find any statistically significant associations between current WIC status (by the caregiver or a non-study child, or both) at 72 months and any of the feeding practices listed in Table 5-2 (above).

5.5.1 Feeding Practices and Reasons for Leaving WIC

One of the research questions for this chapter asked to what extent feeding practices vary by reasons for exiting the WIC program;[105] consequently, the bivariate analyses also assessed whether there were associations between reasons for leaving WIC prior to the child turning 54 months of age and the feeding practices listed in Table 5-2. The only feeding practice associated with reasons for leaving was trying to get the child to eat even if he or she does not seem hungry. This practice was associated with two reasons mother-child dyads left WIC prior to the 54-month interview: no longer qualifying for WIC and inconvenience. Table 5-6 presents the findings.

[105] More information about reasons study participants left WIC prior to their 54-month interview can be found in the *Fifth Year Report* (2022).

Table 5-6. The frequency of trying to get the child to eat even when he or she is not hungry by reasons the mother-child dyad left WIC prior to the 54-month interview[a]

Did not leave WIC and reason left WIC	Frequency of trying to get the child to eat even if he or she is not hungry			Unweighted *n*	Weighted *n*
	Usually/ Always	About half the time/ Occasionally	Never		
Did not leave WIC prior to 54-month interview	34.6[b] (3.5)	27.4 (2.4)	38.0 (3.2)	399	186,804
Left WIC prior to 54-month interview because no longer qualified for the program	15.1[b] (3.7)	32.7 (5.3)	52.2 (5.3)	121	54,332
Left WIC prior to 54-month interview because WIC was inconvenient	27.8 (3.8)	32.7 (4.1)	39.5 (4.6)	240	98,897

[a] This analysis uses the longitudinal weight because departure from WIC was assessed over the entire period from 1 or 3 months through 60 months.

[b] The percentages are significantly different at $p \leq 0.05$.

5.5.2 Bivariate Associations between Feeding Practices and Diet Quality

The analysis of feeding practices, thus far, has primarily focused on how they differ by key sociodemographic characteristics. However, associations with nutrition outcomes are of concern because these outcomes may influence the child's development over time, including the child's weight status. The relationship between diet quality and obesity is complex, but diet quality has been linked to children's fat mass (Okubo et al., 2015). This section presents findings from assessing the relationships between feeding practices listed in Table 5-2 (above) and children's diet quality as measured by total HEI-2015 total scores. Table 5-7 presents the significant associations between feeding practices and HEI-2015 total scores based on univariate regression results.

Table 5-7. Associations from univariate regressions of study children's Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 72 months on feeding practices

Feeding practice or belief	Regression coefficient	*p*-value	Unweighted *n*	Weighted *n*
Use mealtimes to teach about healthy eating: reference group is never				
Always/Usually	6.06	0.010*	2,119	438,260
About half the time/Occasionally	2.91	0.151		
Carefully control how much the child eats: reference group is never				
Always/Usually	3.76	<0.001*	2,117	435,985
About half the time/Occasionally	1.54	0.086		
Be very careful not to feed the child too much: reference group is never				
Always/Usually	2.24	0.013*	2,117	437,856
About half the time/Occasionally	1.66	0.140		

* Indicates a statistically significant difference at $p \leq 0.05$ compared with the reference group.

Compared with children with caregivers that *never* use mealtimes to teach about healthy eating, children with caregivers who *always* or *usually* use mealtimes to teach about healthy eating have HEI-2015 total scores that are about 6 points higher on average based on univariate regression analysis. Unexpectedly, the direction of the association between carefully controlling how much the child ate and HEI-2015 total scores was opposite of what was hypothesized, with controlling behaviors associated with higher HEI-2015 total scores. As mentioned, WIC ITFPS-2 did not ask the entire battery of questions associated with determining a caregiver's feeding style. It is, therefore, possible that responses to this item reflected engagement with the child around his or her eating and not an authoritarian approach to controlling the child intake *per se*. The association found is consistent with the literature that children with responsive caregivers have higher diet quality (Hughes & Papaioannou, 2018; Yee, Lwin, & Ho, 2017; Mahmood, Flores-Barrantes, Moreno, Manios, & Gonzalez-Gil, 2021).

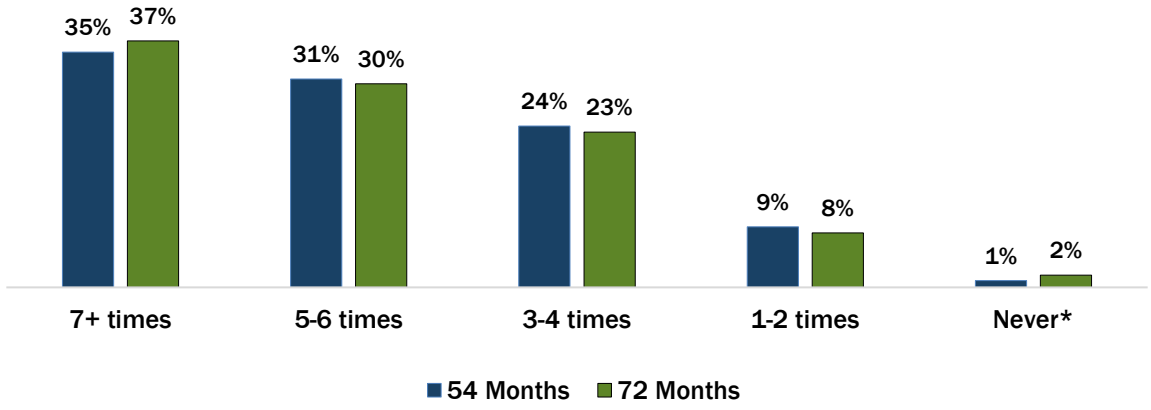
5.6 Home Feeding Environment at 72 Months

The environment in which children eat may influence their diet quality. This section examines two aspects of the child's home feeding environment at 72 months that have been shown to be related to diet quality and dietary outcomes: how frequently the family eats together in a typical week (Haines et al., 2019) and how often the TV is on during meals (Avery, Anderson, & McCullough, 2017).

5.6.1 Family Eats Together

During the 72-month interview, caregivers were asked how often all or most of the family sat down together to eat a meal in the past week. More than one-third (37%) of mothers indicated that their family ate together seven or more times in the past week. Slightly less than one-third (30%) of mothers indicated that their families ate together five to six times in the past week. Taken together, an estimated two-thirds of families ate meals together at least five times in the past week. Figure 5-2 presents the findings for each response option in the 72-month interview. The findings from the 54-month interview are provided for context.

Figure 5-2. Frequency of families eating meals together during the past week at 54[a] and 72[b] months



[a] At 54 months, unweighted *n*=2,562 and weighted *n*=441,078.

[b] At 72 months, unweighted *n*=2,137 and weighted *n*=441,226. Appendix Table B2d-3 offers additional detail.

* Indicates statistically significant difference at $p \leq 0.05$.

Key sociodemographic characteristics associated with the frequency of the family eating meals together in the past week included maternal ethnorace, marital status, maternal educational attainment at 54 months, household food security status, and timing of WIC enrollment for the study child. Table 5-8 presents the findings from bivariate analyses.

Table 5-8. Key sociodemographic characteristics associated with the frequency of the family eating meals together at 72 months

Key sociodemographic characteristic	Times per week that the family eats together % (standard error) 7+	5-6	3-4	1-2	Never	Unweighted *n*	Weighted *n*
Maternal ethnorace							
Non-Hispanic Black	25.0[a,b] (2.3)	27.6 (2.1)	30.5[a] (2.5)	13.8[a] (2.0)	3.0[a] (0.9)	618	89,857
Non-Hispanic White	39.7[a] (2.3)	27.4 (2.5)	23.6 (2.1)	8.0 (1.2)	1.3 (0.6)	610	118,390
Non-Hispanic All Other	29.5 (6.0)	39.6 (5.2)	23.4 (4.0)	6.9 (2.3)	0.5[a] (0.5)	118	26,602
Hispanic	40.9[b] (2.3)	32.0 (2.1)	19.6[a] (1.5)	5.8[a] (0.9)	1.8 (0.5)	790	206,229
Marital status							
Married	43.7[a] (2.5)	31.5 (2.0)	16.7[a] (1.5)	7.2 (1.2)	0.9[a] (0.3)	869	189,886
Not married	31.3[a] (1.6)	29.5 (1.1)	28.0[a] (1.6)	8.8 (1.0)	2.5[a] (0.5)	1,267	251,193
Maternal educational attainment at 54 months							
High school or less	36.2 (2.0)	28.8 (1.6)	23.0 (1.3)	9.5[a] (1.1)	2.5[a] (0.5)	1,129	235,590
More than high school	37.2 (2.0)	32.1 (1.9)	23.2 (1.5)	6.4[a] (0.8)	1.1[a] (0.3)	1,007	205,489
Household food security status							
High or marginal	38.3[a] (2.0)	31.2[a] (1.6)	21.1[a] (1.2)	7.5 (0.8)	1.8 (0.3)	1,658	351,616
Low	28.1[a] (2.6)	31.2 (3.6)	31.4[a] (3.4)	7.9 (1.9)	1.6 (0.9)	264	53,728
Very low	33.8 (3.5)	20.2[a] (3.8)	30.0 (4.0)	13.8 (3.2)	2.2 (1.0)	214	35,735
Timing of WIC enrollment							
1st trimester	44.4[a,b] (2.0)	28.1 (2.1)	18.5[a] (1.4)	7.0 (1.0)	1.9 (0.4)	665	140,480
2nd trimester	30.9[a] (2.8)	31.2 (2.0)	26.9[a] (1.7)	9.2 (1.7)	1.7 (0.5)	859	176,965
3rd trimester	37.1 (3.6)	31.8 (3.1)	22.5 (1.9)	7.7 (1.7)	1.0 (0.5)	316	65,935
Postnatal	34.8[b] (2.6)	31.4 (2.6)	23.3 (2.8)	7.8 (1.4)	2.8 (1.1)	296	57,699

[a,b] Given the key sociodemographic characteristic under analysis, pairs of matching letters within a column indicate statistically significant differences at $p \leq 0.05$.

Pre-/Post-COVID ED Analysis. How frequently the family ate together during the past week varied by timing of the 72-month interview. Consistent with the closure of many businesses and schools in the attempt to mitigate the spread of the virus, there was a statistically significant increase in seven or more meals being eaten together in the past week reported post-COVID ED than pre-COVID ED. Table 5-9 presents the findings.

Table 5-9. Frequency of family meals at 72 months by timing of the 72-month interview

Temporal timing of the 72-month interview	Times per week that the family eats together % (SE)					Unweighted *n*	Weighted *n*
	7+	5-6	3-4	1-2	Never		
Pre-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED)	34.5[a] (1.7)	31.4 (1.3)	23.8 (1.1)	8.4 (0.9)	1.9 (0.3)	1,626	353,646
Post-COVID ED	45.3[a] (2.8)	25.9 (2.7)	20.3 (1.8)	7.0 (1.1)	1.6 (0.6)	510	87,432

[a] Pairs of matching letters within a column indicate statistically significant differences at $p \leq 0.05$.

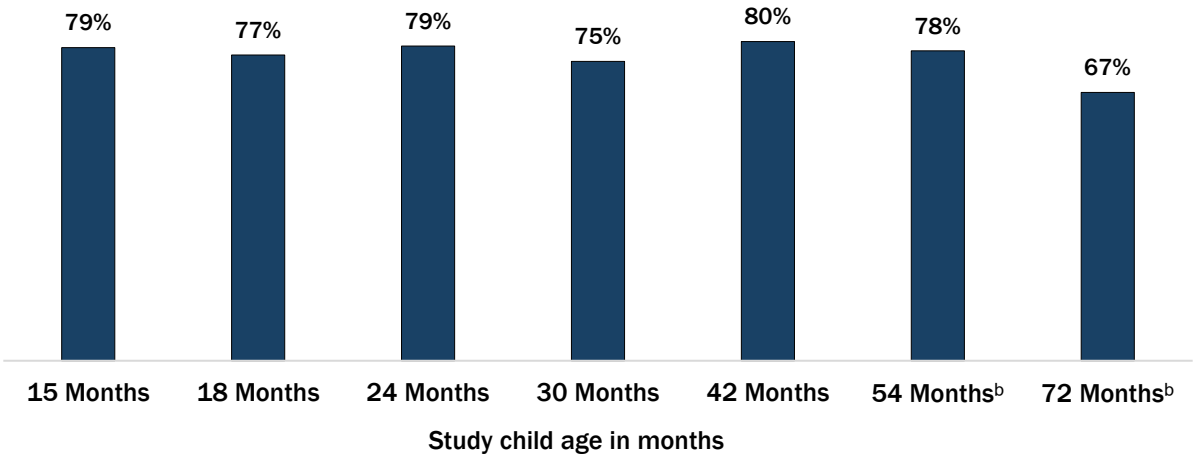
Change in the Practice over Time.[106] Because feeding practices may change as a child ages, the analysis looked retrospectively to examine whether the practice of eating together changed over time. The population ratio method was used to examine the consistency of the reporting that the family ate at least five meals together as a family in the past week. The retrospective analysis was among those who reported this practice at the 72-month interview. Figure 5-3 presents the findings. Seventy-nine percent of study families who reported eating at least five meals together in a week at 72 months reported eating at least five meals together in the past week when the child was 15 months old. Similar percentages of study families reported eating at least five meals together at each interview month preceding the 72-month interview.[107] This suggested that many families who adopted the practice of eating together when the child was younger maintained it as the child got older. Against the backdrop of a fairly consistent trend, the drop between 54 months and 72 months is noteworthy.

To further examine the consistency of this feeding practice over time, the analysis also looked prospectively. Results of prospective analysis from age 15 months forward to 72 months mirrored the retrospective analysis. Among those who ate at least five meals together when the child was 15 months old, about 69 percent did so when the child was 72 months old (not shown). In other words, over two-thirds of study participants kept using the practice as the child grew older.

[106] The methods used in this report differ from those in the *Fifth Year Report*. In the *Fifth Year Report*, the set of cases analyzed were limited to those who reported at the 60-month interview eating five or more meals together in the past week.

[107] Pairwise t-tests comparing the percentages at 15 and 54 months indicated that there was not a statistically significant difference.

Figure 5-3. Among study families who ate together at least five times in the past week at 72 months, the percentages that report eating together at least five times in the past week at select preceding interview months[a]



[a] At 72 months, unweighted *n*=965 and weighted *n*=441,269.

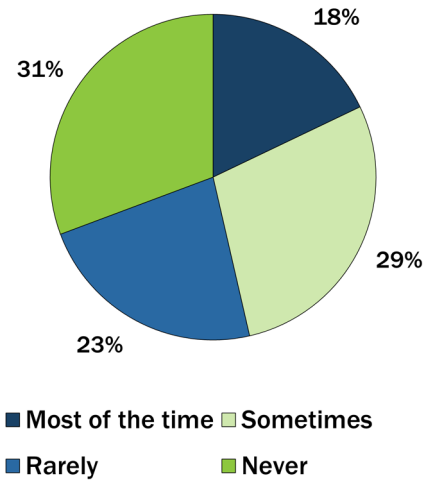
[b] The percentages at 54 and 72 months are significantly different at $p \leq 0.05$.

5.6.2 TV during Meals

During the 72-month interview, study mothers were asked how often the TV is on during meals. Figure 5-4 presents the findings. The percentage of caregivers reporting at 72 months that they *never* had the TV on during meals (31%) differed significantly from the percentage reporting *never* at 54 months (23%) (not shown).

Both maternal ethnorace and marital status were significantly associated with the frequency of television viewing during mealtimes when the study child was 72 months old. Table 5-10 presents the findings.

Figure 5-4. Percentage of study mothers reporting how often the television is on during meals at 72 months[a]



[a] Unweighted *n*=2,137; weighted *n*=441,226. Appendix Table B2d-3 offers additional detail.

Note: Percentages may not sum to 100 due to rounding.

