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

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

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Authors

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
Lauren Au, PhD, RD, University of California, Davis
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 fifth annual 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). The primary sources of data are interviews administered at child ages 54 and 60 months (i.e., during the child's fifth year), though this report draws from data collected from previous years of the study as needed for context.

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.[1]

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 residential guidelines and have a household income at or below 185 percent of the Federal Poverty Guidelines (FPG)[2] ($45,510 for a family of 4 in 2017[3]) 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[4] 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 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.

2 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/poverty-guidelines. Retrieved on June 15, 2020.

3 The income-poverty variable used for analysis in this report is based on the 2017 values. Values vary by state. This is the value for a family of four in the 48 contiguous states and the District of Columbia.

4 At the time data collection for the *Fifth Year Report* began, there were 90 WIC SAs; however, during the last month of data collection (June 2019), one SA closed, thus there are currently 89 WIC SAs.

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 with WIC.

This study is heavily predicated on the design used for the 1997 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 complements other 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 changes over time.

The primary research questions for the WIC ITFPS-2 at age 5 years include the following:

- What are the background and environmental characteristics that may influence families' feeding practices and, ultimately, their children's nutrition and health outcomes?

- What is the influence of WIC on the nutrition and health of children in the study?
- What are children's nutrient intake, meal, and snack practices, and how do feeding practices influence weight and growth?

The study addresses these three topics and answers 15 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), and fourth year (Borger et al., 2020) are available online.

The WIC ITFPS-2 methodology remains unchanged from the previous years. For brevity, 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 Chapter 1 of 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 cross-sectional samples of women and their infants (mother-child dyads) 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 are followed regularly until they are 72 months old, with up to 18 maternal (or primary caregiver[5]) interviews occurring prenatally, and at 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. Though interviewed less frequently prior to the study child's second birthday, the supplemental sample

[5] 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. Throughout this report the term "infant" applies to the 0-13-month period; the term "child" applies to the entire period from 0 to 72 months.

received all the interviews that the core sample received from the 24-month interview onward, for a total of 12 interviews (1 or 3, 7, 13, 24, 30, 36, 42, 48, 54, 60, and 72 months, and at age 9 years).[6]

To be eligible for inclusion in the analysis sample, participants must have completed either a 1- or 3-month interview (i.e., their first postnatal interview). This report focuses on data from the 54- and 60-month interviews, which include both the core and supplemental samples. After years of study attrition, the unweighted number of study participants eligible for the 60-month interview was 3,074.

1.3 Sample Selection

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[7]) 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

[6] Study interviews are 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.

[7] 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 September 3, 2019.

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 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 only 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 included the following:

- **Peer Counseling Program.** Whether the SA had a breastfeeding peer counseling program in place.[8]
- **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 permits 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

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

who are "high weight for height"[9] 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.[10] The recruitment window was a series of consecutive 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).[11] 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 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.[12]

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[9] 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/m2 or higher.

[10] 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.

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

[12] 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 to be 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.[13] The main source was a series of telephone interviews with the study child's mother or caregiver. Key information such as child's weight and length/height is obtained periodically through 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.[14] 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, and 60 months;[15]
- Measurements taken at WIC sites or by healthcare providers for height and weight measurements when the babies are born and around 6, 12, 24, 36, 48, and 60 months;[16]

[13] The study collected data over a 5-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 5.8 years, whereas mothers who enrolled when their baby was 2.5 months old were in the study for about 4.8 years. These timeframes do not include the 72-month interview or the planned follow-up interview when the child is 9 years old.

[14] Characteristics of the WIC sites are used in earlier reports as covariates in exploring the variation in infant feeding practices.

[15] Interviews at study child age 72 months were in the field when this report was written. A follow-up interview at child age 9 years is planned.

[16] Height/weight measurements will be collected around child age 72 months and 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;[17]
- 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]).

Table 1-1 presents an overview of the information obtained from each data source. Key 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 during the study child's fifth year of life, most of which comes from the 54- and 60-month telephone interviews. The 54-month interview focuses broadly on WIC program utilization. In addition, the 54-month interview captures lifestyle and feeding practices, and specific child developmental milestones. The 60-month interview includes the child's dietary intake.

[17] 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.

Table 1-1. Domains by data source

Domain	Source of data																						
	WIC ITFPS-2 participant interview by timing																					WIC admin. data	Staff survey/key informant interviews
	Screening/ enrollment	Baseline[a]	Prenatal	1 month	3 months	5 months	7 months	9 months	11 months	13 months	15 months	18 months	24 months	30 months	36 months	42 months	48 months	54 months	60 months	72 months[b]	9 years[c]		
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[d]														✓	✓		✓		✓	✓	✓	✓	
WIC food package type[e]																						✓	
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 module completed at that same interview.

[b] At the time of this writing, this interview is in the field.

[c] The domains identified are anticipated for the interview at child age 9 years but instrument has not yet been approved by the Office of Management and Budget.

[d] 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.

[e] 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 *Fifth 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.[18] For more details 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 time spent participating in each telephone interview and (after child 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 with the follow-up interview at study child age 9 years. During the first 2 years, study participants assigned to the core sample are interviewed more frequently than those in the supplemental sample. However,

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

all participants (from both the core and supplemental samples) received interviews at 54 and 60 months (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 54-month interview was fielded between October 2017 and January 2019, and the 60-month interview was fielded between April 2018 and August 2019 (Table 1-2).

Table 1-2. Dates of interviews administered through the 60-month interview

Interview	Date interview opened	Date interview closed
Prenatal[a]	7/12/2013	2/5/2014
Month 1[b]	7/3/2013	8/28/2014
Month 3[b]	7/11/2013	10/31/2014
Month 5[b]	10/1/2013	12/17/2014
Month 7[b]	11/11/2013	2/28/2015
Month 9[b]	2/1/2014	4/17/2015
Month 11[b]	4/1/2014	6/17/2015
Month 13[c]	5/11/2014	8/28/2015
Month 15[c]	8/1/2014	10/17/2015
Month 18[c]	11/1/2014	1/17/2016
Month 24[c]	4/11/2015	8/11/2016
Month 30[a]	10/15/2015	2/11/2017
Month 36[c]	4/11/2016	8/11/2017
Month 42[a]	10/11/2016	2/11/2018
Month 48[c]	4/11/2017	8/11/2018
Month 54[a]	10/11/2017	2/11/2019
Month 60[c]	4/11/2018	8/11/2019

[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 study participants. A second day of 24-hour dietary recall information was collected on a 10-percent subsample of study participants.

Note: Appendix A offers the typical age of the child at the interview open and close dates.

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 is 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 54-month interview, the window for the interview spanned 14 days prior to this interview to 28 days after this interview.

From age 3 years onward, the target dates were the child's birthday. In addition, within 10 days of the initial dietary intake interview, the study collects a second 24-hour dietary recall on a randomly selected 10-percent subsample of children. These second recalls are collected at 13, 15, 18, 24, 36, 48, and 60 months, and are used to calculate usual intake of energy, nutrients, and food pattern equivalent values for all participants.[19]

1.5.3 Collecting Height and Weight Data

The study collected height/length and weight measurements of the children at birth and around ages 6, 12, 24, 36, 48, and 60.[20] Table 1-3 presents the time periods during which the data collections occurred.

Table 1-3. Dates height/length[a] and weight collected

Study child's approximate age[b]	Start date	End date
6 months	7/25/2013	1/15/2015
12 months	4/1/2014	7/17/2015
24 months	4/6/2015	8/11/2016
36 months	4/6/2016	9/18/2017
48 months	3/27/2017	9/11/2018
60 months	3/6/2018	8/30/2019

[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 Section 6.3.1.

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-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 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 asked to bring children back to a WIC location for measurements. If participants did not wish to return to a WIC location, they were asked to complete a medical records release authorization and

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

[20] Interviews at study child age 72 months were in the field when this report was written. A follow-up interview at child age 9 years is planned.

to provide contact information for the child's healthcare provider to obtain child height/weight data.

At child ages 48 and 60 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 card that WIC staff or healthcare professionals were asked to complete.

1.5.4 Additional Data Collected for WIC ITFPS-2

In early years of the study, WIC ITFPS-2 collected administrative data on food package receipt and qualitative and quantitative data on site characteristics. The latter were collected using site visits, key informant interviews, and staff surveys. Neither food package data nor data on sites are used in analyses for this report. More detail on these data collections can be found in Chapter 1 of the *WIC ITFPS-2: Third Year Report* (Weinfield et al., 2019).

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 are at least 16 years old, spoke either English or Spanish, and were enrolling in WIC either while the mother is pregnant or postnatally before the child is 3 months of age at a site expected to enroll at least 30 new pregnant women or infants per month. The statistical weights inflate the sample to represent the study-eligible population by compensating for both the unequal sampling rates and nonresponse. All study findings represent the characteristics, views, behaviors, and experiences of this population (i.e., study-eligible pregnant/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 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 1.8.2). 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.)

Table 1-4. Unweighted study sample participation

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 60-month interview % (*n*)
Total sample	4,489	4,367	3,775[a]	67.0% (2,529)
Core sample	3,605	3,503	3,019	65.9% (1,989)
Prenatal core sample	3,122	3,037	2,595	68.0% (1,766)
Postnatal core sample	483	466	424	52.6% (223)
Supplemental sample	884	864	756	71.4% (540)
Prenatal supplemental sample	688	678	588	74.3% (437)
Postnatal supplemental sample	196	186	168	61.3% (103)

[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, so from the 54-month interview onward *n*=3,775.

Across all the sampling groups, 3,775 (86%) 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 comprise the main analysis sample.[21] By the 60-month interview, 67 percent of those eligible responded to the interview. However, due to attrition over the years, 3,074 of the original 3,775 respondents received the 60-month interview, which indicates an 82 percent (=2,529 out of 3,074) unweighted cooperation rate with this interview (not shown).

Over the course of the study thus far, a total of 1,317 of the 4,365[22] enrolled participants no longer participate with the study. This total reflects both those who were eligible and ineligible to continue participating. By the 60-month interview, 83 percent (*n*=1,093) of those who had left the study were eligible to continue and 17 percent (*n*=224) were not eligible.[23]

Table 1-5 presents the percentage of the main analysis sample that has completed interviews through the 60-month interview. In addition, Table 1-5 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.

[21] After the *Fourth Year Report* was submitted, two cases were found to be fraudulent and were removed from the main analysis sample.

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

[23] Table B1-3 in Appendix B1 offers additional detail on attrition.

Table 1-5. Unweighted counts and percentage of respondents who completed interviews by sample type and interview month

Interview	Percentage of sample that completed the interviews		
	Main analysis sample (*n*=3,777)[a]	Core sample[b] (*n*=3,020)	Supplemental sample[c] (*n*=757)
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)

[a] 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- and 60-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

Weight and length/height[a] and food package data	Number received	Percentage received[b]
Weight and length 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%
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, length was requested; subsequently, height was requested.

[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 certification as applicable and at 6 months.

1.8 Analysis

Using data from the 54- and 60-month interviews, and anthropometric measurements obtained around the fifth birthday, this report focuses on outcomes reported during the fifth 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 60-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 examine associations with a standard set of 12 sociodemographic characteristics which are subsequently referred to in 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 60-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 estimates of children's typical intakes using methods recommended by the National Cancer Institute (NCI).

NCI offers different methods for estimating usual intake, depending on the type of dietary component(s) 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.[24] (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

[24] In the usual intake models, the cross-sectional 60-month statistical weights are used to adjust for all key sociodemographic characteristics. Usual intake was also adjusted for pattern of WIC participation (see Chapter 7). When adjustments include pattern of WIC participation, the 1- or 3- through 60-month longitudinal statistical weights are used because pattern of WIC participation is only available for the longitudinal sample.

the child's dietary intakes. In ratio estimation, it is important to account for this correlation among foods and nutrients within a person's diet. The MCMC method accounts for the correlations between dietary components and total energy[25] within a person's diet while allowing for 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 mean scores for ratios of dietary components, including 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 report are analyzed by a set of 12 sociodemographic characteristics. Because the 12 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 in this study included nonmodifiable and modifiable characteristics of the participant and her household. Data on nonmodifiable key sociodemographic characteristics were collected at a baseline interview[26] 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 48-month interview. If the characteristics were not assessed during the 48-month interview, values from the closest (in time) interview prior to the 48-month interview were used. Assessing relationships with modifiable key characteristics in the child's fourth year allows for lagged effects on outcome analyzed.[27]

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

[26] 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.

[27] The exception is maternal educational attainment, which was not collected during the 48-month interview. Accordingly, data collected during the 54-month interview are used.

The following bulleted list includes all the key sociodemographic characteristics used in this report. Those that do not reference an interview date were collected at baseline and updated only if the caregiver changed.

- Mother's[28] race;
- Mother's ethnicity;
- Age of mother at the birth of the study child;
- Mother's educational attainment at 54 months;
- Mother's marital status at 48 months;
- Household food security at 48 months based on the USDA six-item food security module;[29]
- Participation[30] in non-WIC benefit programs at 48 months;
- Parity (birth order);
- Self-reported weight status of mother at 42 months;
- Income poverty at 48 months;
- Timing of WIC enrollment; and
- WIC participation status at 48 months.

The timing of the data collection on modifiable key characteristics distinguishes them from other characteristics. For example, data collected on maternal marital status collected at child age 48 months is a key sociodemographic characteristic, but data collected on maternal marital status collected at child age 60 months is not key. Key characteristics are consistently used in analyses while

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

[29] The questions inquire about household food security status over the past 12 months. See https://www.ers.usda.gov/media/8282/short2012.pdf for more information.

[30] 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 SNAP, Temporary Assistance for Needy Families (TANF), Medicaid, the National School Lunch Program (NSLP), School Breakfast Program (SBP), or the Summer Food Service Program (SFSP).

others are used selectively. Though responses to key sociodemographic characteristics were largely complete across the fifth-year interviews, missing values are imputed.

Table 1-7 presents the unweighted and weighted key sociodemographic characteristics of the WIC ITFPS-2 analysis sample. The percentages are of the main analysis sample at the start of the study (i.e., those who completed their first postnatal interview [*n*=3,775]) as well as the sample size at 60 months (*n*=2,529). As discussed, data on key sociodemographic characteristics are collected at the interview indicated even though the denominator used in the table varies as indicated.

Table 1-7. Unweighted and weighted key sociodemographic characteristics used in this report, as a percentage of the main analysis sample

Sociodemographic characteristics	Main analysis sample (*n*=3,775) % (count)[a,b]	Unweighted percentage of 60-month interview respondents (*n*=2,529) % (count)[b]	Weighted percentage of 60-month respondents (*n*=441,248) % (count)[b]
Race of mother/caregiver			
African American or Black	25.5% (964)	29.3% (740)	21.9% (96,695)
White	58.7% (2,216)	55.6% (1,405)	58.5% (258,247)
All Other[c]	15.8% (595)	15.2% (384)	19.6% (86,305)
Ethnicity of mother/caregiver			
Hispanic or Latino	38.2% (1,441)	37.6% (951)	46.7% (206,032)
Not Hispanic or Latino	61.8% (2,334)	62.4% (1,578)	53.3% (235,215)
Age of mother or caregiver at the study child's birth			
16-19 years	11.8% (446)	10.6% (267)	11.4% (50,444)
20-25 years	41.6% (1,569)	40.6% (1,027)	40.0% (176,593)
26 years or older	46.6% (1,760)	48.8% (1,235)	48.5% (214,211)
Maternal educational attainment at 54 months[d]			
High school or less	56.3% (2,127)	53.5% (1,354)	54.0% (238,122)
More than high school	43.7% (1,648)	46.5% (1,175)	46.0% (203,125)
Maternal/caregiver marital status at 48 months[e]			
Married	35.9% (1,354)	37.5% (949)	39.4% (173,727)
Not married (including divorced and widowed)	64.1% (2,421)	62.5% (1,580)	60.6% (267,520)
Household food security (measured using 6-item module) at 48 months[e]			
High or marginal	75.2% (2,838)	75.9% (1,919)	76.7% (338,322)
Low	13.0% (492)	12.6% (319)	12.9% (56,767)
Very low	11.8% (445)	11.5% (291)	10.5% (46,158)
Participation in non-WIC programs at 48 months[e]			
Does not participate in other programs[f]	19.7% (744)	17.9% (453)	17.8% (78,569)
Participates in Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[f]	44.9% (1,696)	47.0% (1,189)	46.8% (206,556)
Participates in other programs[f] excluding SNAP	35.4% (1,335)	35.1% (887)	35.4% (156,122)

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

Sociodemographic characteristics	Main analysis sample (*n*=3,775) % (count)[a,b]	Unweighted percentage of 60-month interview respondents (*n*=2,529) % (count)[b]	Weighted percentage of 60-month respondents (*n*=441,248) % (count)[b]
Parity			
Firstborn	41.7% (1,575)	41.6% (1,052)	42.4% (187,269)
Second born	27.0% (1,018)	27.2% (689)	26.8% (118,407)
Third or subsequently born	31.3% (1,182)	31.2% (788)	30.7% (135,571)
Self-reported weight status of mother at 42 months[g]			
Normal or underweight	32.4% (1,222)	31.2% (790)	31.5% (139,004)
Overweight	31.2% (1,176)	30.6% (773)	31.1% (137,169)
Obese	36.5% (1,377)	38.2% (966)	37.4% (165,074)
Income poverty at 48 months[e]			
75% of Federal Poverty Guidelines (FPG) or below	44.8% (1,693)	44.8% (1,134)	44.6% (196,917)
Above 75% but ≤ 130% of FPG	30.1% (1,138)	30.1% (762)	32.1% (141,467)
Above 130% of FPG	25.0% (944)	25.0% (633)	23.3% (102,862)
Timing of WIC enrollment			
First trimester	29.6% (1,118)	32.5% (821)	31.7% (139,810)
Second trimester	38.9% (1,470)	40.3% (1,020)	39.5% (174,286)
Third trimester	16.1% (607)	14.6% (369)	15.7% (69,089)
Postnatal	15.4% (580)	12.6% (319)	13.2% (58,062)
WIC participation status at 48 months[e]			
Receiving WIC	50.3% (1,897)	50.6% (1,279)	52.6% (232,298)
No longer receiving WIC	49.7% (1,878)	49.4% (1,250)	47.4% (208,949)

[a] The main analysis sample includes 3,775 cases that have 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] All Other races include respondents who indicated multiple races.

[d] Data used to determine maternal educational attainment are not collected at the 48- or 60-month interview. They are collected at the 54-month interview. The values at 54 months are imputed if missing.

[e] If the participant does not complete the 48-month interview (*n*=2,572), or the data are missing, data for key sociodemographic characteristics are imputed.

[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] Data used to calculate self-reported maternal weight status are self-reported at the 42-month interview. They are not reported at the 48- or 60-month interviews. For this report, the 42-month value is imputed if missing.

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

The unweighted key sociodemographic characteristics describe the sample used for analysis at child age 60 months as follows. The majority are White (56%) while approximately one-quarter (29%) are African American or Black. Nearly two-fifths (38%) report they are Hispanic or Latino. Most (89%) were at least 20 years old when they gave birth to the study child. Slightly less than two-thirds (63%) are unmarried. About one-third (31%) of caregivers consider themselves normal weight or underweight at the 42-month interview, and nearly two-fifths (38%) indicate that they are obese at this interview. The study child is the firstborn child in about two-fifths (42%) of the families followed. Just under half (45%) report household incomes at 75 or below percent of the FPG at 48 months. A similar percentage (47%) of study families participate either in SNAP or in SNAP plus other public assistance programs such as TANF, Medicaid, or the NSLP. Despite several risk factors, about three-quarters (76%) report their households have high or marginal food security at 48 months.

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.[31] Participation in non-WIC benefit programs, education level, and WIC participation status are each associated with nine of the other key sociodemographic characteristics used in this study. These findings suggest that several of the key sociodemographic variables may, to some extent, be measuring the same underlying phenomenon.

[31] The main analysis sample consists of those who responded to their first postnatal interview. The analysis uses the 48-month weight because the majority of modifiable key sociodemographic characteristics are assessed at the 48-month interview. Chi-square tests are appropriately adjusted for our complex sample design. Statistical significance is at the 95-percent confidence level.

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

	Caregiver race	Caregiver ethnicity	Caregiver marital status	Household food security	Participation in non-WIC benefit programs	Parity	Timing of WIC enrollment	Caregiver weight status	Income poverty	Age of mother at child's birth	Education level	WIC participation status
Caregiver race		✓	✓		✓							✓
Caregiver ethnicity	✓			✓	✓		✓		✓	✓	✓	✓
Caregiver marital status	✓			✓	✓	✓	✓		✓	✓	✓	
Household food security		✓	✓				✓		✓			
Participation in non-WIC benefit programs	✓	✓	✓			✓	✓	✓	✓		✓	✓
Parity			✓		✓			✓	✓	✓	✓	✓
Timing of WIC enrollment		✓	✓	✓	✓				✓	✓		✓
Caregiver weight status					✓	✓				✓	✓	✓
Income poverty		✓	✓	✓	✓	✓	✓				✓	✓
Age of mother at child's birth		✓	✓			✓	✓	✓			✓	✓
Education level		✓	✓		✓	✓		✓	✓	✓		✓
WIC participation status	✓	✓			✓	✓	✓	✓	✓	✓	✓	

[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, SD36–SD40, MH1, MH2, MH29, KA2, and KA6.

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 receiving WIC benefits at 48 months).

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 WIC participation rates vary across racial 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 White and African American caregivers employing a particular feeding practice are significantly different).[32] 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 ITPFS-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.[33] Bivariate associations explored in this report were not limited to the key sociodemographic characteristics but typically include them. Bivariate findings should be interpreted with caution because associations are not adjusted for potential confounders.

1.8.5 Multivariable Models

For the subset of research questions that focus on identifying the factors independently associated with the outcomes observed, bivariate analyses alone are not sufficient. Accordingly, multivariable regression analysis[34] 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

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

[33] 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).

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

after accounting for sociodemographic factors. 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.

As mentioned, 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.

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

Key Findings:

- Sixty-one percent of study mothers with 54-month-old children have work and/or school commitments. Over half (56%) of study mothers are working either full- or part-time. Thirteen percent of study mothers attend school, and more than half of these mothers also work.
- Sixty-four percent of study children are in a regular, nonparental childcare arrangement at 54 months of age. For those children in regular childcare, childcare providers provide most of the food for roughly half (52%) of study children while they are in care.
- About half (52%) of study families report participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) at the 54-month interview. For about one-quarter (26%) of study families, a non-study child in the family is receiving WIC when the study child is 54 months old.
- At the 54-month interview, 46 percent of study families participate in the Supplemental Nutrition Assistance Program (SNAP), and half (50%) of study families have a child participating in the National School Lunch Program (NSLP), the School Breakfast Program (SBP), or the Summer Food Service Program (SFSP).
- Almost one in five (19%) study families live in areas with limited food access, sometimes referred to as food deserts.
- About 90 percent of study mothers report that fresh fruits and vegetables are available and plentiful in their communities; however, nearly one-third (30%) of study mothers report that cost is a barrier to purchasing fresh fruits and vegetables.

2.1 Overview

This chapter focuses on the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) families' personal and household characteristics, including their engagements with work, school, and childcare, as well as their participation in Federal benefit programs, access to fresh fruits and vegetables, and use of medical care. The wide array of topics covered effectively provides context for interpreting the findings discussed in subsequent chapters and specifically addresses the following research questions:[35]

- How do feeding practices vary with working and family care/childcare/preschool circumstances?
- What are the main barriers to eating healthy?

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

- Does continued participation in WIC have a positive corollary effect on access to healthcare and continuity of care?

Data for this chapter are primarily drawn from interviews conducted at child ages 54 and 60 months, although data from earlier interview months are sometimes provided for context. Interview questions on work, childcare, fruit and vegetable access, and child's medical home are asked at 54 months. Interview questions on Federal program participation, including WIC, the Supplemental Nutrition Assistance Program (SNAP), Medicaid, and school and summer meals, are asked at both 54 and 60 months. Consequently, analyses reference different time points depending on the specific content.[36]

2.2 Background

Readers are encouraged to review the *Fourth Year Report* for a detailed background on the relevant research related to the personal and household characteristics covered in this chapter. In light of a labor force participation rate of 66.4 percent for mothers with children under 6 years old (Bureau of Labor Statistics, 2020), and rates of use of nonparental care for children between 3 and 5 years at 73 percent (Corcoran & Steinley, 2017), this chapter begins with an exploration of the associations between maternal employment, use of childcare, and key sociodemographic characteristics of WIC ITFPS-2 families. This chapter subsequently explores how the provision of food differs by type of childcare provider in order to better understand influences on the child's dietary intake.

Because participation in Federal nutrition assistance programs may also influence children's dietary intakes and health outcomes (Leung et al., 2013), this chapter describes WIC ITFPS-2 families' participation in Federal nutrition assistance programs, including SNAP, the National School Lunch Program (NSLP), the School Breakfast Program (SBP), and the Summer Food Service Program (SFSP), as context for understanding WIC program influence on WIC ITFPS-2 families. Additional factors that may influence dietary intakes and health outcomes include the neighborhoods in which families live. Inadequate access to high-quality, affordable, and convenient fruits and vegetables has been identified as a barrier to healthy eating (Walker, Keane, & Burke, 2010) and is discussed in this chapter along with an analysis of the percentage of WIC ITFPS-2 families living in food deserts.

[36] Table 1-1 in Chapter 1 provides a summary of the content domains by interview month. The complete set of survey instruments is in Appendix B4.

One of WIC's core benefits is screening and referrals to other health, welfare, and social services (U.S. Department of Agriculture [USDA], Food and Nutrition Service, 2013). Research has shown that Medicaid-enrolled children who participate in WIC have greater use of healthcare services than Medicaid-enrolled children who do not participate in WIC (Buescher et al., 2003). Participation in WIC may help women and children with establishing a medical home and completing wellness visits. As such, this chapter concludes by examining the extent to which WIC ITFPS-2 children have a medical home.

2.3 Sample and Analysis Approach

2.3.1 Sample

The analyses in this chapter primarily use data from 54- and 60-month interviews. Table 2-1 shows the number of respondents to those interviews.[37] Both the core and supplemental samples were eligible for these interviews. In analyses, the responses to each interview are weighted so that findings reflect the study-eligible population as described in Chapter 1. Because WIC eligibility for the study child ceases when the child is 5 years old (i.e., at 60 months), it is important to note that 77 percent (unweighted) of the 60-month interviews took place after the child's fifth birthday.

Table 2-1. Unweighted number of respondents by interview month

Sample structure	54-month interview	60-month interview
Core prenatal sample	1,791	1,766
Core postnatal sample	227	223
Supplemental prenatal sample	441	437
Supplemental postnatal sample	104	103
Total	2,563	2,529

2.3.2 Analysis

Bivariate associations are assessed using the set of 12 key sociodemographic characteristics discussed in Section 1.8.2. Nonmodifiable key sociodemographic characteristics assessed at the time of the first interview were only refreshed as needed (i.e., if the caregiver changes). However, for key characteristics that may change over time, such as household food security, income relative to

[37] Because the study is longitudinal, and participants are retained for future events if they miss an interview, the number of respondents at each interview may fluctuate either up or down over time.

Federal Poverty Guidelines (FPG), or WIC participation status, values reported at the 48-month interview are used.[38]

Chi-square tests were used to assess associations between key sociodemographic characteristics and outcomes of interest. If a significant association was found, typically, two-tailed t-tests were used to determine which pairwise subgroup differences are statistically significant. Subgroup differences discussed in the chapter were limited to those that form a pattern over time or across questions, and are large in magnitude, to avoid focusing on findings that, while statistically significant, may have little practical importance.[39] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

Table presentation. In tables presenting associations between key sociodemographic characteristics and household characteristics, child behaviors, or 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) 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.

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

[38] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

[39] 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.

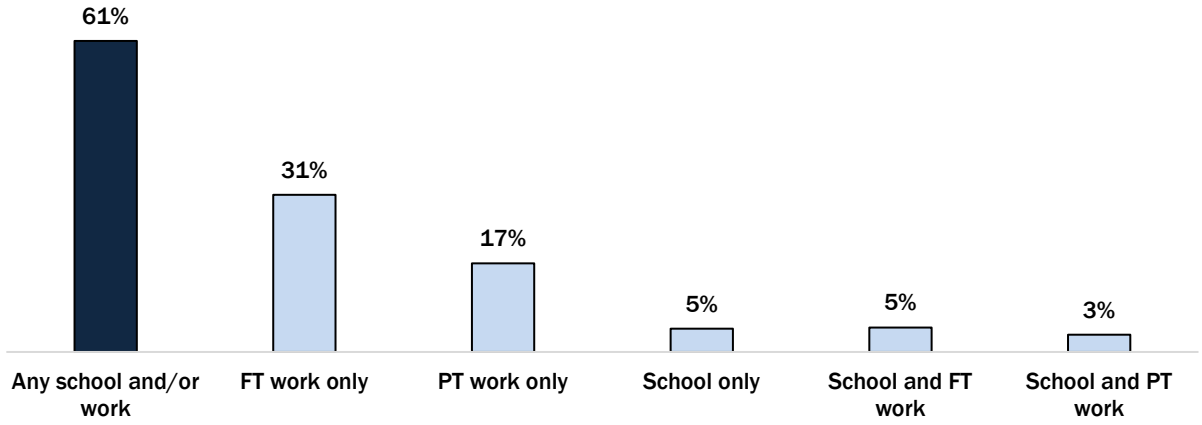
2.4 Working and Going to School

The following analyses explore the engagement of WIC ITFPS-2 mothers[40] in work and/or school. This includes whether caregivers are working full-time (FT), part-time (PT), or not working outside the home. Analyses also explore whether caregivers are attending school, and whether there are caregivers who both work and attend school.

2.4.1 Work and School at 54 Months

At the 54-month interview, 61 percent of study mothers are working, going to school, or doing both (Figure 2-1; Appendix Tables B2a-1 and B2a-2 offer more detail). Thirty-one percent of study mothers reported working FT and not attending school, and 17 percent reported working PT and not attending school. While the majority of mothers who reported working were not in school, about 8 percent are working and attending school. A small percentage (5%) of mothers reported attending school and not working for pay.

Figure 2-1. Percentage of WIC ITFPS-2 mothers working, either full-time (FT) or part-time (PT), and going to school at 54 months[a]

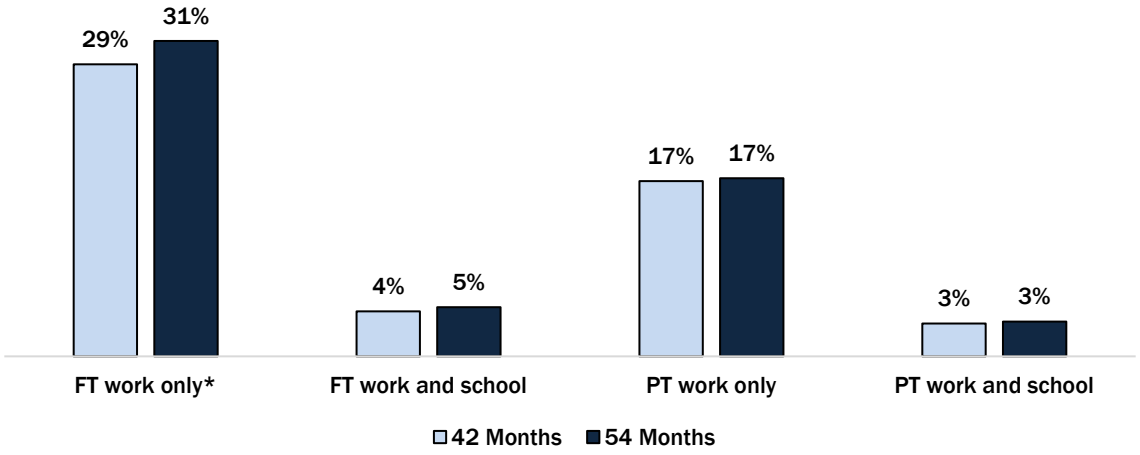


[a] At 54 months, unweighted *n*=2,560; weighted n=440,806.

[40] Throughout this report, the terms "study mothers" and "caregivers" are used interchangeably to refer to adult WIC ITFPS-2 participants.

At the 54-month interview, more than half (56%) of study mothers report working for pay. This percentage is significantly different from the 53 percent of study mothers who reported working for pay at the 42-month interview. The change is primarily driven by a significant uptick in FT employment: 29 percent at 42 months, and 31 percent at 54 months. The upward change likely reflects both personal and macroeconomic circumstances that fluctuate over time. Figure 2-2 presents the total percentage of caregivers working at 42 and 54 months, and the breakdown by FT and PT employment, including whether the caregiver is in school while working (Appendix Table B2a-1 contains more detail). The figure focuses on those employed and excludes mothers who are attending school but not employed.