Table 5-10. Key sociodemographic characteristics associated with the frequency of television viewing during mealtimes at 72 months

Key sociodemographic characteristic	Frequency of television viewing during mealtimes % (standard error)				Unweighted *n*	Weighted *n*
	Most of the time	Sometimes	Rarely	Never		
Maternal ethnorace						
Non-Hispanic Black	26.9[a,b] (2.2)	23.1 (2.2)	18.1[a] (1.6)	31.9 (2.1)	619	90,005
Non-Hispanic White	17.0[a] (2.0)	33.2 (2.8)	21.8 (2.2)	28.0 (2.4)	610	118,390
Non-Hispanic All Other	22.4 (5.7)	38.5 (7.3)	17.7 (6.1)	21.5 (4.5)	118	26,602
Hispanic	13.9[b] (1.4)	26.8 (1.6)	26.3[a] (2.0)	33.0 (2.0)	790	206,229
Marital status						
Married	14.3[a] (1.6)	31.3 (2.0)	25.3 (2.2)	29.1 (1.5)	869	189,886
Not married	20.7[a] (1.4)	26.4 (1.3)	21.0 (1.5)	32.0 (1.6)	1,268	251,341

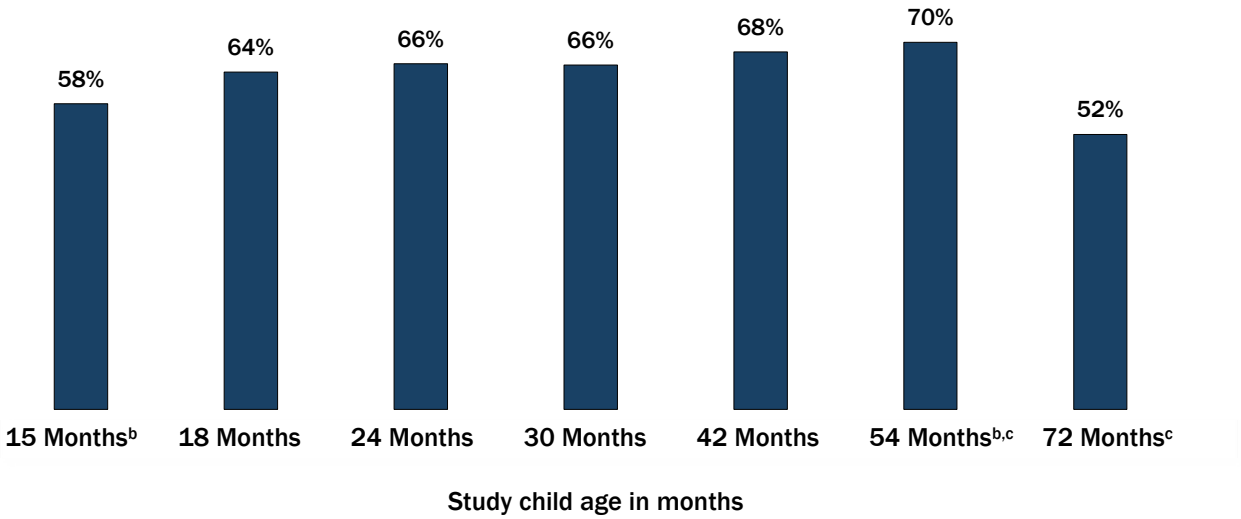
[a,b] Given the key sociodemographic characteristic under analysis, pairs of matching letters indicate statistically significant differences at $p \leq 0.05$.

Based on chi-square tests of association, there was not a significant association between frequency of TV viewing during meals and timing of the 72-month interview (i.e., pre-/post-COVID ED). Neither was there a statistically significant association between the frequency of TV viewing during meals and current WIC participation by the caregiver or another (non-study) child.

Change in the Practice over Time.[108] A retrospective lens was employed to understand the stability of this feeding practice. The population ratio method was used to examine the consistency of the reporting that the TV was *never* or *rarely* on during meals. The retrospective analysis was among those who reported this practice at the 72-month interview. Figure 5-5 presents the results. Fifty-eight percent of those who reported *rarely* or *never* watching TV during meals at child age 72 months reported that they *rarely* or *never* watched TV during meals when the study child was 15 months old. When the child was 18 months old, 64 percent of the group reported this practice. The percentage rose to 70 percent by 54 months. The clear upward trend between 15 and 54 months suggests that a notable percentage of study mothers who reported *rarely* or *never* watching TV during meals at 72 months adopted this feeding practice as the child aged. Against the backdrop of a rising trend between 15 and 54 months, the drop between 54 and 72 months is noteworthy.

[108] The methods used in this report differ from those in the *Fifth Year Report*. In the previous report, the set of cases analyzed was limited to those who reported at the 60-month interview *rarely* or *never* having television on during meals.

Figure 5-5. Among study families who *rarely* or *never* have the television on during meals at 72 months, the percentages that *rarely* or *never* have it on at select preceding interview months[a]



[a] At 72 months, unweighted *n*=503 and weighted *n*=231,126.

[b] The percentages at 15 and 54 months are significantly different at $p \leq 0.05$.

[c] The percentages at 54 and 72 months are significantly different at $p \leq 0.05$.

To further examine the idea that the feeding practice of *never* or *rarely* having TV on during meals was adopted over time, the analysis also looked prospectively. Prospective analysis of the data from age 15 months forward to 72 months revealed that among those who *never* or *rarely* had the TV on during meals when the child was 15 months old, about 48 percent did so when the child was 72 months old (not shown). In other words, less than half of study participants maintained the practice as the child grew older. This indicated more variability in the duration of employing this feeding practice than of the previous one analyzed, eating meals together as a family. In short, though increasing percentages of caregivers adopted the practice of *never* or *rarely* watching TV during meals as the child grew older, many did not continue long-term with the practice of *never* or *rarely* watching TV during meals.

5.6.3 Childcare and the Child's Home Eating Environment

As reported in Chapter 2, study participants were asked about childcare use during the school year. Chapter 2 included associations between key sociodemographic characteristics and use of childcare before school, during school, and while school was not in session. In addition, associations with the timing of the 72-month interview were examined. There were no statistically significant associations

between use of childcare relative to school and timing of the 72-month interview (i.e., pre-/post-COVID ED), though the primary focus of Chapter 2 was on who provides the food for the child while in childcare. This chapter explores the association between childcare and the child's eating environment at home.

The analysis in this chapter identified five groups among potential users of care: those who used childcare before school only, those who used childcare after school only, those who used childcare when school is not in session (school breaks or summer), those who used a combination of the previous three types of care, and those who did not use childcare.

About 2 percent of caregivers used before-school childcare only, 5 percent used after-school care only, 9 percent used childcare during the school year when school was not in session, 33 percent used some combination of the preceding three, and 51 percent did not use childcare during the school year. Because the percentages using before-school care only, after-school care only, and care only during breaks from school were small, the subsequent analyses examine association between use of any type of childcare (49% of caregivers) and the child's home feeding environment.

The chi-square test of association between maternal work status (employed full-time, employed part-time, and not employed) and the number of times families ate together in the past week did not reveal a statistically significant association. Neither was there a statistically significant association between maternal work status and the frequency of TV viewing during meals. However, there was a significant association between childcare use and the frequency of meals together, but not between childcare use and the frequency of TV viewing during meals. Table 5-11 presents the findings with the response options for frequency of meals together collapsed to 0 to 4 times and 5 or more times. Families more frequently ate five or more meals together if the mother did not use childcare than if she did.

Table 5-11. Percentage of study mothers by the number of times their family eats together and childcare use

Number of times the family ate together in the past week	Used childcare during the school year (before school, after school, when school was not in session)	Did not use child childcare during the school year
5 or more	62.4[a] (1.8)	71.4[a] (1.7)
0-4 times	37.6[b] (1.8)	28.6[b] (1.7)
Unweighted *n*	1,050	1,064
Weighted *n*	213,645	223,183

[a,b] Pairwise difference from those not using childcare during the school year is statistically significant at $p \leq 0.05$.

5.6.4 Bivariate Associations between the Child's Home Eating Environment and Diet Quality

To inform multivariable analysis, the analyses initially examined bivariate associations between the child's home eating environment and diet quality, as measured by HEI-2015 total scores on a given day at 72 months. Table 5-12 presents results from regressing the frequency of meals together on children's HEI-2015 total scores. Compared with children in families that eat meals together less than five times a week, children in families that eat meals together five or more times a week had HEI-2015 total scores on a given day that were about 3 points higher. It is important to note that the bivariate association reported in Table 5-12 does not account for other factors that may influence HEI-2015 total scores.

Table 5-12. Association between frequency of meals together at 72 months and study children's Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 72 months

Frequency of meals together	Estimate	*p*-value	Unweighted *n*	Weighted *n*
5 or more times compared with 0 to 4 times	3.10	<0.001*	2,119	438,260

* Indicates a statistically significant difference at $p \leq 0.05$ compared with the reference group.

Table 5-13 presents the results from regressing the frequency of TV viewing during meals on study children's HEI-2015 total scores on a given day at 72 months. Compared with those who *never* watched TV during meals, those who watched it *most of the time* had significantly lower diet quality as measured by children's total HEI-2015 total scores on a given day. Though coefficients on the other levels of TV viewing were not statistically significant relative to those who never watched television during meals, the increasingly detrimental effect on HEI-2015 total scores of increased TV viewing is clear. It is important to note, again, that the bivariate association reported does not account for other factors that may influence children's HEI-2015 total scores.

Table 5-13. Association between frequency of television (TV) viewing during meals at 72 months and study children's Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 72 months

Frequency of TV viewing during meals	Estimate	*p*-value	Unweighted *n*	Weighted *n*
Most of the time compared with never	-4.92	<0.001*		
Sometimes compared with never	-1.68	0.144	2,120	438,408
Rarely compared with never	-0.03	0.979		

* Indicates a statistically significant difference at $p \leq 0.05$ compared with the reference group.

5.7 Multivariable Regression Analysis of Study Children's Healthy Eating Index-2015 (HEI-2015) Total Scores on a Given Day at 72 Months

Chapter 3 presented findings on children's HEI-2015 scores. As reported there, the mean total score for all children was 56.2. This section draws from information presented previously in this and other chapters and uses multivariable regression analysis to examine factors independently associated with study children's HEI-2015 total scores on a given day at 72 months.

The model presented was informed by findings in past WIC ITFPS-2 reports, as well as preceding analyses examining various feeding practices that exhibited statistically significant relationships with children's HEI-2015 total scores based on univariate regressions. Lacking a compelling theory for which feeding practices should be included in a regression model, the process for determining the model reported was iterative, with all significantly associated feeding practices originally incorporated in the model and the resulting statistically insignificant ones subsequently removed. In addition to feeding practices associated with children's HEI-2015 total scores based on univariate analyses, factors originally considered included household participation in the Supplemental Nutrition Assistance Program (SNAP) at 72 months; household participation in the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP) at 72 months; and pattern of WIC participation by the study child, which reflects the child's duration of WIC participation. Participation in SNAP or NSLP, SPB, or SFSP at 72 months was not associated with HEI-2015 total scores in preliminary models, so they were excluded from the model presented.

Table 5-14 presents the findings. As indicated by an adjusted R-squared of 0.05, the model does not explain much of the variance in children's HEI-2015 total scores on a given day at 72 months. This suggests that other factors are important. Nonetheless, given the model, study children with either Hispanic or non-Hispanic Black caregivers had diet quality scores that were about 2.7 points higher, on average, on a given day at 72 months than children with non-Hispanic White caregivers. This finding was unexpected because there were no statistically significant differences in mean total scores based on bivariate analyses (see Chapter 3, Section 3.6.). Children introduced to sugar-sweetened beverages (SSBs) in the first year of life had diet quality scores that were about 4.2 points lower, on average, on a given day at 72 months than children who were not introduced to SSBs in

the first 2 years of life. In addition, compared to children who participated consistently with WIC during the first 5 years of life, children who left WIC after the first year had diet quality scores that were about 3.4 points lower, on average, on a given day at 72 months. In other words, children with 5 full years of WIC participation had diets at age 6 years that more closely aligned with the *Dietary Guidelines for Americans* than children who left WIC after their first year. This latter finding suggests that consistent WIC participation during the child's first 5 years of life may have enduring positive effects on the child's diet, which, if maintained, may positively impact health over the longer term. However, more work is needed to substantiate this suggestion, as a different combination of feeding practices, including indexes that combine feeding practices, may yield different results.

Table 5-14. Results of multivariable regression of study children's Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 72 months on covariates[a]

Covariate	Coefficient	*p*-value
Child sex: female compared with male	2.02	0.057
Ethnorace: reference category is Non-Hispanic White		
Hispanic	2.69	0.023*
Non-Hispanic All Other	0.46	0.850
Non-Hispanic Black	2.66	0.028*
Timing of the introduction of sugar-sweetened beverages (SSBs): reference is not in first 2 years		
Introduced in first year	-4.18	0.001*
Introduced in second year	-0.41	0.751
Family ate together 5 or more times in the past week compared to less than 5 times during the week	2.91	0.007*
Pattern of WIC participation: reference is consistently through 5 years		
1st year only	-3.43	0.049*
2nd or 3rd year only	-1.36	0.310
4th or 5th year only	-1.80	0.196
Intermittently	1.52	0.284
Timing of 72-month interview: pre-coronavirus disease 2019 (COVID-19) emergency declaration (COVID ED) compared with post-COVID ED	-1.08	0.307

[a] The 1- or 3-month through 72-month longitudinal weight was used for this analysis because pattern of WIC participation was derived based on responses to every postnatal interview. Unweighted *n*=954; weighted *n*=436,446. Adjusted R-squared = 0.053. Appendix Table B2d-4 offers additional detail.

* Indicates a statistically significant difference at $p \leq 0.05$ compared with the reference group.

6. Child Health, Lifestyle Characteristics, Development, and Weight

Key Findings around Age 6 Years:

- About 6 percent of caregivers reported that study children had health conditions that affected eating.
- About 9 percent of caregivers reported that a doctor had told them that the study child had a condition that affected his or her development and learning.
- Most study children played outdoors 1 hour or more on a typical weekday (79%) or a typical weekend (88%) day. Median weekly outdoor playtime for study children was 12.8 hours per week.
- Median time spent watching television (TV) or playing video games over the course of a week was 14.5 hours.
- Around age 6 years, 59 percent of study children had healthy weight status. Four percent of study children were underweight, 18 percent were overweight, and 19 percent were obese.
- The lowest point in the mean and median age- and sex-adjusted body mass index (BMI) trajectories of study children appeared around age 4 years. Though this is later than age 3 years, the age at which the literature has associated with later childhood obesity, there may be children that experience the rebound around age 3 years.
- Bivariate analysis did not find an association between participation in Federal nutrition assistance programs at 72 months and study children's age- and sex-adjusted BMI; however, in multivariable regression analysis, duration of past participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was inversely associated with children's age- and sex-adjusted BMI expressed as a percentage of the 95th percentile. This may reflect self-selection, as those who were receiving WIC in the study child's fifth year indicated that they stayed with WIC because WIC staff listened to their thoughts about their child's health.

6.1 Overview

This chapter focuses on the health, lifestyle characteristics, development, and growth of 6-year-old children who formerly participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and are participating in the WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2). The emphasis is on development and growth indicators collected around the time of the child's sixth birthday, with weight and height measurements being collected between ages 67 and 77 months.[109] This chapter reports on associations between health, developmental, lifestyle, diet, and growth outcomes after the study child has transitioned off WIC. The analyses use

[109] The window for collection of anthropometric data was extended because of the coronavirus disease 2019 (COVID-19) health emergency. Data collected for the WIC ITFPS-2 72-month interview spanned from 2 weeks before to 4 weeks after the child's sixth birthday.

both survey data and anthropometric data on study children[110] to address the following research questions from a different perspective than those in previous chapters:

- How many 5-6-year-olds exhibit unhealthy eating patterns, and what characteristics, including weight-for-height status, are associated with these habits?
- How do early feeding practices impact children's weight status and growth during the sixth 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 5-6-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?
- What is the impact of participation in other Federal food assistance programs (e.g., National School Lunch Program [NSLP]/School Breakfast Program [SBP], Summer Food Service Program [SFSP], Supplemental Nutrition Assistance Program [SNAP]) on feeding practices and health outcomes (i.e., weight status, developmental outcomes) during the sixth year of life?
- How many 5-6-year-olds exhibit unhealthy eating patterns, and what characteristics are associated with these habits?

6.2 Background

As discussed in the *Fifth Year Report*, lifestyle characteristics such as physical activity, sedentary time, and sleep duration influence children's health and development. This chapter reports on associations between health, developmental, lifestyle, diet, and growth outcomes after the study child has transitioned off WIC. Zuckerman, Chavez, and Reeder (2017) find that caregivers frequently raise concerns about their child's development and behavior with WIC staff. Koleilat, Whaley, Esguerra, and Sekhobo (2017) note that WIC has the potential to play a notable role in obesity prevention. But little is known about what happens to children when WIC support is no longer available.

The main outcome explored in this chapter is children's weight status around age 6 years. Based on data from the 2017-2018 National Health and Nutrition Examination Survey (NHANES), obesity

[110] Length measurements are used from birth through 28 months (i.e., the measurement taken around the child's second birthday), then height measurements are used for all subsequent measurements.

prevalence among 6- to 11-year-old children was 20.3 percent, with differing prevalence by ethnoracial and sociodemographic characteristics (Fryar, Carroll, & Afful, 2020). Children in families with low incomes (≤130% of the Federal Poverty Guidelines [FPG]) exhibited higher rates of obesity than their counterparts in families with higher incomes (>350% FPG) and rates diverged between boys and girls (Ogden et al., 2018). Studies have also shown an uptick in child obesity since the pandemic (Chang et al., 2021). Some of the data for this study was collected after the coronavirus disease 2019 (COVID-19) emergency was declared, March 13, 2020.

The chapter begins by summarizing whether there are developmental concerns that healthcare providers have discussed with study mothers. Because most children are in school, receipt of special education services is also examined. The discussion subsequently transitions to an examination of lifestyle characteristics, specifically physical activity and sedentary time, as these have been associated with weight, adiposity, and health in young children (Pate et al., 2019). The chapter concludes with a presentation of factors from this and previous chapters of this report associated with children's age- and sex-adjusted body mass index (BMI).

6.3 Sample and Analysis Approach

6.3.1 Sample

The analyses in this chapter use interview data through the 72-month interview and weight/height measurements obtained around the child's sixth birthday. The focus is on activities, behaviors, and age- and sex-adjusted BMI around age 6 years. Chapter 3, Table 3-1 shows the number of respondents to the 60- and 72-month interviews, including both the survey and the dietary recall portions. Both the core and supplemental samples were eligible for the interviews.

The study collected weight and length/height measurements of the children around seven periods of time[111] through the end of the sixth year of life: 6 months, 12 months, 24 months, 36 months, 48 months, 60 months, and 72 months (see Table 6-1). Section 1.5 in Chapter 1 of this report details the data collection procedures for these data.

[111] Although data are also requested on birth weight and length, the data are not consistently available from WIC records.

Table 6-1. Unweighted number of analysis sample children[a] on whom the study received weight and length/height data by source of measurement

Time period	Number received	Source of measurement		
		WIC administrative data	WIC site or healthcare provider records	Caregiver report of provider measurement
6-month measurements	2,568	2,394	62	112
12-month measurements	2,577	2,347	147	83
24-month measurements	1,731	1,449	158	124
36-month measurements	1,886	1,139	747	0
48-month measurements	2,115	296	1,819	0
60-month measurements	1,825	0	1,825	0
72-month measurements	1.,386	0	1,386	0

[a] The analysis sample constitutes all the cases used in analysis, *n*=3,775. To be in the analysis sample, the respondent must have responded to either the 1- or 3-month interview.

The timing of measurements at WIC sites and by healthcare providers varied. In order to facilitate analysis, the data are broken into seven age periods eligible for analysis. ***Early infancy*** ranges from 1 to less than 7 months. ***Late infancy*** ranges from 7 through 13 months. ***Toddlerhood*** ranges from 20 through 28 months. The ***third year*** ranges from 32 through 40 months. The ***fourth year*** ranges from 44 through 52 months, and the ***fifth year*** ranges from 56 through 64 months. The window for data collection for the ***sixth year*** was extended because of the COVID-19 public health emergency. The window spans from 67 to 77 months. Table 6-2 reports the number of observations within the time periods around each age and, thus, were available for analysis. A majority of study children have repeated measures. However, the time between measures of any given study child may be uneven over the course of the study. For convenience, the third-, fourth-, fifth-, and sixth-year ranges are sometimes referred to as at age 3 years, at age 4 years, at age 5 years, and at 6 years, respectively.

Table 6-2. Number of study children in the analysis sample[a] with weight and length or height measurement data used for analysis by age group

Age period	Unweighted *n*	Weighted *n*	Source of measurement		
			WIC administrative data	WIC site or healthcare provider records	Caregiver report of provider measurement
Early infancy (1 through <7 months)	2,014[b]	349,824	1,918	48	48
Late infancy (7 through 13 months)	2,015[b]	348,553	1,860	104	51
Toddlerhood (20 through 28 months)	1,731	442,713	1,449	158	124
Third year (32 through 40 months)	1,886	442,544	1,139	747	0
Fourth year (44 through 52 months)	2,115	442,085	296	1,819	0
Fifth year (56 through 64 months)	1,825	441,932	0	1,825	0
Sixth year (67 through 77 months)	1,386	449,287	0	1,386	0

[a] The analysis sample constitutes all the cases used in analysis. To be in the main analytic sample, the respondent must have responded to either the 1- or 3-month interview (i.e., their first postnatal interview).

[b] Not all measures reported were in the correct timeframe, so these counts are lower than in Table 6-1.

6.3.2 Growth Standards

To assess the weight status and growth trajectories of study children, analyses in this chapter use the Centers for Disease Control and Prevention (CDC) growth charts. These growth charts consist of a series of percentile curves illustrating the expected distribution of BMI-for-age for males and females in the U.S. population.[112] Age- and sex-specific BMI percentiles are the most commonly used clinical indicators to assess the size and growth patterns of individual children in the United States (Kuczmarski et al., 2002; CDC, 2018). Unless otherwise noted, BMI measures reported in this chapter are sex- and age-adjusted. To simplify the discussion, subsequent text does not repeatedly mention the adjustments, but simply refers to BMI.

Using the sex-specific CDC growth charts (CDC, 2018), study children are classified as underweight if their BMI is less than the 5th percentile, normal/healthy weight if their BMI is between the 5th and less than the 85th percentile, overweight if their BMI is between the 85th and less than the 95th

[112] Source: CDC Growth Charts. Available at: https://www.cdc.gov/growthcharts/index.htm. Retrieved on: May 1, 2019.

percentile, and obese if their BMI equals or exceeds the level at the 95th percentile.[113] For this report, the analysis includes findings on a subset of children with obesity: those with severe obesity. Severe obesity is defined as BMI ≥ 120 percent of the 95th percentile (Freedman, Goodman, King, & Blanck, 2019).

When analyzing trends in children's BMI over time, this report follows CDC guidance and applies the World Health Organization (WHO) growth standards to children less than 24 months of age and the CDC growth reference to children ages 24 months and older. For simplicity of presentation, sex- and age-adjusted BMI percentiles are referred to henceforth as BMI percentiles.

6.3.3 Analysis

This chapter includes both cross-sectional and longitudinal analyses. The cross-sectional analyses indicate outcomes at a point in time, often around child age 72 months, but other time points are presented for context. Cross-sectional analyses use the 72-month interview cross-sectional sample weights. The longitudinal analyses examine outcomes that take place over time. Examples of longitudinal analyses include examination of the stability of the feeding practices in the study child's home environment as he or she grew older and examination of associations between outcomes of interest and the study child's pattern of WIC participation in the first 5 years of life. For longitudinal analyses involving survey responses, the 1- or 3-month through 72-month interview core longitudinal sample weights were used. Longitudinal analyses involving BMI used the 1- or 3-month through 72-month interview core sample longitudinal weights with all cases that had 72-month measurement data (see Table 6-1).

Descriptive statistics, including percentages, means, and medians, were used to summarize outcomes of interest. Medians were sometimes used in place of means because they are less influenced by extreme outliers.

Several outcomes examined in this chapter are based on parental report of the child's activity. Analysis of the amount of outdoor physical activity uses data from survey questions that ask parents to provide the typical amount of time that the child spends playing outdoors on a typical weekday

[113] The healthy/normal weight status category includes the 5th percentile but excludes the 85th percentile; the overweight weight status category includes the 85th percentile but excludes the 95th percentile.

and on a typical weekend day. Similarly, analysis of sedentary time uses data from survey questions that ask about typical time spent watching television on weekdays and weekend days, and typical time playing video or computer games, including games on handheld devices, on weekdays and weekend days. For analysis of nighttime sleep duration, analysis uses data from parental report on the time the child usually goes to sleep and the time the child usually wakes in the morning.

Bivariate analyses focused on whether interview responses were associated with the study's key sociodemographic characteristics (see Chapter 1, Section 1.8.2 for a list of key sociodemographic variables), as well as the timing of the 72-month interview (i.e., whether it took place prior to or on March 13, 2020, or after March 13, 2020, when the COVID-19 emergency declaration [COVID ED] occurred). We refer to the early period as pre-COVID ED and the latter as post-COVID ED. Nonmodifiable key sociodemographic characteristics are measured at the time of the first interview, and only refreshed, as needed, if the caregiver changes. However, for key characteristics that may change over time, such as household food security, income relative to FPG, or WIC participation status, values reported at the 72-month interview were used. It is important to note that bivariate associations do not account for potential confounders.

For the bivariate analyses of categorical variables, chi-square tests of association were used to examine whether survey responses are associated with primary outcomes of interest (e.g., weight status categories). If a significant association is found, typically, two-tailed t-tests, with Bonferroni adjustment for multiple tests, were used to determine which pairwise subgroup differences were statistically significant. Subgroup differences discussed in the chapter are limited to those that are large in magnitude,[114] to avoid focusing on findings that, while statistically significant, may have little practical importance. Statistical significance, when indicated, is at the level of $p \leq 0.05$. For continuous outcomes of interest (e.g., BMI), univariate regression is used to assess whether there exists a statistically significant association between a survey response and the outcome. These regressions do not control for other factors that may influence the outcome. As planned, the bivariate approach, along with input from the scientific literature, lays the groundwork for more nuanced multivariable analyses.

[114] Proportional differences are typically discussed if they are more than 3 percentage points in magnitude and/or form a pattern over time or items. See Chapter 1 for details. Median differences are discussed if they exceed half a scale-point of difference. Both indicate very small effect sizes (Cohen, 1988).

Relationships between BMI and Healthy Eating Index-2015 (HEI-2015) scores were assessed using univariate regressions. HEI-2015 scoring was described in Chapter 3. HEI-2015 is the current version of HEI and can be used to assess diet quality for people ages 2 years and older.

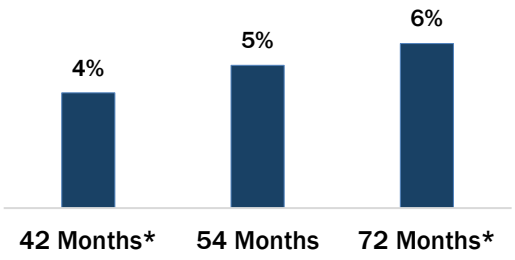
6.4 Child Health, Developmental Concerns, and Special Education Service Receipt

This section discusses findings around health conditions that affect eating, concerns about the child's cognitive and social development, and receipt of special education services. These contextualize subsequent findings of associations between activities and weight.

6.4.1 Health Conditions That Affect Eating

Based on maternal report at 72 months, about 6 percent of study children had a medical condition that affected their eating (such as food allergies, diabetes, metabolic disorders, gastrointestinal disorders, and mouth or facial conditions or any long-term problems that affect the child's ability to eat and swallow). Figure 6-1 offers a glimpse of the trend in reporting health conditions that affect the child's eating, reporting the findings at 42, 54, and 72 months. Though the percentages at each interview month are small, the slow upward trend is noteworthy. There were no statistically significant associations between the key sociodemographic characteristics used in this report and the child having a medical condition that affects eating.

Figure 6-1. Percentage of study children with a medical condition that affects eating, reported at 42, 54, and 72 months[a]



[a] At 42 months, unweighted *n*=2,632 and weighted *n*=441,286. At 54 months, unweighted *n*=2,563 and weighted *n*=441,244. At 72 months, unweighted *n*=2,135 and weighted *n*=440,188. Appendix Table B2e-1 offers additional detail.

* Significantly different at $p \leq 0.05$, with Bonferroni adjustment for two comparisons with the 72-month value.

6.4.2 Developmental Concerns

At age 6, the child is old enough to be in school; consequently, the 72-month survey instrument asked caregivers whether a doctor had told them that their child had a condition that affected his or her development and learning, such as developmental delay, learning problems, attention problems, behavior problems, or autism. About 9 percent of study participants indicated that a doctor had told them their child had such a condition. The percentages differed significantly by child sex: 12 percent were males and 6 percent were females.

Among the caregivers who indicated that a doctor had told them that their child had a condition that affects his or her development and learning, 26 percent indicated that their children had been diagnosed with autism, 20 percent indicated attention problems, and 17 percent indicated their child was developmentally delayed. To contextualize the findings involving autism, about 2.3 percent of all study mothers reported that they had been told the child had autism. This aligns with national findings. The CDC reports that 2.3 percent of 8-year-old children in the United States were estimated to have Autism Spectrum Disorder (ASD), with prevalence being 4.2 times greater among males than females.[115] In the WIC ITFPS-2 data, there was a statistically significant difference in prevalence by child sex, but the difference was not as large as in the general population: Prevalence was 2.3 times greater among males than females.

Whether having been told that the study child had a condition that affected development and learning was associated with several of the 12 key sociodemographic characteristics used in this study: maternal ethnorace, maternal educational attainment at 54 months, household food security status, and participation in non-WIC benefit programs.[116] Table 6-3 presents the findings. It is important to note that bivariate associations do not account for other factors that may affect the percentages reported. Possible factors include, for example, differences in access to testing or differences in the willingness to report.

[115] Source: https://www.nimh.nih.gov/health/statistics/autism-spectrum-disorder-asd#:~:text=Across%20the%20CDC%20surveillance%20sites,all%20racial%20and%20ethnic%20groups. Retrieved on: April 1, 2022.

[116] Though SNAP is a means-tested program (that is, there are income limits that participants cannot exceed), there was not an association between this outcome and the income poverty measures used in this study.

Table 6-3. Percentage of study children who have a condition affecting their development and learning by select key sociodemographic characteristics

Key sociodemographic characteristic	Child has a condition affecting development and learning % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	7.0[a] (1.2)	619	90,005
Non-Hispanic White	15.5[a,b,c] (1.7)	610	118,390
Non-Hispanic Other	6.4[b] (2.9)	117	26,364
Hispanic	6.8[c] (1.5)	790	206,229
Maternal educational attainment at 54 months			
High school or less	7.3[a] (1.1)	1,130	235,738
More than high school	11.3[a] (1.3)	1,006	205,251
Household food security status			
High or marginal	7.5[a] (0.9)	1,659	351,764
Low	11.3 (2.9)	263	53,490
Very low	21.9[a] (3.8)	214	35,735
Participation in non-WIC benefit programs			
Does not participate in any other programs[d]	3.7[a,b] (1.0)	358	71,611
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[d]	12.3[a] (1.5)	905	181,618
Participates in other program(s) excluding SNAP[d]	8.2[b] (1.2)	873	187,759

[a,b,c] Given the key characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between subgroups at $p \leq 0.05$.

[d] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

6.4.3 Receipt of Special Education Services

After inquiring about conditions that affected development and learning, the survey asked if the child was receiving special education services. About 9 percent of study children were receiving these services, with a significant difference in the percentages by child sex: 11 percent were males and 6 percent were females. Among those who had been told of a developmental concern, about 58 percent were receiving special education services.

Of the 9 percent of study children receiving special education services, 50 percent were receiving services to facilitate learning, 31 percent were receiving services to make friends, and about 28 percent were receiving services to participate in sports, clubs, or other organized activities. Receipt of special education services was associated with several key sociodemographic characteristics used in this study: maternal ethnorace, maternal employment status, household food security status, and participation in non-WIC benefit programs. Table 6-4 presents the findings.

Table 6-4. Percentage of study children receiving special education services by select key sociodemographic characteristics

Key sociodemographic characteristic	Child receiving special education services % (standard error)	Unweighted *n*	Weighted *n*
Maternal ethnorace			
Non-Hispanic Black	6.3[a] (1.1)	618	89,856
Non-Hispanic White	12.3[a] (1.3)	610	118,390
Non-Hispanic Other	5.4 (3.3)	118	26,602
Hispanic	8.0 (1.7)	789	205,805
Employment status			
Full-time	6.2[a] (1.0)	842	171,430
Part-time	9.5 (1.7)	426	89,927
Not employed	10.6[a] (1.6)	867	179,296
Household food security status			
High or marginal	7.1[a] (0.8)	1,658	351,340
Low	10.8 (2.9)	263	53,579
Very low	20.9[a] (4.3)	214	35,735
Participation in non-WIC benefit programs			
Does not participate in any other programs[b]	5.4[a] (1.3)	358	71,611
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[b]	11.3[a] (1.5)	904	181,283
Participates in other program(s) excluding SNAP[b]	7.4 (1.1)	873	187,759

[a] Given the key characteristic under analysis, pairs of matching letters in a column indicate a statistically significant difference between subgroups at $p \leq 0.05$.

[b] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

6.5 Physical Activity and Sedentary Time

To better understand the lifestyles of study children, the study examined physical activity and sedentary time, as these are commonly understood to influence children's development and health. Caregiver report of children's usual amount of outdoor playtime was used as a proxy for physical activity. Sedentary time was estimated using caregiver reports of the time children spend watching television or playing video games that do not involve movement.

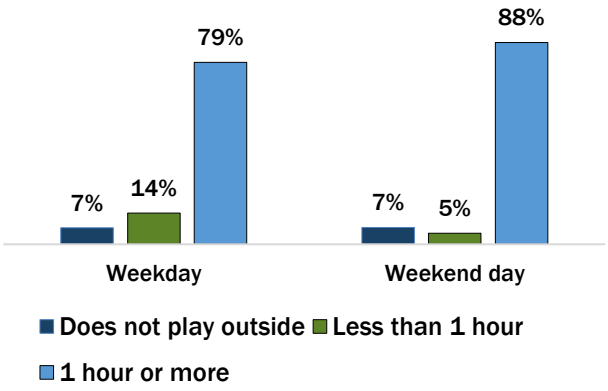
6.5.1 Outdoor Playtime

Physical activity is important for children's optimal health and development. The U.S. Department of Health and Human Services (HHS) Physical Activity Guidelines note that physical activity has many benefits. In addition to weight management, it has been positively associated with cognitive

function for children ages 6 to 11 years (HHS, 2018). The guidelines encourage children ages 6 to 17 years to do 60 minutes (1 hour) of moderate-to-vigorous physical activity each day (HHS, 2018).

Research indicates that results from direct measures of physical activity are positively correlated with parental report of outdoor playtime (Burdette, Whitaker, & Daniels, 2004). Additional research notes that higher activity levels are associated with outdoor play (Vanderloo, Tucker, Johnson, & Holmes, 2013; Baranowski, Thompson, Durant, Baranowski, & Puhl, 1993; Sallis et al., 1993). This study uses caregiver report of outdoor playtime to approximate the physical activity levels of study children.