Figure 2-2. Percentage of WIC ITFPS-2 mothers working, either full-time (FT) or part-time (PT), by school status at 42 and 54 months[a]

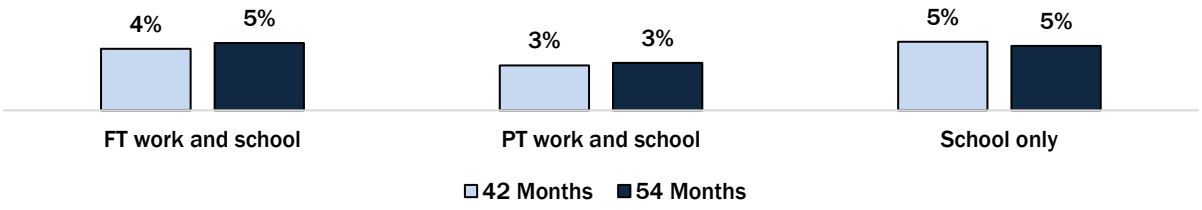


[a] At 42 months, unweighted *n*=2,623; weighted *n*=439,251. At 54 months, unweighted *n*=2,560; weighted *n*=440,806.

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

At 54 months, 13 percent of study mothers are in school (Figure 2-3; Appendix Table B2a-2 offers more detail). Of these mothers, more than half are also working for pay, either PT or FT. When examining change between 42 and 54 months, there were no significant differences between the percentages of mothers in school and working either FT or working PT.

Figure 2-3. Percentage of WIC ITFPS-2 mothers who attend school by work status, either full-time (FT) or part-time (PT), at 42 and 54 months[a]



[a] At 42 months, unweighted *n*=2,623; weighted *n*=439,251. At 54 months, unweighted *n*=2,560; weighted *n*=440,806.

2.4.2 Characteristics of Those Working and/or Going to School at 54 Months

At 54 months, chi-square tests yield statistically significant associations between working and/or going to school and several key sociodemographic characteristics: race, ethnicity, marital status, parity, income poverty, caregiver educational attainment, participation in non-WIC benefit programs, timing of WIC enrollment, and WIC participation status. Table 2-2 presents the findings.

Table 2-2. Row percentages of key sociodemographic characteristics associated with working and/or going to school at 54 months

Key sociodemographic characteristics	Study mothers working and/or going to school % (standard error)	Unweighted *n*	Weighted *n*
Race			
African American	72.3 (1.7)[a,b]	743	96,180
White	57.7 (1.6)[a]	1,443	259,677
All Other	57.6 (3.9)[b]	377	85,388
Ethnicity			
Hispanic or Latino	55.5 (3.0)[a]	955	205,731
Not Hispanic or Latino	65.5 (1.1)[a]	1,608	235,513
Marital status			
Married	52.6 (2.4)[a]	951	172,615
Not married	66.1 (1.6)[a]	1,612	268,629
Parity			
Firstborn	65.8 (1.8)[a,b]	1,068	187,725
Second born	57.6 (2.3)[a]	702	118,169
Third or subsequent born	56.8 (3.3)[b]	793	135,350
Income poverty			
75% of Federal Poverty Guidelines (FPG) or below	49.0 (2.3)[a,b]	1,137	195,787
Above 75% but ≤ 130% of FPG	66.9 (2.5)[a]	783	141,897
Above 130% of FPG	74.9 (1.9)[b]	643	103,560
Mother's educational attainment			
High school or less	50.1 (2.4)[a]	1,369	237,647
More than high school	73.4 (1.3)[a]	1,194	203,597
Participation in non-WIC benefit programs			
Does not participate in other programs[c]	73.9 (2.9)[a,b]	468	80,346
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[c]	55.4 (2.0)[a]	1,192	205,253
Participates in other programs[c] excluding SNAP	61.4 (2.6)[b]	903	155,645
Timing of WIC enrollment			
First trimester	59.3 (2.8)	830	138,921
Second trimester	57.9 (2.1)[a]	1,046	174,185
Third trimester	66.7 (2.7)[a]	363	68,489
Postnatal	66.2 (2.5)	324	59,649
WIC participation status at 48 months			
Receiving WIC	55.4 (2.5)[a]	1,311	234,734
No longer receiving WIC	67.0 (1.5)[a]	1,252	206,511

[a,b] Given the key characteristics under analysis, pairs of matching letters indicate a statistically significant pairwise difference between sociodemographic subcategories 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).

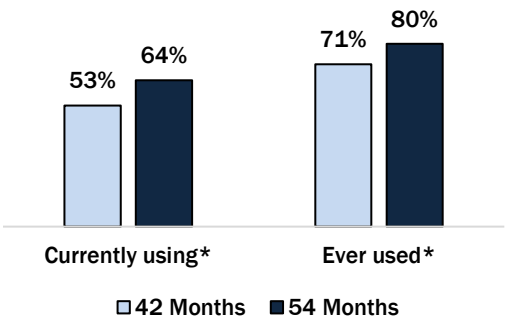
Though the bivariate analyses indicate that several of the key sociodemographic characteristics used in this study are significantly associated with working and/or school attendance, it is important to remember that many of the key characteristics are correlated (Chapter 1, Table 1-7). For example, marital status, educational attainment, and non-WIC benefit program participation are each significantly associated with income poverty, which, in turn, is positively associated with employment.

2.5 Childcare and Feeding Practices

WIC ITFPS-2 continues to explore the use of childcare at 54 months. The study defines 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. Childcare arrangements examined include childcare centers, family daycare homes, Head Start, preschool other than Head Start, someone caring for the child in their home, someone caring for the child in the child's home, and other nonspecified arrangements. Analyses explore overall use of childcare, types of childcare used, and who provides food for children in regular childcare arrangements.

2.5.1 Childcare Use at 54 Months

Figure 2-4. Percentage of study children in regular childcare, currently and ever at 42 and 54 months[a]



[a] At 42 months, unweighted *n*=2,636; weighted *n*=441,987. At 54 months, unweighted *n*=2,563; weighted *n*=441,244.

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

Figure 2-4 presents the percentage of study children currently in regular childcare and the percentage who have ever been in regular childcare (Appendix Table B2a-3 offers more detail). At 54 months, nearly two-thirds (64%) of respondents currently use childcare, which is significantly different from 53 percent currently using childcare at 42 months. The percentage of children who have ever used childcare also changes between 42 and 54 months, from 71 percent to 80 percent. The upward movement may reflect the upward trend in FT employment noted earlier.

WIC ITFPS-2 asks caregivers who currently use regular childcare to indicate the type of childcare used. Table 2-3 presents the percentage distribution of study children currently in regular childcare at 54 months, by type of childcare arrangement. The most commonly used regular childcare arrangements are a preschool other than Head Start (21%), Head Start (14%), and childcare centers (10%). Less frequently used regular childcare arrangements include someone caring for the child in their home (9%), someone caring for the child in the child's home (8%), and family daycare homes (1%).

In order to facilitate analyses, types of childcare are categorized as formal or informal. Table 2-3 indicates the types of care in each category. Formal arrangements are types of care that may be licensed and regulated, may be eligible for food reimbursements through the Child and Adult Care Food Program (CACFP), and may provide early education services. These formal arrangements include childcare centers, family daycare homes, Head Start, and preschool. Informal arrangements include providers who provide care in their own homes or the child's home as well as other (unspecified) childcare settings. These definitions of childcare are consistent with definitions presented in previous WIC ITFPS-2 reports.

Table 2-3. Percentage of study children in regular childcare by type of childcare at 54 months

Type of childcare	Study children % (standard error)
Not currently in childcare	36.2 (1.6)
Currently using any type of childcare	63.8 (1.6)
Preschool other than Head Start (formal)	21.0 (1.2)
Head Start (formal)	13.6 (1.4)
Childcare center (formal)	10.2 (1.1)
Someone cares for child in their home (informal)	8.7 (0.7)
Someone cares for child in the child's home (informal)	8.4 (0.6)
Family daycare home (formal)	1.3 (0.2)
Other (informal)	0.7 (0.2)
Unweighted *n*	2,563
Weighted *n*	441,244

Chi-square testing indicates that at 54 months there is a statistically significant association between current use of regular childcare and almost all of the key sociodemographic characteristics used in this study: race, ethnicity, marital status, parity, income poverty, caregiver educational attainment, participation in non-WIC benefit programs, timing of WIC enrollment, and child's WIC participation status. Table 2-4 presents the findings.

Table 2-4. Row percentages of key sociodemographic characteristics associated with current use of regular childcare at 54 months

Key sociodemographic characteristics	Study mothers who currently use regular childcare % (standard error)	Unweighted *n*	Weighted *n*
Race			
African American	74.3 (1.8)[a,b]	743	96,180
White	61.7 (1.7)[a]	1,443	259,677
All Other	58.0 (3.8)[b]	377	85,388
Ethnicity			
Hispanic or Latino	56.2 (2.8)[a]	955	205,731
Not Hispanic or Latino	70.4 (1.2)[a]	1,608	235,513
Marital status			
Married	55.9 (2.2)[a]	951	172,615
Not married	68.9 (1.8)[a]	1,612	268,629
Parity			
Firstborn	70.4 (1.9)[a,b]	1,068	187,725
Second born	60.5 (2.4)[a]	702	118,169
Third or subsequent born	57.4 (3.1)[b]	793	135,350
Income poverty			
75% of Federal Poverty Guidelines (FPG) or below	54.4 (2.3)[a,b]	1,137	195,787
Above 75% but ≤ 130% of FPG	68.0 (2.6)[a]	783	141,897
Above 130% of FPG	75.6 (2.3)[b]	643	103,560
Mother's educational attainment			
High school or less	54.8 (2.2)[a]	1,369	237,647
More than high school	74.2 (1.4)[a]	1,194	203,597
Participation in non-WIC benefit programs			
Does not participate in other programs[c]	71.4 (2.9)[a]	468	80,346
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[c]	60.6 (2.0)[a]	1,192	205,253
Participates in other programs[c] excluding SNAP	64.0 (2.1)	903	155,645
Timing of WIC enrollment			
First trimester	63.7 (2.6)	830	138,921
Second trimester	58.9 (1.7)[a,b]	1,046	174,185
Third trimester	69.2 (3.4)[a]	363	68,489
Postnatal	71.9 (3.3)[b]	324	59,649
WIC participation status at 48 months			
Receiving WIC	60.8 (2.0)[a]	1,311	234,734
No longer receiving WIC	67.1 (1.7)[a]	1,252	206,511

[a,b] Given the key characteristic under analysis, pairs of matching letters indicate a statistically significant pairwise difference between sociodemographic subcategories 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).

Many of the key sociodemographic characteristics associated with current use of regular childcare (Table 2-3) are also those associated with caregiver employment and/or school attendance (Table

2-2). The majority of mothers of young children who work and/or attend school likely use childcare while they are away from home. Because work and income are closely linked, and income is associated with several key sociodemographic characteristics in this study (Chapter 1, Table 1-7), it is likely that several significant differences between subgroups reflect income differences that result from working.

About 46 percent of study children are cared for in formal childcare settings and about 18 percent are cared for in informal settings (see Table 2-3). This finding represents a significant shift between the 42- and 54-month interviews in the types (formal vs. informal) of childcare settings. At 42 months, 30 percent of study children were cared for in formal childcare settings and 23 percent were cared for in informal settings.

There are few significant associations between informal and formal childcare use and participation in non-WIC benefit programs and income poverty. Those who do not participate in non-WIC benefit programs are less likely (65%) than those who do participate in non-WIC programs including SNAP (77%) to use formal care. Those in the highest income-poverty subgroup are less likely (64%) than those in the lowest income-poverty subgroup (78%) to use formal childcare.

2.5.2 Source of Foods Consumed While in Childcare

Because children in regular childcare may consume many of their meals and snacks in that setting, analyses were conducted to explore who provides the foods that children eat while in childcare. The majority of food provided to children in regular childcare may come from the childcare provider, the child's mother, or both the provider and the child's mother. Among study children in regular childcare when they are 54 months old, 52 percent receive the majority of their food (while in childcare) from the childcare provider; 26 percent receive the majority of their food from their mothers; and 22 percent receive food from both the childcare provider and their mothers (Table 2-5). These percentages represent two significant shifts between the 42- and 54-month interviews: childcare providers are providing the majority of food for a greater percentage of study children in regular childcare, and study mothers are providing food for a smaller percentage of study children. This is consistent with the shift toward more formal care settings between the 42- and 54-month interviews.

Table 2-5. Among study children in regular childcare, percentage of children by source of food at interview months 42 and 54

Source of food	Interview	
	Month 42 % (standard error)	Month 54 % (standard error)
Childcare provider	45.2[a] (1.8)	52.1[a] (1.9)
Mother	32.8[b] (1.6)	26.4[b] (1.5)
Equally divided	21.9 (1.3)	21.6 (1.1)
Unweighted *n*	1,424	1,640
Weighted *n*	229,002	276,789

[a,b] Pairs of matching letters indicate statistically significant differences between 42-month and 54-month percentages at $p \leq 0.05$.

Note: Percentages may not sum to 100 percent due to rounding.

The prevalence with which childcare providers provide most of the food differs by the type of childcare arrangement—formal versus informal. Among children in formal childcare arrangements, 66 percent of study mothers report that the childcare provider is responsible for providing most of the food eaten during care. Among children in informal care arrangements, only 15 percent of study mothers report that the childcare provider is responsible for providing most of the food eaten during care.

There are several significant bivariate associations between key sociodemographic characteristics and who is responsible for providing most of the food in formal childcare settings. Significantly associated key sociodemographic characteristics include ethnicity, marital status, age of the mother at the child's birth, and participation in non-WIC benefit programs. Caregivers are more likely to provide most of the food in formal settings if they are non-Hispanic (19%) compared to Hispanic (12%); married (22%) compared to unmarried (13%); older than 20 years of age (20-25 years, 16%; 26 years or older, 19%) compared to younger than 20 (16-19 years, 4%); or do not participate in any other Federal programs (24%) compared to those who participate in SNAP including or excluding other non-WIC benefit programs (14%).

Switching from key sociodemographic characteristics associated with the study mother reporting that she provides the majority of food to key sociodemographic characteristics of mothers who report that the childcare provider provides most of the food reveals that Hispanic caregivers are more likely (73%) than non-Hispanic caregivers (62%) to report that the provider provides the majority of food in formal care settings. Unmarried caregivers are more likely (68%) than married caregivers (63%) to report that the provider provides most of the food in formal settings. Caregivers

who were 16-19 years old at the birth of the child are more likely (83%) than their older counterparts (63% for those who were 20-25 years old at the study child's birth; 65% for those who were 26 years or older at the study child's birth) to report that the provider provides most of the food. Those who participate in non-WIC benefit programs including SNAP are more likely (70%) than those who do not participate in other non-WIC benefit programs (57%) to indicate that the childcare provider provides most of the food in formal settings.

2.6 Participation in Federal Programs during the Fifth Year

All participants in WIC ITFPS-2 were low-income at the time of enrollment in this study. Though several factors affect eligibility for WIC, the income limit for WIC program participation is 185 percent of the FPG.[41] The majority of study participants report incomes well below this level. By child age 5 years (60 months), 69 percent of study mothers report household incomes at or below 130 percent of FPG. For context, about 75 percent of study mothers reported incomes at or below 130 percent of FPG at age 4 years (48 months).

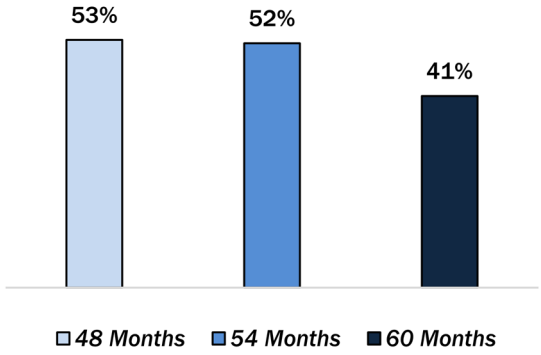
Analyses explore participation in several Federal programs that have income limits for participation. These include WIC (whether for the study child/mother or another child in the household), SNAP, NSLP, SBP, and SFSP. Receipt of Temporary Assistance for Needy Families (TANF) is also explored. Program participation questions are asked during interviews at both 54 and 60 months; thus, results are reported at both time points. Analyses also explore whether there are differences in program participation by key sociodemographic subgroups.

[41] Families may participate in other programs (e.g., Medicaid or TANF) that confer automatic WIC eligibility.

2.6.1 WIC Participation

Similar to the findings when the study child was 48 months old (4 years), at 54 months, slightly more than half of study mothers report that either they or the study child is receiving WIC (Figure 2-5; Appendix Table B2a-4 offers additional detail). At 60 months, the percentage falls to 41 percent. The drop is not surprising because children become ineligible for WIC the month following their fifth birthday, and 77 percent (unweighted) of the 60-month study interviews took place after the child's fifth birthday. In about one-quarter of study families, another child in the family is also receiving WIC—26 percent at both 54 and 60 months.

Figure 2-5. Percentage of WIC ITFPS-2 mothers reporting they receive WIC for themselves or the study child at 48, 54, and 60 months[a]



[a] At 48 months, unweighted *n*=2,569; weighted *n*=441,056. At 54 months, unweighted *n*=2,562; weighted *n*=440,974. At 60 months, unweighted *n*=2,526; weighted *n*=440,571.

At both 54 and 60 months, chi-square analyses yield several significant associations between key sociodemographic characteristics and WIC participation by the study child or study mother. Table 2-6 presents significant findings that are evident at both 54 and 60 months. To emphasize the consistency of the relationship at both time points, the percentages are not repeated in the text.

Table 2-6. Key sociodemographic characteristics associated with WIC participation at both 54 and 60 months

Key sociodemographic characteristics	Percentage of study mothers participating with WIC	
	At 54 months % (standard error)	At 60 months % (standard error)
Ethnicity		
Hispanic or Latino	60.4 (3.0)[a]	48.2 (3.4)[b]
Not Hispanic or Latino	44.2 (2.4)[a]	33.9 (2.1)[b]
Income poverty		
75% of Federal Poverty Guidelines (FPG)	63.3 (2.3)[a,b]	50.9 (2.4)[c,d]
Above 75% but ≤ 130% of FPG	53.4 (3.0)[a,e]	40.1 (3.0)[c,f]
Above 130% of FPG	27.6 (3.0)[b,e]	21.6 (1.9)[d,f]
Mother's educational attainment		
High school or less	57.6 (2.7)[a]	46.4 (2.8)[b]
More than high school	44.9 (2.7)[a]	33.8 (2.6)[b]
Participation in non-WIC benefit programs		
Does not participate in other programs[g]	27.1 (3.5)[a,b]	19.8 (3.0)[c,d]
Participates in the Supplemental Nutrition Assistance Program (SNAP), or in SNAP and other programs[g]	60.3 (2.4)[a,e]	47.5 (2.4)[c]
Participates in other programs[g] excluding SNAP	53.2 (2.9)[b,e]	41.9 (3.3)[d]
Timing of WIC enrollment		
First trimester	58.7 (3.1)[a,b]	48.4 (3.2)[d,f]
Second trimester	54.4 (2.9)[c,e]	44.1 (3.0)[h,i]
Third trimester	42.7 (3.5)[a,e]	29.2 (3.1)[d,h]
Postnatal	38.4 (3.9)[b,c]	24.7 (2.7)[f,i]
WIC participation status at 48 months		
Receiving WIC	87.1 (1.2)[a]	66.6 (2.0)[b]
No longer receiving WIC	11.7 (1.6)[a]	11.6 (1.4)[b]
Unweighted *n*	2,562	2,526
Weighted *n*	440,974	440,571

[a,b,c,d,e,f] Given the key characteristic under analysis, pairs of matching letters (in a column) indicate a statistically significant pairwise difference in the percentages of the sociodemographic subcategory at $p \leq 0.05$.

[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,i] Given the key characteristic under analysis, pairs of matching letters (in a column) indicate a statistically significant pairwise difference in the percentages of the sociodemographic subcategory at $p \leq 0.05$.

At both interview months, Hispanic caregivers are more likely than non-Hispanic caregivers to participate in WIC. Those in lower income-poverty subgroups are more likely than those in higher income-poverty subgroups to participate in the program at both time points. Those with a high school education or less are more likely than those with more than a high school education to participate in WIC at both interview months. Those who participate in non-WIC benefit programs, including or excluding SNAP, are more likely than those who do not participate in non-WIC benefit programs to participate in WIC at both interview months. Those who enrolled in WIC in the first trimester are more likely than those who enrolled in the third trimester or postnatally to participate in

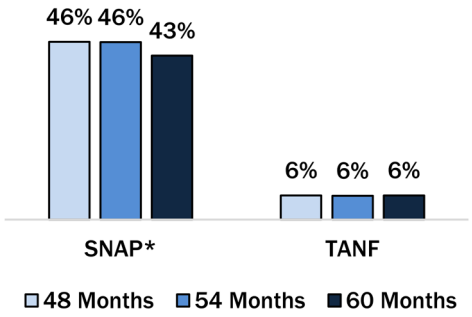
WIC at both time points. The same is true of those who enrolled in the second trimester. Caregivers who participated with WIC (either for themselves or the study child) when the study child was 48 months old are more likely than caregivers who did not participate in WIC (either for themselves or the study child) when the study child was 48 months old to participate in WIC at both 54 and 60 months.

As mentioned, families may also participate in WIC with a child other than the study child. In other words, they may participate in WIC with multiple children. The discussion of key sociodemographic characteristics associated with participation in WIC for another (non-study) child focuses on associations that are consistent across the two interview months, when the study child is 54 and 60 months old. Those who participate in other non-WIC benefit programs, including or excluding SNAP, are more likely than those who do not participate in other non-WIC benefit programs to participate in WIC with another child when the study child is 54 and 60 months old. Those for whom the study child was the firstborn child are more likely to participate at both interview months than those for whom the study child was the third or subsequently born child. Those in the lower income-poverty subgroups are more likely than those in higher income-poverty subgroups to participate. Those who were younger at the time of the study child's birth are more likely than those who were older to participate with another child when the study child is 54 and 60 months old. Those who participated in WIC with the study child when the study child was 48 months old are more likely to participate in WIC with another child when the study child is 54 and 60 months old.

2.6.2 SNAP and TANF Participation

Findings at 54 months match those obtained when the study child was 48 months old (4 years): 46 percent of WIC ITFPS-2 mothers report participating in SNAP and 6 percent report receiving TANF (Figure 2-6; Appendix Table B2a-5 offers additional detail). At 60 months, 43 percent of study mothers report participating in SNAP. The decline is statistically significant.

Figure 2-6. Percentage of WIC ITFPS-2 mothers reporting they participate in Supplemental Nutrition Assistance Program (SNAP) and Temporary Assistance for Needy Families (TANF) at 48, 54, and 60 months[a]



[a] At 48 months, unweighted *n*=2,559; weighted *n*=439,680. At 54 months, unweighted *n*=2,545; weighted *n*=437,658. At 60 months, unweighted *n*=2,503; weighted *n*=437,645.

* Percentages at 54 and 60 months within the designated category are significantly different at $p \leq 0.05$.

Chi-square analyses indicate significant associations at both 54 and 60 months between SNAP participation and several key sociodemographic characteristics, including race, marital status, food security, parity, weight status of the caregiver, income poverty, caregiver educational attainment, and WIC participation at 48 months. African American study mothers are more likely than White study mothers to report SNAP receipt at both the 54- and 60-month interviews. Unmarried study mothers are more likely than their married counterparts to report SNAP receipt at both 54 and 60 months. Those with very low household food security are more likely than those with marginal or high household food security to report receipt of SNAP at 54 and 60 months. Those for whom the study child was the third or subsequently born child are more likely than those for whom the study child was firstborn to participate in SNAP at both interview months. Caregivers who report heights and weights consistent with being obese are more likely than their overweight or normal weight counterparts to participate in SNAP at both interview months. Those in lower income-poverty subgroups are more likely than those in higher income-poverty subgroups to participate in SNAP at both time points. Those with at most a high school education are more likely than those with more than a high school education to participate in SNAP. Those who received WIC at 48 months are more likely to participate in SNAP at 54 and 60 months.

Chi-square analyses also yielded significant associations between TANF participation at both 54 and 60 months and several sociodemographic characteristics, including marital status, weight status of the caregiver, income poverty, participation in WIC at 48 months, and caregiver educational attainment. Unmarried caregivers are more likely than married caregivers to report TANF receipt at both interview months. Caregivers who report heights and weights consistent with being obese are more likely than caregivers who report heights and weights consistent with being overweight or report heights and weights consistent with being underweight or normal weight to report TANF participation at both time points. Those in the lowest income-poverty subgroup (75% of FPG or below) are more likely than those in the higher income-poverty subgroups (between 75% and 130% of FPG or above 130% of FPG) to report receipt at both interview months.

2.6.3 Household Participation in School and Summer Food Programs

At both 54 and 60 months, the interview probes whether any children in the household are participating in the NSLP, SBP, or SFSP. At both interview months, about half (50% at 54 months and 52% at 60 months) of study mothers report that children in their households participate in one or more of these programs.[42] It is not surprising that the percentages reporting participation in these programs at 54 months or at 60 months are up significantly from the percentage reporting participation in one or more of these programs at 48 months (41%), as many of the households participating in this study are income-eligible for these programs and study children may enter kindergarten around the time that they turn 5 years old.

Key sociodemographic characteristics significantly associated with participation in any of these programs at both 54 and 60 months include parity, weight status of the mother, income poverty, age of mother at the birth of the child, maternal educational attainment, timing of WIC enrollment, and WIC participation status at 48 months. Those for whom the study child was the second born or third or subsequently born are more likely than those for whom the study child was the firstborn to indicate that they have children participating in school or summer food programs at 54 and 60 months. Caregivers who report heights and weights consistent with being obese are more likely than caregivers who report heights and weights consistent with being underweight or normal weight to

[42] As with other benefit programs information, the findings are based on self-report and are not verified with administrative data.

report that they have children participating in these programs at both time points. Those in either of the two lower income-poverty subgroups (at or below 75% of FPG; between 75% and 130% of the FPG) are more likely than those in the highest income-poverty subgroup (above 130% of the FPG) to participate at both interview months. Those mothers who were older at the time of the child's birth are more likely than those who were younger to have children participating in school or summer food programs at both interview months. Caregivers with a high school education or less are more likely than those with more than a high school education to report that they have children who participate in school or summer food programs at 54 and 60 months. Those who enrolled in WIC during their first trimester are more likely than those who enrolled postnatally to have children participating in school or summer food programs at 54 and 60 months. Those mothers who reported that they or their study children received WIC benefits at 48 months are more likely than those who reported that they or their children did not receive WIC benefits at 48 months to report that they have children participating in school or summer food programs at 54 and 60 months.

2.7 Food Access

To examine food access, the current study uses the respondent's physical home address and determines whether respondents live in a food desert, an area lacking stores that carry affordable and nutritious food, at the 54- and 60-month interviews. For these analyses, food deserts are defined as low-income areas with low access to supermarkets such that residents are more than a mile from a supermarket if they live in an urban area and more than 10 miles from a supermarket if they live in a rural area (USDA, Economic Research Service, 2011). Low-income areas are those "with a poverty rate of 20 percent or greater, or a median family income at or below 80 percent of the statewide or metropolitan area median family income" (USDA, Economic Research Service, 2011).

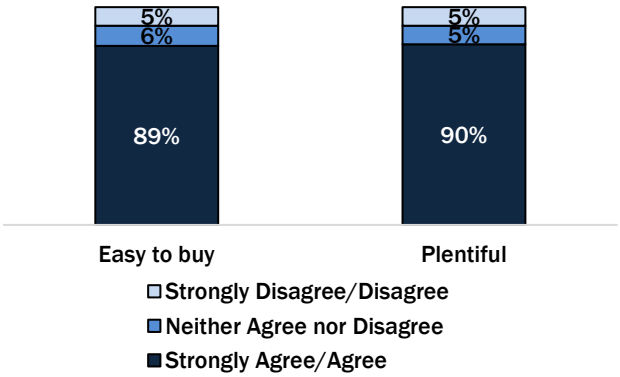
Data from the 54-month interview are used to explore caregivers' perceptions of the ability to purchase fresh fruits and vegetables, and the quantity and quality of the produce available to them. WIC ITFPS-2 caregivers are also asked about potential barriers to consuming fresh fruits and vegetables, including cost, effort required to prepare them, and dislike of fresh produce. In addition to examining associations with key sociodemographic characteristics, the bivariate analyses explore whether perceptions of access and barriers are associated with living in a food desert.

2.7.1 Households Living in a Food Desert

At the 54- and 60-month interviews, nearly one in five (19%) study mothers live in a food desert, or area with low access to supermarkets. This percentage is unchanged from the 42- and 48-month findings. None of the key sociodemographic characteristics are significantly associated with living in a food desert at both 54 and 60 months. The chi-square analyses indicate that participation in non-WIC benefit programs at 54 months is the only key sociodemographic characteristic significantly associated with whether the respondent lives in a food desert. Follow-up pairwise tests indicate that those who participate in non-WIC benefit programs including SNAP are more likely to live in a food desert than those who do not participate in other non-WIC benefit programs.

2.7.2 Availability of Fresh Fruits and Vegetables

Figure 2-7. Percentage of study mothers agreeing or disagreeing that fresh fruits and vegetables are easy to buy and plentiful in their communities at 54 months[a]

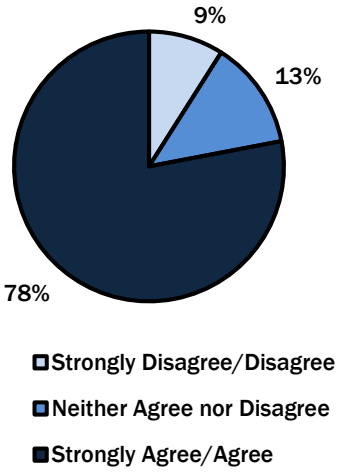


[a] Unweighted *n*=2,552; weighted *n*=439,652.

At 54 months, the majority of study mothers (89%) *strongly agree* or *agree* that it is easy to buy fresh fruits and vegetables in their community (Figure 2-7; Appendix Table B2a-6 offers additional detail), and only 5 percent *strongly disagree* or *disagree* with this statement. Similarly, 90 percent of study mothers *strongly agree* or *agree* that fruits and vegetables are plentiful in their communities, and only 5 percent of mothers *strongly disagree* or *disagree*.

Responses are somewhat more varied when study mothers are asked about the quality of the fresh fruits and vegetables available to them. Seventy-eight percent of mothers *strongly agree* or *agree* that the fresh fruits and vegetables available to them are of high quality, and 9 percent *strongly disagree* or *disagree* (Figure 2-8; Appendix Table B2a-6 offers additional detail).

Figure 2-8. Percentage of study mothers agreeing that fresh fruits and vegetables available in their communities are of high quality at 54 months[a]



[a] Unweighted *n*=2,552; weighted *n*=439,652.

Living in a food desert is not associated with study mothers' perceptions of access at 54 months, as measured by ease of purchasing fresh fruits and vegetables, whether fresh fruits and vegetables are plentiful, and whether they are of high quality. While none of the key sociodemographic characteristics are significantly associated with all three survey items assessing perceived access, several are significantly associated with perceptions of quality. Table 2-7 presents the findings for key sociodemographic characteristics that are significantly associated with perceptions of quality.

Table 2-7. Key sociodemographic characteristics associated with perceptions of quality of fresh fruits and vegetables in their communities at 54 months

Key sociodemographic characteristic	Percentage of study mothers by their level of agreement with the statement that fresh fruits and vegetables in their communities are of high quality			Unweighted *n*	Weighted *n*
	Strongly Disagree/ Disagree % (standard error)	Neither Agree nor Disagree % (standard error)	Strongly Agree/Agree % (standard error)		
Race					
African American	14.3 (2.1)[a,b]	14.4 (1.5)	71.3 (2.0)[c,d]	739	95,661
White	7.9 (0.8)[a]	12.8 (1.0)	79.3 (1.0)[c]	1,436	258,604
All Other	6.9 (1.4)[b]	12.2 (2.3)	80.9 (3.0)[d]	377	85,388
Ethnicity					
Hispanic or Latino	7.6 (0.9)[a]	11.9 (1.1)	80.5 (1.6)[b]	953	205,547
Not Hispanic or Latino	10.5 (1.2)[a]	14.0 (1.0)	75.5 (1.4)[b]	1,599	234,105
Marital status					
Married	7.5 (1.1)[a]	11.9 (1.2)	80.6 (1.5)[b]	951	172,615
Not married	10.2 (1.0)[a]	13.8 (1.0)	76.1 (1.4)[b]	1,601	267,037
Household food security					
High or marginal	8.1 (0.9)	11.5 (0.9)	80.4 (1.1)[a]	1,946	337,550
Low	11.0 (1.8)	13.8 (1.9)	75.2 (2.9)[b]	325	56,281
Very low	14.2 (2.6)	23.4 (3.6)	62.4 (4.1)[a,b]	281	45,822
Participation in non-WIC benefit programs					
Does not participate in other programs[e]	8.0 (1.4)	13.9 (2.3)	78.2 (3.1)	467	80,200
Participates in the Supplemental Nutrition Assistance Program (SNAP), or in SNAP and other programs[e]	11.3 (1.2)[a]	11.4 (1.0)	77.3 (1.4)	1,186	204,439
Participates in other programs[e] excluding SNAP	6.9 (1.2)[a]	14.7 (1.1)	78.4 (1.5)	899	155,013
Age of mother at study child's birth					
16-19 years	7.1 (2.3)	12.8 (3.1)	80.1 (3.9)	262	49,722
20-25 years	12.0 (1.3)[a]	15.1 (1.5)	72.9 (1.7)[b]	1,045	176,534
26 years or older	7.2 (0.7)[a]	11.4 (1.0)	81.4 (1.3)[b]	1,245	213,396

[a,b,c,d] Given the key characteristic and interview month, pairs of matching letters (in a column) indicate a statistically significant pairwise difference between sociodemographic categories at $p \leq 0.05$.

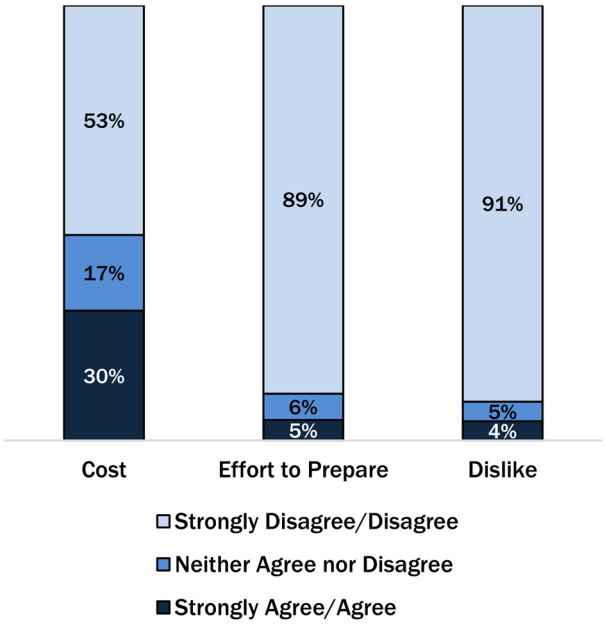
[e] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

Note: Unweighted *n*=2,552; weighted *n*=439,652.

2.7.3 Perceived Barriers to Consuming Fresh Fruits and Vegetables

During the 54-month interview, study mothers are asked about the extent to which they agree that cost, effort involved in preparation, or dislike of fresh produce makes it more difficult to eat fresh fruits and vegetables (Figure 2-9; Appendix Table B2a-7 offers additional detail). Effort involved in preparing fresh fruits and vegetables and dislike for them do not emerge as particularly strong barriers to consumption. Nearly one-third (30%) of study mothers, however, *strongly agree* or *agree* that cost is a barrier to consuming fresh fruits and vegetables.

Figure 2-9. Percentage of study mothers agreeing or disagreeing with select barriers to consumption of fresh fruits and vegetables at 54 months[a]



[a] Unweighted *n*=2,560; weighted *n*=439,954.

There are several key sociodemographic variables significantly associated with cost as a barrier to fresh fruit and vegetable consumption. Table 2-8 presents the findings for significantly associated key sociodemographic characteristics. Though a majority (59%) of those reporting high household food security *strongly disagree* or *disagree* with the statement that fresh fruits and vegetables in their communities cost too much, about 25 percent of those in this subgroup *strongly agree* or *agree* with the statement.

Table 2-8. Key sociodemographic characteristics associated with perceptions that fresh fruits and vegetables in their communities cost too much at 54 months

Key sociodemographic characteristic	Percentage of study mothers by their level of agreement with the statement that fresh fruits and vegetables in their communities cost too much			Unweighted *n*	Weighted *n*
	Strongly Disagree/Disagree % (standard error)	Neither Agree nor Disagree % (standard error)	Strongly Agree/Agree % (standard error)		
Race					
African American	57.8 (2.4)[a]	13.5 (1.0)[b]	28.7 (2.3)	742	96,014
White	50.0 (1.3)[a]	18.7 (1.2)[b]	31.3 (1.7)	1,442	258,752
All Other	55.6 (3.2)	17.6 (1.9)	26.7 (2.8)	376	85,188
Household food security					
High or marginal	58.5 (1.2)[a,b]	16.6 (0.9)	24.9 (1.2)[c,d]	1,950	337,219
Low	37.3 (3.1)[a]	20.3 (3.1)	42.4 (3.2)[c]	328	56,804
Very low	29.4 (4.2)[b]	19.5 (3.0)	51.1 (4.5)[d]	282	45,932
Parity					
Firstborn	54.5 (1.8)	18.4 (0.9)	27.2 (1.6)[a]	1,066	187,360
Second born	54.4 (2.3)	17.8 (1.9)	27.8 (2.2)[b]	701	117,245
Third or subsequent born	49.0 (1.7)	15.6 (1.3)	35.4 (1.6)[a,b]	793	135,350
Self-reported weight status of mother at 42 months					
Normal or underweight	56.8 (1.9)[a]	16.6 (1.8)	26.6 (2.2)[c]	810	138,363
Overweight	55.9 (1.8)[b]	18.0 (1.7)	26.1 (1.8)[d]	776	138,167
Obese	46.8 (2.1)[a,b]	17.5 (1.7)	35.7 (2.3)[c,d]	974	163,425
Mother's educational attainment					
High school or less	56.2 (2.0)[a]	17.2 (1.2)	26.6 (1.4)[b]	1,366	236,357
More than high school	48.8 (1.8)[a]	17.6 (1.3)	33.6 (1.7)[b]	1,194	203,597

[a,b,c,d] Given the key characteristic and interview month, pairs of matching letters (in a column) indicate a statistically significant pairwise difference within the sociodemographic category at $p \leq 0.05$.

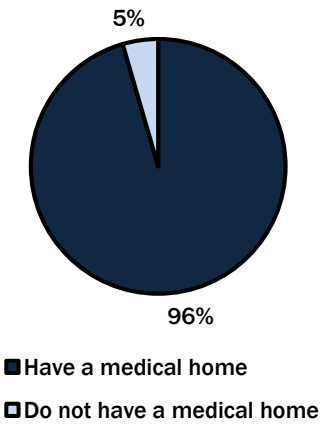
2.8 Medical Care

An important benefit of WIC is providing participants with referrals to other services, including medical care (USDA, Food and Nutrition Service, 2013). To better understand study children's access to medical care, at 54 months, WIC ITFPS-2 asks whether study children have a medical home for regular care and whether anyone in the household receives Medicaid.

2.8.1 Medical Home at 54 Months

At 54 months, nearly all study mothers (96%) reported that their children have a medical home, defined by caregiver report that the child has a doctor's office, health clinic, or other medical facility that they visit for routine physical examinations or well-child checkups (Figure 2-10; Appendix Table B2a-8 offers additional detail). These findings are largely unchanged from findings when the study child was 36 months or 48 months old—92 percent and 95 percent, respectively.

Figure 2-10. Percentage of study children who have a medical home at 54 months[a]



[a] Unweighted *n*=2,563; weighted *n*=441,244.

Note: Percentages may not sum to 100 because of rounding.

Income poverty, mother's educational attainment, and participation in WIC at 48 months are significantly associated with having a medical home. Though the difference is relatively small, those in the middle income-poverty subgroup (between 75% and 130% of FPG) are more likely (97%) than those in the lowest income-poverty subgroup (at or below 75% of FPG, 94%) to report that their child has a medical home. Caregivers with more than a high school education are more likely (97%) than those with at most a high school education (94%) to report that their child has a medical home. Those who did not participate with WIC at 48 months are more likely (97%) than those who did participate with WIC at 48 months (94%) to report that their child has a medical home. In addition to examining the data by differences among key sociodemographic subgroups, the analyses also examined whether the child had a medical home by WIC participation status at 54 months. Chi-square test results did not indicate a significant association between WIC participation status at 54 months and the child having a medical home.

2.8.2 Household Medicaid Participation

At 54 and 60 months, study mothers are asked whether anyone in the household is participating in Medicaid. At 54 months, 73 percent of households include someone who is receiving Medicaid; at 60 months, 72 percent of households include someone who is receiving Medicaid. These findings

were similar to those from previous reports which found that the percentage varied between 73 and 76 percent at ages 30, 36, 42, and 48 months.

There are several key sociodemographic characteristics associated with household Medicaid participation at both the 54- and 60-month interviews. These include ethnicity, marital status, parity, self-reported maternal weight status, income poverty, maternal educational attainment, timing of WIC enrollment, and WIC participation status at 48 months. At both interview months, Hispanic caregivers are more likely than non-Hispanic caregivers to report that someone in the household is participating in Medicaid. Unmarried caregivers are more likely than married caregivers to report that someone in the household is participating in Medicaid. Caregivers for whom the study child was the third or subsequently born child are more likely than caregivers for whom the study child was the firstborn child to report Medicaid participation at both interview months. At both interview months, caregivers who report heights and weights consistent with being obese are more likely than caregivers who report heights and weights consistent with being underweight or normal weight to report Medicaid participation. Those in lower income-poverty subgroups are more likely than households in higher income-poverty subgroups to report Medicaid participation. Caregivers with at most a high school education are more likely than caregivers with more than a high school education to report Medicaid participation. Those who enrolled in WIC during their first trimester are more likely than those who enrolled in their third trimester or enrolled postnatally to report Medicaid participation. Those who enrolled in WIC in their second trimester are more likely than those who enrolled in their third trimester or enrolled postnatally to report Medicaid participation. Finally, those who reported participating in WIC at 48 months are more likely to report Medicaid participation at both the 54- and 60-month interviews than those not participating in WIC at 48 months.

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

Key Findings:

On a given day at 60 months:

- Almost all study children are consuming breakfast, lunch, and dinner, and nearly 90 percent are consuming at least one snack.
- Most (88%) study children consume fruit including 100 percent fruit juice; 73 percent consume fruit (excluding 100% fruit juice); and 62 percent consume 100 percent fruit juice. The change between 48 and 60 months in the percentage of children consuming 100 percent fruit juice, 65 percent and 62 percent, respectively, is statistically significant.
- About two-thirds (67%) of study children consume a vegetable, including 100 percent vegetable juice, which is a statistically significant change from 64 percent at 48 months.
- Eighty-two percent of study children consume cow's milk, which is similar to findings from National Health and Nutrition Examination Survey (NHANES) data indicating that 84 percent of children between the ages of 4 and 5 years drink milk.
- Almost all (99%) study children consume a grain; however, less than half (44%) consume any whole grains, but those who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) at 48 months are more likely (46%) than those who did not participate at 48 months (41%) to consume whole grains on a given day at 60 months.
- Most (84%) children consume some type of dessert, candy, sugar-sweetened beverage (SSB), or other sweets.
- Multivariable logistic regression analysis of added sugars intake indicates that introduction of sugar-sweetened beverages in the first year of the study child's life and the number of snacking occasions at child age 60 months are independently and inversely associated with the likelihood of meeting the Dietary Guidelines for Americans (DGA) recommendation for added sugars intake, after controlling for total energy intake. Further, compared to families that did not participate in WIC or the Supplemental Nutrition Assistance Program (SNAP), participation in WIC but not SNAP during the study child's fifth year independently increases the likelihood of meeting the DGA recommendation related to limiting added sugar intake.

With regard to diet quality:

- Study children's average total score on the Healthy Eating Index-2015 (HEI-2015) is 59.1 out of 100. This score is similar to the mean score (60.1) from a nationally representative sample of children ages 2 to 5 years, but still indicates a need for improvement.
- At 60 months, just over half (53%) of study children meet the DGA recommendation to consume less than 10 percent of calories from added sugars.

3.1 Overview

Using dietary intake data collected from study children at age 60 months (i.e., 5 years), this chapter focuses on food intake and meal and snack patterns. Where applicable, data from study children at

age 48 months (i.e., 4 years) are included to provide context. Research questions addressed in this chapter include the following:

- What are the meal and snack patterns of study children, both overall and by subgroups of interest?
- What is the food and nutrient intake of 5-year-olds, both overall and by subgroups of interest?
- When do "unhealthy" eating habits typically begin, and are there early warning signs that a change is occurring?
- Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to feeding practices, meal/snack patterns, food and nutrient intakes, and health status at age 5 years?

3.2 Background

As discussed in the *Fourth Year Report*, 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). Research indicates that household income and participation in Federal feeding programs are associated with improved consumption of fruits and vegetables (Condon et al., 2015; Weinfield et al., 2020). Associations with participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and other benefit programs are explored in this chapter.

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 by the end of the period (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); therefore, they are an important contributor to children's intakes.

The 2015-2020 Dietary Guidelines for Americans (DGA) recommends limiting intake of added sugars to no more than 10 percent of total daily calories; however, nearly two-thirds of children exceed this recommendation during the fifth year of life (Wang, Guglielmo, & Welsh, 2018). 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 44 percent of children ages 2 to 5 years in the United States consume SSBs on a given day (Lott, Callahan, Duffy, Story, & Daniels, 2019).

SSB intake has been associated with increased weight gain in young children (Luger et al., 2017) and in metabolic syndrome and cardiovascular disease in older children and adults (Rodríguez, Madsen, Cotterman, & Lustig, 2016; Yang et al., 2014). Because of the adverse health effects related to SSB intake, and because SSBs are a top contributor of added sugar in children's diets (Reedy & Krebs-Smith, 2010), this chapter examines factors associated with consumption of added sugars, including the timing of the introduction of SSBs, when children are 60 months old.

Excessive sodium intake is also a concern among children. The 2015-2020 DGA recommends reducing the intake of sodium (U.S. Department of Health and Human Services [HHS] & U.S. Department of Agriculture [USDA], 2015), and in 2019 the National Academies of Sciences, Engineering, and Medicine set a new sodium target (referred to as chronic disease risk reduction or CDRR) to reduce risk of hypertension and cardiovascular disease. For children ages 4 to 8 years, the new 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. An analysis of children receiving WIC from the 2011-2014 NHANES found that average intakes of sodium exceeded the CDRR recommendations (Zimmer, Rubio, Kintziger, & Barroso, 2019).

Assessing alignment with the 2015-2020 DGA,[43] total Healthy Eating Index-2015 (HEI-2015) scores provide a comprehensive measure of diet quality beyond assessing individual food groups or nutrients (Thomson, Tussing-Humphreys, Goodman, & Landry, 2019). In the United States, mean total HEI-2015 scores for children ages 2 to 5 years have improved over time from 49.4 in the 1999-2000 NHANES cycle to 54.4 in the 2007-2008 cycle to 55.0 in the 2015-2016 cycle (Liu, Rehm, Onopa, & Mozaffarian, 2020). A similar trend was seen in children participating in WIC, with

[43] The 2020-2025 DGA was released after this report was in production. The 2015-2020 DGA was in effect during the time of data collection for this report.

a significant linear increase in total HEI-2015 scores across the NHANES cycles (47.2 in 1999-2000, 49.7 in 2007-2008, and 51.3 in 2015-2016) (Liu et al., 2020).

3.3 Sample and Analysis Approach

3.3.1 Sample

The analyses in this chapter primarily use 24-hour dietary recall information from the 48- and 60-month interviews; however, other survey information is used where applicable. Both the core and supplemental samples of the WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) were eligible for these 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 are weighted so that findings reflect the study-eligible WIC population as described in Chapter 1.

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

Sample structure	48-month interview		60-month interview	
	Survey interview	Dietary recall	Survey interview	Dietary recall
Core prenatal sample	1,787	1,781	1,766	1,742
Core postnatal sample	235	234	223	220
Supplemental prenatal sample	445	443	437	434
Supplemental postnatal sample	105	104	103	102
Total	2,572	2,562	2,529	2,498

3.3.2 Analysis

Analyses in this chapter examine eating occasions (i.e., breakfast, lunch, dinner, snack) to describe meal and snack patterns and consumption of specific food groups. Because one of the original goals of WIC ITFPS-2 was to enable comparisons to previous studies, particularly the Feeding Infants and Toddlers Study (FITS), this report uses the same food group classifications as 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 are based on the Continuing Survey of Food Intakes by Individuals and may not always be an exact match to the food groups described in other sources such as the DGA and the USDA Food Pattern Equivalents Database. Appendix B3 offers additional information on dietary coding procedures.

In addition to exploring meal and snack patterns and consumption of select food groups, this chapter explores diet quality using HEI-2015 scores. 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. HEI-2015 assesses dietary alignment with the 2015-2020 DGA, accounting for total calorie intake. HEI-2015 total scores assess total diet quality and range from 0 to 100, with higher scores indicating better alignment with the 2015-2020 DGA (Krebs-Smith et al., 2018). HEI-2015 component scores assess how well the child's intake meets the specific recommendations within the Healthy U.S.-Style Dietary Pattern provided by the 2015-2020 DGA. 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 WIC supplemental food package is an important source of dietary energy for many study families. Accordingly, this chapter also investigates participants' consumption of foods in the WIC food package using data from the telephone survey (i.e., not the dietary recall data). This complementary investigation provides broader contextual information on food consumed by study families.

Dietary Data. In WIC ITFPS-2, all postbirth interviews through 24 months, as well as the interviews at 36, 48, 60, and 72 months, include 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 guides the caregiver through the prior day's intake, and asks 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 collects 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 are 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 conducts second recalls on a 10-percent subset of the study sample and uses those replicate recalls to estimate usual intake, but the proxy intakes themselves may still be subject to reporting error.

National Cancer Institute Methods. Analyses of meal and snack patterns and food group intakes use 1 day of dietary recall information, while diet quality analyses incorporate both days of recall information. 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 are used to generate estimates of children's usual intakes using methods offered by the NCI.

NCI recommends different methods for estimating usual dietary intake, depending on the type of dietary component under analysis.[44] In this chapter, estimates of usual intake underlying HEI-2015 scores rely on NCI's multivariate Markov Chain Monte Carlo (MCMC) method. NCI's MCMC method is the preferred approach for estimating HEI because it accounts for the correlations between dietary components and total dietary energy.[45] In the MCMC model, all usual intake estimates are adjusted for the 12 key sociodemographic characteristics described in Section 1.8.2. Throughout this chapter, the population ratio method (i.e., the ratio of the means) is used to generate HEI-2015 mean scores.

Bivariate Analyses. Analyses explore key sociodemographic characteristics associated with patterns of intake and foods consumed from the WIC food package. Section 1.8.2 presents the 12 key sociodemographic characteristics used. Nonmodifiable key sociodemographic characteristics are measured at the time of the first interview, and only refreshed if the caregiver changes. For key characteristics that may change over time, such as household food security, income relative to Federal Poverty Guidelines (FPG), or WIC participation status, analyses use values reported at the 48-month interview.[46]

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

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

[46] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

Specific analyses in this chapter include chi-square tests to examine whether outcomes of interest are associated with key sociodemographic characteristics. If a significant association is found, typically, two-tailed t-tests are used to determine which pairwise subgroup differences are statistically significant. Subgroup differences discussed in the chapter are limited to those that form a pattern over time or across items, and are large in magnitude. The latter criteria are applied in order to avoid focusing on findings that, while statistically significant, may have little practical importance.[47] 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 analyses isolate the unique association between a model variable and an outcome while holding the influence of other variables constant. In this chapter, multivariable linear regression is used to explore factors associated with the likelihood of meeting the DGA recommendation for consumption of added sugars on a given day at 60 months.[48] In this regression model, the role of participation in Federal feeding programs is examined. The model incorporates WIC participation at 54 months, instead of participation at 48 or 60 months, because the effect of program participation during the child's fifth year was of interest, and at the time of their 60-month interview, some study children were too old to be eligible for WIC.

3.4 Meal and Snack Patterns on a Given Day at 60 Months

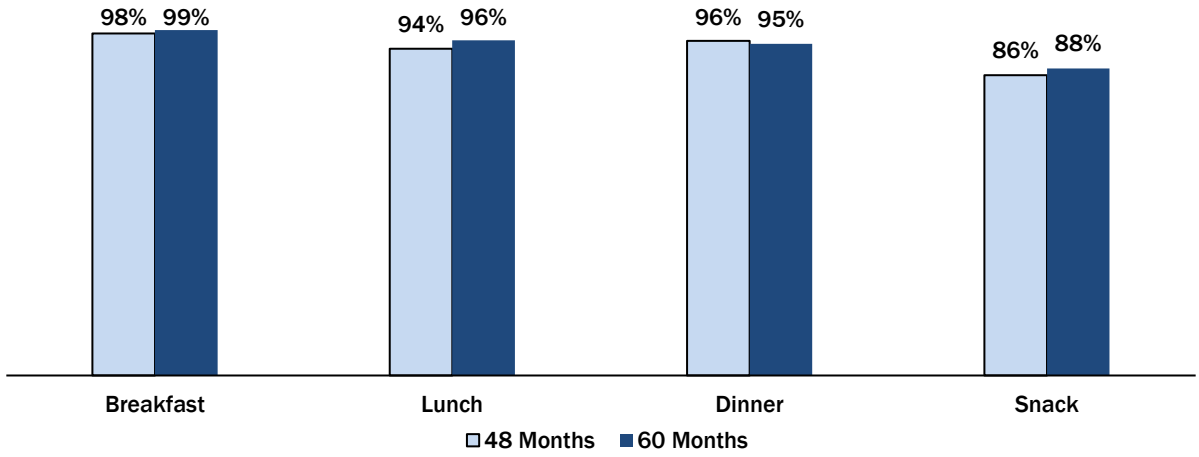
As a part of the AMPM protocol, WIC ITFPS-2 caregivers identify each eating occasion when completing their child's 24-hour dietary recall. Eating occasions include meals (e.g., breakfast, lunch, and dinner) as well as events in between meals (e.g., snacks). At 60 months, almost all children are eating breakfast (99%), lunch (96%), and dinner (95%) on a given day (Figure 3-1; Appendix Table B2b-1 offers additional detail). The percentage of children who consume foods and/or beverages for at least one snack occasion did not change significantly between 48 and 60 months. Eighty-six percent of study children had at least one snack on a given day at 48 months, and 88 percent had at least one snack at 60 months. Among children who consume at least 1 snack on a typical day, the

[47] 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.

[48] Data are weighted in all regression analyses.

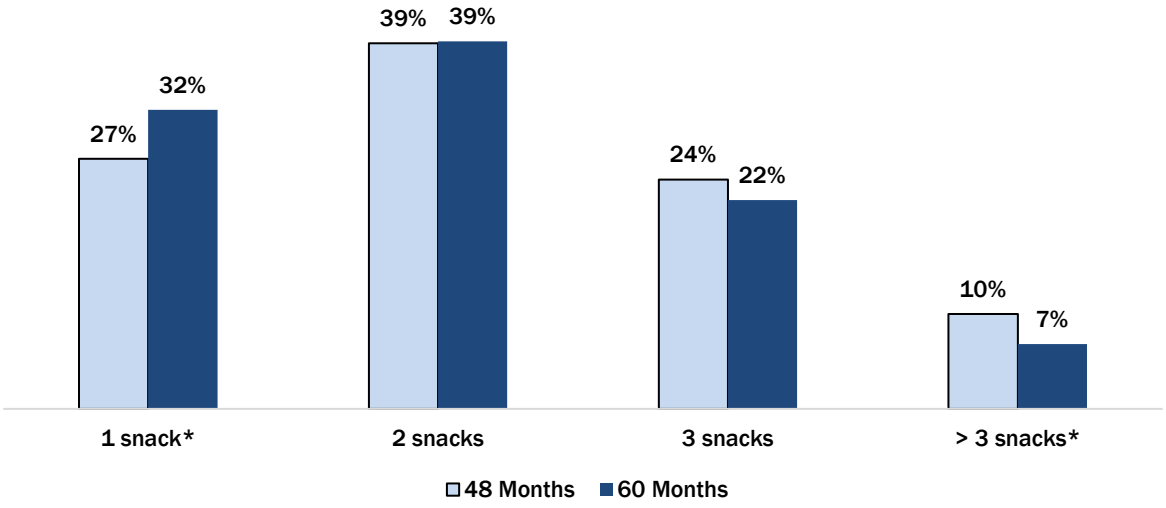
average number of daily snacks reported at 60 months is 2.1 snacks, which is significantly different from the mean number of daily snacks at 48 months (2.2). Among those consuming snacks, the distribution of the number of snacks consumed changes (Figure 3-2), with smaller percentages of study children consuming more than three snacks a day at 60 months (7%) compared to 48 months (10%), and larger percentages of study children consuming less than two snacks a day at 60 months (32%) compared to 48 months (27%).

Figure 3-1. Percentage of study children consuming foods/beverages by eating occasion on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,561; weighted *n*=439,572. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

Figure 3-2. Among study children consuming at least one snack, the distribution of the number of snacks consumed at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,212; weighted *n*=377,570. At 60 months, unweighted *n*=2,192; weighted *n*=382,822.

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

3.5 Food and Beverage Intake on a Given Day at 60 Months

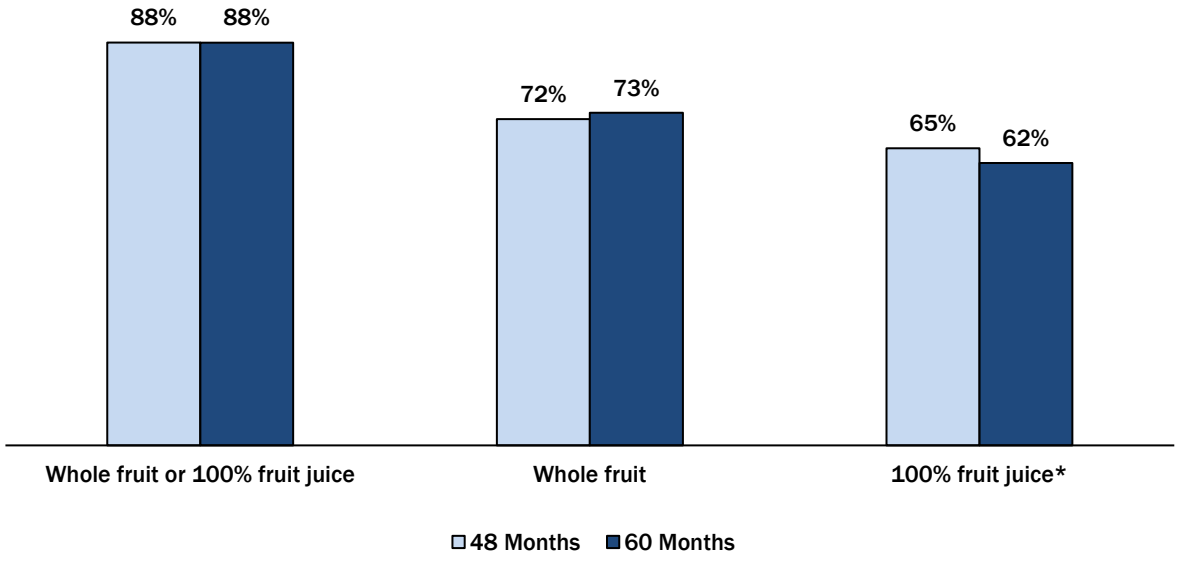
Knowing which foods and beverages children typically consume can inform recommendations for dietary improvements. Furthermore, this information can be leveraged to evaluate associations between diet and health outcomes. The following sections report the kinds of foods and beverages consumed on a given day by the WIC ITFPS-2 children at 60 months. The quantity of different foods and beverages is not reported in this section but is discussed in the context of diet quality in Section 3.6. So, for example, when reporting the top foods consumed, we examine the prevalence of consumption, not the quantity. The foods and food groups addressed in this chapter include fruits, vegetables, milk and other dairy, meats and other proteins, grains, desserts, and salty snacks. SSB consumption is also included. This section reports whether the food groups or foods are consumed on a given day, as well as caregivers' reports of food consumed from the WIC food package.

3.5.1 Fruit Consumption

The percentage of WIC ITFPS-2 children consuming any fruit[49] or 100 percent fruit juice on a given day is unchanged between 48 and 60 months (Figure 3-3; Appendix Table B2b-2 offers additional detail). However, the percentage of study children consuming 100 percent fruit juice at 60 months is significantly different from the percentage at 48 months, decreasing from 65 percent at 48 months to 62 percent at 60 months. Nonetheless, estimated consumption among study children is higher than other national estimates. According to 2011-2014 NHANES data, 49 percent of U.S. children ages 4 to 5 years consume 100 percent fruit juice on a given day (Lott et al., 2019).

For simplicity, we refer to any fruit excluding 100 percent fruit juice as whole fruit. The most common form of whole fruit children consume at 60 months is fresh or frozen fruit (67%), followed by canned fruit (13%).

Figure 3-3. Percentage of study children consuming fruit on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,562; weighted *n*=439,736. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

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

In bivariate analyses, key sociodemographic characteristics significantly associated with consumption of whole fruit or 100 percent fruit juice at 60 months include ethnicity, parity, age of the mother at

[49] Any fruit refers to all forms of fruit: raw, canned, or frozen.

the child's birth, non-WIC benefit program participation, and WIC participation status at 48 months. As compared to children with non-Hispanic caregivers, children with Hispanic caregivers are more likely to report consuming whole fruit or 100 percent fruit juice on a given day (92% vs. 85%). This finding is driven by significant differences in children's consumption of both whole fruit and 100 percent fruit juice. Children with mothers who were 26 years of age or older at the time of the study child's birth are more likely (91%) than those with mothers who were between 20 and 25 years of age at the time of the study child's birth (86%) to consume whole fruit or 100 percent fruit juice. This finding is driven by a significant difference in children's consumption of whole fruit. Children in families that participate in other non-WIC benefit programs excluding the Supplemental Nutrition Assistance Program (SNAP) are more likely (92%) than those in families that participate in other programs including SNAP (87%) or those who do not participate in other non-WIC benefit programs to consume whole fruit or 100 percent fruit juice (87%). This finding is driven by a significant differerence in children's consumption of whole fruit, not consumption of 100 percent fruit juice. Additionally, those who received WIC at 48 months are more likely (91%) to consume whole fruit or 100 percent fruit juice on a given day than those who did not receive WIC at 48 months (86%). This latter finding is driven by a significant difference in the consumption of 100 percent fruit juice.

Consumption of whole fruit (i.e., any fruit excluding 100% juice) is assocatied with race, ethnicity, caregiver's marital status, parity, age of caregiver at the child's birth, the caregiver's educational attainment, and participation in non-WIC benefit programs. Children with caregivers of Other races (81%) are more likely than children with White (72%) or African American (69%) caregivers to consume whole fruit. As alluded to above, children with Hispanic caregivers are more likely (77%) than children with non-Hispanic caregivers (70%) to consume whole fruit. Children with married caregivers are more likely (78%) than children with unmarried caregivers (70%) to consume whole fruit. Study children who are born third or subsequently in their families are more likely (78%) than those born first (70%) to consume whole fruit. As mentioned earlier, children with caregivers who were 26 years or older when the child was born are more likley (77%) than children with caregivers who were between 20 and 25 years of age at the child's birth (68%) to consume whole fruit. Children with caregivers who have more than a high school education are more likely (76%) than children with caregivers that have at most a high school education (71%) to consume whole fruit. Also alluded to above, children in families that participate in non-WIC benefit programs excluding

SNAP are more likely (78%) than children who participate in non-WIC benefit programs including SNAP (69%) to consume whole fruit.

The top five most commonly consumed whole fruits on a given day at 48 and 60 months are shown in Table 3-2. The top five fruits remain the same across the two interviews, and the distribution only slightly changes.