Figure 6-2. Percentage of study children by parental report of typical outdoor playtime, weekday and weekend day, at 72 months[a]

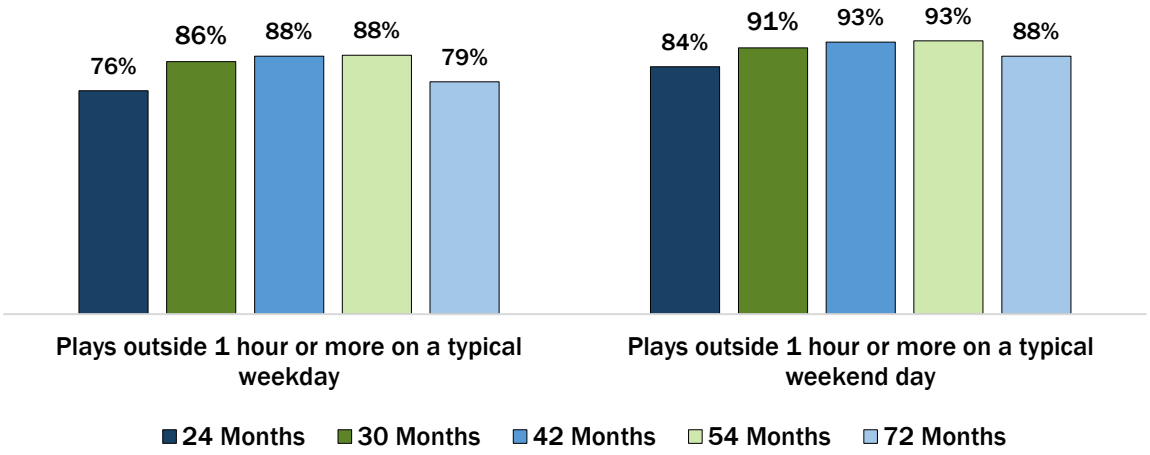


[a] Unweighted *n*=2,126 and weighted *n*=439,818. Appendix Table B2e-2 offers additional detail.

Figure 6-2 shows the distribution of study children by reported amounts of outdoor playtime on weekdays and weekend days. Most children played outdoors 1 hour or more on a typical weekday or a typical weekend day. Based on weekday and weekend day reports, median outdoor playtime over the course of a typical week was 12.8 hours (standard error [SE]=0.4) and mean time was 14.1 hours (SE=0.3).

Figure 6-3 presents the percentages of the study children who played outside at least 1 hour on a typical weekday and weekend day at 24, 30, 42, 54, and 72 months. The range reported was extended to include the 24-month interview because reported outdoor playtime may have been affected by the months during which data were collected, and the months of collection for the 30-, 42-, and 54-month data collections did not align with those of the 72-month data collection (see Table 1-2 in Chapter 1). Months of data collection for the 36-, 48-, and 60-month interviews aligned with the months of data collection for the 72-month interview, but outdoor playtime was not assessed at these interviews. The months of data collection for the 24-month interview also aligned with those of the 72-month interview, and percentages playing outdoors at 24 months are closer to those at 72 months (Figure 6-3). However, the children were much younger at age 2, which may have affected their outdoor playtime.

Figure 6-3. Percentages of children who play outside 1 hour or more on a typical weekday or weekend day at 24, 30, 42, 54, and 72 months[a,b]



[a] The months of data collection for the 30-, 42-, and 54-month surveys did not align with those of the 24- or 72-month survey.

[b] At 24 months, unweighted *n*=2,444 and weighted *n*=439,524. At 30 months, unweighted *n*=2606 and weighted *n*=438,301. At 42 months, unweighted *n*=2,615 and weighted *n*=439,463. At 54 months, unweighted *n*=2,549 and weighted *n*=439,261. At 72 months, unweighted *n*=2,126 and weighted *n*=439,818. Appendix Table B2e-3 offers additional detail.

Bivariate analyses indicated that outdoor play at 72 months was associated with maternal ethnorace and timing of WIC enrollment (for the study child). Table 6-5 presents the findings.

Table 6-5. Percentage of study children who play outside 1 hour or more at 72 months by select key sociodemographic characteristics

Key sociodemographic characteristic	Plays outdoors 1 hour or more on a typical weekday % (standard error [SE])	Plays outdoors 1 hour or more on a typical weekend day % (SE)	Unweighted *n*	Weighted *n*
Maternal ethnorace				
Non-Hispanic Black	67.9[a,b] (2.9)	79.3[a,b] (3.6)	613	89,218
Non-Hispanic White	85.6[a] (1.7)	90.1[a] (1.2)	606	117,965
Non-Hispanic Other	81.3 (4.1)	87.9 (3.7)	118	26,602
Hispanic	80.3[b] (2.0)	90.3[b] (1.5)	789	206,034
Timing of WIC enrollment				
First trimester	79.0[a] (2.4)	89.0[a,b] (1.8)	663	140,246
Second trimester	73.0[b,c] (2.3)	81.5[a,c,d] (2.0)	854	176,397
Third trimester	84.2[b] (3.2)	94.0[c] (1.5)	315	65,821
Postnatal	93.6[a,c] (1.5)	97.7[b,d] (0.9)	294	57,353

[a,b,c,d] Pairs of matching superscripts within a column for a key sociodemographic category indicate that there is a statistically significant difference at $p \leq 0.05$ between the percentages.

There was not a significant association between child sex and outdoor playtime as categorized in Figure 6-2 based on chi-square analysis. However, there was a statistically significant difference

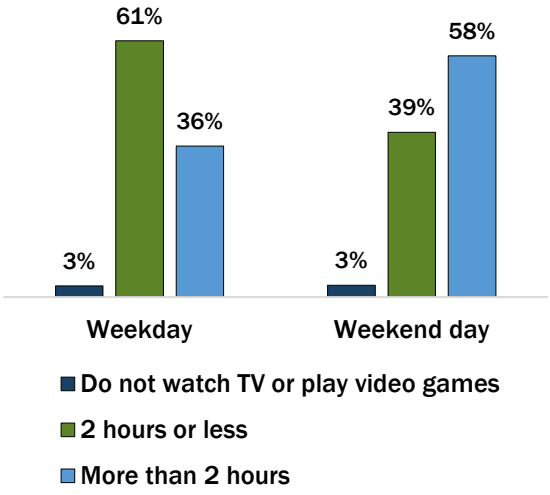
between the percentages of male (6%) and female (8%) children who do not play outside on a typical weekday based on pairwise t-tests. All other pairwise differences were not statistically significant.

As mentioned, bivariate analyses presented do not control for potential confounding among the characteristics assessed or by factors not assessed such as geographic (e.g., climate, urbanicity) differences across the United States that may affect outdoor playtime. Therefore, significant bivariate associations should be interpreted with caution.

6.5.2 Sedentary Time

Because WIC ITFPS-2 did not objectively measure children's daily activity levels, it relied on caregiver reports of time spent watching television and playing video games (i.e., screen time) to approximate children's sedentary time.[117] Figure 6-4 presents the findings using 2 hours per day as a cutoff. Just over one-third (36%) of study children had more than 2 hours of sedentary screen time on the average weekday, while more than half (58%) were sedentary for more than 2 hours on the average weekend day. Based on weekday and weekend day report,

Figure 6-4. Percentage of study children by parental report of screen time, weekday and weekend day, at 72 months[a]



[a] Unweighted *n*=2,131 and weighted *n*=439,926. Appendix Table B2e-4 offers additional detail.

[117] Data from the following four survey questions used in this analysis are:

a. CH17a. On an average weekday, how many hours does {CHILD} watch television? Only include time when [HE/SHE] is actually watching TV, not playing video games, and just give your best estimate.

b. CH17b. On an average weekend day, how many hours does {CHILD} watch television? Only include time when [HE/SHE] is actually watching TV, not playing video games, and just give your best estimate.

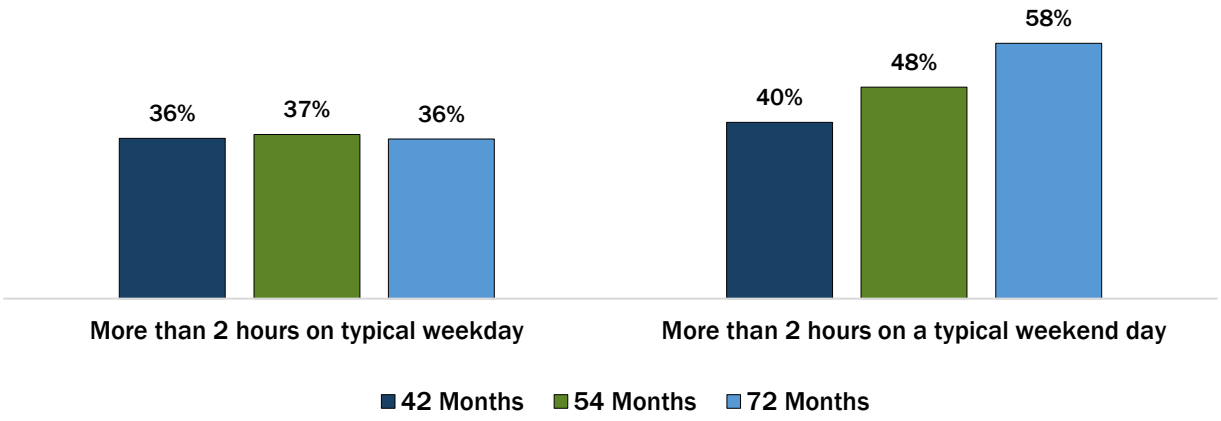
c. CH18b. On an average weekday, how many hours does {CHILD} play video or computer games, including games on handheld devices like a cellphone? Do not include time spent playing video or computer games that involve physical activity such as Wii. Just give your best estimate.

d. CH18c. On an average weekend day, how many hours does {CHILD} play video or computer games, including games on handheld devices like a cellphone? Do not include time spent playing video or computer games that involve physical activity such as Wii. Just give your best estimate.

median time spent watching TV or playing video games over the course of a week was 14.5 hours (SE=0.5). Mean time was 17.2 hours (SE=0.4).

Figure 6-5 presents the percentage of study children whose caregivers reported more than 2 hours of screen time on typical weekdays or weekend days at the 42-, 54-, and 72-month interviews. Findings from previous interviews are not presented because the survey items assessing screen time did not distinguish between weekdays and weekend days. The percentage of study children watching more than 2 hours on a typical weekday is relatively constant across the 42-, 54-, and 72-month interviews. However, there is an apparent upward trend in the percentage watching more than 2 hours on a typical weekend day. Some caution is warranted when interpreting the apparent trend, as the months of data collection for the 72-month survey differed from those of the 42- and 54-month interviews, and seasonality may affect screen time.

Figure 6-5. Percentages of children whose caregivers report 2 or more hours of screen time on a typical weekday or weekend day at 42, 54, and 72 months[a]



[a] At 42 months, unweighted n=2,537 and weighted n=441,390. At 54 months, unweighted n=2,558 and weighted n=440,548. At 72 months, unweighted n=2,131 and weighted n=439,926.

Maternal ethnorace was the only key sociodemographic characteristic associated with both weekday and weekend day screen time. Maternal educational attainment at 54 months was associated with screen time on weekdays, and maternal employment status was associated with screen time on weekend days. Additional analysis did not find significant differences in reported sedentary time pre-

or post-COVID ED; however, the final 72-month interview was administered early in the pandemic, June of 2020.[118] Table 6-6 presents the findings.

Table 6-6. Percentage of study children who spend more than 2 hours on an average day watching television (TV) and playing video games at 72 months by select key sociodemographic characteristics

Key sociodemographic characteristic	More than 2 hours on an average weekday % (standard error [SE])	More than 2 hours on an average weekend day % (SE)	Unweighted *n*	Weighted *n*
Maternal ethnorace				
Non-Hispanic Black	55.2[a,b] (2.5)	74.0[a,b] (2.1)	616	89,337
Non-Hispanic White	29.2[a] (2.2)	55.7[a,c] (2.8)	608	118,134
Non-Hispanic Other	41.7 (5.4)	69.8[c,d] (3.9)	118	26,602
Hispanic	30.9[b] (2.0)	50.3[b,d] (2.9)	789	205,854
Maternal educational attainment at 54 months				
High school or less	38.9[a] (1.9)	56.4 (2.0)	1,128	235,127
More than high school	32.8[a] (1.8)	59.3 (2.6)	1,003	204,800
Employment status				
Full-time	33.9 (2.2)	62.4[a] (2.5)	838	170,790
Part-time	37.0 (3.0)	59.4 (3.6)	426	89,927
Not working	37.7 (2.0)	52.4[a] (2.7)	867	179,209

[a,b,c,d] Pairs of matching superscripts within a sociodemographic category indicate that there is a statistically significant difference at $p \leq 0.05$ between the percentages.

There was a statistically significant association between watching TV and playing video games on a typical weekend day and child sex based on chi-square analysis. Follow-up pairwise t-tests indicated that a greater percentage of males (63%) than females (52%) played more than 2 hours on a typical weekend day.

6.6 BMI around Age 6 Years

As mentioned, data collection for the 72-month interview took place during the early months of the COVID-19 pandemic. Because many caregivers were unable to readily access WIC clinics and medical professionals, the window for collecting data on height and weight was extended. Nonetheless, in addition to adjusting for sex, all assessments of weight status are adjusted for the

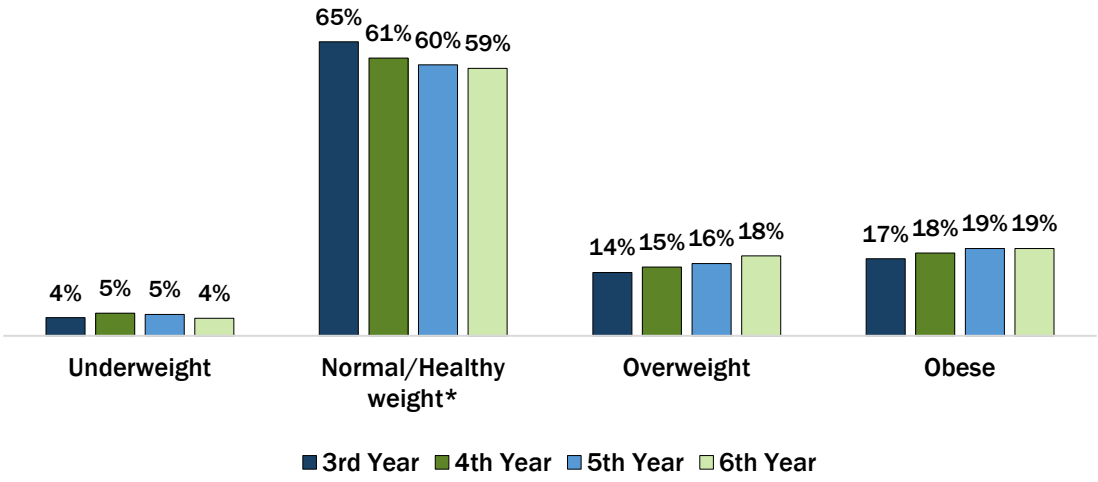
[118] The window for 72-month data collection spanned through August 2020 (see Chapter 1, Table 1-2), but the final completed 72-month interview occurred in late June 2020.

child's age at the time of data collection. The analytical approach included examining BMI weight status categories, z-scores, and BMI expressed as a percentage relative to the 95th percentile.[119]

6.6.1 BMI Distribution

Figure 6-6 presents the percentage distribution of study children by weight status categories at ages 3 through 6 years (Appendix Table B2e-3 offers additional details). Around age 6 years, 59 percent of study children had BMI percentiles in the normal/healthy weight status category. Four percent were underweight. About 18 percent of study children were overweight, and 19 percent of study children were in the obese category. There were no statistically significant differences between the 72-month estimates within a weight status category and any given previous year's estimates based on pairwise t-tests with Bonferroni adjustment for three comparisons. At 72 months, there were no statistically significant differences in weight status by child sex.

Figure 6-6. Percentage of study children by body mass index (BMI)-for-age categories around ages 3, 4, 5, and 6 years[a]



[a] Around age 3 years, unweighted *n*=1,885 and weighted *n*=442,274. Around age 4 years, unweighted *n*=2,115 and weighted *n*=442,085. Around age 5 years, unweighted *n*=1,825 and weighted *n*=441,932. Around age 6 years, unweighted *n*=1,386 and weighted *n*=441,932. Appendix Table B2e-6 offers additional detail.

Note: Percentages may not sum to 100 due to rounding.

[119] The 97th percentile was the highest percentile estimated in the CDC growth charts. When a high percentage of children in a sample have severe obesity (BMI >120% of the 95th percentile in the CDC growth charts, which is approximately equal to the empirical 99th percentile), the CDC recommends the use of an alternative identifying and characterizing children with severe obesity. We examined children's BMI relative to 95th percentile expressed as a percentage. See https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm#defining.

Table 6-7 presents the percentages of study children exhibiting severe obesity, defined as at or above 120 percent of the 95th BMI-for-age percentile. The percentage of children with severe obesity in WIC ITFPS-2 more than doubled between the third- and sixth-year measurement periods.

Table 6-7. Prevalence of severe obesity[a] among WIC ITFPS-2 study children around ages 3, 4, 5, and 6 years

Measurement period	Severe obesity % (standard error)	Unweighted *n*	Weighted *n*
Third year	2.5 (0.5)[b]	1,885	442,274
Fourth year	4.3 (0.6)	2,115	442,085
Fifth year	5.0 (0.6)	1,825	441,932
Sixth year	6.3 (1.1)[b]	1,386	441,932

[a] Severe is defined as body mass index (BMI) ≥ 120 percent of the 95th percentile.

[b] Pairs of matching superscripts indicate that there is a statistically significant difference at $p \leq 0.05$ between percentages after Bonferroni adjustment for three comparisons.

6.6.2 Characteristics Associated with Children's Weight Status around Age 6 Years

Chi-square analyses of associations between weight status categories and the key sociodemographic characteristics used in this study found that self-reported maternal weight status at 72 months was the only key sociodemographic characteristic associated with children's BMI weight status category around age 6 years. Table 6-8 presents the findings.

Table 6-8. Percentage of study children by age- and sex-adjusted body mass index (BMI) weight status category and select key sociodemographic characteristics

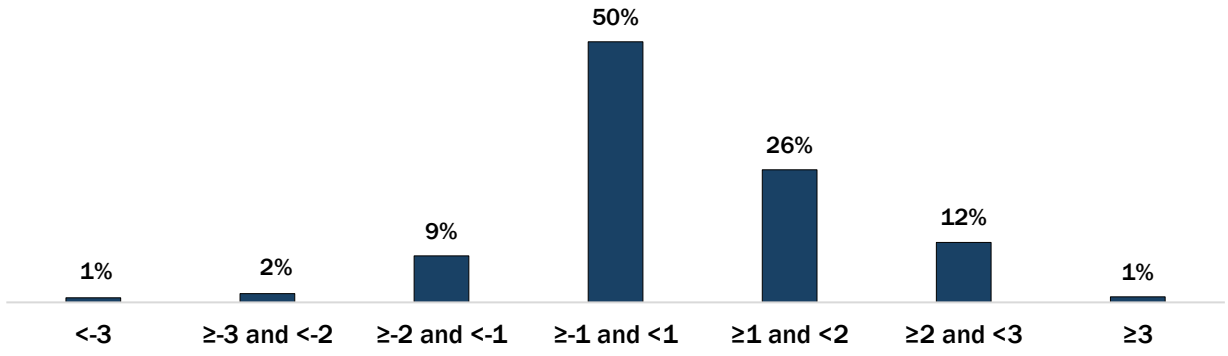
Key sociodemographic characteristic	Child's weight status around age 6 years				Unweighted *n*	Weighted *n*
	Underweight % (standard error [SE])	Normal/ healthy weight % (SE)	Overweight % (SE)	Obese % (SE)		
Report maternal weight status at 72 months						
Normal or underweight	6.2 (1.2)	65.7[a] (3.2)	12.9[a] (1.6)	15.2 (3.0)	334	70,493
Overweight	3.6 (1.2)	63.8[b] (3.3)	13.0[b] (1.6)	19.6 (2.5)	408	81,846
Obese	3.1 (1.1)	52.9[a,b] (2.8)	21.7[a,b] (2.9)	22.2 (2.5)	613	131,569

[a,b] Pairs of matching superscripts within the key sociodemographic category indicate that there is a statistically significant difference between the percentages in the column at $p \leq 0.05$.

BMI z-scores were used to assess the distribution of children by weight status in more detail. A z-score indicates the difference from a group mean. In this analysis, BMI z-scores indicate how far a child's BMI is from the CDC population mean. A z-score of +/- 1 indicates that the child's BMI is more/less than one standard deviation away from the mean. A z-score of +/- 2 indicates that the

child's BMI is more/less than two standard deviations from the mean and so forth as the absolute values of the number become greater. Figure 6-7 presents the distribution of study children by their BMI z-scores. As evident in the previous figure (Figure 6-6), the distribution is clearly skewed to the right. As in the analysis by weight status category, the only key sociodemographic associated with children's BMI z-scores around age 6 was self-reported maternal weight status at 72 months (not shown).

Figure 6-7. Distribution of study children by body mass index (BMI) z-scores around age 6 years[a]



[a] Around age 6 years, unweighted *n*=1,386 and weighted *n*=441,932. Appendix Table B2e-7 offers additional detail.

6.6.3 Characteristics Associated with Children's Weight around Age 6 Years

The CDC notes that the use of percentiles and z-scores to characterize children with severe obesity can be misleading. The CDC recommends reframing BMI relative to the 95th percentile in these cases when a relatively high proportion of children in a sample have severe obesity.[120] At age 6 years, about 6 percent of study children had severe obesity (see Table 6-7 above) and 2 percent exhibited class III obesity (i.e., had BMIs that were above 140 percent of the 95th percentile [not shown]). Therefore, BMI expressed as a percentage of the 95th percentile was used as the dependent variable in univariate regressions assessing associations between characteristics and children's BMI. For the univariate analyses, the 1- or 3-month through 72-month interview core sample longitudinal weights with all cases that had 72-month measurement data were used because there was particular interest

[120] See https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm.

in assessing the association with the study child's pattern of WIC participation over the first 5 years of life, which was developed using the core longitudinal sample.

The bivariate analyses included the assessment of associations with the 12 key sociodemographic characteristics used in this study, as well as assessment of associations with other characteristics discussed in this report. Of the 12 key sociodemographic characteristics assessed, several evidenced statistically significant associations with BMI expressed as a percentage of the 95th percentile: maternal age at the study child's birth, parity, reported maternal weight status, household participation in non-WIC benefit programs, and pattern of WIC participation for the study child.[121] Table 6-9 presents a summary of findings for additional (non-key) characteristics assessed.

Table 6-9. Summary of lifestyle and dietary characteristics associated with study children's body mass index (BMI) expressed as a percentage of the 95th percentile based on univariate regression results

Characteristic	Significant association with weight status around age 6 years	
	Yes	No
Characteristics of the child's lifestyle and dietary intake during the sixth year		
Child has a health condition that affects eating (categorical: yes/no)		✓
Outdoor playtime greater/less than 1 hour on a typical weekday (categorical: yes/no)		✓
Healthy Eating Index-2015 (HEI-2015) total score on a given day at 72 months (continuous: score)[a]		✓
Dietary energy intake on a given day at 72 months (continuous: kcal)[a]		✓
Early and contemporary (72-month) feeding practices		
Breastfeeding duration (continuous: days through 13-month interview)		✓
Complementary foods introduced prior to 4 months (categorical: prior to 4 months compared with after 4 months)	✓	
Timing of sugar-sweetened beverage introduction (categorical: in first year, in second year, not introduced in first 2 years)		✓
I keep track of *what* food {CHILD} eats (categorical: reference group is never)[b]		✓
Try to get {CHILD} to finish his or her food (categorical: reference group is never)[b]	✓	
Try to get {CHILD} to eat even if he or she seems not hungry (categorical: reference group is never)[b]	✓	
Carefully control how much {CHILD} eats (categorical: reference group is never)[b]		✓
Very careful not to feed {CHILD} too much (categorical: reference group is never)[b]	✓	
Use mealtimes to teach {CHILD} about healthy eating (categorical: reference group is never)[b]		✓
Ask {CHILD} to help me prepare food (categorical: reference group is never)[b]	✓	

[121] Reported maternal weight status, maternal educational attainment at 54 months, and pattern of WIC participation for the study child evidenced statistically significant associations when the 72-month combined sample cross-sectional weights were used.

Table 6-9. Summary of lifestyle and dietary characteristics associated with study children's body mass index (BMI) expressed as a percentage of the 95th percentile based on univariate regression results (continued)

Characteristic	Significant association with weight status around age 6 years	
	Yes	No
Tell {CHILD} he or she has to try at least a couple of bites of new foods, but doesn't have to eat it all (categorical: reference group is never)[b]	✓	
Frequency of television viewing during meals (categorical: reference group is never)[c]		✓
Frequency of family eating together in a week (categorical: 5 times or more compared to less than 5 times)		✓
Program participation at 72 months		
Participation with WIC for non-study child(ren) (categorical: yes/no)		✓
Supplemental Nutrition Assistance Program (SNAP) receipt (categorical: yes/no)		✓
Household participation in the National School Lunch Program, the School Breakfast Program, or the Summer Food Service Program (categorical: yes/no)		✓
Medicaid receipt (categorical: yes/no)		✓

[a] Intake estimates are based on 1 day of dietary recall data. Results based on univariate regressions using the 1- or 3-month through 72-month interview core sample longitudinal weights with all cases that had 72-month measurement data.

[b] Response categories compared with never include *always*, *sometimes*, *about half the time*, and *occasionally*.

[c] Response categories compared with never include *most of the time*, *sometimes*, and *rarely*.

Table 6-10 presents the results from univariate regressions evidencing statistically significant associations between the key or non-key characteristic assessed and the child's BMI expressed as a percentage of the 95th percentile. If the variable assessed is categorical, the findings are relative to the reference group. Positive estimates indicate a positive association with obesity relative to the reference group. In these cases, the child's BMI is further to the right on the distribution of BMI percentiles relative to the 95th percentile. Negative estimates indicate a negative association with obesity relative to the reference group. In these cases, the child moves to the left on the distribution. For example, as shown on Table 6-10, children with caregivers age 16-19 years at the child's birth exhibited BMIs that were, on average, almost 7 percentage points greater than those of children with caregivers who were 26 years or older at the study child's birth. It is important to note that feeding practices assessed at 72 months may have been adopted because the child was in a particular weight status category, as opposed to being the cause of the weight status category. Moreover, early feeding practices may essentially be proxies for other unmeasured attitudes, characteristics, and behaviors of caregivers. Finally, these bivariate analyses of BMI outcomes should be interpreted with caution, as they do not control for other factors that may influence the outcome.

Table 6-10. Univariate regression results from characteristics and practices associated with the child's body mass index (BMI) (kg/m^2) around age 6, where BMI is expressed as a percentage of the 95th percentile[a]

Characteristic	Estimate	*p*-value	Unweighted *n*	Weighted *n*
Maternal age at the study child's birth: reference is 26+ years				
16-19 years	6.56	0.010*		
20-25 years	-1.07	0.522	647	441,269
Parity: reference is firstborn				
Second born	-1.77	0.380		
Third or subsequent born	-3.43	0.031*	647	441,269
Maternal weight status: reference is normal/health weight				
Overweight	0.50	0.796		
Obese	5.69	0.010*	647	441,269
Participation in non-WIC benefit programs: reference is does not participate in any other programs[b]				
Participates in other program(s) including the Supplemental Nutrition Assistance Program (SNAP)[b]	5.31	0.007*		
Participates in other program(s) excluding SNAP[b]	2.89	0.152	647	441,269
Pattern of study child's WIC participation: reference group is consistently				
1st year only	-4.94	0.035		
2nd or 3rd year only	0.41	0.903		
4th or 5th year only	-4.01	0.041*		
Intermittently	-6.84	0.012*	645	439,588
Early introduction of complementary foods (prior to 4 months compared with after 4 months)	4.41	0.015*	647	441,269
Try to get {CHILD} to finish his or her food: reference is never				
Always	-9.26	0.022*		
Usually	-5.75	0.135		
About half the time	-1.96	0.674		
Occasionally	-3.76	0.313	647	441,269
Try to get {CHILD} to eat even if he or she seems not hungry: reference is never				
Always	-6.85	0.008*		
Usually	-7.80	0.001*		
About half the time	-0.64	0.838		
Occasionally	-6.11	0.005*	647	441,269
Very careful not to feed {CHILD} too much: reference is never				
Always	7.00	0.001*		
Usually	7.38	0.007*		
About half the time	8.62	0.039*		
Occasionally	4.26	0.165	644	439,381
Ask {CHILD} to help me prepare food: reference group is never				
Always	-3.52	0.254		
Usually	-3.79	0.139		
About half the time	-4.47	0.047*		
Occasionally	-1.68	0.499	647	441,269

Table 6-10. Univariate regression results from characteristics and practices associated with the child's body mass index (BMI) (kg/m²) around age 6, where BMI is expressed as a percentage of the 95th percentile[a] (continued)

Characteristic	Estimate	*p*-value	Unweighted *n*	Weighted *n*
Tell {CHILD} he or she has to try at least a couple of bites of new foods: reference is never				
Always	-9.16	0.029*		
Usually	-8.47	0.025*		
About half the time	-5.34	0.413		
Occasionally	-7.02	0.093	646	441,102

[a] Univariate regression used the 1- or 3-month through 72-month interview core sample longitudinal weights with all cases that had 72-month measurement data.

[b] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

* Indicates statistically significant difference at $p \leq 0.05$.

6.6.4 Adiposity Rebound

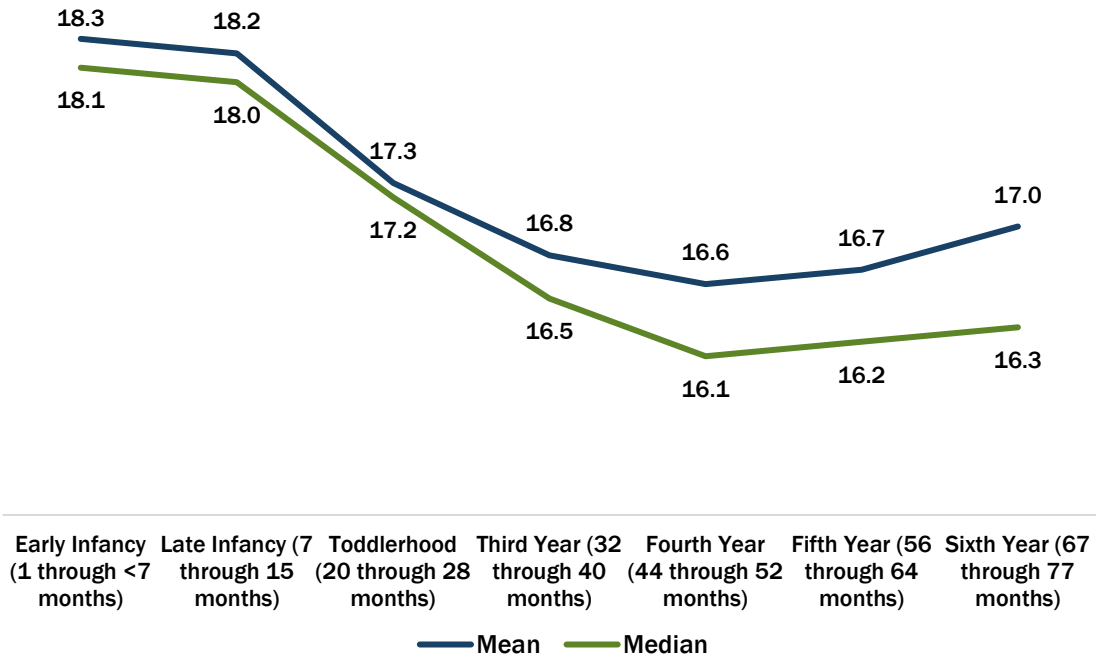
As children develop, their BMIs change. Typically, BMI declines to a low point between ages 5 and 7, after which it rebounds (Rolland-Cachera et al., 1984). This rebound is called adiposity rebound. Early adiposity rebound, defined as a renewed rise in adiposity around age 3 to 4 years, has been associated with increased risk of later obesity (Rolland-Cachera et al., 1984; Whitaker, Pepe, Wright, Seidel, & Dietz, 1998).

Leveraging the repeated measures of height and weight over the course of the study, Figure 6-8 presents the mean and median BMI for study children at each point. Mean and median BMI decline until about the fourth year, after which they turn up. There is a noteworthy uptick between ages 5 and 6. The trend for median BMI is similar to that of the mean; however, the uptick between ages 5 and 6 is not as striking. The divergence between the mean and median indicates that outliers (children with exceptionally high BMI) are increasing the mean.

Research examining associations between adiposity rebound and obesity has specifically associated an early rebound at age 3 years with obesity in children (Rolland-Cachera, Deheeger, Maillot, & Bellisle, 2006). Though a turn at age 3 years is not apparent in the trends of the mean and median, it is important to note that a subset of study children may experience an early rebound before age 4 years. Identifying whether a subset of children experiences a rebound around age 3 years and ascertaining characteristics of this subset is an area for further research.

Caution should be used when interpreting the general trend. Each time period listed on Figure 6-8 spans multiple months. Moreover, between ages 2 and 3 years, some measures may include length rather than height, so the data taken around these time points may include different measurement protocols.[122] Nonetheless, the absence of a clear upward turn in BMI around the third year suggests a general pattern that is not consistent with early adiposity rebound.

Figure 6-8. Mean and median body mass index (BMI) (kg/m²) of study children across the first 6 years of life[a,b]



[a] For the early infancy estimate, unweighted *n*=2,568 and weighted *n*=442,841. For the late infancy estimate, unweighted *n*=2,577 and weighted *n*=442,802. For the toddlerhood estimate, unweighted *n*=1,731 and weighted *n*=442,713. For the third year estimate, unweighted *n*=1,885 and weighted *n*=442,274. For the fourth year estimate, unweighted *n*=2,115 and weighted *n*=442,085. For the fifth year estimate, unweighted *n*=1,825 and weighted *n*=441,932. For the sixth-year estimate, unweighted *n*=1,386 and weighted *n*=441,932. Appendix Table B2e-8 offers additional detail.