Table 3-2. Top five whole fruits consumed by study children on a given day at 48 and 60 months

Top five whole fruits	Percentage of study children who consumed the fruit on a given day
48 months	
Apple	27.3
Banana	27.1
Grapes	13.1
Orange	11.6
Strawberries	10.4
Unweighted *n*	2,562
Weighted *n*	439,736
60 months	
Banana	27.4
Apple	26.0
Grapes	12.9
Orange	12.4
Strawberries	10.8
Unweighted *n*	2,496
Weighted *n*	436,443

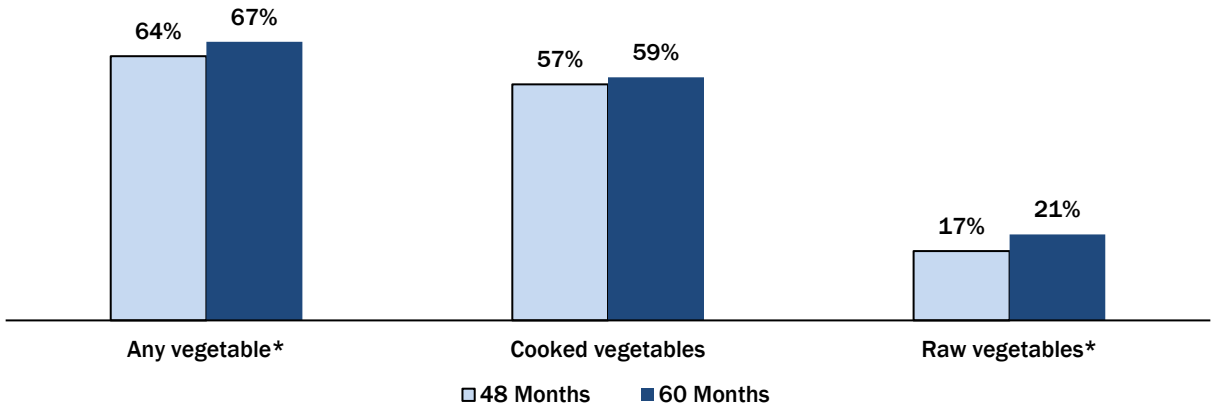
Note: 100 percent fruit juice is excluded from this table.

3.5.2 Vegetable Consumption

The percentage of WIC ITFPS-2 children consuming any type of vegetable, including 100 percent vegetable juice,[50] rises from 64 percent at 48 months to 67 percent at 60 months. The statistically significant change is driven by a statistically significant change in percentage of study children consuming raw vegetables: 17 percent at 48 months and 21 percent at 60 months (Figure 3-4; Appendix Table B2b-2 offers additional detail).

[50] One hundred percent vegetable juice, when reported, is grouped with cooked vegetables.

Figure 3-4. Percentage of study children consuming vegetables on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,562; weighted *n*=439,736. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

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

Note: Any vegetable includes cooked vegetables and raw vegetables. One hundred percent vegetable juice, when reported, is coded as a cooked vegetable.

Several different vegetable subgroups are examined, including dark-green vegetables, deep-yellow or orange vegetables, white potatoes (nonfried), French fries or other fried potatoes, other starchy vegetables, and other vegetables.[51] Comparing the 48- and 60-month findings reveals that consumption of most vegetable subgroups across the two time points is within 2 percentage points (Table 3-3). On a given day at 60 months, only about 13 percent of study children consume dark-green vegetables, and a similar percentage consume deep-yellow or orange vegetables. As at 48 months, at 60 months the highest percentage of study children (39%) consume at least one vegetable from the other vegetables category, which includes both green beans and tomatoes that may be consumed as sauce.

[51] The vegetable subgroups were constructed to match the FITS 2008 study and do not match the vegetable subgroups used in the DGA. Examples of dark-green vegetables include broccoli, spinach, other greens, and romaine lettuce; examples of deep-yellow or orange vegetables include carrots, pumpkin, sweet potatoes, and winter squash; examples of starchy vegetables include corn, green peas, immature lima beans, black-eyed peas (not dried), cassava, and rutabaga; and examples of other reported vegetables include artichoke, asparagus, beets, Brussels sprouts, cabbage, cauliflower, celery, cucumber, eggplant, green beans, lettuce, mushrooms, okra, onion, pea pods, peppers, tomatoes/tomato sauce, wax/yellow beans, and zucchini/summer squash.

Table 3-3. Percentage of study children consuming different vegetable subgroups on a given day at 48 and 60 months

Vegetable subgroup	Interview month	
	48 months	60 months
French fries or other fried potatoes	18.4	17.3
White potatoes[a]	13.5	13.2
Dark-green vegetables[b]	12.2	13.3
Deep-yellow or orange vegetables[c]	12.4	12.7
Other starchy vegetables[d]	13.9	13.0
Other vegetables[e]	35.0	38.8
Unweighted *n*	2,562	2,496
Weighted *n*	439,736	436,443

[a] White potatoes include mashed potatoes.

[b] Examples of reported dark-green vegetables include broccoli, spinach, other greens, and romaine lettuce.

[c] Examples of reported deep-yellow or orange vegetables include carrots, pumpkin, sweet potatoes, and winter squash.

[d] Examples of reported starchy vegetables include corn, green peas, immature lima beans, black-eyed peas (not dried), cassava, and rutabaga.

[e] Examples of other reported vegetables include artichoke, asparagus, beets, Brussels sprouts, cabbage, cauliflower, celery, cucumber, eggplant, green beans, lettuce, mushrooms, okra, onion, pea pods, peppers, tomatoes/tomato sauce, wax/yellow beans, and zucchini/summer squash.

At 60 months, ethnicity is the only key sociodemographic characteristic associated with consumption of vegetables (including 100% vegetable juice) in bivariate analyses. Children with non-Hispanic caregivers are significantly more likely (72%) to eat any vegetable on a given day than children with Hispanic caregivers (62%). The sources of this difference are the consumption of white potatoes, French fries and other fried potatoes, other starchy vegetables, and other vegetables. Children with non-Hispanic caregivers are more likely than children with Hispanic caregivers to consume vegetables within each of these three food groups.

The top five vegetables consumed on a given day are the same between 48 and 60 months (Table 3-4). At both interview months, the top two vegetables are tomatoes, including those cooked in sauces, and French fries or other fried potatoes.

Table 3-4. Top five vegetables consumed by study children on a given day at 48 and 60 months

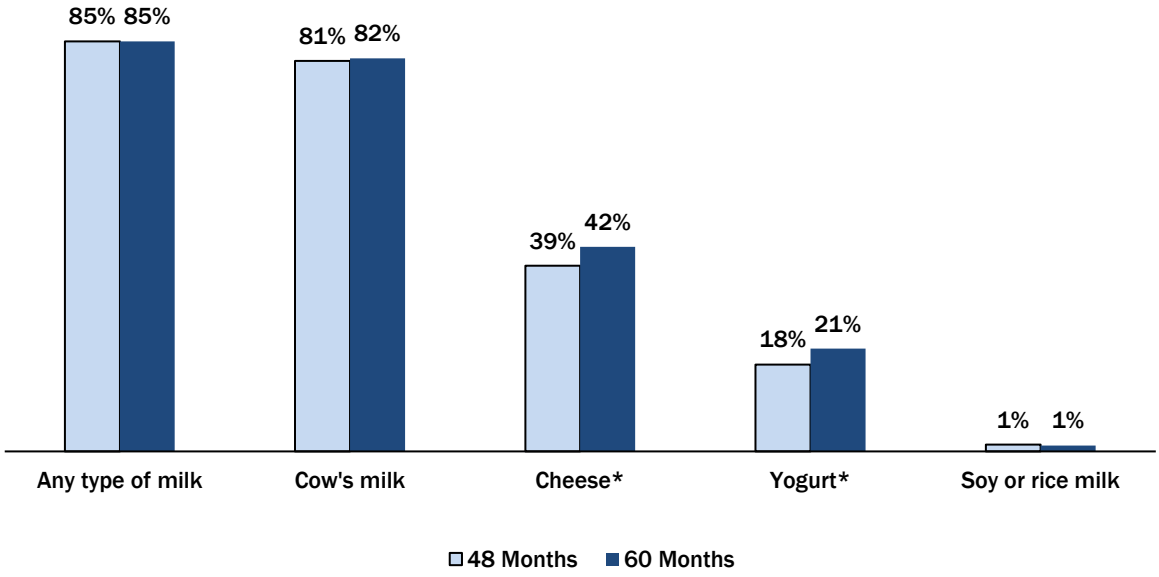
Top five vegetables	Percentage of study children who consumed the vegetable on a given day
48 months	
Tomatoes	18.9
French fries or other fried potatoes	18.4
Carrots	9.7
Broccoli	9.7
Mashed potatoes	9.0
Unweighted *n*	2,562
Weighted *n*	439,736
60 months	
Tomatoes	21.2
French fries or other fried potatoes	17.3
Carrots	9.8
Broccoli	9.8
Mashed potatoes	8.7
Unweighted *n*	2,496
Weighted *n*	436,443

3.5.3 Dairy, Meats, and Other Protein Consumption

The percentage of WIC ITFPS-2 children consuming dairy products on a given day at 48 and 60 months remains steady (Figure 3-5; Appendix Table B2b-2 offers additional detail). At both interviews, cow's milk is consumed by most of the children (81% at 48 months and 82% at 60 months). Though the definition of milk differs somewhat from the one used in this study, recent research using 2011-2014 NHANES data indicates that 84 percent of U.S. children ages 4 to 5 years consume milk (Lott et al., 2019).[52] The percentages of study children consuming cheese on a given day are significantly different between interview months, increasing from 39 percent at 48 months to 42 percent at 60 months. The percentage of study children consuming yogurt is also significantly different, rising from 18 percent at 48 months to 21 percent at 60 months. At both 48 and 60 months, very small percentages of the study children consume nondairy milks such as a soy-based or rice beverage.

[52] The definition of milk used by Lott et al. (2019) includes plain milk, flavored milk, milk substitutes, milkshakes, and other dairy drinks. WIC ITFPS-2 analyses do not include milk substitutes in its definition of milk.

Figure 3-5. Percentage of study children consuming dairy or milk substitutes on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,562; weighted *n*=439,736. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

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

Analysis of the types of cow's milk WIC ITFPS-2 children are consuming on a given day at 60 months indicates that 28 percent are consuming whole milk, 30 percent are consuming reduced-fat milk (2% milk fat), and 26 percent are consuming low-fat milk (1% milk fat) on a given day. An estimated 2 percent are consuming skim (nonfat) milk on a given day. Comparing these 60-month findings to those from 48 months indicates there is a significant difference in children's consumption of reduced-fat milk, with consumption rising 4 percentage points from 26 percent at 48 months to 30 percent at 60 months. The other differences between the 48-month and 60-month percentages of children consuming different types of cow's milk are not statistically significant.

Aligning with the DGA recommendation (HHS et al., 2015), the content of the children's food package for WIC after age 2 years typically provides milk with lower fat content.[53] Consumption of low-fat (1%) milk on a given day is associated with most of the key sociodemographic characteristics used in this study: race, ethnicity, marital status, parity, income poverty, caregiver educational attainment, age of the mother at the child's birth, non-WIC program participation, timing of WIC enrollment, and WIC participation status at 48 months. Table 3-5 presents the findings.

[53] Special Supplemental Nutrition Program for Women, Infants, and Children: Supplemental Foods. 79 C.F.R. § 246.10 (2014), https://www.ecfr.gov/current/title-7/subtitle-B/chapter-II/subchapter-A/part-246#246.10.

Table 3-5. Key sociodemographic characteristics associated with study children's consumption of low-fat (1%) milk on a given day at 60 months

Key sociodemographic characteristics	Percentage of study children who drink low-fat milk % (standard error)
Race	
African American	20.3 (1.9)[a]
White	25.6 (1.6)
All Other	32.4 (4.1)[a]
Ethnicity	
Hispanic or Latino	32.1 (2.2)[a]
Not Hispanic or Latino	20.3 (1.3)[a]
Marital status	
Married	29.2 (2.3)[a]
Not married	23.6 (1.4)[a]
Parity	
Firstborn	22.3 (1.7)[a]
Second born	28.4 (2.5)
Third or subsequent born	28.3 (2.4)[a]
Income poverty	
75% of Federal Poverty Guidelines (FPG) or below	27.3 (2.0)[a]
Above 75% but ≤ 130% of FPG	29.1 (2.2)[b]
Above 130% of FPG	18.3 (2.0)[a,b]
Age of the mother at the study child's birth	
16-19 years	21.9 (2.9)
20-25 years	23.1 (2.1)[a]
26 years or older	28.9 (2.0)[a]
Mother's educational attainment	
High school or less	29.7 (2.1)[a]
More than high school	21.3 (1.5)[a]
Participation in non-WIC benefit programs	
Does not participate in other programs[c]	15.1 (2.0)[a,b]
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[c]	27.0 (1.9)[a]
Participates in other programs[c] excluding SNAP	29.6 (2.1)[b]
Timing of WIC enrollment	
First trimester	27.3 (2.0)[a]
Second trimester	28.2 (2.0)
Third trimester	23.7 (3.0)[b]
Postnatal	17.4 (2.6)[a,b]
WIC participation status at 48 months	
Receiving WIC	36.9 (2.0)[a]
No longer receiving WIC	13.6 (1.2)[a]
Unweighted *n*	2,496
Weighted *n*	436,443

[a,b] Pairs of matching letters indicate a statistically significant pairwise difference within the sociodemographic category 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).

On a given day at both 48 months and 60 months, nearly all (97%) WIC ITFPS-2 children are consuming a meat or other protein source.[54] The most commonly consumed types of meat at 60 months are chicken, including fried chicken (54%), and hot dogs, sausages, or cold cuts (31%). Other common protein sources include cheese (42%), protein sources in mixed dishes[55] (31%), and eggs (28%). Consumption of other protein sources is associated with race, ethnicity, and marital status. Children with African American caregivers are less likely (75%) than children with White (85%) or Other race (84%) caregivers to consume other (nonmeat) protein sources. Children with non-Hispanic caregivers are less likely (79%) than children with Hispanic caregivers (87%) to consume other (nonmeat) protein sources. Children with unmarried caregivers are less likely (81%) than children with married caregivers (86%) to consume other (nonmeat) protein sources.

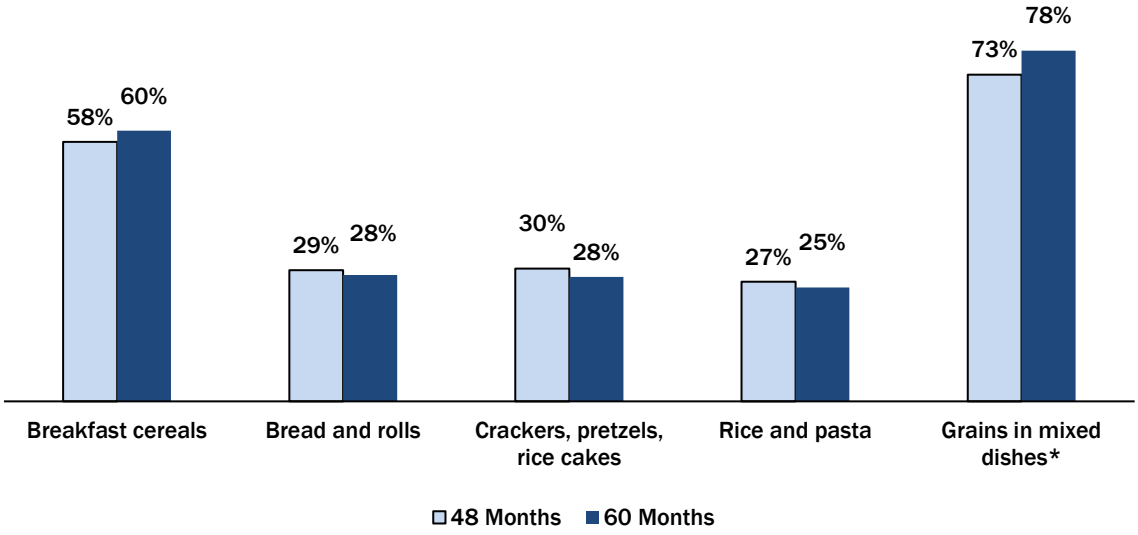
3.5.4 Grain Consumption

Almost all WIC ITFPS-2 children are consuming a grain product on a given day at 60 months (99%). The most commonly consumed types of grains are breakfast cereals (60%); breads and rolls (28%); crackers, pretzels, or rice cakes (28%); rice and pasta (25%); or grains in mixed dishes (78%) (Figure 3-6; Appendix Table B2b-2 offers additional detail). The percentage of children consuming grains in mixed dishes rises between interview months, with a significant change from 73 percent at 48 months to 78 percent at 60 months. Differences for other grain subgroups are not statistically significant.

[54] Other protein sources include dried beans or peas; vegetarian meat substitutes; eggs; peanut butter, nuts, and seeds; cheese; yogurt; protein sources in mixed dishes such as beans and rice, chili, and other bean mixtures; and mixtures with vegetables and/or rice or pasta. Cheese and yogurt, while also noted as dairy foods in this chapter, are included as other protein sources to align with food classifications in FITS 2008.

[55] Mixed dishes include beans and rice, chili, other bean mixtures, and mixtures with vegetables and/or rice or pasta.

Figure 3-6. Percentage of study children consuming different types of grains on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,562; weighted *n*=439,736. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

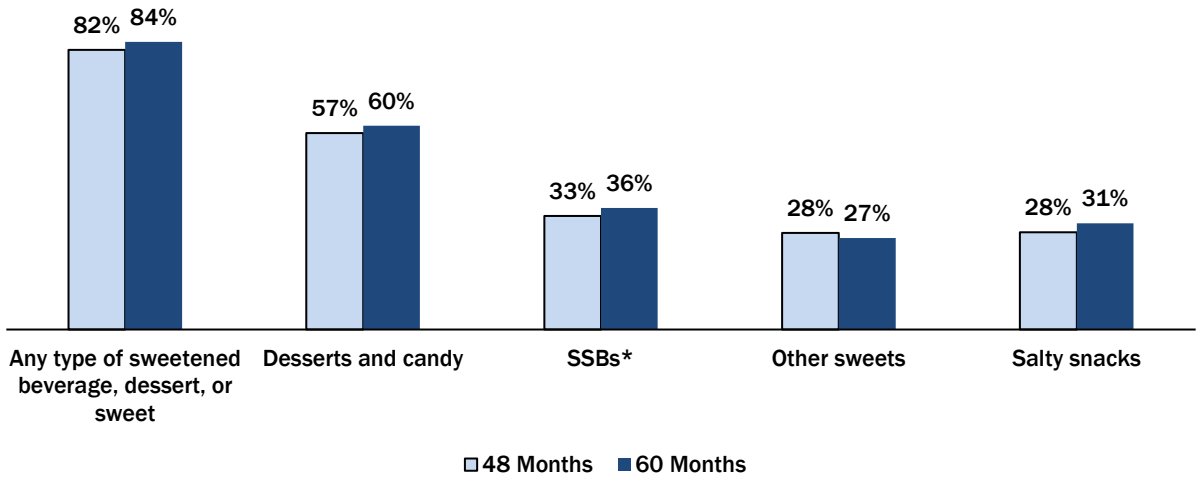
* Percentages within the designated category are significantly different at $p \leq 0.05$.

There are no key sociodemographic characteristics associated with consumption of any grains; however, there is a significant association between WIC participation status at 48 months and consumption of any whole grains. Though less than half (44%) of study children are consuming a whole grain on a given day at 60 months, those who participated in WIC at 48 months are more likely (46%) than those who did not participate at 48 months (41%) to consume whole grains on a given day at 60 months. Examination of the underlying contributions to the association reveal differences in types of breakfast cereals consumed. Children who participated in WIC at 48 months are more likely (40%) to consume whole grain breakfast cereals than children who did not participate in WIC at 48 months (35%). Many whole grain cereals are available through the WIC food package.

3.5.5 Desserts and Sweets, SSBs, and Salty Snacks Consumption

Most (84%) WIC ITFPS-2 children consume some type of dessert, candy, SSB, or other sweets[56] on a given day at 60 months. This percentage is not significantly different from reported consumption at 48 months (82%) (Figure 3-7; Appendix Table B2b-2 offers additional detail).

Figure 3-7. Percentage of study children consuming desserts and candy, sugar-sweetened beverages (SSBs), and salty snacks on a given day at 48 and 60 months[a]



[a] At 48 months, unweighted *n*=2,562; weighted *n*=439,736. At 60 months, unweighted *n*=2,496; weighted *n*=436,443.

* 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.

A majority (60%) of study children consume a dessert or candy on a given day at 60 months. Within this food subgroup, cakes, pies, cookies, and pastries are the most commonly consumed dessert items (35%). Candy is consumed on a given day by 18 percent of study children.

Slightly more than one-third (36%) of study children consume some type of SSB on a given day at 60 months. This is a significant change from 48 months when 33 percent of study children

[56] "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 the report, "other sweets" is used to be inclusive of the wide variety of sweet foods included.

consumed SSBs. Within this subgroup, fruit-flavored drinks are the most frequently consumed (24%) SSB, with carbonated sodas the second most frequently consumed (9%).

Other sweets are consumed by more than a quarter (27%) of study children. Sugar, syrup, and preserves (26%) and milk flavorings (1%) are included in this subgroup.

There are a few significant associations between key sociodemographic characteristics and consumption of desserts, candy, SSBs, or other sweets at 60 months. These include household food security, non-WIC benefit program participation, and WIC participation status at 48 months. Children in households with high or marginal food security are less likely (83%) than children in households with very low (88%) food security to consume desserts, candy, SSBs, or other sweets at 60 months.

Those who participate in other non-WIC benefit programs excluding SNAP are less likely (81%) than those who participate in other non-WIC benefit programs including SNAP (86%) or those who do not participate in any other non-WIC programs (87%) to consume desserts, candy, SSBs, or other sweets at 60 months. Those who participated in WIC at 48 months are less likely (82%) than those who did not participate in WIC at 48 months (87%) to consume desserts, candy, SSBs, or other sweets at 60 months.

Consumption of salty snacks (e.g., potato chips, popcorn, cheese curls/puffs, tortilla chips, and other types of chips and salty snacks) remains largely unchanged between the 48- and 60-month interviews (28% and 31%, respectively). Consumption of salty snacks is significantly associated with race, ethnicity, marital status, and household food security. Children with African American caregivers are more likely (41%) than children with White caregivers (29%) or caregivers of Other races (25%) to consume salty snacks. Children with non-Hispanic caregivers are more likely (36%) than children with Hispanic caregivers (25%) to consume salty snacks. Children with unmarried caregivers are more likely (33%) than children with married caregivers (28%) to consume salty snacks. Follow-up pairwise testing did not reveal statistically significant differences between household food security subgroups.

3.6 Indicators of Diet Quality at 60 Months

Knowing whether children consume foods and beverages on a given day 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 quality of children's diets in WIC ITFPS-2, further analyses explore dietary intake using the HEI-2015. The intakes underlying HEI-2015 scores use 2 days of dietary recall information to adjust intakes for day-to-day variation; therefore, these intakes are referred to as usual intakes.

3.6.1 HEI-2015 Scores

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 (Krebs-Smith et al., 2018). Using usual intake estimates from dietary intake data, the HEI-2015 produces scores for 13 individual dietary components, as well as a total score. 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. In the current study, HEI-2015 scores are calculated using usual intakes estimated with the population ratio method (NCI, 2017).

The average total HEI-2015 score for study children, 59.1, is in the range indicating a need for improvement; however, this average total score is similar to the average total HEI-2015 score of 60.1 for children aged 2 to 5 years from NHANES 2009-2014 (Thomson et al., 2019). The methodology for estimating HEI scores changed between this report and the previous one. Table 3-6 shows the mean HEI-2015 score for WIC ITFPS-2 children across the same timeframe (i.e., ages 2 to 5 years) for informational purposes only.

Table 3-6. Average Healthy Eating Index-2015 (HEI-2015) scores for study children at 24, 36, 48, and 60 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
Adequacy						
Total fruits	5	≥0.8 cup equiv. per 1,000 kcal	4.7	4.8	4.6	4.6
Whole fruits	5	≥0.4 cup equiv. per 1,000 kcal	3.6	4.2	3.7	4.6
Total vegetables	5	≥1.1 cup equiv. per 1,000 kcal	2.5	2.6	2.3	2.5
Greens and beans	5	≥0.2 cup equiv. per 1,000 kcal	2.2	1.9	1.3	1.8
Whole grains	10	≥1.5 oz. equiv. per 1,000 kcal	3.5	3.5	3.6	3.2
Dairy	10	≥1.3 cup equiv. per 1,000 kcal	9.5	9.1	8.6	8.6
Total protein foods	5	≥2.5 oz. equiv. per 1,000 kcal	4.3	4.5	4.6	4.3
Seafood and plant proteins	5	≥0.8 oz. equiv. per 1,000 kcal	1.7	1.6	1.0	2.1
Fatty acids[c]	10	(PUFAs + MUFAs)/ SFAs ≥2.5	1.7	2.9	3.8	3.3
Moderation						
Refined grains	10	≤1.8 oz. equiv. per 1,000 kcal	7.5	6.5	5.9	5.6
Sodium	10	≤1.1 gram per 1,000 kcal	5.6	5.0	4.6	4.4
Added sugars	10	≤6.5% of energy	9.1	8.7	8.3	8.0
Saturated fats	10	≤8% of energy	6.2	6.2	6.5	6.2
Total HEI-2015 score	100		60.5	61.4	58.7	59.1
Unweighted *n*			2,199	2,586	2,562	2,496
Weighted *n*			371,245	438,319	439,736	436,443

[a] In this report, new methods were used to estimate HEI scores at study child age 60 months, so scores from prior years are not directly comparable with the 60-month score. Prior years' estimates are incorporated 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] Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

At 60 months, among adequacy components, the average component scores that are 50 percent or more below their respective maximum scores are those for total vegetables, greens and beans, whole grains, seafood and plant proteins, and fatty acids. Among the components that should be consumed in moderation, sodium had the lowest mean score for children at 60 months (4.4 out of 10). These findings are consistent with findings from a national sample of children 2 to 5 years of age (Thomson et al., 2019). These components with the lowest scores relative to their maximums are the focus of the bivariate analyses. Table 3-7 presents statistically significant differences in HEI-2015

component scores by key sociodemographic characteristics. None were found for sodium, so it is not listed.

Table 3-7. Statistically significant differences in average Healthy Eating Index-2015 (HEI-2015) component scores by key sociodemographic characteristics

HEI-2015 component and key sociodemographic characteristics	HEI-2015 component score[a] Mean (standard error)
Total vegetables scores	
Gender	
Male	2.4 (0.1)[b]
Female	2.7 (0.1)[b]
Greens and beans scores	
Gender	
Male	1.6 (0.1)[b]
Female	2.1 (0.2)[b]
Race	
African American or Black	1.6 (0.1)[b]
White	1.8 (0.2)
All Other Races	2.3 (0.3)[b]
Ethnicity	
Hispanic	2.5 (0.1)[b]
Non-Hispanic	1.3 (0.1)[b]
Household food security status	
Marginal/high	1.9 (0.1)[b]
Low	1.9 (0.3)
Very low	1.2 (0.2)[b]
Whole grains scores	
Parity	
Firstborn	3.3 (0.2)
Second born	2.8 (0.2)[b]
Third or subsequent born	3.4 (0.2)[b]
Seafood and plant proteins scores	
Ethnicity	
Hispanic	1.8 (0.2)[b]
Non-Hispanic	2.3 (0.2)[b]
Fatty acids scores	
Race	
African American or Black	4.1 (0.2)[b,c]
White	3.0 (0.1)[b]
All Other Races	3.3 (0.2)[c]
Unweighted *n*	2,496
Weighted *n*	436,443

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

[b,c] For each HEI-2015 component, pairs of matching letters indicate a statistically significant pairwise difference in the sociodemographic category at $p \leq 0.05$.

3.6.2 DGA-Recommended Food Group Servings

Another way to assess children's diet quality is to quantify intakes using food groups and recommendations from the DGA. According to the 2015-2020 DGA, 60-month-old males and females need 1,200 calories per day if they are sedentary; 1,400 calories per day if they are moderately active; and 1,600 calories per day if they are active. The DGA then recommends that individuals at the various aforementioned calorie levels consume a specified amount of food from each food group, as shown in the Healthy U.S.-Style Dietary Patterns.[57] Table 3-8a presents the DGA recommendations for sedentary, moderately active, and active 60-month-old males and females; Table 3-8b provides the mean and median intakes of study children on a given day at 48 and 60 months in cup- or ounce-equivalents per day. At 60 months, mean and median intakes of fruit on a given day are at or above the DGA range for 5-year-olds. The estimated mean for study children also exceeds estimated average consumption by 5-year-old children nationally (1.6 cup-equivalents) based on 2009-2010 NHANES data (Ramsay, Eskelsen, Branen, Shultz, & Plumb, 2014). For grains, mean and median intake on a given day both exceed the upper end of the recommended range. Mean and median intake from the protein food group fall within the DGA range. Mean and median intakes of vegetables and dairy all fall below the DGA range, but mean intake for vegetables exceeds national estimates of mean vegetable intake for 5-year-olds (0.6 cup-equivalents) based on 2009-2010 NHANES data (Ramsay et al., 2014).

Table 3-8a. Recommended amounts of food from each food group at respective calorie levels for 60-month-old males and females[a]

Food group	Male and female children		
	Sedentary (1,200 calories per day)	Moderately active (1,400 calories per day)	Active (1,600 calories per day)
Vegetables	1.5 cup eq.	1.5 cup eq.	2 cup eq.
Fruits	1 cup eq.	1.5 cup eq.	1.5 cup eq.
Protein	3 oz. eq.	4 oz. eq.	5 oz. eq.
Dairy	2.5 cup eq.	2.5 cup eq.	3 cup eq.
Grains	4 oz. eq.	5 oz. eq.	5 oz. eq.
Whole grains	2 oz. eq.	2.5 oz. eq.	2.5 oz. eq.

[a] For all food groups except whole grains, amounts of food are those shown in the Healthy U.S.-Style Dietary Pattern described in the 2015-2020 Dietary Guidelines for Americans (DGA). The amount of whole grains is based on the DGA recommendation of having 50 percent of grains as whole grains.

[57] Appendix 3 from the 2015-2020 DGA (https://health.gov/dietaryguidelines/2015/guidelines/appendix-3).

Table 3-8b. Mean and median consumption by study children on a given day of Dietary Guidelines for Americans (DGA)-recommended food groups by interview month

Select food groups	48 months		60 months	
	DGA range[a]	Intake	DGA range[a]	Intake
Vegetables[b]				
Recommendation	1.5-2 cup eq.		1.5-2 cup eq.	
Mean intake (cup eq.)		0.7		0.8
Median intake (cup eq.)		0.6		0.6
Fruits[c]				
Recommendation	1-1.5 cup eq.		1-1.5 cup eq.	
Mean intake (cup eq.)		1.8		1.8
Median intake (cup eq.)		1.6		1.5
Protein[b]				
Recommendation	3-5 oz. eq.		3-5 oz. eq.	
Mean intake (oz. eq.)		3.6		3.8
Median intake (oz. eq.)		3.0		3.3
Dairy				
Recommendation	2.5-3 cup eq.		2.5-3 cup eq.	
Mean intake (cup eq.)		2.0		2.1
Median intake (cup eq.)		1.8		1.9
Grains[d]				
Recommendation	4-5 oz. eq.		4-5 oz. eq.	
Mean intake (oz. eq.)		5.2		5.5
Median intake (oz. eq.)		4.6		5.1
Unweighted *n*[e]		2,562		2,496
Weighted *n*		439,736		436,443

[a] The recommended level depends on age, sex, and activity level.

[b] Excludes legumes.

[c] Includes 100 percent fruit juice.

[d] With regard to grain intake, the DGA recommends that individuals make at least half of grains whole grain, which equates to 2 to 2.5 ounce-equivalents per day for WIC ITFPS-2 children. The mean and median intakes of whole grains on a given day for WIC ITFPS-2 children age 60 months are 0.8 oz. eq. and 0.5 oz. eq., respectively. The Feeding Infants and Toddlers Study (FITS) food groups (Fox et al., 2004) include salty snacks in the main food category "Any dessert, sweetened beverage, or sweet." However, WIC ITFPS-2 is including whole grain salty snacks when reporting consumption of whole grain foods. There are three unweighted participants who consume whole grain salty snacks; these are not included in the results for consumption of the main food category "Any grain."

[e] *n* is the number of respondents who completed the recall.