[b] These estimates used the cross-sectional combined sample weights at each time period.

[122] CDC indicates that standing height measures about 0.8 centimeters less than recumbent length. Centers for Disease Control and Prevention. (n.d.). *Growth chart training: Using the WHO growth charts*. Atlanta, GA: Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/nccdphp/dnpao/growthcharts/who/using/transitioning.htm.

6.6.5 Multivariable Analysis of Factors Associated with Age- and Sex-Adjusted BMI around Age 6

The multivariable analysis focused on factors independently associated with BMI around age 6 years, when BMI was expressed as a percentage of the 95th percentile. The preceding bivariate analysis informed the model presented. In light of the research questions at the beginning of this chapter, variables of particular interest included early and contemporary feeding practices and pattern of WIC participation in the first 5 years of life. Though not associated with BMI based on the preceding bivariate analysis, the importance of breastfeeding prompted its inclusion in the model presented in Table 6-11.

Table 6-11. Results of multivariable regression of study children's sex- and age-adjusted body mass index (BMI) around 72 months, expressed as a percentage of the 95th percentile, on covariates[a]

Covariate	Coefficient	*p*-value
Intercept	83.58	<0.001
Maternal ethnorace: reference category is Non-Hispanic White		
Hispanic	-0.45	0.820
Non-Hispanic All Other	-5.93	0.064
Non-Hispanic Black	-2.03	0.396
Reported maternal weight status category: reference is normal or underweight		
Obese	3.89	0.079
Overweight	2.32	0.313
Income poverty: reference is above 130 percent of the Federal Poverty Guidelines (FPG)		
75 percent of FPG or below	1.20	0.632
Between 75 percent of FPG and 130 percent of FPG	1.95	0.323
Breastfeeding duration	-0.01	0.291
Early introduction of complementary foods: introduced prior to 4 months compared to after 4 months	6.00	0.044*
Frequency of being very careful not to feed the child too much: reference is never		
Always	6.99	0.010*
Usually	7.03	0.002*
About half the time	9.15	0.066
Occasionally	6.22	0.052
Pattern of WIC participation: reference is consistently through 5 years		
1st year only	-7.39	0.025*
2nd or 3rd year only	-3.73	0.288
4th or 5th year only	-3.71	0.079
Intermittently	-6.50	0.009*
Weight-for-length around age 6 months	2.84	0.005*

[a] The 1- or 3-month through 72-month core sample longitudinal weight with cases that have measurements around age 6 was used for this analysis because pattern of WIC participation was derived based on responses to every postnatal interview. Unweighted n=398; weighted n=277,958. R-squared = 0.167. Because the weighted sample size was notably smaller than the population, this regression was also run using a categorical version of birth weight, a variable that was imputed early in the study so all cases were available—birth weight replacing weight-for-length around age 6 months. This latter version of the model increased the coverage of the population and did not substantively change the findings.

* Indicates a statistically significant difference at $p \leq 0.05$ compared with the reference group.

As investigative analyses, several multivariable models were run with different combinations of early and contemporary feeding practices that had exhibited significant associations with BMI based on bivariate analyses. However, when assessed in a multivariable context, most feeding practices were statistically insignificant. Additionally, multicollinearity with the primary variable of interest—pattern of WIC participation—was evident for one feeding practice after analysis of variance inflation factors. Thus, the model presented has only a few feeding practices. After assessment of data availability, the 6-month weight-for-length measure was included in the regression model.

Among the early feeding practices examined in the model presented (Table 6-11), introduction of complementary foods prior to age 4 months was positively associated with study children's BMI at age 6 years, expressed as a percentage of the 95th percentile. The only contemporary feeding practice (i.e., a practice assessed during the 72-month interview) that was independently associated was being very careful not to feed the child too much. Compared to caregivers who *never* used this feeding practice, caregivers who used it *always*, *usually*, or *occasionally* have children with significantly higher BMI after adjustment for other factors in the model. Pattern of WIC participation during the first 5 years of the child's life was also independently associated with BMI expressed as a percentage of the 95th percentile. The association was inverse: Compared to children who consistently participated with WIC during the first 5 years of the study child's life, children who left WIC during the child's first year of life or participated intermittently had lower BMI.

The inverse association between duration of participation with WIC and BMI was unexpected. However, it may reflect self-selection for continued WIC participation. The 54-month interview revealed that among those receiving WIC at the 54-month interview, 92 percent of study families indicated that one of the reasons they stayed with WIC in the study child's fifth year was that WIC staff listened to their thoughts about their child's health. It is unknown if those who left prior to the child's fifth year differed in their need for this support.

7. Summary, Conclusions, and Interpreting the Data

7.1 Summary

The chapter summarizes findings presented in the preceding chapters on the diet-related behaviors and outcomes of study children in the year after eligibility for participation in the Special Supplemental Nutrition Program for Woman, Infants, and Children (WIC) ends, a period about which little is known.

The research focused on associations between former WIC participation and dietary outcomes at study child age 6 years (i.e., around 72 months). Bivariate analysis found that compared with those who left WIC after their first year, children who participated consistently through the 5 years of the program drank more skim or 1 percent fat milk as a proportion of their dairy consumption. Multivariable analysis found independent associations between pattern of WIC participation and saturated fat intake and diet quality at age 6 years. Compared with children who left WIC after their first or second year, children who participated consistently through age 5 had lower saturated fat intake on a given day at age 6. Compared with children who left WIC after their first year, children who participated consistently through age 5 had better diet quality as measured by the Healthy Eating Index-2015 (HEI-2015) on a given day at age 6. The enduring nature of healthier dietary practices for those with the longest participation is consistent with previous caregiver report at child age 54 months of the importance of both WIC supplemental foods and WIC nutrition education. These practices, if continued, may mitigate poor health outcomes for children in low-income families, potentially saving healthcare costs associated with diet-related chronic disease.

Analyses of 72-month data found that more than half (52%) of study children lived in families that reported income below 100 percent of the 2019 Federal Poverty Guidelines (FGP), and 68 percent of families reported household income below 130 percent of the 2019 FPG. Just under two-thirds (64%) of study mothers were working or going to school or both. However, the coronavirus disease 2019 (COVID-19) pandemic significantly reduced employment, but not self-reported income (Borger et al., 2021), in the latter months of the collection window for the 72-month interview

(March through August of 2020).[123] Despite the limited financial resources reported by many families, nearly 80 percent reported high/marginal household food security status at their 72-month interview, and there was not a statistically significant difference in the percentages reporting higher or marginal household food security status pre-/post-March 13, 2021, the date of the COVID-19 public health emergency declaration.[124] Nonetheless, after adjusting for household income being below 130 percent FPG, multinomial logistic regression found caregivers were more likely to report food insecurity (i.e., low or very low household food security) if they also reported receiving Supplemental Nutrition Assistance Program (SNAP) benefits at their 72-month interview.

Nearly all study children (99%) had started school by the time of their 72-month interview. About two-thirds (65%) of study families reported that someone in the household participated in the National School Lunch Program (NSLP), the School Breakfast Program (SBP), or the Summer Food Service Program (SFSP), which was an increase from 52 percent participating in any (or multiple) of these three programs reported at the fifth-year interview.

The average HEI-2015 total score for study children at 72 months was 56 out of a possible 100 points, which is similar to the national average of 53 for 6- to 11-year-old children. As a percentage of the maximum possible score, the lowest HEI-2015 component scores around age 6 were for whole grains, fatty acids, and seafood and plant proteins; however, other component scores were similarly low. Multivariable regression of HEI-2015 total scores on sociodemographic characteristics and feeding practices found that, compared with study children who left WIC after their first year, study children who consistently participated with WIC through age 5 ate a healthier diet, on average.

Consistent with HEI-2015 scores, food group analysis indicated that about half (51%) of study children met the recommendation for fruit intake in the 2020-2025 *Dietary Guidelines for Americans* (DGA), while only 1 percent met the DGA recommendation for vegetables. On a given day at 72 months, 85 percent of study children consumed sugar-sweetened beverages, desserts, candy, or other sweets.

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[123] The 72-month data collection window remained open through August 2020; the final 72-month interview occurred in late June 2020.

[124] As indicated in Chapter 1, Table 1-2, the 72-month interview spanned from April 2019 through August 2020, which included the early months of the COVID-19 pandemic.

With the exception of dietary fiber, most intakes of macronutrients analyzed (fat, carbohydrate, protein, and fiber) met or exceeded recommended levels. Among the micronutrients analyzed, only vitamins D and E and calcium had a notable prevalence of inadequate intake: 71 percent for vitamin D, 36 percent for vitamin E, and 24 percent for calcium. Based on analysis of mean intakes at 72 months, about 48 percent of study children met the 2020-2025 DGA recommendation to consume less than 10 percent of calories from added sugars, and 31 percent met the DGA recommendation to consume less than 10 percent of calories from saturated fat. Multivariable regression analyses found that duration of WIC participation was inversely associated with saturated fat intake as a percentage of dietary energy on a given day at 72 months: Compared with children who consistently participated with WIC over the first 5 years of life, children who left WIC after their first year or left after the second or third years had significantly higher saturated fat intake as a percentage of total energy on a given day when they were 6 years old. Only 3 percent of study children had sodium intakes less than the Chronic Disease Risk Reduction (CDRR) level of less than 1,500 mg/day (d). Mean usual intake of sodium was 2,830 mg/d, nearly 1.9 times the CDRR level.

Analysis of feeding practices found that about two-thirds (67%) of study families reported that they ate together as a family at least five times a week. The majority of these study families (69%) reported this practice when the child was 15 months old. This practice was positively associated with diet quality as assessed by HEI-2015 total scores on a given day at 72 months based on univariate regression. Over half (54%) of study mothers reported that the television (TV) was *never* or *rarely* on during meals, and many of these caregivers adopted this practice between child age 18 and 54 months (i.e., as the child grew older). Compared with those who reported that they never had the TV on during meals, children in families that had it on *most of the time* had lower HEI-2015 total scores on a given day at 72 months based on univariate regression.

Most study children played outdoors 1 hour or more on a typical weekday (79%) or a typical weekend day (88%) at age 6. Median weekly outdoor playtime for study children was 12.8 hours per week. Median time spent watching TV or playing video games over the course of a week was 14.5 hours.

Although the majority (59%) of study children were in the normal/healthy range weight status category based on sex- and age-adjusted body mass index (BMI), about 18 percent were in the overweight range, and 19 percent were in the obese range, yielding a total of 37 percent in either the

overweight or obese range. Around age 6 years, about 6 percent of study children have severe obesity (i.e., had sex- and age-adjusted BMI that was at least 120% of the 95th percentile).

Multivariable regression analysis of factors associated with children's BMI around age 6 years found that BMI measured as a percentage of the 95th percentile was inversely associated with pattern of participation, after accounting for select sociodemographic characteristics and feeding practices. Compared with children who participated consistently with WIC, children who left WIC in the first year or participated intermittently over the first 5 years of the study child's life were less likely to have obesity. This finding may reflect self-selection, as the 54-month interview revealed that among those receiving WIC at that interview, 92 percent of study families indicated that one of the reasons they stayed with WIC in the study child's fifth year was that WIC staff listened to their thoughts about their child's health. Those who left prior to the child's fifth year may have had a different need for this support.

Taken together, the multivariable results assessing the independent relationships between the study child's pattern of WIC participation and HEI-2015 total scores and the study child's BMI suggest that continuous participation in WIC from infancy to age 5 years is associated with higher diet quality but not lower obesity at age 6 years. Improved diet quality 1 year after WIC eligibility ended suggests that WIC's nutrition assistance with supplemental healthy foods and nutrition education may influence behaviors that last into the child's sixth year. However, because childhood obesity is associated with multiple factors, including patterns of physical activity and sedentary behavior, all of which cannot be addressed by WIC, program participation may not prevent obesity among WIC-eligible children. Additional work exploring the nuanced relationship between caregiver attitudes toward child overweight and obesity and reasons for staying with WIC as a child grows older may be needed to accurately interpret associations between pattern of participation in WIC and a child's BMI.

7.2 Interpreting the Data: Study Limitations

As with all research studies, design decisions and study-specific goals for WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) result in limitations to the conclusions that the study team can draw, both now and in future analyses. These limitations are most evident with regard to estimating usual intake, establishing causal relationships, generalizing beyond the population

represented by our probability sample, comparing findings with other national studies, and disentangling caregivers' perceptions of their experiences from their actual experiences.

7.2.1 Estimating Usual Intake

Estimates of usual intake are model-dependent. In other words, estimates may differ if alternative variables are used in the models recommended by the National Cancer Institute (NCI) 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, 12 key sociodemographic variables, the timing of the 72-month interview, and cross-sectional and longitudinal weights were used in models to adjust for usual intake, depending on the nature of analyses. The incorporation of these variables in the adjustment models posed challenges for model convergence, especially for episodically consumed foods.

Given the many feeding practices assessed and the scope of planned regression analyses, early and contemporary feeding practices were not included in the models used to generate usual intake estimates in this report. Accordingly, multivariable regression analyses of intakes with feeding practices as covariates were based on 1 day of recall. Further work is needed to incorporate feeding practices into usual intake analyses and to examine the extent to which incorporating other variables influences usual intake estimates.

Additionally, as noted throughout the chapters, 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.

7.2.2 Establishing Causal and Direct Relationships

This is an observational study, which is a design well-suited to evaluate ongoing public programs when it is not possible to randomly assign participants to a treatment group that participates in the program and a control group that does not participate. Because WIC reaches a substantial portion of its eligible infant population, recruitment of a naturally occurring, well-matched, unbiased comparison group would be challenging and likely not possible. As such, while WIC ITFPS-2 lacks a

non-WIC comparison group, it employs the best alternative available—a longitudinal study following 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, the study team can only infer causality between program predictors and outcomes rather than establishing it with certainty.

This report focuses primarily on descriptive analyses of key outcome variables, and bivariate analyses between sociodemographic subgroups and those key variables, painting a detailed picture of the circumstances, choices, and status of families who were receiving WIC at the outset of the study. A limited number of key sociodemographic variables are employed in the analyses. Some bivariate relationships between sociodemographic variables and outcomes may mask other third-variable characteristics, circumstances, or experiences that actually underlie these associations. This report included preplanned multivariable analysis aimed at addressing specific research question. Further research using complex multivariable modeling would be useful in identifying unique predictors of the important outcomes.

7.2.3 Generalizing Findings

Study eligibility rules and sample design also limited the generalizability of the findings, particularly to the entire WIC population. Eligible mothers were either pregnant, or their infants were 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. For operational reasons, the sampling frame excluded WIC clinics expected to serve small numbers of new participants each month. The study team chose these eligibility characteristics to be inclusive of a large portion of the WIC population, though this population is concentrated in less than half of WIC clinics nationally. After accounting for geographic exclusion (American Samoa, Guam, Northern Mariana Islands, and the U.S. Virgin Islands), 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.[125] Nonetheless, there may be characteristics or feeding patterns not captured that pertain to mothers who are very young, who speak a language other than English or Spanish, who enroll in WIC for the first time after 2.5-months postpartum, or who receive services

[125] The proportion of WIC sites covered is likely to exceed the 37 percent estimate because single reporting units that were too small are more likely to have been single WIC sites than reporting units that were large enough to participate in this study.

at WIC clinics serving smaller populations. Similarly, the weighted sample represents the infants from the population who enrolled in WIC during our 20-week enrollment period. It does not represent a full year of WIC enrollments, and if there were strong seasonal differences in WIC enrollees, the sample would not capture that full variation.

7.2.4 Comparisons to Other Studies

One of the goals of WIC ITFPS-2 is to examine how the feeding choices and practices of WIC mothers have changed since the first WIC Infant Feeding Practices Study (WIC IFPS-1), conducted more than 20 years ago. An equally important objective is to compare findings from WIC ITFPS-2 to other studies such as the Food and Drug Administration/Centers for Disease Control and Prevention Infant Feeding Practices Study II (FDA/CDC IFPS II) and the Gerber/Nestle Feeding Infants and Toddler Studies (FITS) 2016. Now that the WIC ITFPS-2 children are 6 years old, however, these studies no longer offer relevant benchmarks for comparison. Consequently, findings from the National Health and Nutrition Examination Survey (NHANES) have been incorporated where relevant. However, it should be noted that NHANES differs from WIC ITFPS-2 in several ways, including the study population and the timing of data collection, so some caution is warranted when comparing findings from this study to those from NHANES data.

The study was unable to collect reliable information on participation in the Child and Adult Care Food Program (CACFP), which supports child nutrition in all Head Start programs and some childcare centers and family daycare homes. WIC ITFPS-2 planned to match the names of childcare providers given by respondents to organizations that participate in the CACFP. This proved infeasible because respondents did not provide names that could be readily matched. More identifying information, such as childcare provider addresses, would have been required to uniquely identify childcare providers that participate in the CACFP.

7.2.5 Influence of Caregiver Perceptions

Most of the study data about individual experiences and practices come from caregiver report during telephone interviews. Although the study team collected child measurement data from WIC State Agencies, sites, and healthcare providers, most data rely on caregiver responses and are, therefore, filtered through the perceptions and memories of those caregivers. Primary caregivers are the most

knowledgeable informants about dietary intake and their feeding practices with their children. Westat implemented procedures to help participants accurately report foods their children consumed. These included mailing a letter in advance of the interview to remind participants to collect information on foods eaten away from home, the inclusion of a "Notes" page for participants to record foods eaten, and the ability to submit information on foods eaten away from home at a later date if unknown at the time of the interview. However, all reports that rely primarily on a single informant may contain some elements of bias or misreporting. Other major studies of feeding practices have also relied on caregiver report, thus WIC ITFPS-2 is not unusual. Nonetheless, caregivers may at times be imperfect informants.

Additionally, WIC ITFPS-2 relies on respondents to provide information about current receipt of benefits from WIC and from other Federal benefit programs. Program participation is not verified through external records. Consequently, to the extent that respondents misreport participation, data on program participation may be inaccurate.

7.2.6 Scope of the Study

WIC ITFPS-2 currently plans to follow up with this national sample of study children when they are 9 years old. A key question is whether former WIC participation is associated with healthy dietary behaviors as children continue to age. It is of interest to understand whether pattern of WIC participation during the study child's first 5 years of life is associated with dietary intakes and feeding practices at age 9 years. While this is an unprecedented opportunity, and the study will yield many years of rich data, not all issues related to childhood weight and health outcomes are apparent by age 6 years, and may not be apparent by age 9 years. Factors beyond those explored in this study may influence, and continue to influence, eating and health as obesity risk continues into middle childhood and beyond.

7.3 Next Steps

This *Sixth Year Report* follows the release of six previous WIC ITFPS-2 reports (see https://www.fns.usda.gov/wic/infant-and-toddler-feeding-practices-study-2-fourth-year-report). WIC ITFPS-2 will continue to track median energy and nutrient intake, and weight and height measurements of study children during the ninth year of life to better understand their nutrition and

growth. The *Ninth Year Report* will cover feeding practices, eating patterns, and nutrition outcomes around the child's ninth birthday. The *Ninth Year Report* will also include analysis of associations between patterns of WIC participation in early childhood and dietary behaviors and intakes several years after WIC eligibility ended.

The data from WIC ITFPS-2, which the Food and Nutrition Service has made publicly available at https://data.nal.usda.gov/dataset/wic-infant-and-toddler-feeding-practices-study-2-wic-itfps-2-prenatal-infant-year-second-year-third-year-and-fourth-year-datasets-0, provides researchers and the public with a landmark platform of data from which to pursue further analyses on nutrition and health among children who participated in WIC in early life.

References

Ahluwalia, N., Herrick, K.A., Rossen, L.M., Rhodes, D., Kit, B., Moshfegh, A., and Dodd, K.W. (2016). Usual nutrient intakes of US infants and toddlers generally meet or exceed dietary reference intakes: Findings from NHANES 2009-2012. *The American Journal of Clinical Nutrition,* 104(4*)*, 1167-1174. doi: 10.3945/ajcn.116.137752.

Anater, A.S., Catellier, D.J., Levine, B.A., Krotki, K.P., Jacquier, E.F., Eldridge, A.L., Bronstein, K.E., Harnack, L.J., Lorenzana Peasley, J.M., and Lutes, A.C. (2018). The Feeding Infants and Toddlers Study (FITS) 2016: Study design and methods. *The Journal of Nutrition*, 148(9S)*,* 1516S-1524S. doi: 10.1093/jn/nxy035.

Anderson, C.E., Martinez, C.E., Ritchie, L.D., Paolicelli, C., Reat, A., Borger, C., and Whaley, S.E. (2022). Longer WIC participation is associated with higher diet quality at age 5 years. *Journal of Nutrition* [manuscript submitted for publication].

Anderson, S.E., and Whitaker, R.C. (2010). Household routines and obesity in US preschool-aged children. *Pediatrics*, 125(3), 420-428. doi: 10.1542/peds.2009-0417.

Arteaga, I., Heflin, C., and Gable, S. (2016). The impact of aging out of WIC on food security in households with children. *Children and Youth Services Review*, 69(C), 82-96. doi: 10.1016/j.childyouth.2016.07.015.

Avery, A., Anderson, C., and McCullough, F. (2017). Associations between children's diet quality and watching television during meal or snack consumption: A systematic review. *Maternal & Child Nutrition*, 13(4), e12428. https://doi.org/10.1111/mcn.12428.

Baranowski, T., Thompson, W.O., Durant, R.H., Baranowski, J., and Puhl, J. (1993). Observations on physical activity in physical locations: Age, gender, ethnicity, and month effects. *Research Quarterly for Exercise and Sport*, 64(2), 127-133. doi: 10.1080/02701367.1993.10608789.

Bassul, C., Corish, C.A., and Kearney, J.M. (2020). Associations between the home environment, feeding practices and children's intakes of fruit, vegetables and confectionary/sugar-sweetened beverages. *International Journal of Environmental Research and Public Health*, 17(13), 4837. doi: 10.3390/ijerph17134837.

Baydar, N., McCann, M., Williams, R., and Vesper, E. (1997). *Final report: WIC infant feeding practices study*. Alexandria, VA: U.S. Department of Agriculture, Food and Consumer Service, Office of Analysis and Evaluation. Available at: https://www.fns.usda.gov/wic/wic-infant-feeding-practices-study.

Borger, C., Paolicelli, C., Ritchie, L., Whaley, S. E., DeMatteis, J., Sun, B., Zimmerman, T.P., Reat, A., and Dixit-Joshi, S. (2021). Shifts in sources of food but stable nutritional outcomes among children in the early months of the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, 18(23), 12626. doi: 10.3390/ijerph182312626.

Borger, C., Paolicelli, C.P., and Sun, B. (2022). Duration of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participation is associated with children's diet quality at age 3 years. *American Journal of Preventive Medicine* [advance online publication]. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0749379722000629.

Borger, C., Weinfield, N.S., Zimmerman, T., MacAllum, C., DeMatteis, J., Whaley, S.E., Ritchie, L., Sallack, L., Au, L., Jenkins, F., and May, L. (2018). *WIC infant and toddler feeding practices study 2: Second year report.* Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

Borger, C., Zimmerman, T., DeMatteis, J., Gollapudi, B., Whaley, S.E., Ritchie, L., Au, L., Sallack, L., and May, L. (2022). *WIC infant and toddler feeding practices study 2: Fifth year report.* Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

Borger, C., Zimmerman, T., Vericker, T., DeMatteis, J., Gollapudi, B., Whaley, S.E., Ritchie, L., Au, L., Sallack, L., and May, L. (2020). *WIC infant and toddler feeding practices study 2: Fourth year report.* Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

Börnhorst, C., Bel-Serrat, S., Pigeot, I., Huybrechts, I., Ottavaere, C., Sioen, I., De Henauw, S., Mouratidou, T., Mesana, M.I., Westerterp, K., Bammann, K., Lissner, L., Eiben, G., Pala, V., Rayson, M., Krogh, V., Moreno, L.A., and IDEFICS Consortium. (2014). Validity of 24-h recalls in (pre-) school aged children: Comparison of proxy-reported energy intakes with measured energy expenditure. *Clinical Nutrition*, 33(1), 79-84. doi: 10.1016/j.clnu.2013.03.018.

Brauchla, M., Juan, W., Story, J., and Kranz, S. (2012). Sources of dietary fiber and the association of fiber intake with childhood obesity risk (in 2-18 year olds) and diabetes risk of adolescents 12-18 year olds: NHANES 2003-2006. *Journal of Nutrition and Metabolism*, 2012, 736258. doi: 10.1155/2012/736258.

Brouillard, A.M., Deych, E., Canter, C., and Rich, M.W. (2020). Trends in sodium intake in children and adolescents in the US and the impact of US Department of Agriculture guidelines: NHANES 2003-2016. *The Journal of Pediatrics*, 225, 117-123. doi: 10.1016/j.jpeds.2020.04.048.

Burdette, H.L., Whitaker, R.C., and Daniels, S.R. (2004). Parental report of outdoor playtime as a measure of physical activity in preschool-aged children. *Archives of Pediatrics & Adolescent Medicine*, 158(4), 353-357. doi: 10.1001/archpedi.158.4.353.

Butte, N.F., Wong, W.W., Adolph, A.L., Puyau, M.R., Vohra, F.A., and Zakeri, I.F. (2010). Validation of cross-sectional time series and multivariate adaptive regression splines models for the prediction of energy expenditure in children and adolescents using doubly labeled water. *The Journal of Nutrition*, 140(8), 1516-1523. Available at: https://pubmed.ncbi.nlm.nih.gov/20573939/.

Centers for Disease Control and Prevention (CDC). (2018). *Overweight & obesity*. Available at: https://www.cdc.gov/obesity/childhood/defining.html. Retrieved on: April 23, 2019.

Chang, T.H., Chen, Y.C., Chen, W.Y., Chen, C.Y., Hsu, W.Y., Chou, Y., and Chang, Y.H. (2021). Weight gain associated with COVID-19 lockdown in children and adolescents: A systematic review and meta-analysis. *Nutrients*, 13(10), 3668. doi: 10.3390/nu13103668.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: L. Erlbaum Associates.

Collin, L.J., Judd, S., Safford, M., Vaccarino, V., and Welsh, J.A. (2019). Association of sugary beverage consumption with mortality risk in US adults: A secondary analysis of data from the REGARDS study. *JAMA Network Open*, 2(5), e193121. doi: 10.1001/jamanetworkopen.2019.3121.

Datar, A., Nicosia, N., and Shier, V. (2014). Maternal work and children's diet, activity, and obesity. *Social Science & Medicine*, 107, 196-204. doi: 10.1016/j.socscimed.2013.12.022.

Del Valle, H.B., Yaktine, A.L., Taylor, C.L., and Ross, A.C. (Eds.). (2011). *Dietary reference intakes for calcium and vitamin D*. Washington, DC: National Academies Press.

Dunford, E.K., and Popkin, B.M. (2018). 37 year snacking trends for US children 1977–2014. *Pediatric Obesity*, 13(4), 247-255. doi: 10.1111/ijpo.12220.

Eicher-Miller, H.A., Boushey, C.J., Bailey, R.L., and Yang Y.J. (2020). Frequently consumed foods and energy contributions among food secure and insecure U.S. children and adolescents. *Nutrients*, 12(2), 304. doi: 10.3390/nu12020304.

Fein, S.B., Labiner-Wolfe, J., Shealy, K.R., Li, R., Chen, J., and Grummer-Strawn, L.M. (2008). Infant feeding practices study II: Study methods. *Pediatrics*, 122(Suppl 2), S28-S35. doi: 10.1542/peds.2008-1315c.

Fisher, J.O., Butte, N.F., Mendoza, P.M., Wilson, T.A., Hodges, E.A., Reidy, K.C., and Deming, D. (2008). Overestimation of infant and toddler energy intake by 24-h recall compared with weighed food records. *The American Journal of Clinical Nutrition*, 88(2), 407-415. doi: 10.1093/ajcn/88.2.407.

Fox, M.K., Pac, S., Devaney, B., and Jankowski, L. (2004). Feeding infants and toddlers study: What foods are infants and toddlers eating? *Journal of the American Dietetic Association,* 104(1 Suppl 1), s22-30. doi: 10.1016/j.jada.2003.10.026.

Frankel, L.A., Powell, E., and Jansen, E. (2018). The relationship between structure-related food parenting practices and children's heightened levels of self-regulation in eating. *Childhood Obesity*, 14(2), 81-88. doi: 10.1089/chi.2017.0164.

Freedman, D.S., Goodman, A.B., King, R.J., and Blanck, H.M. (2019). Tracking of obesity among 2- to 9-year-olds in an electronic health record database from 2006 to 2018. *Obesity Science and Practice*, 6(3), 300-306. doi: 10.1002/osp4.407.

Fryar, C.D., Carroll, M.D., and Afful, J. (2020). Prevalence of overweight, obesity, and severe obesity among children and adolescents aged 2–19 years: United States, 1963-1965 through 2017-2018. *NCHS Health E-Stats*.

Fulgoni, V.L. 3rd, Brauchla, M., Fleige, L., and Chu, Y. (2020). Association of whole-grain and dietary fiber intake with cardiometabolic risk in children and adolescents. *Nutrition and Health*, 26(3), 243-251. doi: 10.1177/0260106020928664.

Gaskell, G.D., Wright, D.B., and O'Muircheartaigh, C.A. (2000). Telescoping of landmark events: Implications for survey research. *The Public Opinion Quarterly*, 64(1), 77-89. doi: 10.1086/316761.

Haines, J., Haycraft, E., Lytle, L., Nicklaus, S., Kok, F.J., Merdji, M., Fisberg, M., Moreno, L.A., Goulet, O., and Hughes, S.O. (2019). Nurturing children's healthy eating: Position statement. *Appetite*, 137, 124-133. doi: 10.1016/j.appet.2019.02.007.

Harrison, G., Hirschman, J., Owens, T., McNutt, S., and Sallack, L. (2014). WIC infant and toddler feeding practices study: Protocol design and implementation. *American Journal of Clinical Nutrition*, 99(3), 742s-746s. doi: 10.3945/ajcn.113.073585.

Holick, M.F. (2006). High prevalence of vitamin D inadequacy and implications for health. *Mayo Clinic Proceedings,* 81(3), 353-373. doi: 10.4065/81.3.353.

Hughes, S.O., and Papaioannou, M.A. (2018). Maternal predictors of child dietary behaviors and weight status. *Current Nutrition Reports*, 7(4), 268-273. doi: 10.1007/s13668-018-0250-1. PMID: 30350172

Institute of Medicine. (2005). *Dietary reference intakes for water, potassium, sodium, chloride, and sulfate: Panel on dietary reference intakes for electrolytes and water*. Washington, DC: National Academies Press. Available at: https://www.nal.usda.gov/sites/default/files/fnic_uploads/water_full_report.pdf.

Kim, S.A., Moore, L.V., Galuska, D., Wright, A.P., Harris, D., Grummer-Strawn, L.M., Merlo, C.L., Nihiser, A.J., and Rhodes, D.G. (2014). Vital signs: Fruit and vegetable intake among children - United States, 2003-2010. *Morbidity and Mortality Weekly Report*, 63(31), 671-676. Available at: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6331a3.htm.

Koleilat, M., Whaley, S.E., Esguerra, K.B., and Sekhobo, J.P. (2017). The role of WIC in obesity prevention. *Current Pediatric Reports*, 5, 132-141. https://doi.org/10.1007/s40124-017-0135-6.

Koma, J.W., Vercammen, K.A., Jarlenski, M.P., Frelier, J.M., and Bleich, S.N. (2020). Sugary drink consumption among children by Supplemental Nutrition Assistance Program status. *American Journal of Preventive Medicine*, 58(1), 69-78. doi: 10.1016/j.amepre.2019.08.033.

Krebs-Smith, S.M., Pannucci, T.E., Subar, A.F., Kirkpatrick, S.I., Lerman, J.L., Tooze, J.A., Wilson, M.M., and Reedy, J. (2018). Update of the healthy eating index: HEI-2015. *Journal of the Academy of Nutrition and Dietetics*, 118(9), 1591-1602. doi: 10.1016/j.jand.2018.05.021.

Kuczmarski, R.J., Ogden, C.L., Guo, S.S., Grummer-Strawn, L.M., Flegal, K.M., Mei, Z., Wei, R., Curtin, L.R., Roche, A.F., and Johnson, C.L. (2002). 2000 CDC growth charts for the United States: Methods and development. *Vital Health Statistics,* 11(246), 1-190. PMID: 12043359

Liu, J., Micha, R., Li, Y., and Mozaffarian, D. (2021). Trends in food sources and diet quality among US children and adults, 2003-2018. *JAMA Network Open*, 4(4), e215262. doi: 10.1001/jamanetworkopen.2021.5262.

Lorson, B.A., Melgar-Quinonez, H.R., and Taylor, C.A. (2009). Correlates of fruit and vegetable intakes in US children. *Journal of the American Dietetic Association*, 109(3), 474-478. https://doi.org/10.1016/j.jada.2008.11.022.

Luger, M., Lafontan, M., Bes-Rastrollo, M., Winzer, E., Yumuk, V., and Farpour-Lambert, N. (2017). Sugar-sweetened beverages and weight gain in children and adults: A systematic review from 2013 to 2015 and a comparison with previous studies. *Obesity Facts*, 10(6), 674-693. doi: 10.1159/000484566.

Mahmood, L., Flores-Barrantes, P., Moreno, L.A., Manios, Y., and Gonzalez-Gil, E.M. (2021). The influence of parental dietary behaviors and practices on children's eating habits. *Nutrients*, 13(4), 1138. doi: 10.3390/nu13041138. PMID: 33808337

Marriott, B.P., Hunt, K.J., Malek, A.M., and Newman, J.C. (2019). Trends in intake of energy and total sugar from sugar-sweetened beverages in the United States among children and adults, NHANES 2003-2016. *Nutrients*, 11(9), 2004. doi: 10.3390/nu11092004.

Matvienko-Sikar, K., Toomey, E., Delaney, L., Harrington, J., Byrne, M., Kearney, P.M., and the Choosing Healthy Eating for Infant Health (CHErIsH) Study Team. (2018). Effects of healthcare professional delivered early feeding interventions on feeding practices and dietary intake: A systematic review. *Appetite*, 123, 56-71. doi: 10.1016/j.appet.2017.12.001.