Because the added sugars recommendation is tied to actual caloric intake regardless of activity level, Table 3-8c presents the percentage of children meeting the DGA recommendation of less than 10 percent of calories from added sugars, in addition to the mean percentage of total calories from added sugars. At 60 months, just over half (53%) of study children consume less than 10 percent of

total calories from added sugars. The mean percentage of calories from added sugars is slightly over 10 percent, which is similar to the percentage at 48 months, slightly under 10 percent.[58]

Table 3-8c. Dietary Guidelines for Americans (DGA)-recommended intake for added sugars and percentage of study children meeting the recommendation at 60 months

Food group	60 months	
	DGA standard	Intake
Added sugars (% total kcals)		
Percentage of children meeting DGA	<10% kcal	52.8%
Mean added sugars (% total kcal)		10.2
Unweighted *n*[a]		2,496
Weighted *n*		436,443

[a] *n* is the number of respondents who completed the recall and is less than 2,562 due to missing data.

There were several key sociodemographic characteristics associated with meeting the DGA recommendation for added sugars, including race, ethnicity, timing of WIC enrollment, and participation in WIC at 48 months. Children with caregivers of Other races (non-Black, non-White, or multiracial) were more likely than children with caregivers who were Black or African American or children with caregivers who were White to meet the DGA recommendation. Children with caregivers who enrolled in WIC during their first trimester were more likely than children whose caregivers enrolled postnatally to meet the recommendation. Children in families receiving WIC when the child was 48 months old were more likely than those not receiving WIC benefits at the 48-month interview to meet the recommendation.

It is important to acknowledge the contribution of the WIC food package to the dietary intakes of participants who receive WIC benefits. Previous sections in this chapter describe bivariate associations between WIC participation at 48 months and consumption of fruit, vegetables, protein sources, dairy, and grains and whole grains, all of which the WIC food package provides. To assess the child's consumption of foods and beverages that could be purchased with WIC benefits, the 54-month interview asks, "which of the following WIC foods does [your] child eat?" and, subsequently, proceeds to list foods and beverages from the WIC food package, stating "from WIC"

[58] The estimate at 60 months uses the MCMC method from NCI which incorporates the correlation among added sugars intake and total energy intake. The estimate at 48 months is derived from the univariate estimates of intakes using the population ratio method.

Table 3-9. Percentage of children receiving WIC at 54 months who report consuming WIC foods[a]

Type of WIC food	Study mothers % (standard error)
Whole fruit	99.0 (0.3)
100% juice	96.6 (0.6)
Milk (including cow's milk, soy milk, or other milk)	96.9 (0.6)
Breakfast cereal	96.6 (0.7)
Eggs	95.2 (0.8)
Whole grain bread or other whole grains	94.3 (0.8)
Vegetables	94.1 (1.1)
Cheese	92.1 (1.4)
Peanut butter	76.1 (2.1)
Other food[b]	39.2 (1.8)
Unweighted *n*	1,249
Weighted *n*	228,163

[a] Fifty-two percent of study participants participate with WIC at the 54-month interview.

[b] Includes items reported by respondents in a text field, primarily yogurt, beans and lentils, and canned tuna, as well as a small number of reports of tortillas, grits, pasta, nutritional drinks, and baby food.

after each item.[59] As shown in Table 3-9, nearly all caregivers of children receiving WIC at 54 months report that children are consuming whole fruit and 100 percent fruit juice (99% and 97%, respectively) provided in the WIC food package; 97 percent report that their children consume milk and breakfast cereal provided by the WIC food package. Ninety-four percent of study mothers report that their children eat whole grain bread or other whole grains provided in the WIC food package, and 94 percent report that their children eat the vegetables provided. Cheese from the food package is consumed by 92 percent of study children. Peanut butter is consumed by slightly more than three-quarters of children (76%).

The analyses assess bivariate relationships between key sociodemographic characteristics and caregiver reports (from the survey interview) of the child's consumption of items available in the WIC food package. Among the 52 percent of study participants receiving WIC at 54 months, there are significant associations between key sociodemographic characteristics and reported consumption of foods available in the WIC food package. For reasons presented in Section 3.3.2, the following discussion highlights percentage differences between subgroups that are greater than 3 percentage points, and it focuses on foods and beverages that are consumed by less than 90 percent of the population—predominantly peanut butter and "other" foods which include yogurt, beans and lentils, and canned tuna. Children with White caregivers (42%) are more likely than children with African American caregivers (29%) to consume other foods from the food package. Children with

[59] Appendix B-4 includes the 54-month survey interview. These questions are CF43a through j. It is possible that the respondent did not realize that the intent of the items was to assess whether the child consumed foods and beverages purchased with WIC benefits.

non-Hispanic caregivers are more likely (86%) to consume peanut butter and less likely (31%) to consume other foods from the food package than children with Hispanic caregivers (peanut butter, 67%; other foods, 46%).

3.7 Relationship between Early Feeding Practices and Consumption of Added Sugars on a Given Day at Age 5 Years

At the 60-month interview, the percentage of study children meeting the DGA recommendation for added sugars was 53 percent (Table 3-8c). This means that at 60 months, slightly less than half (47%) of study children are consuming more than the recommended amount of added sugar. Most study children (84%) are consuming some sweetened food or SSB on a typical day. Consumption of added sugar, particularly in the form of SSBs, has been associated with increases in childhood obesity and risk for other chronic disease in children (Welsh, Sharma, Cunningham, & Vos, 2011; Scharf & DeBoer, 2016; Luger et al., 2017; World Health Organization, 2019).

In this section, multivariable logistic regression independently assesses factors associated with meeting the DGA recommendation for added sugars on a given day at 60 months. In particular, the model focuses on early feeding practices. Early feeding practices explored include breastfeeding duration; early (prior to 4 months) introduction of complementary foods; timing of the introduction of sweetened foods including items like cakes, pies, cookies, and candy; and (separately) the timing of the introduction of SSBs.

Early feeding practices are included in the multivariable model because research indicates that food preferences are established in infancy and toddlerhood and shape food intake and health status in later years (Koletzko et al., 2017; Adair, 2012; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2004). Researchers have found that longer breastfeeding duration is associated with lower intake of SSBs later in childhood (Perrine, Galuska, Thompson, & Scanlon, 2014; Borkhoff et al., 2018) and that exposure to SSBs at any time during infancy is associated with greater SSB intake at age 6 years (Park, Pan, Sherry, & Li, 2014).

The outcome of interest in the logistic model uses a binary dependent variable: whether the child met the DGA recommendation for added sugars on a given day at 60 months or not. In addition to incorporating the early feeding practices mentioned, the model includes sociodemographic

characteristics, the child's total energy intake, the daily number of snacking occasions at 60 months, and WIC and/or SNAP participation status at 54 months (because the study child may be too old to participate in WIC at the time of the 60-month interview). Table 3-10 presents the adjusted odds ratio and confidence intervals from the regression. Because the recommendation for added sugars consumption is to limit consumption to less than 10 percent of daily caloric intake, differences in the likelihood of meeting the added sugars recommendation are inversely related to sugars consumption. In other words, a higher likelihood, or odds, of meeting the recommendation for added sugars consumption means that the child consumes less than 10 percent of calories as added sugars; lower likelihood of meeting the recommendation means that the child consumes more than 10 percent of calories as added sugars at 60 months. All variables in the model are categorical except for the age of the mother at the child's birth, breastfeeding duration, and the number of snacking occasions.

Table 3-10. Adjusted odds ratios and confidence intervals from multivariable logistic regression examining factors affecting the likelihood of added sugars consumption on a given day at 60 months meeting the 2015-2020 Dietary Guidelines for Americans (DGA) recommendation for added sugars[a]

Characteristic	Odds ratio	95% confidence limit	
		Lower	Upper
Breastfeeding duration (days)[b]	1.001	1.000	1.002
Timing of sugar-sweetened beverage (SSB) introduction: In child's first year compared to not introduced in first 2 years*	0.620	0.415	0.928
Timing of SSB introduction: In child's second year compared to not introduced in first 2 years	0.746	0.496	1.122
Complementary foods introduced after 4 months compared to prior to 4 months	1.254	0.982	1.601
Age when sweet foods are introduced: Introduced in first year compared to not introduced in first 2 years	0.651	0.399	1.063
Age when sweet foods are introduced: Introduced in second year compared to not introduced in first 2 years	0.714	0.401	1.270
Child's energy intake at 60 months*	1.000	1.000	1.000
Number of snacking occasions on a given day at 60 months[b,*]	0.823	0.747	0.907
WIC and Supplemental Nutrition Assistance Program (SNAP) status at 54 months: Receiving SNAP only compared to not receiving benefits from either program	0.885	0.647	1.211
WIC and SNAP status at 54 months: Receiving both WIC and SNAP compared to not receiving benefits from either program	1.123	0.793	1.591
WIC and SNAP status at 54 months: Receiving WIC but not SNAP compared to not receiving benefits from either program*	1.465	1.162	1.847

[a] Results are weighted. Weighted *n*=441,247; unweighted *n*=2,529. Additional detail on model results is available in Appendix Table B2b-3.

[b] Continuous variable.

* Indicates statistical significance at $p \leq 0.05$.

After controlling for sociodemographic characteristics, the model results suggest that both early and contemporary feeding practices are independently associated with whether the child meets the DGA recommendation for added sugars intake on a given day at age 60 months (or 5 years). Compared to children who were not introduced to SSBs in the first 2 years of life, those introduced to SSBs in the first year had lower likelihood of meeting the DGA recommendation to consume less than 10 percent of calories from added sugars at 60 months. Children who eat more daily snacks at 60 months of age were also less likely to meet the DGA recommendation for added sugars.

WIC and/or SNAP participation during the study child's fifth year of life also independently influenced the likelihood of meeting the DGA recommendation. Compared to children in families that were not receiving these benefits, children who participated with WIC only were likely to meet the recommendation to consume less than 10 percent of calories from added sugars.

4. Energy and Nutrient Intake

Key Findings:

- As expected, median energy intake of study children increases between 48 and 60 months. At 60 months, median usual intake of total daily energy is 1,660 kcal/day and 1,539 kcal/day for male and female study children, respectively.
- With the exception of dietary fiber, median macronutrient intakes meet or exceed recommended levels at 60 months, and fall within acceptable levels as percentages of total daily energy intake.
- Just over two-thirds (68%) of study children had inadequate intake of vitamin D at 60 months. More than two-fifths (45%) of study children had inadequate intake of vitamin E, and a quarter (25%) had inadequate intake of calcium at 60 months.
- At 60 months, median usual intake of sodium (2,584 mg/d) continues to exceed the newly developed Chronic Disease Risk Reduction (CDRR) level (1,500 mg/d), with nearly 98 percent of children above the level recommended to reduce risk of chronic disease.
- Multivariable regression analysis indicates that the number of children's snacking occasions is inversely related to their sodium intake on a given day at 60 months.
- Multivariable regression analysis also indicates an independent inverse relationship between Federal nutrition assistance program participation and children's sodium intake on a given day at 60 months. Compared to those who do not participate in either the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) or the Supplemental Nutrition Assistance Program (SNAP), children who participate in WIC during the fifth year of life—with or without additional SNAP participation by the household—exhibit lower sodium intake on a given day at 60 months.

4.1 Overview

This chapter focuses on children's energy and nutrient intake at 60 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 the 48-month interview are included, where applicable, to provide context. Research questions addressed in this chapter include:

- What is the food and nutrient intake of 5-year-olds, both overall and by subgroups of interest?
- Does the nutrient intake of 5-year-olds reflect nutrients provided in the WIC food package?
- Do early feeding practices,[60] meal/snack patterns, or food and nutrient intakes relate to feeding practices, meal/snack patterns, food and nutrient intakes, and health status at age 5 years?

[60] Throughout the study, "early" feeding practices are those that take place within the first 2 years of the study child's 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 60 months can be evaluated using the Dietary Reference Intakes (DRIs). The DRIs are nutrient standards (National Academies of Sciences, Engineering, and Medicine [NASEM], 2019) used to assess the nutrient intakes of healthy people, and thus can be used to estimate the prevalence of inadequate or excessive intakes. The meal patterns and recommendations from the 2015-2020 Dietary Guidelines for Americans (DGA) provide standards for a healthy, nutritionally adequate diet (U.S. Department of Health and Human Services [HHS] & U.S. Department of Agriculture [USDA], 2015).

4.2.1 Energy and Nutrient Intake

To examine dietary intake comprehensively, the usual intake of total dietary energy (kilocalories [kcal]), macronutrients, and micronutrients are estimated using the National Cancer Institute's (NCI's) univariate model, incorporating adjustments for the key sociodemographic variables used throughout this report. When appropriate, findings are compared to existing standards or references.

For total dietary energy, comparisons may be made using the Estimated Energy Requirement (EER). 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 did collect data on weight and height around the time of the fifth birthday (i.e., between 56 and 64 months of age), measurements were not obtained on the same day as the dietary recall was conducted. In addition, the study does 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.[61]

[61] 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).

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 compile nutrient reference standards from a series of reports issued by NASEM, formerly the Institute of Medicine.[62] These standards 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 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. In this study, EARs are used as a cut point for nutrient intakes; 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

[62] 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: October 12, 2020.

new category based on chronic disease, called the Chronic Disease Risk Reduction Intakes (CDRRs). However, CDRRs have not yet been established for nutrients other than sodium.

In addition to DRIs, macronutrients can also be expressed as absolute amounts or as percentages of total 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 the nutrient intake of young children, it is important to consider the intake of several micronutrients that are essential for growth and development, notably iron, zinc, vitamin D, calcium, sodium, and potassium. Iron deficiency is implicated in impaired neurodevelopment (Baker & Greer, 2010; Micronutrient Initiative, 2009), and inadequate zinc intake has been associated with growth faltering and impaired immune function (Wessells & Brown, 2012; Krebs, Miller, & Hambidge, 2014). 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). In addition, 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). 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). As such, this chapter explores factors associated with children's sodium intakes.

4.3 Sample and Analysis Approach

4.3.1 Sample

The analyses in this chapter use data from dietary intake interviews when the child is 48 and 60 months old. Results from recalls obtained at 48 months were previously reported (Borger et al., 2020). They are presented in this report to provide context and identify trends. Table 4-1 shows the unweighted number of respondents by sample and type of interview (i.e., survey interview or dietary

recall). Both the core and supplemental samples participated in these interviews. In analyses, the responses to each interview are 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.

Table 4-1. Unweighted number of respondents by interview month and interview type

Sample structure	48-month interview		60-month interview[a]	
	Survey interview	Dietary recall	Survey interview	Dietary recall
Core prenatal sample	1,787	1,781	1,766	1,742
Core postnatal sample	235	234	223	220
Supplemental prenatal sample	445	443	437	434
Supplemental postnatal sample	105	104	103	102
Total	2,572	2,562	2,529	2,498

[a] Table 5-1 presents the total number of participants who completed both the 60-month survey interview and dietary recall.

4.3.2 Analysis

All postbirth WIC ITFPS-2 interviews through 24 months, as well as the interviews at 36, 48, 60, and 72 months, include a 24-hour dietary recall using the USDA's Automated Multiple Pass Method (AMPM) (Raper, Perloff, Ingwersen, Steinfeldt, & Anand, 2004), as described in Chapter 1. Using the computer-assisted interview protocol, an interviewer guides the caregiver through the prior day's intake, and asks the caregiver to report all foods, beverages, and dietary supplements the child consumed for each eating occasion during the 24-hour period. The interviewer records all information and trained coders then code and analyze the data for nutrient content.

Within 10 days of the initial dietary intake interview, the study collects 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 is used in conjunction with the first to statistically adjust intakes for day-to-day variation in order to estimate "usual" intake. This report uses methods recommended by NCI to estimate usual intake. Specifically, in this chapter, NCI's univariate model underlies the single-nutrient estimates.[63] With one exception, the NCI univariate model incorporates

[63] For more information, see the NCI method for adjusting for dietary measurement error at https://prevention.cancer.gov/research-groups/biometry/measurement-error-impact/measurement-error-0. Retrieved on: April 1, 2022.

the 12 key sociodemographic characteristics used throughout this report and the 60-month cross-sectional weight. The exception to this approach is when producing estimates that account for pattern of WIC participation; the 60-month longitudinal weight is used because patterns of participation were assessed longitudinally.

Research indicates 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 finds 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 conducts second recalls on a 10-percent subset of the study sample and uses the second recall to estimate usual intake, the proxy reports of intakes may still be subject to reporting error.

In this chapter, it is important to distinguish between dietary intake estimates that use 2 days of dietary recall information and estimates that use a single day of dietary recall information. As mentioned, usual intake estimates use 2 days of recall information. Estimates of intake that use 1 day of recall information are "on a given day" and are not adjusted for day-to-day variation. In this chapter, the majority of the discussion is about usual intake; however, analysis by eating occasion and analysis assessing independent correlates of sodium intake use a single day of dietary recall information, so these estimates represent dietary intake on a given day.

The single-nutrient presentation highlights median intakes, as opposed to mean intakes, to reduce the influence of extreme values in the summary statistics. However, if the outcome of interest is the ratio of two nutrients (e.g., carbohydrates as a percentage of energy), the mean is reported. Mean calculations employ the population ratio method (i.e., the ratio of the means of each nutrient).

Bivariate analyses were used to examine associations between the 12 key sociodemographic characteristics and dietary outcomes of interest. Nonmodifiable sociodemographic characteristics assessed at the time of the first interview were refreshed as needed (i.e., if the caregiver changes). However, for characteristics that may change over time, such as household food security, income

relative to Federal Poverty Guidelines (FPG), or WIC participation status, values reported at the 48-month interview were used.[64]

Two-tailed t-tests were used to determine which pairwise subgroup differences are statistically significant.[65] Subgroup differences discussed in the chapter were limited to those that form a pattern over time or across questions, and are large in magnitude, to avoid focusing on findings that, while statistically significant, may have little practical importance.[66] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

For outcomes that are jointly determined by a variety of factors, multivariable analysis such as regression analysis is used to explore how choices and characteristics are associated with outcomes. Multivariable analyses isolate the unique effects of individual variables on an outcome, while holding the influence of other variables constant. In this chapter, multivariable linear regression is used to assess factors independently associated with sodium intake on a given day.[67] In this regression model, the role of participation in Federal feeding programs is examined. The model incorporates WIC participation at 54 months, instead of participation at 48 months, because there was interest in assessing the association between WIC participation during the study child's fifth year of life and sodium intake on a given day. At the time of their 60-month interview, some study children were too old to be eligible for WIC.

Table presentation of findings. For single-nutrient outcomes, medians and means are reported without corresponding unweighted and weighted sample sizes for each key sociodemographic. This presentation reflects aspects of the NCI method. The method takes each observed intake and computes a host[68] of "pseudo-individual" intakes—a distribution of estimated intakes around the

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[64] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

[65] Because the usual-intake-adjusted values for individual nutrients are not linked at the individual level, the analysis does not account for the correlation in reported intakes at 48 and 60 months. As a result, the standard error of the difference in the denominator of the independent t-test is likely too large when comparing 48-month and 60-month values. This means that the test is likely conservative; some statistically significant differences may not be identified by the test.

[66] 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.

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

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

original person's data. Given this approach, reporting actual sample size for any key sociodemographic characteristic would be misleading. Though total unweighted and weighted samples sizes are reported at the bottom of the tables, they should be interpreted with caution. They are offered to provide a sense of the number of *original* unweighted and weighted observations that were used in the NCI univariate model to generate the numerous pseudo-individual observations underlying the estimated medians and means presented.

4.4 Energy and Nutrient Intake at 60 Months

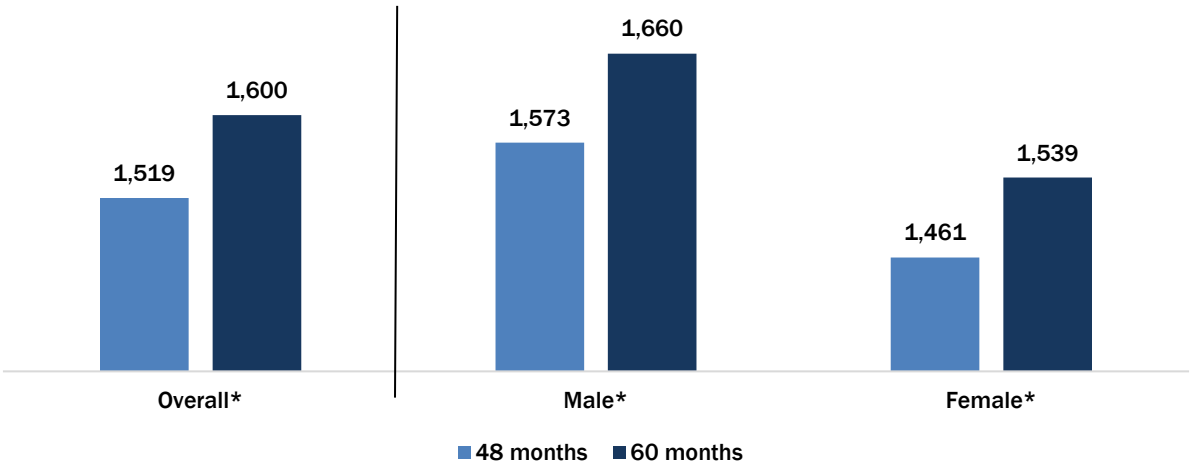
4.4.1 Energy Intake

At 60 months, median energy intake of study children is 1,600 kcal/day (standard error [SE]=23.0), up from 1,519 kcal/day (SE=21.7) at 48 months. The change in median energy intakes, between 48 and 60 months, for both male and female children is significant (Figure 4-1). For context, the DGA-recommended level for energy intake is 1,200-1,600 kcal/day and 1,200-1,400 kcal/day for 4-year-old males and females, respectively, and 1,200-1,600 kcal/day for both genders[69] at age 5.[70] At age 60 months, median energy intake by WIC ITFPS-2 children (1,600 kcal/day) is at the upper limit of the DGA recommendation for active children.

[69] Gender was determined from the following interview question at the baseline interview, "Is your baby a boy or a girl?"

[70] 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 intake of energy by study child's gender at 48 and 60 months[a]



[a] The sample underlying these estimates is reported in Table 4-1. 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.

* Percentages within the designated category are significantly different at $p \leq 0.05$. The method used to estimate usual intake was revised for this report, so energy estimates at 48 months differ from those previously reported.

Table 4-2 presents statistically significant differences in median energy intake at 60 months by key sociodemographic characteristics for male and female study children. For both genders, median energy intakes differ by race, ethnicity, maternal age at study child's birth, and household food security status. Though not all pairwise comparisons by age of the mother at the child's birth or by household food security status are significantly different, the apparent patterns by maternal age and food insecurity are noteworthy.

Table 4-2. Statistically significant differences by key sociodemographic characteristics in median usual energy intake at 60 months

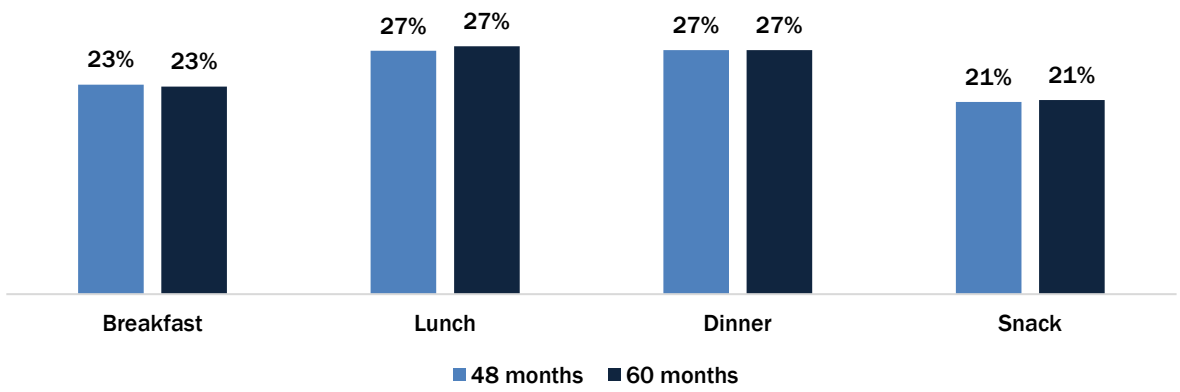
Sociodemographic characteristics	Median energy intake at 60 months	
	Male children kcal/day (standard error)	Female children kcal/day (standard error)
Race		
African American	1,771 (30.1)[a,b]	1,632 (33.3)[c,d]
White	1,644 (28.6)[a]	1,526 (21.8)[c]
All Other	1,583 (40.6)[b]	1,476 (51.7)[d]
Ethnicity		
Hispanic or Latino	1,578 (30.0)[a]	1,465 (25.3)[c]
Not Hispanic or Latino	1,731 (26.5)[a]	1,605 (30.0)[c]
Maternal/caregiver marital status at 48 months		
Married	1,586 (32.1)[a]	1,472 (31.3)[c]
Not married	1,711 (27.2)[a]	1,582 (27.0)[c]
Age of mother or caregiver at child's birth		
16-19 years	1,794 (61.7)[a]	1,674 (59.9)[c]
20-25 years	1,688 (31.1)	1,573 (25.4)
26 years or older	1,604 (30.4)[a]	1,484 (28.3)[c]
Household food security at 48 months		
High or marginal	1,634 (24.4)[a]	1,519 (24.7)[c]
Low	1,670 (35.7)	1,529 (36.5)[d]
Very low	1,839 (71.3)[a]	1,706 (57.0)[c,d]
Unweighted *n*	1,282	1,214
Weighted *n*	225,129	211,314

[a,b] Pairs of matching letters in a column indicate that for male children the difference in the designated medians for the two subgroups within the key characteristics is statistically significant at $p \leq 0.05$.

[c,d] Pairs of matching letters in a column indicate that for female children the difference in the designated medians in the two subgroups within the key characteristic is statistically significant at $p \leq 0.05$.

Another way to examine energy intake is to look at the median percentage of daily energy intake contributed by each eating occasion (Figure 4-2; Appendix B2c-1 offers additional detail). The median percentage of daily energy contributed by each eating occasion on a given day does not differ between 48 and 60 months. As it did at 48 months, breakfast contributes slightly less than one-quarter (23%) of total daily energy. Lunch and dinner each contribute over one-quarter (27%) of daily energy. Snacks contribute just over one-fifth (21%) of daily energy intake.

Figure 4-2. Mean percentage of total energy intake on a given day contributed by eating occasion[a] at 48 and 60 months[b]



[a] The percentage of total energy by eating occasion = (sum of energy for foods reported at the eating occasion on a given day)/(total energy on a given day) times 100. Because of the way it is calculated, the sum of the mean percentages is not expected to sum to 100 percent.

[b] At 48 months, unweighted *n*=2,501 and weighted *n*=431,593 for breakfast. At 48 months, unweighted *n*=2,406 and weighted *n*=414,731 for lunch. At 48 months, unweighted *n*=2,463 and weighted *n*=422,183 for dinner. At 48 months, unweighted *n*=2,205 and weighted *n*=376,535 at snack. 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 48 months, unweighted *n*=2,189 and weighted *n*=382,390 at snack.

4.4.2 Macronutrient Intake

WIC ITFPS-2 examines median macronutrient intakes of carbohydrate, protein, fat, and fiber using the AIs/RDAs, EARs, and AMDRs as points of comparison when available.

At 48 and 60 months, EARs are available for carbohydrate intake. Using the cut-point method to estimate prevalence of inadequate intakes, the prevalence of inadequate carbohydrate intake is zero at 60 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 exceed the RDA[71] at both 48 and 60 months (Table 4-3). 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 median percentage of total energy intake for carbohydrate, protein, and fat are within their respective AMDRs. The DRIs include an AI for fiber. Median intake of fiber at the 60-month interview is significantly higher than at the 48-month interview but remains below the AI.

[71] 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 4-3. Usual macronutrient and fiber intake of study children at 48 and 60 months compared to recommendations and National Health and Nutrition Examination Survey (NHANES) findings for 4- to 8-year-olds

	Usual intake			
	WIC ITFPS-2		NHANES 4- to 8-year-olds	
Macronutrients	48 months[a]	60 months	Under 131% of poverty level[b]	National[c] m=males f=females
Median intake				
Fat (g/d)	51.8[d]	55.3[d]	61.9	66.2 (m); 59.8 (f)
AI[e]	*ND*[f]	*ND*[f]	*ND*[f]	*ND*[f]
Carbohydrate (g/d)	207.8[d]	218.1[d]	223	235 (m); 215 (f)
EAR[g]	*100*	*100*	*100*	*100*
Protein (g/d)	57.4[d]	60.7[d]	57.9	62.2 (m); 55.4(f)
RDA[h]	*19*	*19*	*19*	*19*
Fiber (g/d)	12.7[d]	13.4[d]	12.5	13.5 (m); 12.3 (f)
AI[e]	*25*	*25*	*25*	*25*
Mean percentage of total energy intake[i]				
Fat	31.3%	31.9%	33.2%	33.4% (m); 33.3% (f)
AMDR[j]	*25-35*	*25-35*	*25-35*	*25-35*
Carbohydrate	54.8	54.1	54.0	53.6 (m); 54.1 (f)
AMDR[j]	*45-65*	*45-65*	*45-65*	*45-65*
Protein	15.2	15.2	14.1	14.2 (m); 14.0 (f)
AMDR[j]	*10-30*	*10-30*	*10-30*	*10-30*
Unweighted *n*	2,562	2,496		
Weighted *n*	439,736	436,443		

[a] The method used to estimate usual intake was revised for this report; consequently, the estimates at 48 months differ from those previously reported.

[b] U.S. Department of Agriculture (USDA), Agricultural Research Service (May 2019). *Usual nutrient intake from food and beverages, among individuals under 131% of poverty level, What We Eat in America, NHANES 2013-2016, Table F.* Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Under_131_WWEIA_2013_2016.pdf.

[c] USDA, Agricultural Research Service (May 2019). *Usual nutrient intake from food and beverages, by gender and age, Table A.* Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_gender_WWEIA_2013_2016.pdf. Note that these data do not contain intakes from dietary supplements.

[d] Difference between median usual intake estimates at 48 months and 60 months for the macronutrient is statistically significant at $p \leq 0.05$.

[e] Adequate Intake (AI).

[f] Not determined (ND).

[g] Estimated Average Requirement (EAR).

[h] Recommended Daily 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.

[i] The population ratio method is used to estimate the means of these ratios.

[j] Acceptable Macronutrient Distribution Range (AMDR), measured as calories from macronutrient as a percentage of total energy.

For contextualizing this study's findings, Table 4-3 also offers findings from the 2013-2016 NHANES for two different groups: 4- to 8-year-old children in families with income below 131

percent of the poverty level (USDA & Agriculture Research Service [ARS], 2019a) and 4- to 8-year-old children nationally (USDA & ARS, 2019b). Nearly 70 percent of WIC ITFPS-2 families have household income at or below 130 percent of the FPG, so the NHANES low-income group of children is relevant for the majority of WIC ITFPS-2 families. It is also of interest to understand how study children's intakes compare to those of their peers nationally. As a percentage of energy, median intakes of carbohydrate and protein are very similar to both NHANES estimates. The lower median intake of fat as a percentage of energy intake for study children is significantly different from the percentages for both of the NHANES groups.

Bivariate analyses using the key sociodemographic characteristics in this study found that median usual intake of fat, carbohydrate, and protein significantly differed by the child's gender, with male children exhibiting higher median intakes than female children. Median usual intake of fat and carbohydrate also significantly differed by race, ethnicity, and household food security status. Children with African American caregivers exhibited higher median intake of both macronutrients than children with White caregivers or children with caregivers of Other (non-Black, non-White) races. Children with non-Hispanic caregivers exhibited higher median intakes of total fat and carbohydrate than children with Hispanic caregivers. Children in households with very low food security had higher median intakes of both carbohydrate and fat than children in households with marginal or high food security.

Single macronutrients differed by various key sociodemographic characteristics. Because WIC participation is of particular interest to this study, the discussion focuses on it. Children who did not receive WIC at 48 months exhibited significantly higher median usual intake of total fat than children who did receive WIC. Examination of differences by duration of WIC participation revealed that children who participated intermittently with WIC over the first 5 years of the study child's life had significantly higher median usual intake of total fat than children who participated consistently with the program during the first 5 years of the study child's life.[72]

[72] Appendix A offers a definition of patterns of WIC participation over the first 5 years of the study child's life.

4.4.3 Micronutrient Intake

Table 4-4a displays study children's median usual intakes of select micronutrients at 60 months. The AIs and EARs, as well as findings from NHANES, contextualize the findings. Table 4-4a offers comparisons with median intakes of 4- to 8-year-old children in families with income less than 131 percent of the poverty level. With the exception of folate, WIC ITFPS-2 median usual intakes are similar to or exceed median intakes for the NHANES low-income sample of 4- to 8-year-old children. Despite comparing favorably with the NHANES low-income sample, median usual intakes of vitamins D, K, and choline by study children were below their EARs. Given the 2019 changes in recommendations for sodium and potassium, intakes of these micronutrients are discussed in more detail subsequently.

Table 4-4b presents median usual intakes of the same select micronutrients as Table 4-4a by gender and offers a comparison of study children's median 60-month intakes with median intakes from a national sample of 4- to 8-year-old children from NHANES, which also uses the AMPM to collect dietary recall information. This sample includes children in families with a wide range of household incomes. With the exception of folate and vitamin K, WIC ITFPS-2 median usual intakes are similar to or exceed median intakes for the NHANES national sample of 4- to 8-year-old children. The gender differences observed are statistically significant for all micronutrients analyzed except vitamins C, E, B12, and K. Intakes below their EARs are of particular concern. The focus of the discussion of key sociodemographic subgroup differences is, therefore, on vitamin D.

Table 4-4a. Median usual intake of select micronutrients by study children at 60 months compared to Dietary Reference Intakes (DRIs) and to median intakes of 4- to 8-year-olds below 131 percent of the poverty level from 2013-2016 National Health and Nutrition Examination Survey (NHANES)

Micronutrients	DRIs for children 4-8 years		Median usual intake	
	AI[a]/EAR[b]	RDA[c]	WIC ITFPS-2 at 60 months	NHANES 4- to 8-year-olds, 131% of poverty level[d]
Antioxidants				
Vitamin C (mg/d)	22[b]	25	96.3	74.2
Vitamin E (mg/d)	6[b]	7	6.9	NA[e]
B vitamins				
Thiamin (mg/d)	0.5[b]	0.6	1.6	1.4
Riboflavin (mg/d)	0.5[b]	0.6	2.0	1.8
Niacin (mg/d)	6[b]	8	21.4	18.7
Vitamin B-6 (mg/d)	0.5[b]	0.6	2.0	1.6
Folate (µg/d)	160[b]	200	419.9	494
Vitamin B-12 (µg/d)	1.0[b]	1.2	5.3	4.5
Bone-related nutrients				
Calcium (mg/d)	800[b]	1,000	995.1	923
Phosphorus (mg/d)	405[b]	500	1,157.1	NA[e]
Magnesium (mg/d)	110[b]	130	221.7	204
Vitamin D (µg/d)	10[b]	15	7.6	6.1
Other micronutrients				
Vitamin A (µg RAE/d)	275[b]	400	713.4	NA[e]
Vitamin K (µg/d)	55[a]	NA[e]	49.1	NA[e]
Iron (mg/d)	4.1[b]	10	14.7	13.1
Zinc (mg/d)	4.0[b]	5	9.8	9.0
Sodium (mg/d)	1,000[a,f]	NA[e]	2,583.6	2,580
Potassium (mg/d)	2,300[a,f]	NA[e]	2,165.3	NA[e]
Choline (mg/d)	250[a]	NA[e]	240.5	218
Unweighted *n*			2,496	
Weighted *n*			436,443	

[a] Adequate Intake (AI).

[b] Estimated Average Requirement (EAR).

[c] Recommended Dietary Allowance (RDA).

[d] U.S. Department of Agriculture, Agricultural Research Service (May 2019). *Total usual nutrient intake from food, beverages, and dietary supplements, among individuals under 131% of poverty level, What We Eat in America, NHANES 2013-2016, Table F.* Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Under_131_WWEIA_2013_2016_Table_TF.pdf.

[e] NA indicates that an estimate is not available.

[f] 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).

Table 4-4b. Median usual intake of select micronutrients by study children at 60 months by gender compared to recommendations and National Health and Nutrition Examination Survey (NHANES) national sample

Micronutrients	AI[a]/EAR[b] for children 4-8 years	RDA[c]	Median usual intake			
			WIC ITFPS-2 at 60 months		NHANES 4-8 years, national[d]	
			Male	Female	Male	Female
Antioxidants						
Vitamin C (mg/d)	22[b]	25	97.3	95.4	73.6	72.6
Vitamin E (mg/d)	6[b]	7	7.2	6.6	NA[e]	NA[e]
B vitamins						
Thiamin (mg/d)	0.5[b]	0.6	1.7	1.5	1.5	1.4
Riboflavin (mg/d)	0.5[b]	0.6	2.1	2.0	1.9	1.7
Niacin (mg/d)	6[b]	8	22.3	20.5	19.5	17.8
Vitamin B-6 (mg/d)	0.5[b]	0.6	2.1	1.9	1.8	1.6
Folate (µg/d)	160[b]	200	434.9	404.7	541	495
Vitamin B-12 (µg/d)	1.0[b]	1.2	5.5	5.1	5.0	4.5
Bone-related nutrients						
Calcium (mg/d)	800[b]	1,000	1,031.3	957.6	1,026	904
Phosphorus (mg/d)	405[b]	500	1,203.0	1,109.5	NA[e]	NA[e]
Magnesium (mg/d)	110[b]	130	227.5	215.6	222	199
Vitamin D (µg/d)	10[b]	15	8.0	7.2	7.2	6.2
Other micronutrients						
Vitamin A (µg RAE/d)	275[b]	400	749.3	677.0	NA[e]	NA[e]
Vitamin K (µg/d)	55[a]	NA[e]	49.5	48.7	56.3	52.3
Iron (mg/d)	4.1[b]	10	15.3	14.1	13.3	12.3
Zinc (mg/d)	4.0[b]	5	10.2	9.5	9.9	8.8
Sodium (mg/d)	1,000[a,f]	NA[e]	2,677.0	2,486.6	2,730	2,474
Potassium (mg/d)	2,300[a,f]	NA[e]	2,230.7	2,097.7	NA[e]	NA[e]
Choline (mg/d)	250[a]	NA[e]	249.9	230.9	230	207
Unweighted *n*			1,282	1,214		
Weighted *n*			225,129	211,314		

[a] Adequate Intake (AI).

[b] Estimated Average Requirement (EAR).

[c] Recommended Dietary Allowance (RDA).

[d] U.S. Department of Agriculture, Agricultural Research Service (May 2019). *Total usual nutrient intake from food, beverages, and dietary supplements, by age and gender, What We Eat in America, NHANES 2013-2016, Table TA*. Available at: https://www.ars.usda.gov/ARSUserFiles/80400530/pdf/usual/Usual_Intake_Gender_WWEIA_2013_2016_Tables_TA.pdf.

[e] NA indicates that an estimate is not available.

[f] 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).

Based on bivariate analyses, median usual intakes of vitamin D exhibited statistically significant differences by race, participation in non-WIC benefit programs, self-reported maternal weight, and maternal age at the study child's birth. Children with White caregivers exhibited higher median

intakes of vitamin D than children with African American or Black caregivers. Analysis of median differences by non-WIC benefit program participation indicated that children in families that participated in non-WIC benefit programs excluding the Supplemental Nutrition Assistance Program (SNAP) exhibited higher median intakes than children in families who participated in SNAP or in SNAP and other non-WIC programs. Children in families who participated in SNAP or in SNAP and other programs exhibited higher median intakes than children in families that did not participate in any non-WIC benefit programs. Analysis of median differences by self-reported maternal weight indicated that children with healthy or underweight mothers exhibited higher median intakes than children with obese mothers. Analysis of median differences by maternal age found children whose mothers were 26 years or older at the time of their birth exhibited higher intakes than children whose mothers were 16 to 19 years old at the time of the study child's birth. Despite exhibiting statistically significant differences in median intakes of vitamin D, none of the subgroups discussed had median intakes that met the EAR. It is important to note that bivariate analyses do not control for other factors that may have influenced study children's intakes, so results should be interpreted with caution as they are not independent associations.

Micronutrients of public health concern are either under- or overconsumed by Americans. Those typically underconsumed include the following: calcium, magnesium, potassium, choline, and iron, and vitamins C, E, D, and A (USDA & HHS, 2015). With the exception of vitamins D and E and calcium, study children at 60 months have low estimates of inadequate intake based on the EARs (Table 4-5). Between 48 and 60 months, changes in the estimated prevalence of inadequacy for vitamins D and E are not statistically significant; however, the drop in the estimated prevalence of inadequacy for calcium, from 35 percent to 25 percent (Table 4-5), is statistically significant. It is noteworthy that for all available nutrients of public health concern, median intakes for WIC ITFPS-2 children at 60 months are comparable to intakes of NHANES samples of low-income children (Table 4-4a) and all children (Table 4-4b) ages 4 to 8 years old. The bivariate analyses focused on key sociodemographic characteristics associated with intakes of vitamins D and E, and calcium.

Table 4-5. Median usual micronutrient intake and mean percentage of inadequate intakes of study children at 48 and 60 months compared to recommendations

Micronutrients	AI[a]/EAR[b] for children 4-8 years	Median usual intake of WIC ITFPS-2 children		Mean percentage of inadequate intakes[d]	
		48 months[c]	60 months	48 months[c]	60 months
Antioxidants					
Vitamin C (mg/d)	22[b]	89.3	96.3	1.5%	4.5%
Vitamin E (mg/d)	6[b]	6.5	6.9	44.1	44.9
B vitamins					
Thiamin (mg/d)	0.5[b]	1.5[e]	1.6[e]	0.1	0.0
Riboflavin (mg/d)	0.5[b]	2.0	2.0	0.0	0.0
Niacin (mg/d)	6[b]	19.8[e]	21.4[e]	0.1	0.0
Vitamin B-6 (mg/d)	0.5[b]	1.9	2.0	0.0	0.1
Folate (µg/d)	160[b]	394.8[e]	419.9[e]	1.0	0.4
Vitamin B-12 (µg/d)	1.0[b]	5.0	5.3	0.1	0.0
Bone-related nutrients					
Calcium (mg/d)	800[b]	934.6[e]	995.1[e]	34.6%[f]	25.3%[f]
Phosphorus (mg/d)	405[b]	1,100.3[e]	1,157.1[e]	0.4[f]	0.1[f]
Magnesium (mg/d)	110[b]	211.2[e]	221.7[e]	2.2[f]	0.4[f]
Vitamin D (µg/d)	10[b]	7.5	7.6	74.7	68.4
Other micronutrients					
Vitamin A (µg RAE/d)	275[b]	662.5[e]	713.4[e]	1.4	1.3
Vitamin K (µg/d)	55[a]	43.0[e]	49.1[e]	NA[g]	NA[g]
Iron (mg/d)	4.1[b]	13.9	14.7	0.0	0.1
Zinc (mg/d)	4.0[b]	9.3[e]	9.8[e]	0.7	0.4
Sodium (mg/d)	1,000[a,h]	2,382.3[e]	2,583.6[e]	NA[g]	NA[g]
Potassium (mg/d)	2,300[a,h]	2,089.4	2,165.3	NA[g]	NA[g]
Choline (mg/d)	250[a]	239.1	240.5	NA[g]	NA[g]
Unweighted *n*		2,562	2,496	2,562	2,496
Weighted *n*		439,736	436,443	439,736	436,443

[a] Adequate Intake (AI).

[b] Estimated Average Requirement (EAR).

[c] The method used to estimate usual intake was revised for this report; consequently, the estimates at 48 months differ from those previously reported.

[d] Prevalence of inadequate intakes is estimated as the percentage of the group falling below the EAR.

[e] Difference between median usual intake estimates at 48 months and 60 months for the micronutrient is statistically significant at $p \leq 0.05$.

[f] Difference between the 48-month and 60-month estimate of the prevalence of inadequacy for the micronutrient is significant at $p \leq 0.05$.

[g] NA indicates no EAR is available.

[h] 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).

Table 4-6 presents the mean percentage of children with inadequate usual intake of vitamin D by the key sociodemographic subgroups that exhibited statistically significant differences.

Table 4-6. Mean percentages of inadequate usual intake of vitamin D at 60 months by key sociodemographic subgroups that exhibited statistically significant differences

Key sociodemographic characteristic	Mean percentage of study children with inadequate usual intake of vitamin D % (standard error)
Gender	
Male	63.9[a] (2.8)
Female	73.2[a] (2.7)
Race	
African American	75.9%[a] (3.2)
White	65.2[a] (2.6)
All Other	69.8 (4.1)
Unweighted *n*	2,496
Weighted *n*	436,443

[a] Indicates a statistically significant pairwise difference in percentages within the sociodemographic category at $p \leq 0.05$.

Table 4-7 presents the mean percentages of inadequate usual intake of vitamin E by key sociodemographic subgroups that exhibited statistically significant differences: ethnicity, parity, maternal educational attainment, and WIC participation status at 48 months.

Table 4-7. Mean percentages of inadequate usual intake of vitamin E at 60 months by key sociodemographic subgroups that exhibited statistically significant differences

Key sociodemographic characteristic	Mean percentage of study children with inadequate usual intake of vitamin E % (standard error)
Ethnicity	
Hispanic or Latino	51.2%[a] (2.8)
Not Hispanic or Latino	39.9[a] (2.9)
Parity	
Firstborn	40.3[a] (3.4)
Second born	43.7 (3.4)
Third or subsequently born	52.5[a] (2.5)
Mother's educational attainment	
High school or less	50.3[a] (2.8)
More than high school	39.2[a] (3.4)
WIC participation status at 48 months	
Receiving WIC	50.2[a] (2.9)
Not receiving WIC	38.0[a] (3.4)
Unweighted *n*	2,496
Weighted *n*	436,443

[a] Indicates a statistically significant pairwise difference in percentages within the sociodemographic category at $p \leq 0.05$.

Vitamin E was the only nutrient among those analyzed for which children's intakes exhibited statistically significant differences in the mean percentages of inadequate intakes by pattern of WIC participation. Among those on WIC in the first year only, about 28 percent (SE=6.3) had inadequate intake, which was lower than the 53 percent (SE=3.2) of those who were on WIC consistently into the child's fifth year of life. Those on WIC intermittently also exhibited a lower percentage of inadequate intakes (35%, SE=4.6) than those receiving WIC consistently into the child's fifth year of life (53%, SE=3.2). Bivariate analyses, however, do not account for other factors which may influence the association between participation status and dietary intake, so the reported results should be interpreted with caution.

Table 4-8 presents mean percentages of inadequate usual intake of calcium by the only two key sociodemographic subgroups that exhibited a statistically significant difference.

Table 4-8. Mean percentages of inadequate usual intake of calcium at 60 months by key sociodemographic subgroups that exhibited statistically significant differences

Key sociodemographic characteristic	Mean percentage of study children with inadequate intake of calcium % (standard error)
Gender	
Male	20.1 (3.4)[a]
Female	30.9 (4.1)[a]
Unweighted *n*	2,496
Weighted *n*	436,443

[a] Indicates a statistically significant pairwise difference in percentages within the sociodemographic category at $p \leq 0.05$.

The DRIs for potassium and sodium were revised and new values were released in March 2019 (NASEM, 2019). As shown in Table 4-9, median intake at 60 months was about 135 mg/d or nearly 5 percentage point below the new, lower AI, which was an improvement from the deficit at 48 months when compared to the new AI. As there are no EARs for potassium, there is no standard from which to estimate the prevalence of inadequate intake. Estimated median usual intake of sodium exceeded the AI at both 48 and 60 months; the difference between the estimates at the two time points was statistically significant. For comparison, Table 4-9 presents the 2005 and 2019 DRIs for sodium and potassium, and the median intake of both nutrients by study children at 48 and 60 months.

Table 4-9. Median usual sodium and potassium intake of study children at 48 and 60 months compared to old and new Dietary Reference Intakes (DRIs)

	2005 DRIs		2019 DRIs		Median usual intake of WIC ITFPS-2 children	
	AI[a]	UL[b]	AI[a]	CDRR[c]		
Micronutrients	Children ages 4-8 years				48 months[d]	60 months
Sodium (mg/d)	1,200	1,900	1,000	Reduce intakes above 1,500 mg/day	2,382[e]	2,584[e]
Potassium (mg/d)	3,800	ND[g]	2,300	ND[f]	2,089[e]	2,165[e]
Unweighted n					2,562	2,496
Weighted n					439,736	436,443

[a] Adequate Intake (AI).

[b] Tolerable Upper Intake Level (UL).

[c] Chronic Disease Risk Reduction Intakes (CDRR).

[d] The method used to estimate usual intake was revised for this report; consequently, the estimates at 48 months differ from those previously reported.

[e] Difference between median usual intake estimates at 48 months and 60 months for the micronutrient is statistically significant at $p \leq 0.05$.

[f] Not determined (ND).

The 2019 release of new DRI values for sodium included the removal of the UL for sodium and the addition of the CDRR (Table 4-9), 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 DRI is now captured in the CDRR. The median intake of 2,382 mg/d of sodium by study children at 48 months is close to 1.3 times the previous UL (1,900 mg/day) and 1.6 times the current CDRR (1,500 mg/day). Median intake of 2,584 mg/d of sodium by study children at 60 months is about 1.4 times the previous UL and around 1.7 times the current CDRR.

In sum, at 60 months of age, the prevalence of inadequate intake of most micronutrients was low; however, at least one-quarter of study children had inadequate usual intake of calcium and vitamins D and E. The prevalence of inadequate intake was highest for vitamin D, at about 68 percent. Although the median intake of vitamin K increased between ages 48 and 60 months, the median intake at 60 months was still lower than the AI.[73] Sodium intake at 60 months continued to exceed the level identified with chronic disease risk, reaching about 1.7 times the current CDRR.

[73] The absence of an EAR for vitamin K prohibits estimating the prevalence of inadequate intake of this nutrient among WIC ITFPS-2 children.

4.5 Relationship between Early Feeding Practices and Sodium Intake on a Given Day at 60 Months

Excessive sodium intake is a common problem in the American diet (Gunn et al., 2013). When study children are 60 months old, usual sodium intake of nearly all (97.6%) children exceeds the CDRR-recommended level of 1,500 mg/d. This section presents findings from a multivariable regression analysis examining whether early feeding practices—breastfeeding duration, the early (prior to 4 months) introduction of solid foods, and the age when salty snacks such as chips, pretzels, and crackers are first introduced—are independently associated with children's sodium intakes on a given day at 60 months.

In addition to incorporating early feeding practices, the regression model includes child and caregiver sociodemographic characteristics, contemporary feeding practices (i.e., the number of snacking occasions the child has at 60 months), and participation in Federal nutrition assistance programs (i.e., WIC and/or SNAP) during the child's fifth year of life.[74] Children's total energy intake at 60 months is included to control for the confounding effect of overall diet. The vast majority of the independent variables are categorical; however, the age of the caregiver at the child's birth, breastfeeding duration, total energy intake, and the number of snacking occasions are continuous measures. Table 4-10 summarizes the model's findings (Appendix Table B2c-2 presents detailed model results).

[74] At the time of their 60-month interview, some children were too old to participate in WIC, which meant that the measure at 54 months better reflected WIC participation than the 60-month measure.

Table 4-10. Model results from regression of total sodium intake (mg/d) on a given day at 60 months on sociodemographic characteristics, early feeding practices, and Federal food program participation at 54 months[a]

Covariates	Estimate	*p*-value
Intercept	121.23	0.368
Child gender: Female compared to male	-16.50	0.668
Caregiver race: African American compared to White	28.32	0.599
Caregiver race: All Other races compared to White	36.99	0.484
Caregiver ethnicity: Hispanic compared to non-Hispanic	-10.55	0.781
Caregiver education: High school or less compared to more than high school	3.40	0.910
Age (years) of caregiver at child's birth[b]	0.08	0.985
Marital status: Not married compared to married	35.50	0.367
Parity: Firstborn compared to third or subsequent born	98.96	0.085
Parity: Second born compared to third or subsequent born	57.53	0.136
Breastfeeding duration (days)[b,*]	0.29	0.024
Complementary foods introduced after 4 months compared to prior to 4 months	15.86	0.706
Age when salty snacks are introduced: Introduced in the first year compared to not introduced in the first 2 years	-60.93	0.421
Age when salty snacks are introduced: Introduced in the second year compared to not introduced in the first 2 years	-83.89	0.379
Child's energy intake (kcal/d) at 60 months[b,*]	1.62	<.001
Number of daily snacking occasions at 60 months[b,*]	-76.08	<.001
WIC and Supplemental Nutrition Assistance Program (SNAP) status at 54 months: Receiving SNAP only compared to not receiving benefits from either program	-51.98	0.334
WIC and SNAP status at 54 months: Receiving both WIC and SNAP compared to not receiving benefits from either program*	-75.62	0.034
WIC and SNAP status at 54 months: Receiving WIC only compared to not receiving benefits from either program*	-119.21	0.033

[a] Results are based on weighted data. Weighted *n*=381,428; unweighted *n*=2,201. R-square=0.71. Additional detail on model results is available in Appendix Table B2c-2.

[b] Continuous variable.

* Indicates significance at $p \leq 0.05$.

Duration of breastfeeding was independently and positively associated with sodium intake on a given day when the child was 5 years old, which is striking because research indicates that younger children who are breastfeeding have lower intakes of sodium than those not breastfeeding (Tian, Zhang, Loustalot, Yang, & Cogswell, 2013). Children who exhibited more frequent snacking occasions consumed less sodium, on average, than children who had fewer snacking occasions. This finding is opposite of that for added sugars consumption: The number of snacking occasions was positively associated with children's added sugars intake on a given day at 60 months (Section 3.7). However, the inverse association between eating frequency, as measured by number of snacking

occasions, and sodium intake is consistent with findings in the U.S. adult population using data from the NHANES (Hiza, Casavale, Guenther, & Davis, 2013). Participation in Federal nutrition assistance programs was independently and inversely associated with children's sodium intake at age 60 months. Compared to those who did not participate in either WIC or SNAP, children who participate in WIC during the fifth year of life—with or without additional SNAP participation by the household—exhibited lower sodium intake, on average, on a given day. These findings warrant further analysis of the types of snacks children consume.

5. Feeding Beliefs and Practices

Key Findings:

- **Between the ages of 18 and 54 months, the prevalence of picky eating among study children increases. At 60 months, nearly two-thirds (65%) of study children are described by their caregivers as somewhat picky or very picky eaters.**
- **Among the two-thirds (66%) of study families that reported eating five or more meals together in the past week when the study child is 54 months old, the majority of these families adopted this feeding practice when the child was very young (81% at 15 months of age). Compared to children who eat with their families less than five times a week, those who eat together five or more times exhibited higher diet quality scores on a given day at 60 months based on univariate regression.**
- **Around half (51%) of study households have their televisions (TVs) on during meals at least some of the time. For many, the practice of *never* or *rarely* watching TV during meals at 54 months was adopted over time, with increasing percentages adopting the practice as the child aged. Compared to children who *never* watch TV during meals, children who watch TV *most of the time* or *sometimes* have lower diet quality scores, on average, on a given day at 60 months based on univariate regression results.**

5.1 Overview

This chapter focuses on caregivers' beliefs on and practices for child feeding. The data in this chapter are primarily drawn from the 54-month interview, though other interviews may be referenced. In addition to providing descriptive information on households and families in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2), this chapter addresses the following research questions:[75]

- What is the influence of parenting and broader environmental factors on early dietary behaviors that may affect child obesity?
- How do feeding practices vary with working and childcare circumstances?

5.2 Background

As discussed in the *Fourth Year Report*, parental feeding style may influence children'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,

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

2013; Matvienko-Sikar et al., 2018; Wilson et al., 2019). Parents who follow this kind of feeding style tend to respond appropriately to children's signals of hunger and satiety.

This chapter explores both feeding beliefs (i.e., what parents think are appropriate ways to feed children) and feeding practices (i.e., frequency of behaviors that parents engage in to feed their own child) to examine how parenting practices influence childhood obesity. Some of the feeding beliefs and practices discussed in this chapter were drawn from the Infant Feeding Styles Questionnaire (IFSQ) (Thompson et al., 2009), which was specifically developed for use with low-income families. This chapter also examines broader aspects of the child's food environment including regularly eating family meals together and limiting television (TV) at meals. Research associates these practices 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) and potentially into adulthood (Tahir, Willett, & Forman, 2019).

Though there is no agreed-upon approach for assessing picky eating, many parents characterize their children as picky or fussy eaters. While studies have varied in how they have quantified picky eating and the associations found, some research has shown that picky eating is related to poorer diet quality. However, results are mixed with respect to the relationship between picky eating and body weight (Brown et al., 2018; Brown, Vander Schaaf, Cohen, Irby, & Skelton, 2016). Repeated exposure to tasting new foods has been associated with better acceptance by young children of a variety of foods (Gibson & Cooke, 2017; Birch & Anzman-Frasca, 2011; Wardle, Herrera, Cooke, & Gibson, 2003). This chapter explores both caregiver perceptions of picky eating as well as the number of times mothers introduce new or unfamiliar foods before deciding that the child does not like them.

5.3 Sample and Analysis Approach

5.3.1 Sample

During the 54-month interview, study participants are asked questions about their feeding beliefs and practices. Table 5-1 shows the unweighted number of respondents to this interview. Both the core and supplemental samples were eligible for the 54-month interview. Table 5-1 also includes the number of respondents to the 60-month interview, as dietary recall information from that interview

is used to examine the association of feeding beliefs and practices on diet quality as measured by the Healthy Eating Index-2015 (HEI-2015) total scores on a given day. Both the core and supplemental samples were eligible for the 60-month interview as well. In analyses, the responses to each interview are weighted so that findings reflect the WIC population as described in Chapter 1.

Table 5-1. Unweighted number of respondents by interview month

Sample structure	54-month interview	60-month interview	60-month interview and dietary recall
Core prenatal sample	1,791	1,766	1,740
Core postnatal sample	227	223	220
Supplemental prenatal sample	441	437	434
Supplemental postnatal sample	104	103	102
Total	2,563	2,529	2,496

5.3.2 Analysis

Analyses begin by exploring whether key sociodemographic subgroups of participants differ in their feeding beliefs and practices. 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 Federal Poverty Guidelines (FPG), or WIC participation status, values reported at the 48-month interview are used.[76]

Analyses typically include descriptions of the outcomes of interest, bivariate chi-square tests to examine associations between key sociodemographic characteristics and outcomes of interest, and follow-up t-tests between percentages in all pairs of subgroups to determine which are statistically significantly different from each other. Subgroup differences discussed in the chapter are limited to those that form a pattern over time or across questions and are large in magnitude, in order to avoid

[76] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

focusing on findings that, while statistically significant, may have little practical importance.[77] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

Because HEI-2015 is a continuous variable, univariate regression is used to assess associations between feeding practices and diet quality (HEI-2015). In this chapter, the analyses use 1 day of recall information to estimate a HEI-2015 score, as the models used to estimate usual intake did not include feeding practices. Thus, in this chapter, the HEI-2015 score represents diet quality on a given day. Chapters 1 and 4 offer additional information on differences between usual intake estimates and estimates of intake on a given day.

5.4 Feeding Beliefs and Practices at 54 Months

Survey items involving feeding beliefs probe how strongly caregivers agree with statements regarding controlling children's behavior and consumption during meal and snack time (Thompson et al., 2009). Table 5-2 presents a list of the beliefs and practices probed, indicating the source for the item. To assess beliefs related to behaviors, study caregivers rate the extent to which they agree or disagree with statements on a 5-point scale, ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). In analyses, *strongly agree* and *agree* are collapsed into one category, and *strongly disagree* and *disagree* are collapsed into another single category. For beliefs involving children's access to different types of foods, caregivers indicate how often children should be allowed these foods: *whenever they want*, *occasionally*, or *never* are response options.

Questions involving feeding practices probe what caregivers actually do; that is, the actions that they take as opposed to what they think they should be doing. Table 5-2 also includes a list of the feeding practices probed in the 54-month interview. Survey respondents indicate how frequently they engage in each particular practice using a 5-point scale ranging from 1 (*always*) to 5 (*never*). In analyses of these items, *always* and *usually* are collapsed into a single category, as are *about half the time* and *occasionally*.

[77] 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).

Table 5-2. Interview items probing feeding beliefs and practices at 54 months

Feeding belief items	Pressuring (P) or Restrictive (R) or Neither (N)	Author Thompson (T) or O'Connor (O)[a]
Response options: Agree/Strongly agree = 1; Neither agree nor disagree = 2; Disagree/Strongly disagree = 3		
It is important that the parent decides how much a child should eat.	R	T
The best way to get a child to behave is to offer his or her favorite foods as a reward.	N	O
It is important for the child to finish all the food on his or her plate.	P	T
Response options: Whenever they want to = 1; Occasionally = 2; Never = 3		
Children should be allowed to eat fast food.[b]	R[c]	T
Children should be allowed to eat sugary foods.[d]	R[c]	T
Children should be allowed to eat snack foods.[e]	R[c]	T
Children should be allowed to drink sugary drinks.	R[c]	NA[f]
Feeding practice items		
Response options: Always = 1; Usually = 2; About half the time = 3; Occasionally = 4; Never = 5		
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
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

[a] Thompson et al. (2009) or O'Connor et al. (2010).

[b] Exact wording from Thompson et al. (2009) is "A toddler should never eat fast food."

[c] The belief is restrictive if the respondent answers "never."

[d] Exact wording from Thompson et al. (2009) is "A toddler should never eat sugary food like cookies."

[e] Exact wording from Thompson et al. (2009) is "A toddler should never eat junk food like chips."

[f] New development for WIC ITFPS-2; hence, the item is not applicable (NA) for categorization.

In the literature on parental feeding styles, authors use various combinations of feeding beliefs and practices to assess parental feeding styles. Some researchers employ scales that combine beliefs and practices (Thompson et al., 2009; Thompson, Adair, & Bentley, 2013) while others rely on individual practices to reflect parental approaches to feeding children. Both restrictive and pressuring feeding beliefs and practices emphasize parental control of children's food consumption. A restrictive feeding style is when a parent is concerned with decreasing 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 et al., 2013). A pressuring feeding style is when a parent is concerned with increasing 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 types of feeding styles have been associated

with infant size and, therefore, may be important environmental contributors to obesity (Thompson et al., 2013).

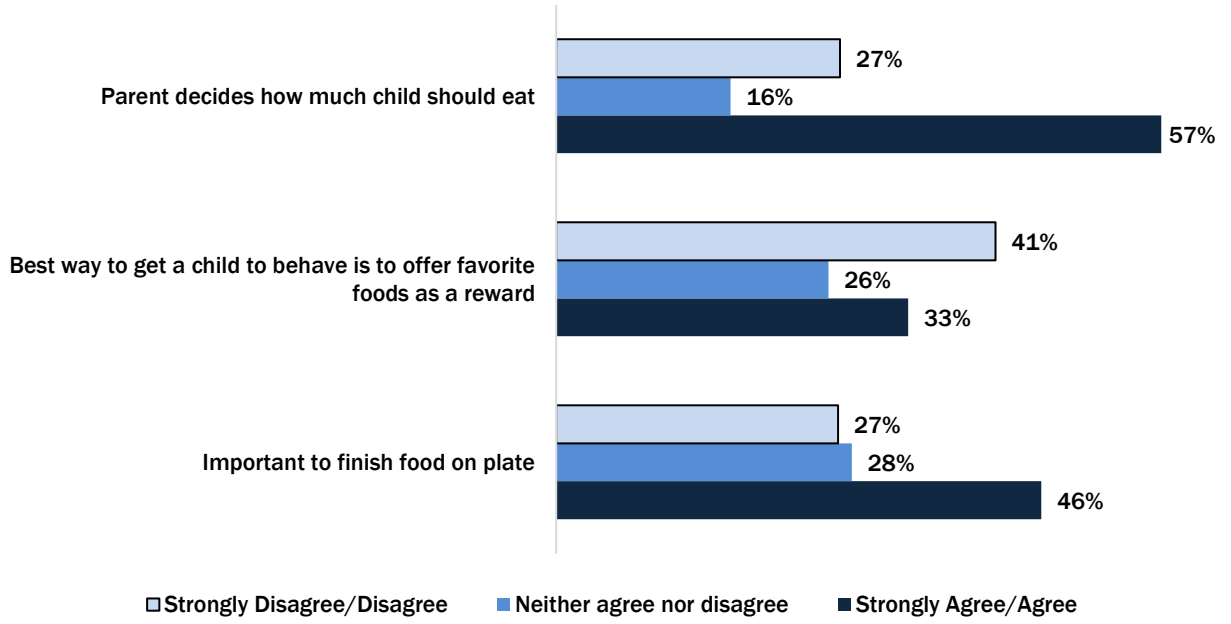
Because the current study explores the association between parental feeding practices and beliefs and increased child risk for obesity, this research focuses on restrictive or pressuring feeding beliefs and practices as indicated in Table 5-2. As noted in the table, whether a parent's belief or practice is restrictive or pressuring may depend on the parent's adherence to the belief or practice. For example, respondents who *never* allow their children to eat fast food exhibit a restrictive practice while respondents who *occasionally* allow their children to eat fast food do not. It is also important to note that restrictive and pressuring feeding practices are subsets of controlling feeding practices. Controlling practices are highly directive and external to the child.