May, L., Borger, C., McNutt, S., Harrison, G., Weinfield, N., MacAllum, C., and Montaquila, J. (2015). *WIC ITFPS-2 infant report: Intention to breastfeed.* Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

May, L., Borger, C., Weinfield, N., MacAllum, C., DeMatteis, J., McNutt, S., Whaley, S., Ritchie, L., and Sallack, L. (2017). *WIC infant and toddler feeding practices study 2: Infant year report.* Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

Min, J., Xue, H., and Wang, Y. (2018). Association between household poverty dynamics and childhood overweight risk and health behaviours in the United States: A 8-year nationally representative longitudinal study of 16 800 children. *Pediatric Obesity*, 13(10), 590-597. doi: 10.1111/ijpo.12292.

Montaño, Z., Smith, J.D., Dishion, T.J., Shaw, D.S., and Wilson, M.N. (2015). Longitudinal relations between observed parenting behaviors and dietary quality of meals from ages 2 to 5. *Appetite*, 87, 324-329. doi: 10.1016/j.appet.2014.12.219.

Moore, C.E., Radcliffe, J.D., and Liu, Y. (2014). Vitamin D intakes of children differ by race/ethnicity, sex, age, and income in the United States, 2007 to 2010. *Nutrition Research*, 34(6), 499-506. doi: 10.1016/j.nutres.2014.06.002.

Murphy, S.P., Guenther, P.M., and Kretsch, M.J. (2006). Using the dietary reference intakes to assess intakes of groups: Pitfalls to avoid. *Journal of the American Dietetic Association*, 106(10), 1550-1553. https://doi.org/10.1016/j.jada.2006.08.021.

National Academies of Sciences, Engineering, and Medicine (NASEM). (2017). *Review of WIC food packages: Improving balance and choice: Final report*. Washington, DC: The National Academies Press. https://doi.org/10.17226/23655.

National Academies of Sciences, Engineering, and Medicine. (2019). *Dietary reference intakes for sodium and potassium*. Washington, DC: The National Academies Press. http://doi.org/10.17226/25353.

National Cancer Institute (NCI). (2017). *The healthy eating index – Population ratio method*. Available at: https://epi.grants.cancer.gov/hei/population-ratio-method.html. Retrieved on: June 14, 2018.

National Cancer Institute. (2018). *Usual dietary intake: Food intakes, U.S. population, 2001-04*. Rockville, MD: Epidemiology and Genomics Research Program, National Cancer Institute. Available at: https://epi.grants.cancer.gov/diet/usualintakes/national-data-usual-dietary-intakes-2001-to-2004.pdf.

O'Connor, T.M., Hughes, S.O., Watson, K.B., Baranowski, T., Nicklas, T.A., Fisher, J.O., Beltran, A., Baranowski, J.C., Qu, H., and Shewchuk, R.M. (2010). Parenting practices are associated with fruit and vegetable consumption in pre-school children. *Public Health Nutrition*, 13(1), 91-101. doi: 10.1017/S1368980009005916.

Ogden, C.L., Carroll, M.D., Fakhouri, T.H., Hales, C.M., Fryar, C.D., Li, X., and Freedman, D.S. (2018). Prevalence of obesity among youths by household income and education level of head of household – United States 2011-2014. *Morbidity and Mortality Weekly Report*, 67(6), 186-189. http://dx.doi.org/10.15585/mmwr.mm6706a3.

Okubo, H., Crozier, S.R., Harvey, N.C., Godfrey, K.M., Inskip, H.M., Cooper, C., and Robinson, S.M. (2015). Diet quality across early childhood and adiposity at 6 years: The Southampton women's survey. *International Journal of Obesity*, 39, 1456-1462. https://doi.org/10.1038/ijo.2015.97

Palakshappa, D., Lenoir, K., Brown, C.L., Skelton, J.A., Block, J.P., Taveras, E.M., and Lewis, K.H. (2020). Identifying geographic differences in children's sugar-sweetened beverage and 100% fruit juice intake using health system data. *Pediatric Obesity*, 15(11), e12663. doi: 10.1111/ijpo.12663.

Pate, R.R., Hillman, C.H., Janz, K.F., Katzmarzyk, P.T., Powell, K.E., Torres, A., Whitt-Glover, M.C., and 2018 Physical Activity Guidelines Advisory Committee. (2019). Physical activity and health in children under 6 years of age: A systematic review. *Medicine and Science in Sports and Exercise*, 51(6), 1282-1291. doi: 10.1249/MSS.0000000000001940.

Patel, A.I., Hecht, C.E., Cradock, A., Edwards, M.A., and Ritchie, L.D. (2020). Drinking water in the United States: Implications of water safety, access, and consumption. *Annual Review of Nutrition*, 40, 345-373. doi: 10.1146/annurev-nutr-122319-035707.

Pérez-Escamilla, R., Segura-Pérez, S., and Lott, M., on behalf of the Best Practices for Promoting Healthy Nutrition, Feeding Patterns and Weight Status for Infants and Toddlers from Birth to 24 Months Expert Panel. (2017). *Feeding guidelines for infants and young toddlers: A responsive parenting approach*. Durham, NC: Healthy Eating Research. Full report available at: bit.ly/HERfeeding.

Piernas, C., and Popkin, B.M. (2010). Trends in snacking among U.S. children. *Health Affairs*, 29(3), 398-404. doi: 10.1377/hlthaff.2009.0666.

Rampersaud, G.C., Pereira, M.A., Girard, B.L., Adams, J., and Metzl, J.D. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association*, 105(5), 743-760. doi: 10.1016/j.jada.2005.02.007.

Rao, J.N.K., and Scott, A.J. (1987). On simple adjustments to chi-square tests with sample survey data. *The Annals of Statistics*, 15(1), 385-397. https://doi.org/10.1214/aos/1176350273.

Raper, N., Perloff, B., Ingwersen, L., Steinfeldt, L., and Anand, J. (2004). An overview of USDA's dietary intake data system. *Journal of Food Composition and Analysis,* 17(3-4), 545-555.

Reedy, J., and Krebs-Smith, S.M. (2010). Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *Journal of the American Dietetic Association*, 110(10), 1477-1484. doi: 10.1016/j.jada.2010.07.010.

Robson, S.M., McCullough, M.B., Rex, S., Munafò, M.R., and Taylor, G. (2020). Family meal frequency, diet, and family functioning: A systematic review with meta-analyses. *Journal of Nutrition Education and Behavior*, 52(5), 553-564. doi: 10.1016/j.jneb.2019.12.012.

Rodríguez, L.A., Madsen, K.A., Cotterman, C., and Lustig, R.H. (2016). Added sugar intake and metabolic syndrome in US adolescents: Cross-sectional analysis of the National Health and Nutrition Examination Survey 2005–2012. *Public Health Nutrition*, 19(13), 2424-2434. doi: 10.1017/S1368980016000057.

Rolland-Cachera, M.F., Deheeger, M., Bellisle, F., Sempé, M., Guilloud-Bataille, M., and Patois, E. (1984). Adiposity rebound in children: A simple indicator for predicting obesity. *The American Journal of Clinical Nutrition*, 39(1), 129-135. https://doi.org/10.1093/ajcn/39.1.129.

Rolland-Cachera, M.F., Deheeger, M., Maillot, M., and Bellisle, F. (2006). Early adiposity rebound: Causes and consequences for obesity in children and adults. *International Journal of Obesity*, 30, S11-17. doi: 10.1038/sj.ijo.0803514. Erratum in: *International Journal of Obesity* (2010, July), 34(7), 1230. PMID: 17133230

Sallis, J.F., Nader, P.R., Broyles, S.L., Berry, C.C., Elder, J.P., McKenzie, T.L., and Nelson, J.A. (1993). Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. *Health Psychology*, 12(5), 390-398. doi: 10.1037//0278-6133.12.5.390.

Shloim, N., Edelson, L.R., Martin, N., and Hetherington, M.M. (2015). Parenting styles, feeding styles, feeding practices, and weight status in 4-12 year-old children: A systematic review of the literature. *Frontiers in Psychology*, 6, 1849. https://doi.org/10.3389/fpsyg.2015.01849.

Shriver, L.H., Marriage, B.J., Bloch, T.D., Spees, C.K., Ramsay, S.A., Watowicz, R.P., and Taylor, C.A. (2018). Contribution of snacks to dietary intakes of young children in the United States. *Maternal & Child Nutrition*, 14(1), e12454. doi: 10.1111/mcn.12454.

Siegfried, Y., DeMatteis, J., and Gollapudi, B. (under review). Designing a sample of program participants using time-location sampling. *PLoS One*.

Stallings, V.A., and Yaktine, A.L. (Eds.). (2007). *Nutrition standards for foods in schools: Leading the way toward healthier youth*. Washington, DC: National Academies Press.

Swyden, K., Sisson, S.B., Lora, K., Castle, S., and Copeland, K.A. (2017). Association of childcare arrangement with overweight and obesity in preschool-aged children: A narrative review of literature. *International Journal of Obesity*, 41(1), 1-12. doi: 10.1038/ijo.2016.198.

Tahir, M.J., Willett, W., and Forman, M.R. (2019). The association of television viewing in childhood with overweight and obesity throughout the life course. *American Journal of Epidemiology*, 188(2), 282-293. doi: 10.1093/aje/kwy236.

Thompson, A.L., Adair, L.S., and Bentley, M.E. (2013). Pressuring and restrictive feeding styles influence infant feeding and size among a low-income African-American sample. *Obesity*, 21(3), 562-571. doi: 10.1002/oby.20091.

Thompson, A.L., Mendez, M.A., Borja, J.B., Adair, L.S., Zimmer, C.R., and Bentley, M.E. (2009). Development and validation of the infant feeding style questionnaire. *Appetite*, 53(2), 210-221. doi: 10.1016/j.appet.2009.06.010.

Thomson, J.L., Tussing-Humphreys, L.M., Goodman, M.H., and Landry, A.S. (2019) Diet quality in a nationally representative sample of American children by sociodemographic characteristics. *The American Journal of Clinical Nutrition*, 109(1), 127-138. https://doi.org/10.1093/ajcn/nqy284.

Trofholz, A.C., Tate, A., Loth, K., Neumark-Sztainer, D., and Berge, J.M. (2019). Watching television while eating: Associations with dietary intake and weight status among a diverse sample of young children. *Journal of the Academy of Nutrition and Dietetics*, 119(9), 1462-1469. doi: 10.1016/j.jand.2019.02.013.

Twarog, J.P., Peraj, E., Vaknin, O.S., Russo, A.T., Woo Baidal, J.A., and Sonneville, K.R. (2020). Consumption of sugar-sweetened beverages and obesity in SNAP-eligible children and adolescents. *Primary Care Diabetes*, 14(2), 181-185. doi: 10.1016/j.pcd.2019.07.003.

U.S. Department of Agriculture and Agricultural Research Service (2021a, January). *Usual nutrient intake from food and beverages, among individuals under 131% of poverty level, what we eat in America, NHANES 2015-2018, table F*. Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Under_131_WWEIA_2015_2018.pdf.

U.S. Department of Agriculture and Agricultural Research Service (2021b, January). *Usual nutrient intake from food and beverages, by gender and age, what we eat in America, NHANES 2015-2018, table A.* Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2015_2018.pdf.

U.S. Department of Agriculture, Food and Nutrition Service, and Office of Policy Support. (2019, April). *School nutrition and meal cost study, final report volume 2: Nutritional characteristics of school meals.* By Elizabeth Gearan, Mary Kay Fox, Katherine Niland, Dallas Dotter, Liana Washburn, Patricia Connor, Lauren Olsho, and Tara Wommack. Project Officer: John Endahl. Alexandria, VA.

U.S. Department of Agriculture and U.S. Department of Health and Human Services. (2020, December). *Dietary guidelines for Americans, 2020-2025* (9th ed.). Washington, DC: Authors. Available at: www.DietaryGuidelines.gov.

U.S. Department of Health and Human Services (HHS). (2018). *Physical activity guidelines for Americans* (2nd ed.). Washington, DC: Author. Available at: https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf.

Vanderloo, L.M., Tucker, P., Johnson, A.M., and Holmes, J.D. (2013). Physical activity among preschoolers during indoor and outdoor childcare play periods. *Applied Physiology, Nutrition, and Metabolism*; 38(11), 1173-1175. doi: 10.1139/apnm-2013-0137.

Vaughn, A.E., Martin, C.L., and Ward, D.S. (2018). What matters most - what parents model or what parents eat? *Appetite*, 126, 102-107. https://doi.org/10.1016/j.appet.2018.03.025.

Vercammen, K.A., Moran, A.J., Soto, M.J., Kennedy-Shaffer, L., and Bleich, S.N. (2020). Decreasing trends in heavy sugar-sweetened beverage consumption in the United States, 2003 to 2016. *Journal of the Academy of Nutrition and Dietetics*, 120(12), 1974-1985.e5. doi: 10.1016/j.jand.2020.07.012.

Vieux, F., Maillot, M., Rehm, C.D., Barrios, P., and Drewnowski, A. (2020). Trends in tap and bottled water consumption among children and adults in the United States: Analyses of NHANES 2011-16 data. *Nutrition Journal*, 19, 10. https://doi.org/10.1186/s12937-020-0523-6.

Vollmer, R.L., and Mobley, A.R. (2013). Parenting styles, feeding styles, and their influence on child obesogenic behaviors and body weight. A review. *Appetite*, 71, 232-241. doi: 10.1016/j.appet.2013.08.015.

Wallace, T.C., Reider, C., and Fulgoni, V.L. 3rd. (2013). Calcium and vitamin D disparities are related to gender, age, race, household income level, and weight classification but not vegetarian status in the United States: Analysis of the NHANES 2001-2008 data set. *Journal of the American College of Nutrition*, 32(5), 321-330. doi: 10.1080/07315724.2013.839905.

Wang, Y.C., Bleich, S.N., and Gortmaker, S.L. (2008). Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988-2004. *Pediatrics*, 121(6), e1604-e1614. doi: 10.1542/peds.2007-2834.

Weinfield, N.S., Borger, C., Zimmerman, T., DeMatteis, J., MacAllum, C., Whaley, S., Ritchie, L., Au, L., Sallack, L., and May, L. (2019). *WIC infant and toddler feeding practices study-2: Third year report*. Alexandria, VA: Food and Nutrition Service, U.S. Department of Agriculture.

Welker, E.B., Jacquier, E.F., Catellier, D.J., Anater, A.S., and Story, M.T. (2018). Room for improvement remains in food consumption patterns of young children aged 2-4 years. *Journal of Nutrition,* 148(9S)*,* 1536S-1546S. doi: 10.1093/jn/nxx053.

Whitaker, R.C., Pepe, M.S., Wright, J.A., Seidel, K.D., and Dietz, W.H. (1998). Early adiposity rebound and the risk of adult obesity. *Pediatrics*, 101(3), E5. doi: 10.1542/peds.101.3.e5.

Wilson, J.W., Enns, C.W., Goldman, J.D., Tippett, K.S., Mickle, S.J., Cleveland, L.E., and Chahil, P.S. (1997, June 2). *Data tables: Combined results from USDA's 1994 and 1995 Continuing Survey of Food Intakes by Individuals and 1994 and 1995 Diet and Health Knowledge Survey.* Available at: Combined results from Continuing Survey of Food Intakes by Individuals (CSFII)/Diet and Health Knowledge Survey (DHKS) 1994-95 (usda.gov) and these two websites: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/DBrief/20_Food_Patterns_Equivalents_0304_1516.pdf and https://publications.aap.org/pediatrics/article/139/6/e20170967/38754/Fruit-Juice-in-Infants-Children-and-Adolescents.

Wilson, T.A., Liu, Y., Adolph, A.L., Sacher, P.M., Barlow, S.E., Pont, S., Sharma, S., Byrd-Williams, C., Hoelscher, D.M., and Butte, N.F. (2019). Behavior modification of diet and parent feeding practices in a community- vs. primary care-centered intervention for childhood obesity. *Journal of Nutrition Education and Behavior*, 51(2), 150-161.e1. doi: 10.1016/j.jneb.2018.05.010.

World Health Organization (WHO). (2012). *Guideline: Potassium intake for adults and children*. Geneva, Switzerland: Author.

Yang, Q., Zhang, Z., Gregg, E.W., Flanders, W.D., Merritt, R., and Hu, F.B. (2014). Added sugar intake and cardiovascular diseases mortality among US adults. *JAMA Internal Medicine*, 174(4), 516-524. doi: 10.1001/jamainternmed.2013.13563.

Yee, A.Z., Lwin, M.O., and Ho, S.S. (2017). The influence of parental practices on child promotive and preventive food consumption behaviors: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 47. doi: 10.1186/s12966-017-0501-3.

Zimmer, M.C., Rubio, V., Kintziger, K.W., and Barroso, C. (2019). Racial/ethnic disparities in dietary intake of U.S. children participating in WIC. *Nutrients*, 11(11), 2607. doi: 10.3390/nu11112607.

Zuckerman, K.E., Chavez, A.E., and Reeder, J.A. (2017). Decreasing disparities in child development assessment: Identifying and discussing possible delays in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). *Journal of Developmental and Behavioral Pediatrics*, 38(5), 301-309. doi:10.1097/DBP.0000000000000446.