5.4.1 Feeding Beliefs

The first set of feeding beliefs probed for how strongly parents agree with statements about controlling children's feeding behaviors (Thompson et al., 2009; O'Connor et al., 2010). Beliefs in this set include whether it is important that parents decide how much children eat, whether parents think the best way to control behavior is by offering foods as reward, and whether parents think it is important for children to finish all the food on their plates. Study caregivers are asked to rate how strongly they agree or disagree with each of these beliefs.

Over half (57%) *strongly agree* or *agree* that it is important that the parent decides how much a child should eat (Figure 5-1; Appendix Table B2d-1 offers additional detail). Nearly half of mothers (46%) *strongly agree* or *agree* that it is important that their child finish the food on his or her plate. In contrast, substantial percentages of study mothers hold opposing positions on using favorite foods as a reward for behavior: 41 percent *strongly disagree* or *disagree,* and 33 percent *strongly agree* or *agree*. Only 17 percent of mothers *strongly agree* or *agree* with all three of these belief statements (not shown).

Figure 5-1. Percentage of study mothers indicating what they believe about feeding practices at 54 months[a]



[a] Unweighted *n*=2,558 and weighted *n*=440,374.

Note: Percentages may not sum to 100 percent due to rounding.

The ensuing discussion highlights key sociodemographic characteristics associated with the restrictive feeding belief that "it is important the parent decides how much the child should eat" and the pressuring belief that "it is important for the child to finish all the food on his/her plate." Table 5-3 presents the statistically significant associations between key sociodemographic characteristics and these two feeding beliefs.

The belief that "it is important the parent decides how much the child should eat" is significantly associated with race, participation in non-WIC benefit programs, income poverty, the age of the mother at the child's birth, the child's WIC participation status at 48 months, and maternal education. The belief that "it is important for the child to finish all the food on his/her plate" is also significantly associated with several sociodemographic variables: race, marital status, food security, participation in non-WIC benefit programs, weight status of the mother at 42 months, income poverty, age of the mother at the child's birth, and maternal education.

Table 5-3. Percentage of caregivers by feeding beliefs and significantly associated with key sociodemographic characteristics at 54 months

Feeding belief at 54 months	Agree or strongly agree % (standard error [SE])	Neither agree nor disagree % (SE)	Disagree or strongly disagree % (SE)	Weighted *n*	Unweighted *n*
It is important that the parent decides how much the child should eat					
Race					
African American	62.4 (2.7)[a]	13.7 (1.3)[b]	23.9 (2.8)	741	95,805
White	52.8 (1.7)[a]	18.9 (1.0)[b,c]	28.4 (1.5)	1,440	259,181
All Other	63.3 (3.6)	12.0 (2.1)[c]	24.7 (2.8)	377	85,388
Participation in non-WIC benefit programs					
Does not participate in other programs[d]	52.5 (2.8)	20.8 (2.2)[a]	26.8 (2.2)	468	80,346
Participates in Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[d]	60.2 (2.0)	14.4 (1.2)[a]	25.4 (1.5)	1,189	204,665
Participates in other programs[d] excluding SNAP	54.9 (2.3)	16.8 (1.7)	28.3 (2.0)	901	155,362
Income poverty					
75% of the Federal Poverty Guidelines (FPG)	61.1 (2.0)[a]	14.6 (1.3)	24.2 (1.7)	1,134	195,335
Above 75% but no more than 130% of the FPG	52.7 (2.8)[a]	19.1 (1.7)	28.2 (1.7)	782	141,688
Above 130% of the FPG	54.7 (2.4)	16.1 (1.9)	29.2 (2.1)	642	103,351
Age of the mother at the study child's birth					
16-19 years	62.1 (3.7)	20.0 (3.9)	17.9 (2.9)[b]	262	49,722
20-25 years	56.9 (2.4)	19.0 (1.2)[a]	24.1 (2.1)	1,047	176,908
26 years or older	55.7 (2.0)	13.4 (1.2)[a]	30.9 (1.8)[b]	1,249	213,744
WIC participation status at 48 months					
Receiving WIC	59.7 (2.0)[a]	14.6 (1.3)[b]	25.7 (1.4)	1,306	233,863
Not receiving WIC	53.8 (2.0)[a]	18.5 (1.4)[b]	27.8 (1.4)	1,252	206,511
Maternal educational attainment					
High school or less	62.6 (1.7)[a]	13.9 (1.2)[b]	23.5 (1.4)[c]	1,365	236,985
More than high school	50.3 (2.6)[a]	19.3 (1.4)[b]	30.4 (2.2)[c]	1,193	203,389
It is important for the child to finish all the food on his/her plate					
Race					
African American	56.4 (1.4)[a,b]	23.4 (1.4)	20.2 (1.7)[c]	741	95,805
White	42.0 (1.9)[a]	28.3 (1.7)	29.7 (1.5)[c]	1,440	259,181
All Other	44.3 (3.9)[b]	31.5 (3.7)	24.2 (3.6)	377	85,388
Marital status					
Married	39.1 (2.0)[a]	28.7 (2.1)	32.2 (1.8)[b]	950	172,541
Not married	49.8 (1.6)[a]	27.3 (1.5)	22.9 (1.4)[b]	1,608	267,833

Table 5-3. Percentage of caregivers by feeding beliefs and significantly associated with key sociodemographic characteristics at 54 months (continued)

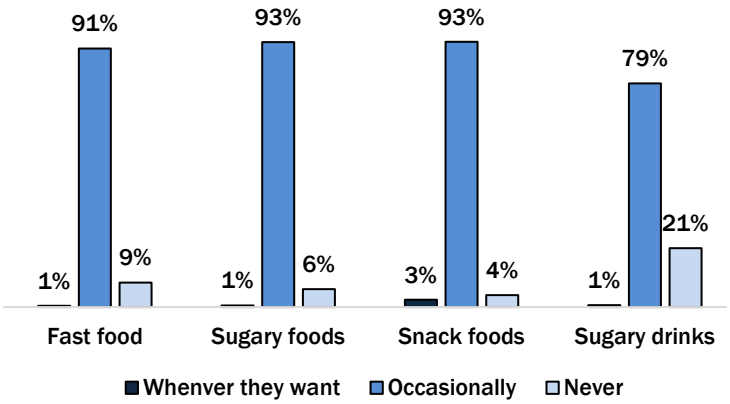
Feeding belief at 54 months	Agree or strongly agree % (standard error [SE])	Neither agree nor disagree % (SE)	Disagree or strongly disagree % (SE)	Weighted *n*	Unweighted *n*
It is important for the child to finish all the food on his/her plate					
Household food security					
High or marginal	46.6 (1.4)[a]	27.3 (1.4)[c]	26.1 (1.3)	1,951	338,133
Low	48.3 (3.6)[b]	24.8 (3.1)[d]	26.8 (2.7)	326	56,383
Very low	35.0 (3.5)[a,b]	35.8 (3.1)[c,d]	29.2 (2.7)	281	45,858
Participation in non-WIC benefit programs					
Does not participate in any other programs[d]	42.4 (2.4)	28.8 (2.2)	28.7 (2.4)	468	80,346
Participates in other programs[d] and is on Supplemental Nutrition Assistance Program (SNAP)	49.1 (2.0)	27.5 (1.9)	23.4 (1.4)[a]	1,189	204,665
Participates in other programs[d] and is not on SNAP	42.7 (2.1)	27.8 (2.0)	29.6 (2.0)[a]	901	155,362
Weight status of the mother at 42 months					
Normal or underweight	51.6 (2.1)[a]	25.9 (1.7)	22.5 (1.7)[b]	807	137,732
Overweight	46.2 (2.7)	28.3 (2.2)	25.6 (1.8)	776	138,167
Obese	40.1 (2.1)[a]	29.1 (2.2)	30.7 (1.6)[b]	975	164,475
Income poverty					
75% of the Federal Poverty Guidelines (FPG)	52.8 (1.9)[a,b]	25.3 (1.5)	21.9 (1.3)[c]	1,134	195,335
Above 75% but no more than 130% of the FPG	39.9 (2.0)[a]	31.6 (2.3)	28.5 (2.4)	782	141,688
Above 130% of the FPG	39.8 (2.7)[b]	27.4 (2.3)	32.8 (2.0)[c]	642	103,351
Age of the mother at the study child's birth					
16-19 years	52.6 (5.1)	32.8 (4.8)	14.6 (2.7)[b]	262	49,722
20-25 years	51.2 (2.2)[a]	26.5 (1.6)	22.3 (1.5)[c]	1,047	176,908
26 years or older	39.3 (1.8)[a]	27.8 (2.1)	32.9 (1.5)[b,c]	1,249	213,744
Maternal educational attainment					
High school or less	51.2 (1.7)[a]	28.2 (1.7)	20.6 (1.6)[b]	1,365	236,985
More than high school	39.1 (2.1)[a]	27.4 (1.9)	33.5 (2.0)[b]	1,193	203,389

[a,b,c] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between percentages within a key sociodemographic category.

[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).

A second set of feeding beliefs probed for caregiver behaviors indicative of a restrictive feeding style. In particular, the study probed for restrictions on children's access to less healthy foods, including fast food; sugary foods such as candy, ice cream, cakes, or cookies; savory snack foods such as potato chips, regular or flavored tortilla chips, and cheese puffs; and sugary drinks like fruit punch, lemonade, soda, and sweet tea. Only a small percentage of study mothers indicate that children should be allowed to eat these foods *whenever they want*: 1 percent, fast food; 1 percent, sugary foods; 3 percent, snack foods; and 1 percent, sugary drinks (Figure 5-2; Appendix Table B2d-2 offers additional detail). Most study mothers believe that occasional access should be allowed (fast food, 91%; sugary foods, 93%; snack foods, 93%; sugary drinks, 79%). About one in five (21%) believe that a child should never have sugary drinks and nearly one in 10 (9%) believe that the child should never have fast food.

Figure 5-2. Percentage of study mothers indicating how often they believe children should be allowed to eat different types of less healthy foods at 54 months[a]



[a] Unweighted *n*=2,559 and weighted *n*=440,409.

Note: Percentages may not sum to 100 percent due to rounding.

There are several statistically significant bivariate associations between these opinions about access and key sociodemographic characteristics; however, in many cases, differences between subgroups are less than 3 percentage points. Tables 5-4a, 5-4b, 5-4c, and 5-4d present the results for differences that are at least 3 percentage points.

As presented in Table 5-4a, marital status, income poverty, and maternal age at the study child's birth are associated with beliefs about how often children should be allowed to consume fast food.

Table 5-4a. Significant associations between key sociodemographic characteristics and caregiver beliefs about how often children should be allowed to consume fast food at 54 months

Key sociodemographic characteristic	Belief about how often children should be allowed to consume fast food: Whenever they want % (standard error [SE])	Occasionally % (SE)	Never % (SE)	Unweighted *n*	Weighted *n*
Marital status					
Married	0.3 (0.2)	93.8 (0.6)[a]	5.9 (0.5)[b]	951	172,615
Not married	0.6 (0.2)	89.1 (0.9)[a]	10.3 (0.9)[b]	1,608	267,795
Income poverty					
At or below 75% of the Federal Poverty Guidelines (FPG)	0.7 (0.3)	88.6 (1.0)[a]	10.8 (1.0)[b]	1,135	195,347
Between 75% and 130% of the FPG	0.2 (0.1)	93.2 (0.9)[a]	6.6 (0.9)[b]	782	141,711
Above 130% of the FPG	0.6 (0.4)	92.3 (1.1)	7.1 (1.1)	642	103,351
Maternal age at the study child's birth					
16-19 years	0.2 (0.2)	91.2 (2.3)	8.6 (2.3)	263	49,888
20-25 years	0.6 (0.3)	88.4 (1.3)	11.1 (1.3)[b]	1,048	176,991
26 years or older	0.5 (0.2)	93.0 (0.9)	6.5 (0.9)[b]	1,248	213,531

[a,b] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between percentages within a key sociodemographic category.

Marital status is the only key sociodemographic characteristic significantly associated with beliefs about frequency of access to sugary foods (Table 5-4b).

Table 5-4b. Significant association between marital status and caregiver beliefs about how often children should be allowed to consume sugary foods[a] at 54 months

Key sociodemographic characteristic	Belief about how often children should be allowed to consume sugary foods: Whenever they want % (standard error [SE])	Occasionally % (SE)	Never % (SE)	Unweighted *n*	Weighted *n*
Marital status					
Married	0.5 (0.2)	95.5 (0.7)[b]	3.9 (0.7)[c]	951	172,615
Not married	0.6 (0.3)	91.5 (0.9)[b]	7.9 (0.8)[c]	1,608	267,795

[a] The survey item reads, "There are many types of sugary foods like candy, ice cream, cakes, or cookies. Which of the following best describes your opinion about children eating sugary foods?"

[b] Indicates a significant difference at $p \leq 0.05$ between percentages of mothers who *occasionally* allow access.

[c] Indicates a significant difference at $p \leq 0.05$ between percentages of mothers who *never* allow access.

Key sociodemographic characteristics associated with beliefs about the frequency of access to snack foods include ethnicity and participation in non-WIC benefit programs (Table 5-4c).

Table 5-4c. Significant associations between key sociodemographic characteristics and caregiver beliefs about how often children should be allowed to consume snack foods[a] at 54 months

Key sociodemographic characteristic	Belief about how often children should be allowed to consume snack foods			Unweighted *n*	Weighted *n*
	Whenever they want % (standard error [SE])	Occasionally % (SE)	Never % (SE)		
Ethnicity					
Hispanic or Latino	3.2 (0.6)	88.9 (1.6)[b]	7.9 (1.3)[c]	955	205,731
Not Hispanic or Latino	2.1 (0.5)	96.9 (0.6)[b]	1.1 (0.3)[c]	1,604	234,678
Participation in non-WIC benefit programs					
Does not participate in other programs	1.6 (0.9)	97.1 (1.1)[b,d]	1.3 (0.7)[c,e]	468	80,346
Participates in Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[f]	2.8 (0.6)	92.8 (1.3)[b]	4.4 (1.2)[c]	1,188	204,418
Participates in other programs[f] excluding SNAP	2.8 (0.6)	91.7 (1.4)[d]	5.5 (1.1)[e]	903	155,645

[a] The survey item reads, "There are many kinds of snack foods like potato chips, regular or flavored tortilla chips, and cheese puffs. Which of the following best describes your opinion about children eating snack foods?"

[b] Indicates a significant pairwise difference at $p \leq 0.05$ within a key sociodemographic category between percentages of mothers who *occasionally* allow access.

[c] Pairs of matching letters indicate a significant difference at $p \leq 0.05$ within a key sociodemographic category between percentages of mothers who *never* allow access.

[d] Pairs of matching letters indicate a significant difference at $p \leq 0.05$ within a key sociodemographic category between percentages of mothers who *occasionally* allow access.

[e] Pairs of matching letters indicate a significant difference at $p \leq 0.05$ within a key sociodemographic category between percentages of mothers who *never* allow access.

[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).

As presented in Table 5-4d, ethnicity exhibits significant association with beliefs about frequency of access to sugary drinks.

Table 5-4d. Association between ethnicity and caregiver beliefs about frequency of access to sugary drinks at 54 months

Key sociodemographic characteristic	Belief about how often children should be allowed to consume sugary drinks			Unweighted *n*	Weighted *n*
	Whenever they want % (standard error [SE])	Occasionally % (SE)	Never % (SE)		
Ethnicity					
Hispanic or Latino	1.0 (0.3)	75.4 (2.3)[a]	23.6 (2.3)[b]	955	205,731
Not Hispanic or Latino	0.4 (0.2)	81.4 (1.1)[a]	18.2 (1.1)[b]	1,604	234,678

[a] Indicates a significant difference at $p \leq 0.05$ between percentages of mothers who *occasionally* allow access.

[b] Indicates a significant difference at $p \leq 0.05$ between percentages of mothers who *never* allow access.

Caregiver marital status and ethnicity are the only two key sociodemographic characteristics significantly associated with more than one of the beliefs about frequency of access to these select less heathy foods (Table 5-4a through Table 5-4d). These two key sociodemographic characteristics are not correlated, so they likely measure different phenomena.

5.4.2 Feeding Practices

Questions about feeding beliefs ask parents to indicate what they think parents *should do* when feeding their children. In contrast, questions about feeding practices ask parents to indicate what behaviors they are *actually doing* when feeding their children. The items probed include feeding practices aimed at controlling—by either pressuring children to eat or restricting children from eating—child consumption. Practices aimed at controlling consumption include trying to get the child to finish his or her food, trying to get the child to eat when he or she does not seem hungry, controlling how much the child eats, and being careful not to feed the child too much. Survey items also probed for feeding practices aimed at engaging children in ways that encourage consumption of unfamiliar healthy foods. Practices intended to encourage consumption of new foods include using mealtimes to teach the child about healthy eating, asking the child to help prepare food, and telling the child that he or she has to try, at least, a couple of bites of new foods, but does not have to eat it all. Response options include *always*, *usually*, *about half the time*, *occasionally*, and *never*. For analyses, these are collapsed into three categories: *always* or *usually*; *about half the time* or *occasionally*; and *never*.

A majority of mothers endorse frequent use of some feeding practices that aim to control their children's eating (Table 5-5). Nearly three-quarters (73%) of caregivers report that they *always* or *usually* try to get the child to finish his or her food. Nearly two-thirds (64%) report that they are *always* or *usually* very careful not to feed the child too much. More than half (54%) of study mothers report that they *always* or *usually* carefully control how much the child eats. On the other hand, only about one-third (33%) indicate that they *always* or *usually* try to get the child to eat even if the child does not seem hungry.

Table 5-5. Percentage of study mothers reporting how often they follow select feeding practices at 54 months[a]

Feeding practice	Always or usually % (standard error [SE])	About half the time or occasionally % (SE)	Never % (SE)
Keep track of what the child eats	69.8 (1.3)	27.4 (1.3)	2.8 (0.4)
Practices that control consumption			
Try to get the child to finish his or her food	73.1 (1.2)	21.7 (1.1)	5.2 (0.5)
Very careful not to feed child too much	63.7 (1.3)	16.9 (1.1)	19.4 (1.1)
Carefully control how much the child eats	53.6 (1.5)	27.0 (1.1)	19.4 (1.0)
Try to get the child to eat even if he or she does not seem hungry	33.1 (1.3)	36.4 (1.2)	30.5 (1.4)
Practices that encourage consumption of new or unfamiliar foods			
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	72.7 (1.3)	24.7 (1.2)	2.6 (0.3)
Use mealtimes to teach child about healthy eating	65.4 (1.1)	31.6 (1.1)	2.9 (0.3)
Ask child to help me prepare food	36.4 (1.2)	48.5 (1.0)	15.1 (1.2)

[a] Unweighted *n*=2,563 and weighted *n*=441,244, where *n* is the number of mothers who completed items CF51a-h on the 54-month interview.

Note: Percentages may not sum to 100 percent due to rounding.

Caregivers' use of practices that encourage consumption of healthy foods is somewhat inconsistent. About 73 percent indicate that they *always* or *usually* tell the child to try, at least, a couple of bites of new foods. Nearly two-thirds (65%) of caregivers *always* or *usually* use mealtimes to teach about healthy eating. However, about a third (36%) of study mothers indicate that they *always* or *usually* ask the child to help prepare food at 54 months, which significantly improved from only 32 percent of caregivers at 42 months.

Using the categories displayed in Table 5-5, the sociodemographic characteristic associated with the greatest number of feeding practices is maternal educational attainment. Table 5-6 presents the five feeding practices associated with this key sociodemographic characteristic. In general, more highly

educated mothers (i.e., those with more than a high school education) are more likely than those with lower educational attainment (i.e., a high school education or less) to consistently keep track of what the child eats, less likely to consistently pressure the child to eat when he or she is not hungry, and most likely to employ feeding practices that encourage consumption of new or unfamiliar foods.

Table 5-6. Feeding practices significantly associated with maternal educational attainment at 54 months

Feeding practice	A high school education or less % (standard error)	More than a high school education % (standard error)
Keep track of what the child eats		
Always/Usually	65.1 (1.6)[a]	75.3 (1.8)[a]
About half the time/Occasionally	31.4 (1.6)[b]	22.8 (1.9)[b]
Never	3.5 (0.5)[c]	1.9 (0.5)[c]
Try to get the child to eat even if he/she does not seem hungry		
Always/Usually	37.0 (1.9)[a]	28.6 (2.1)[a]
About half the time/Occasionally	35.2 (2.0)	37.7 (1.3)
Never	27.8 (1.8)[b]	33.7 (1.9)[b]
Use mealtimes to teach child about healthy eating		
Always/Usually	63.2 (1.5)[a]	68.0 (1.6)[a]
About half the time/Occasionally	33.1 (1.4)	29.9 (1.5)
Never	3.6 (0.5)	2.1 (0.5)
Ask child to help me prepare food		
Always/Usually	34.2 (1.4)[a]	38.9 (1.8)[a]
About half the time/Occasionally	45.8 (1.2)[b]	51.6 (1.7)[b]
Never	20.0 (1.6)[c]	9.5 (1.0)[c]
Tell child he/she has to try at least of couple of bites of new foods, but doesn't have to eat it all		
Always/Usually	67.8 (1.6)[a]	78.3 (1.3)[a]
About half the time/Occasionally	29.1 (1.5)[b]	19.6 (1.3)[b]
Never	3.0 (0.5)	2.1 (0.3)
Unweighted *n*	1,369	1,194
Weighted *n*	237,647	203,597

[a,b,c] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between percentages for a feeding practice.

5.4.3 Associations between Feeding Practices and Beliefs and Diet Quality

The analysis of feeding practices and beliefs, thus far, has focused on how they differ by key sociodemographic categories. However, interest also lies in whether practices and beliefs are associated with eating behaviors that may affect childhood obesity. Because diet quality has been linked to children's adiposity (Okubo et al., 2015), this section addresses interest in the relationship between feeding practices/beliefs listed in Table 5-2 (above) and diet quality on a given day as

measured by total HEI-2015 scores. Because HEI-2015 is a continuous variable, univariate regression is used to examine whether feeding beliefs/practices are associated with this outcome. Table 5-7 presents the significant associations between feeding practices/beliefs and HEI-2015 total scores on a given day based on univariate regression results.

Table 5-7. Statistically significant associations from univariate regressions of Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months on feeding practices/beliefs at 54 months

Feeding practice or belief	Estimated effect on HEI-2015 total score	*p*-value	Unweighted *n*	Weighted *n*
Children should be allowed to eat snack foods: Reference group is never				
Occasionally	-6.96	0.008	2,355	408,359
Whenever they want	-5.95	0.066		
Children should be allowed to drink sugary drinks: Reference group is never				
Occasionally	-2.92	<.001	2,353	407,934
Whenever they want	1.14	0.659		
Use mealtimes to teach about healthy eating: Reference group is never				
Always/Usually	4.00	0.020	2,356	408,729
About half the time/Occasionally	1.95	0.212		

Two potentially restrictive practices are inversely associated with HEI-2015 total scores based on univariate regression results: the parent allowing children to eat snack foods and the parent allowing children to drink sugary drinks. Study children with caregivers who allow snack foods (either *occasionally* or *whenever* [the child] *wants)* have significantly lower HEI-2015 scores than children with caregivers who *never* allow access to these foods ($p \leq 0.05$). Similarly, study children with caregivers who *occasionally* allow access to sugary drinks have significantly lower HEI-2015 scores than children with caregivers who *never* allow access to these drinks ($p \leq 0.05$).

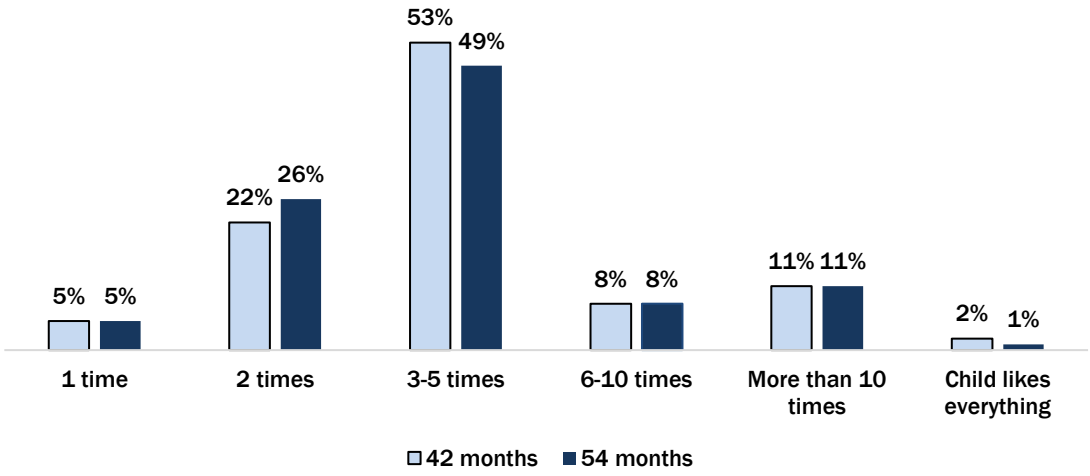
One practice that aims to teach children to try new foods was associated with diet quality. Children with caregivers who *always* or *usually* use mealtimes to teach about healthy eating have significantly higher HEI-2015 scores than children with caregivers who *never* employ this practice ($p \leq 0.05$). It is important to note that univariate regression does not control for other factors that may influence the outcomes. Further research is warranted to determine the degree to which these feeding practices and beliefs are independently associated with children's HEI-2015 total scores in multivariable models.

5.5 Introducing New Foods and Picky Eating at 54 Months

5.5.1 Introducing New Foods

Research indicates that the practice of repeatedly exposing children to new or unfamiliar healthy foods is positively associated with acceptance by young children, and that it can take multiple exposures (e.g., over 10 times) for young children to like an unfamiliar food, especially foods like vegetables (Gibson & Cooke, 2017; Birch & Anzman-Frasca, 2011; Wardle et al., 2003). The 54-month interview asks caregivers how many times they introduce a new food before deciding that their child does not like it. Five percent of caregivers offer a new food once before deciding that the child does not like it, and about one-quarter of caregivers (26%) introduce a new food twice. About one-half (49%) of caregivers report that they introduce new foods 3 to 5 times before deciding the child does not like it, 8 percent introduce a new food 6 to 10 times, and 11 percent introduce them more than 10 times. One percent of caregivers say that their children like all foods. Figure 5-3 presents the findings for 42 months alongside the findings for 54 months to provide context (Appendix Table B2d-3 offers additional detail on the 54-month findings).

Figure 5-3. Distribution of number of times study caregivers introduce a new or unfamiliar food before deciding the child does not like it at 42 months and 54 months[a]



[a] At 42 months, unweighted *n*=2,631 and weighted *n*=441,263. At 54 months, unweighted *n*=2,559 and weighted *n*=440,743.

Several key sociodemographic characteristics are associated with the number of times unfamiliar or new foods are introduced: race, marital status, non-WIC benefit program participation, income poverty, and age of the caregiver at the child's birth. Because more than 10 exposures may be

needed, especially for picky eaters, the discussion in this section focuses on pairwise differences among those introducing more than 10 times; however, this is a relatively small proportion of caregivers (11%).

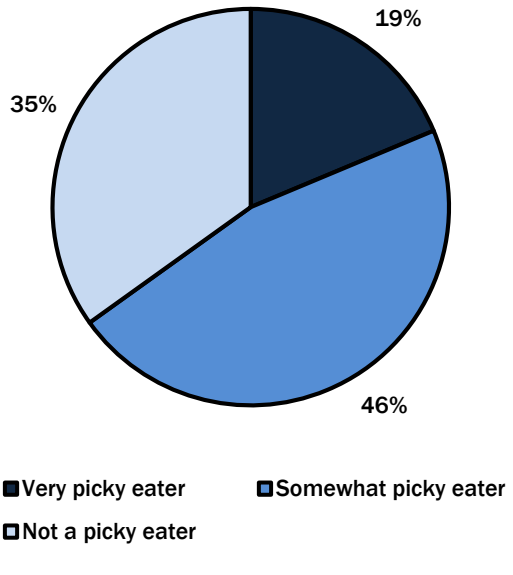
African American caregivers are less likely (4%) than White caregivers (13%) or caregivers classified in the Other racial category (9%) to introduce foods more than 10 times. Unmarried caregivers are less likely (8%) than married caregivers (15%) to introduce foods more than 10 times. Those in the lowest income-poverty subgroup (at or below 75% of the FPG) are less likely (8%) than those in the highest income-poverty subgroup (above 130% of the FPG, 14%) to introduce foods more than 10 times. Mothers who were in the youngest age group (16-19 years) at the time of the child's birth are less likely (6%) than mothers who were in the oldest age group (26 years or older, 12%) to introduce foods more than 10 times.

The analysis included exploring the relationship between the number of times new or unfamiliar foods are introduced and HEI-2015 total score on a given day. Children who like all foods (*n*=31 unweighted cases) were excluded from this analysis. The finding from the univariate regression using the response options to the survey item indicates that, compared to those who introduce new foods once, there is not a statistically significant relationship between the number of times new or unfamiliar foods are offered and children's HEI-2015 total scores on a given day at age 60 months among study children who do not immediately like all foods.

5.5.2 Picky Eating

During the 54-month interview, caregivers are also asked whether the study child is a very picky eater, a somewhat picky eater, or not a picky eater. Approximately one-third (35%) of mothers report that their child is not a picky eater, while nearly half (46%) are somewhat picky eaters, and nearly one in five (19%) are very picky eaters (Figure 5-4;

Figure 5-4. Percentage of study mothers who consider their child to be a picky eater at 54 months[a]



[a] Unweighted *n*=2,560 and weighted *n*=440,974.

Appendix Table B2d-4 offers additional detail). The percentages are not significantly changed from those at 42 months.

Several key sociodemographic characteristics are significantly associated with caregiver perceptions of picky eating, including race, ethnicity, marital status, parity, the timing of WIC enrollment, and WIC participation status at 48 months. Table 5-8 presents the significant associations.

Table 5-8. Significant associations between key sociodemographic characteristics and caregiver perceptions of picky eating at 54 months

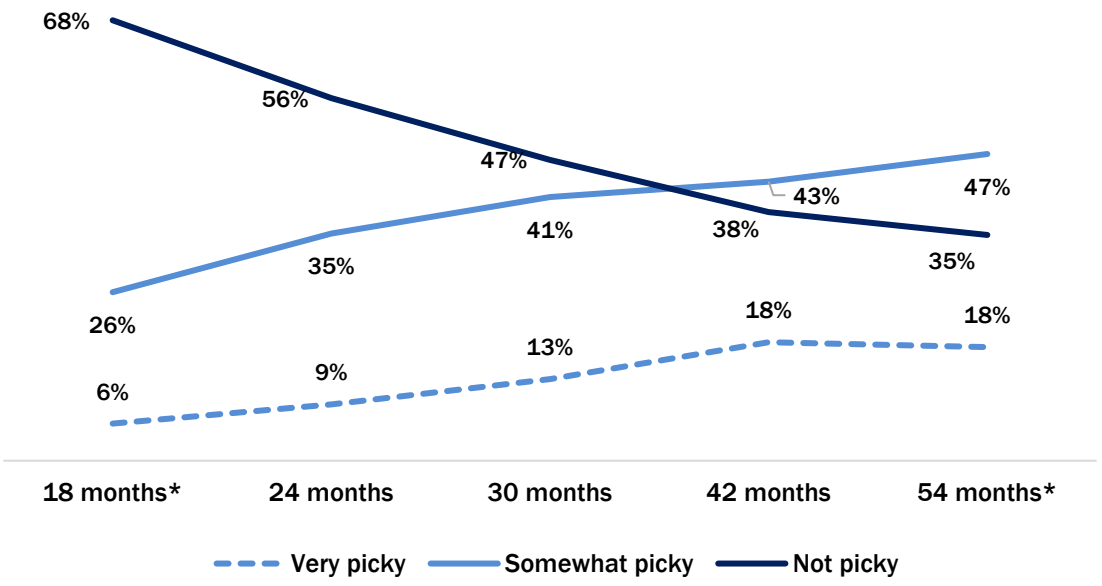
Key sociodemographic characteristic	Caregiver perceptions of picky eating			Unweighted *n*	Weighted *n*
	Very picky % (standard error [SE])	Somewhat picky % (SE)	Not picky % (SE)		
Race					
African American	25.2 (1.5)[a,b]	45.5 (2.9)	29.3 (2.3)[c]	741	95,975
White	18.0 (1.3)[a]	46.3 (1.5)	35.7 (1.8)	1,442	259,611
All Other	13.5 (1.9)[b]	47.9 (3.6)	38.6 (3.4)[c]	377	85,388
Ethnicity					
Hispanic or Latino	13.9 (1.4)[a]	47.0 (2.1)	39.1 (2.3)[b]	954	205,665
Not Hispanic or Latino	22.9 (1.0)[a]	45.9 (2.0)	31.2 (1.6)[b]	1,606	235,309
Marital status					
Married	16.3 (1.1)[a]	44.6 (2.1)	39.1 (2.2)[b]	951	172,615
Not married	20.2 (1.2)[a]	47.6 (1.8)	32.2 (1.9)[b]	1,609	268,359
Parity					
Firstborn	21.3 (1.6)[a]	49.9 (2.1)	28.8 (2.2)[b,c]	1,066	187,521
Second born	17.9 (1.9)	43.8 (2.0)	38.3 (2.4)[b]	702	118,169
Third or subsequent born	15.7 (1.4)[a]	43.9 (2.4)	40.4 (2.6)[c]	792	135,284
Timing of WIC enrollment					
First trimester	17.1 (1.6)	44.5 (2.4)	38.3 (1.8)[a]	829	138,882
Second trimester	19.4 (1.6)	47.4 (2.0)	33.2 (1.8)	1,045	174,019
Third trimester	17.3 (2.0)	43.5 (2.7)	39.2 (2.5)[b]	363	68,489
Postnatal	21.8 (2.2)	51.1 (3.1)	27.1 (2.7)[a,b]	323	59,583
WIC participation status at 48 months					
Receiving WIC	16.1 (0.9)[a]	47.2 (1.8)	36.8 (1.9)	1,309	234,502
Not receiving WIC	21.7 (1.5)[a]	45.5 (1.7)	32.8 (1.6)	1,251	206,472

[a,b,c] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between percentages within a key sociodemographic category.

Leveraging the longitudinal nature of the study, the analysis examines changes in the percentage of picky eaters over time. In order to track how the prevalence is changing within specific groups of study children, the analysis uses the sample that answered all interviews from the 1-month interview or 3-month interview (depending on the age of the study child at enrollment through the 60-month

interview [unweighted *n*=1,075]), so the estimates differ from those using the cross-sectional sample. Figure 5-5 displays the trends in the percentage of picky eaters. The percentage of study mothers who indicate that their child is not a picky eater falls from 68 percent to 35 percent between 18 and 54 months. Concurrently, the percentage of study mothers indicating that the child is a somewhat picky eater rises from 26 percent to 47 percent over the same interval. The percentage of study mothers indicating that the child is a very picky eater triples over this interval, rising from 6 percent at 18 months to 18 percent at 54 months.

Figure 5-5. Trend over time in the percentages of study mothers who consider the study child to be a very picky eater, a somewhat picky eater, or not a picky eater[a,b]



[a] These estimates use the longitudinal weight; therefore, they may differ slightly from point estimates using the cross-sectional weights (Figure 5-4).

[b] At 18 months, unweighted *n*=1,073 and weighted *n*=440,509. At 24 months, unweighted *n*=1,071 and weighted *n*=439,745. At 30 months, unweighted *n*=1,075 and weighted *n*=441,298. At 42 months, unweighted *n*=1,075 and weighted *n*=441,289. At 54 months, unweighted *n*=1,074 and weighted *n*=441,097.

* Percentages at 18 months and 54 months are significantly different at $p \leq 0.05$ for a given level of pickiness.

With the rise in the prevalence of picky eating among WIC ITFPS-2 children as they age from 18 months to 54 months, the analysis explores whether being categorized as a picky eater is associated with HEI-2015 total score. Because HEI-2015 total score on a given day is a continuous measure, univariate regression is used to assess the bivariate relationship. Results of this analysis indicate that those children identified as *somewhat picky* and those who are *very picky* have lower HEI-2015 total

scores on a given day than those who are not picky. Table 5-9 summarizes the findings from regressing picky eating on HEI-2015 total scores. The univariate regression indicates that the effect on HEI-2015 total scores is larger as the degree of pickiness increases from *somewhat* to *very picky*. Additional research is needed to explore whether perceptions of pickiness are independently associated with HEI-2015 scores in a multivariable regression model.

Table 5-9. Association between picky eating at 54 months and Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months

Mother's perception of whether child is a picky eater	Estimated effect on HEI-2015 total score	*p*-value	Unweighted *n*	Weighted *n*
Somewhat picky compared to not picky	-2.38	-0.018	2,355	408,711
Very picky compared to not picky	-4.33	<0.001		

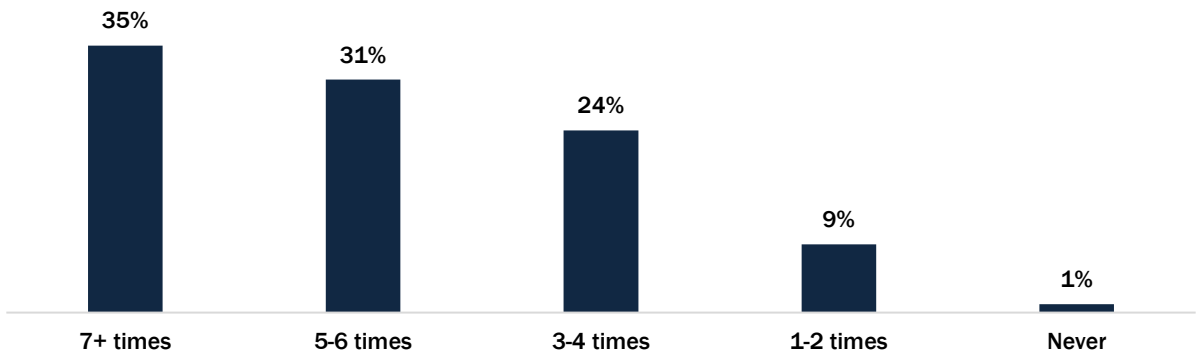
5.6 Family Feeding Practices at 54 Months

The environment in which children eat can influence diet quality of young children. This section examines two feeding practices that have been shown to be related to diet quality: how frequently the family eats together in a typical week and how often the TV is on during meals.

5.6.1 Family Eats Together

Research indicates that eating together as a family is a practice that is related to higher diet quality for children. During the 54-month interview, caregivers are asked how often all or most of the family sat down together to eat a meal in the past week. Slightly more than one-third (35%) of mothers indicate that their family ate together seven or more times in the past week (Figure 5-6; Appendix Table B2d-5 offers additional detail). Slightly less than one-third (31%) of mothers indicate that their families ate together five to six times in the past week. About one-quarter (24%) indicate that they ate together three to four times. Slightly less than 1 in 10 (9%) indicate that they ate together one to two times. Only 1 percent of mothers report that their families did not eat a meal together in the past week.

Figure 5-6. Frequency of the family sitting down for meal together in the past week at 54 months[a]

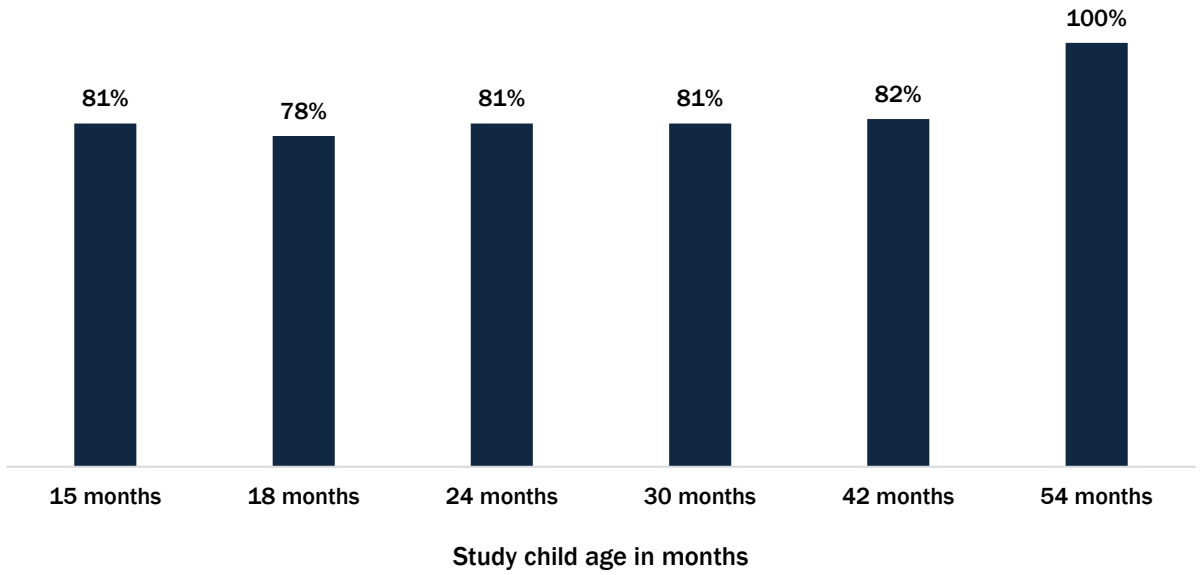


[a] Unweighted *n*=2,562 and weighted *n*=441,078.

Key sociodemographic characteristics associated with the frequency of the family eating meals together include race, ethnicity, marital status, parity, and weight status of the mother at 42 months. The discussion focuses on significant differences for eating seven or more times together. White study mothers (38%) and study mothers of Other races (38%) are more likely than African American study mothers (25%) to report eating seven or more meals together in the past week. Hispanic study mothers are more likely (38%) than non-Hispanic mothers (33%) to report seven or more meals together. Married study mothers (44%) are also more likely than unmarried study mothers (30%) to report eating seven or more meals together in the past week. Study mothers for whom the study child is the third or subsequently born child are more likely (39%) than study mothers for whom the study child is the firstborn child (32%) to report seven or more meals together. Pairwise differences in reports of seven or more meals together per week were not significantly different by weight status of the mother at 42 months.

The analysis leveraged the longitudinal nature of the WIC ITFPS-2 and looked retrospectively to examine the stability of this feeding practice (Figure 5-7). Among those who ate together at least five times a week when the study child was 54 months old, 81 percent did so when the study child was 15 months old. Among those who ate together at least five times a week when the study child was 54 months old, 78 percent of study families did so when the child was 18 months old. A similar percentage (81%) did so when the study child was 24 months old, when the study child was 30 months old (81%), and when the study child was 42 months old (82%). This retrospective analysis indicates that the vast majority of those who reported this feeding practice when the child was 54 months old implemented it earlier in the child's life.

Figure 5-7. Among study families who ate together at least five times in the past week at 54 months, the percentages that report eating together at least five times in the past week at select interview months[a]

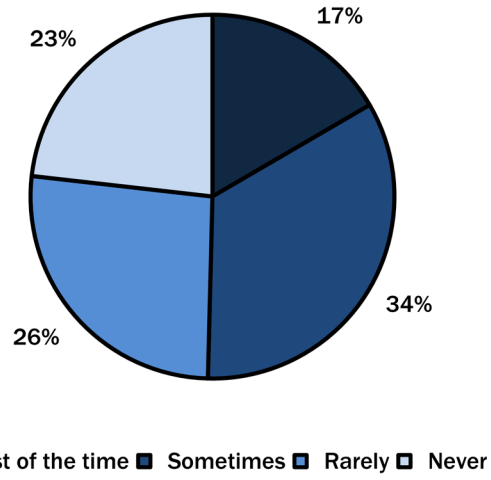


[a] Unweighted *n*=418 and weighted *n*=162,368.

5.6.2 TV during Meals

During the 54-month interview, study mothers are asked how often the TV is on during meals (Figure 5-8; Appendix Table B2d-6 offers additional detail). When asked how often a TV is on during meals, study mothers were almost evenly split between those who either *most of the time* or *sometimes* have the TV on during meals (51%) and those who *rarely* or *never* have the TV on during meals (49%). Slightly less than one-quarter (23%) of study mothers report that the TV is *never* on during meals, while less than one-fifth (17%) report that the TV is on *most of the time* during meals.

Figure 5-8. Percentage of study mothers reporting how often the television is on during meals at 54 months[a]

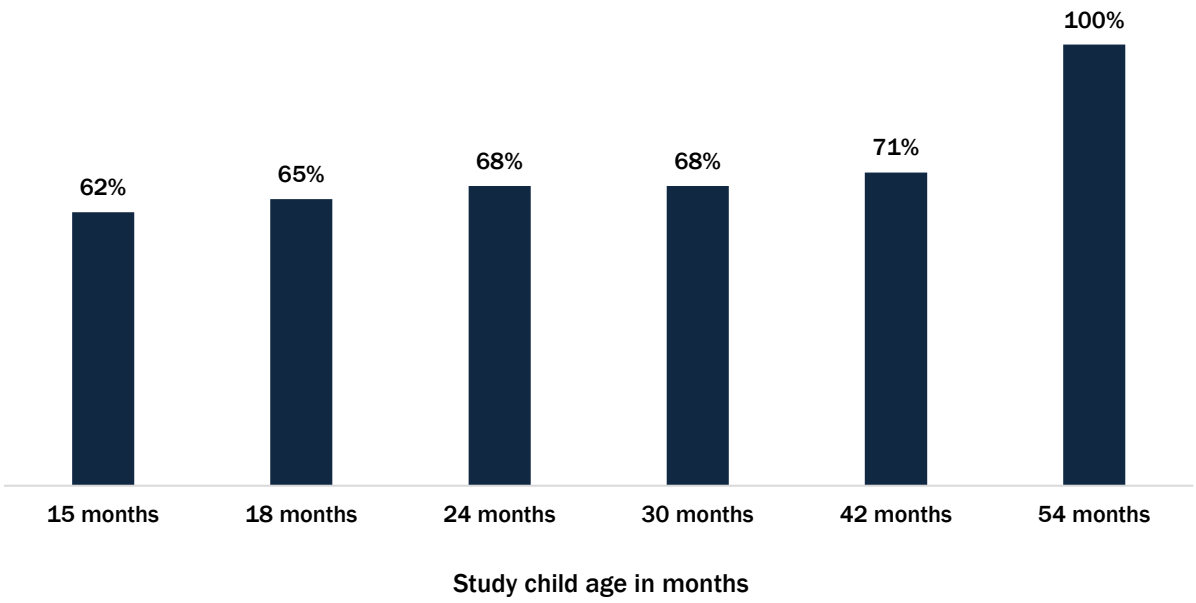


[a] Unweighted *n*=2,561 and weighted *n*=440,842.

Race, ethnicity, marital status, and timing of WIC enrollment are associated with mothers' reports of having the TV on during meals. African American mothers are more likely (25%) to indicate TV is on *most of the time* than White mothers (15%) or mothers of Other races (13%). Compared to African American mothers, White mothers are also more likely to indicate that the TV is *rarely* on during meals (21% compared to 29%). Non-Hispanic mothers are more likely (19%) to indicate that the TV is on *most of the time* and less likely (21%) to indicate that the TV is *never* on than Hispanic mothers (14% and 25%, respectively). Unmarried mothers are more likely (18%) to indicate that the TV is on *most of the time* and less likely (21%) to indicate that the TV is *never* on than married mothers (14% and 26%, respectively). Mothers who enrolled in WIC during their first trimester are more likely (29%) than mothers who enrolled in WIC during their second trimester (19%) to indicate that the TV is *never* on.

Additional analyses leveraged the longitudinal nature of the WIC ITFPS-2 and looked retrospectively to examine the stability of this feeding practice by asking, among those who *rarely* or *never* have the TV on during meals when the child is 54 months old, what percentage reported this feeding practice at earlier time points in the child's life (Figure 5-9). When the child was 15 months old, 62 percent reported *rarely* or *never* watching TV during meals. When the child was 18 months old, 65 percent reported this practice. About 68 percent of those who *rarely* or *never* had the TV on during meals when the child was 54 months old *rarely* or *never* had it on when the child was 24 months old. The same percentage (68%) reported this practice when the child was 30 months old. About 71 percent of those who *rarely* or *never* had the TV on during meals when the child was 54 months old *rarely* or *never* had it on when the child was 42 months old. This retrospective analysis indicates that a substantial minority of study mothers who report *rarely* or *never* watching TV during meals at 54 months adopted this feeding practice as the child aged.

Figure 5-9. Among study families who *rarely* or *never* have the television on during meals at 54 months, the percentages that *rarely* or *never* have it on at select interview months[a]



[a] Unweighted *n*=510 and weighted *n*=214,213.

5.6.3 Associations between Working and Childcare and Family Feeding Practices

The extent to which caregivers work for pay may be associated with feeding practices. Analyses therefore examined the association between caregiver work status and feeding practices, as well as the association between childcare use and feeding practices. The analyses focused on the number of times family members ate together in the past week and how often the TV was on during mealtimes.

There is a significant association between the caregiver's work status and how many times the family ate together during the past week. Table 5-10a displays the percentage of study mothers by the number of times the family ate together in the past week and caregiver work status.

Table 5-10a. Percentage of study mothers by the number of times their family ate together in the past week and work status at 54 months

Number of times family ate together in the past week	Working for pay at 54 months		
	Full-time % (standard error [SE])	Part-time % (SE)	Not at all % (SE)
7 or more times	30.4 (1.7)[a]	31.1 (3.3)[b]	41.0 (1.9)[a,b]
5 to 6 times	30.3 (1.7)	30.7 (2.4)	31.0 (1.6)
3 to 4 times	28.3 (1.7)[a]	26.8 (3.1)[b]	19.1 (1.2)[a,b]
1 to 2 times	10.3 (1.0)	10.2 (1.7)	7.4 (0.9)
Never	0.6 (0.2)	1.3 (0.5)	1.5 (0.5)
Weighted *n*	957	532	1,070
Unweighted *n*	156,744	91,236	192,659

[a] Difference between the percentages for full-time and not at all is statistically significant at $p \leq 0.05$.

[b] Difference between the percentages for part-time and not at all is statistically significant at $p \leq 0.05$.

For analysis, response options are collapsed into two ranges: zero to four times in the past week (includes *never*, *1 to 2 times*, and *3 to 4 times*) and five or more times (includes *5 to 6 times* and *7 or more times*). This alternative version of the data is reported in Table 5-10b. The estimated mean number of times that families ate together in the zero-to-four-times category is 2.9 (median=2.1), and the estimated mean number of times that families ate together in the five-or-more-times category is 6.6 (median=5.6).[78] Families with caregivers working full-time are less likely (61%) to eat together five or more times than families with caregivers who do not work (72%) (Table 5-10b). Alternatively, families with caregivers working full-time are more likely (39%) to eat together four or fewer times than families with caregivers who do not work (28%). A similar pattern is seen for those who work part-time: They are less likely (62%) to eat together five or more times and more likely (38%) to eat together zero to four times than those who do not work (72% and 28%, respectively).

[78] To estimate the mean number of times families eat together each week, each response category was assigned a numeric value: never was assigned zero; one to two times a week was assigned 1.5 meals a week; three to four times was assigned 3.5 times per week; five to six times was assigned 5.5 times per week; and seven or more times was top-coded at 7.5 times per week.

Table 5-10b. Percentage of study mothers by the number of times their family ate together (collapsed categories) and work status at 54 months

Number of times family ate together in the past week	Working for pay at 54 months		
	Full-time % (standard error [SE])	Part-time % (SE)	Not at all % (SE)
0 to 4 times	39.3 (1.8)[a]	38.2 (3.3)[b]	27.9 (1.5)[a,b]
5 or more times	60.7 (1.8)[c]	61.8 (3.3)[d]	72.1 (1.5)[c,d]
Weighted *n*	957	532	1,070
Unweighted *n*	156,744	91,236	192,659

[a] Difference between the percentages for full-time and not at all is statistically significant at $p \leq 0.05$ for families that eat together 0 to 4 times each week.

[b] Difference between the percentages for part-time and not at all is statistically significant at $p \leq 0.05$ for families that eat together 0 to 4 times per week.

[c] Difference between the percentages for full-time and not at all is statistically significant at $p \leq 0.05$ for families that eat together 5 or more times each week.

[d] Difference between the percentages for part-time and not at all is statistically significant at $p \leq 0.05$ for families that eat together 5 or more times per week.

Caregivers typically use childcare while working, and because children may receive meals while in childcare, there may be less opportunity for families to eat together. The study explored the association between family meals together in the past week and childcare status at 54 months. Table 5-11 presents the findings. Nearly two-thirds (63%) of families that use regular childcare ate together five or more times in the past week; nonetheless, families who use regular childcare are less likely to eat together five or more times than families who do not use regular childcare.

Table 5-11. Percentage of study mothers by the number of times their family eats together (collapsed categories) and childcare status at 54 months

Number of times family ate together in the past week	Childcare status at 54 months	
	In regular childcare % (standard error)	Not in regular childcare % (standard error)
0 to 4 times	37.1 (1.5)[a]	28.7 (2.1)[a]
5 or more times	62.9 (1.5)[b]	71.3 (2.1)[b]
Weighted *n*	1,646	913
Unweighted *n*	277,626	163,033

[a] Difference between the percentages in regular childcare and not in regular childcare is statistically significant at $p \leq 0.05$ for families that eat together 0 to 4 times each week.

[b] Difference between the percentages in regular childcare and not in regular childcare is statistically significant at $p \leq 0.05$ for families that eat together 5 or more times each week.

As mentioned, the analysis examines whether the frequency of having the TV on while eating is associated with employment status. Table 5-12 presents the percentage of study mothers by the frequency of TV viewing during meals and work status. Based on the results of the chi-square test,

the association between work status and frequency of TV viewing during meals is not statistically significant.

Table 5-12. Percentage of study mothers by the frequency of television (TV) viewing during mealtimes and caregiver work status at 54 months

Frequency of TV viewing during mealtimes	Working for pay at 54 months		
	Full-time % (standard error [SE])	Part-time % (SE)	Not at all % (SE)
Most of the time	17.8 (1.6)	16.1 (2.1)	15.9 (1.6)
Sometimes	31.7 (1.7)	38.0 (3.0)	33.5 (1.9)
Rarely	29.8 (1.5)	21.5 (2.3)	25.9 (1.8)
Never	20.7 (1.5)	24.3 (2.7)	24.7 (1.6)
Weighted *n*	957	531	1,070
Unweighted *n*	156,744	91,000	192,659

5.6.4 Associations between Family Feeding Practices and Diet Quality

Analyses examined bivariate associations between family feeding practices and diet quality, as measured by HEI-2015 scores on a given day. Family feeding practices included the number of times that the family eats together each week and how often the TV is on during mealtime. Univariate regression was used to examine the association between feeding practices and diet quality.

Table 5-13 presents results from regressing the frequency of meals together (using the collapsed categories reported in Table 5-10b) on children's HEI-2015 total scores on a given day. The statistically significant, positive estimate for the coefficient indicates that children in families who have meals together five or more times per week have better diet quality than families who eat together zero to four times per week. Future work is needed to understand whether the frequency of meals together is independently associated with HEI-2015 scores in multivariable regression models.

Table 5-13. Association between frequency of meals together at 54 months and Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months

Feeding meals together	Estimated effect on HEI-2015 total score	*p*-value	Unweighted *n*	Weighted *n*
5 or more times compared to 0 to 4 times	2.08	0.007	2,357	408,807

Table 5-14 presents the results from regressing the frequency of TV viewing on HEI-2015 total scores. Compared to those who never watch TV during meals, those who watch TV during meals *most of the time* or *sometimes* have significantly lower diet quality as measured by children's HEI-2015 total scores on a given day. As the frequency of TV viewing increases, the estimated coefficient is larger, indicating that the detrimental effect on diet quality worsens with increased frequency. As with other bivariate analytical approaches used in this report, univariate regression analyses focus only on a single factor that may influence the outcome. Many factors influence HEI-2015 scores. Future work is needed to understand whether the associations identified through univariate regression analysis hold in multivariable regression models.

Table 5-14. Association between frequency of television (TV) viewing during meals at 54 months and Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months

Frequency of TV viewing during meals	Estimated effect on HEI-2015 total score	*p*-value	Unweighted *n*	Weighted *n*
Most of the time compared to never	-5.29	<0.001		
Sometimes compared to never	-3.21	0.002	2,356	408,568
Rarely compared to never	-1.94	0.077		

6. Child Health, Development, and Weight

Key Findings:

- **Median weekly outdoor playtime for study children is 15.7 hours, slightly more than 2 hours per day on average.**
- **For most (80%) study children, screen time, as measured by watching television or playing video games, exceeds 1 hour per day. Median weekly screen time is 13.9 hours.**
- **Median sleep time is 10.4 hours per night at 54 months, which meets the American Academy of Sleep Medicine (AASM) recommendation of 10 to 13 hours per day.**
- **Around age 5 years, 60 percent of study children have a healthy weight status. Five percent of study children are underweight, 16 percent are overweight, and 19 percent are obese.**

6.1 Overview

This chapter focuses on the health, development, and growth of children in the Special Supplemental Nutrition Program for Women, Infants, and Children (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 fifth birthday, with weight and height measurements being collected between ages 56 and 64 months.[79] Analyses in this chapter explore the relationships between children's physical and sedentary activities; maternal beliefs, opinions, and practices related to child feeding; family eating routines; and outcomes including children's personal and social development and physical growth. The analyses use both survey data and weight and length/height measurement data on study children.[80] The research questions this chapter addresses are:

- How do feeding practices impact children's weight and growth?
- Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to feeding practices, meal/snack patterns, food and nutrient intakes, and health status at age 5 years?
- Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to weight trajectories or child overweight/obesity at age 5 years?

[79] Data collected for the WIC ITFPS-2 60-month interview spanned from 2 weeks before to 4 weeks after the child's fifth birthday, but data collection for children's weight and length permitted an age window from 56 to 64 months.

[80] 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.

- What is the impact of WIC experience on outcomes beyond nutrition and health such as developmental outcomes?
- What is the impact of participation in other Federal food benefit programs on health outcomes?

Additional questions[81] addressed in this chapter include:

- What percentage of study children have health conditions that affect their eating?
- How long do study children typically play outside?
- How long are study children typically sleeping during the night?

6.2 Background

As discussed in the *Fourth Year Report*, lifestyle characteristics such as physical activity, sedentary time, and sleep duration influence children's health and development. In this chapter, we investigate associations between lifestyle characteristics and anthropometric development such as children's weight status and growth. This report differs from the *Fourth Year Report* in that it investigates school readiness. To accomplish this, we assess children's problem-solving skills at age 4.5 years and compare them to accepted standards.

As mentioned, one of the main outcomes explored in this chapter is children's weight status. Based on data from the National Health and Nutrition Examination Survey (NHANES), obesity prevalence among 2- to 5-year-old children in the United States began declining in 2003-2004 and continued through 2013-2014 (Ogden et al., 2016; Ogden, Carroll, Fryar, & Flegal, 2015; Ogden, Carroll, Kit, & Flegal, 2014). However, data from the NHANES suggest an increase in obesity prevalence among this age group in 2015-2016 (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018; Hales, Fryar, Carroll, Freedman, & Ogden, 2018). An additional NHANES cycle is needed to confirm a recent increase in obesity among young children in the United States. Despite these national findings, closer examinations of childhood obesity trends within the WIC population have yielded important insights. For example, an analysis of data from the WIC Participant and Program Characteristics (WIC PC) studies found a significant decline in obesity rates between 2010 and 2016

[81] These questions were not required under the U.S. Department of Agriculture (USDA) contract and, therefore, are not part of the study research questions included in Appendix A.

among 2- to 4-year-old WIC participants (Pan et al., 2019). While encouraging, this finding warrants further exploration using more recent data—a gap that the current study intends to fill.

6.3 Sample and Analysis Approach

6.3.1 Sample

The analyses in this chapter use interview data through the 60-month interview and weight/height measurements obtained around the child's fifth birthday. The focus is on activities, personal-social development, and body mass index (BMI) around age 5 years. Chapter 2, Table 2-1 shows the number of respondents to the 54- and 60-month interviews. Both the core and supplemental samples were eligible for these interviews. In analyses, responses to each interview are weighted so that findings reflect the WIC population as described in Chapter 1.

The study collects weight and length/height measurements of the children around six periods of time[82] through the end of the fifth year of life: 6 months, 12 months, 24 months, 36 months, 48 months, and 60 months (see Table 6-1). Section 1.5 in Chapter 1 of this report details the data collection procedures for these data.

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

[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 providers varied. In order to facilitate analysis, the data are broken into six age periods eligible for analysis. *Early infancy* ranges from 1 to less than 7 months. *Late infancy* ranges from 7 through 15 months. *Toddlerhood* ranges from 20 through

[82] Although data are also requested on birth weight and length, the data are not consistently available from WIC records.

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. Table 6-2 reports the number of observations within these time periods and, thus, were available for analysis. Although the majority of study children have repeated measures, the time between measures is uneven. For convenience, the third-, fourth-, and fifth-year ranges are sometimes referred to as at age 3 years, at age 4 years, and at age 5 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 15 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

[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 in the U.S. population.[83] Age- and gender-specific BMI percentiles are the most commonly used clinical indicator to assess the size and growth patterns of individual children in the United States (Kuczmarski et al., 2002; CDC, 2018).

[83] CDC homepage, available at https://www.cdc.gov/growthcharts/index.htm. Retrieved on May 1, 2019.

Using the gender-specific CDC growth charts (CDC, 2018), study children are classified as underweight if their BMI-for-age is less than the 5th percentile, normal/healthy weight if their BMI-for-age is between the 5th and less than the 85th percentile, overweight if their BMI-for-age is between the 85th and less than the 95th percentile, and obese if their BMI-for-age equals or exceeds the level at the 95th percentile.[84] For this report, the analysis includes a subset of obese children: those severely obese. Severe obesity is defined as BMI-for-age ≥ 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, BMI-for-age percentiles are referred to henceforth as BMI percentiles.

6.3.3 Problem-Solving Scale Scores at 54 Months

At 54 months, the study measured the problem-solving skills domain of child development using the *Ages & Stages Questionnaires (ASQ-3™): A Parent-Completed Child Monitoring System, Third Edition*. The ASQ-3 is comprised of a set of questionnaires that can identify infants or young children who may be at risk of developmental delay. While the full questionnaire at 54 months covers five areas of development with 30 questions, study time constraints required the selection of one area. The problem-solving domain was selected as it assesses a comprehensive set of skills using the following six questions:[85]

- When shown objects and asked "What color is this?" does {CHILD} name five different colors, like red, blue, yellow, orange, black, white, or pink?
- Does {CHILD} dress up and "playact," pretending to be someone or something else? For example, your child may dress up in different clothes and pretend to be a mommy, daddy, brother, sister, or an imaginary animal or figure.
- If you place five objects in front of {CHILD}, can [HE/SHE] count them by saying "one, two, three, four, five" in order?

[84] 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.

[85] The 54-month ASQ can be administered any time between 31 months and 0 days and 56 months and 30 days.

- When shown circles of different sizes and asked "Which circle is the smallest?" does {CHILD} point to the smallest circle?
- Does {CHILD} count up to 15 without making mistakes?
- Does {CHILD} know the names of numbers? For example, if you show [HIM or HER] the numbers one, two, and three, can [HE or SHE] name all of them?

Each question has three response options and a respective score: "Yes, regularly" (10 points); "Yes, sometimes" (5 points); and "No, not yet" (0 points).[86] Responses to each question are equally weighted then aggregated to create a problem-solving subscale score; thus, the range is from 0 to 60. Based on the published scoring rubric of the ASQ-3, total scores at or below 28.12 indicate that the child needs further evaluation. Children with scores between 28.12 and 39.68 are encouraged to be provided with learning activities and monitored. Development appears to be on schedule or typical if scores are above 39.68.[87,88] For this study, families were not given feedback about their child's development—their problem-solving scores were coded as "needs further evaluation," "needs monitoring," or "typical."

6.3.4 Analysis

Descriptive statistics, including percentages, means, and medians, are used for outcomes of interest. For example, we show the percentage of children whose caregivers report that they have a long-term medical condition that affects what or how they eat. Medians are 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

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[86] Response options may contain additional words. For example, "Yes, regularly up to 15" is a response option when asking if the child can count up to 15.

[87] The published cutoff points were derived by subtracting to standard deviations from the mean score. Two standard deviations were selected in order to minimize the percentages of children overidentified and underidentified. Cutoff scores can be found in the *ASQ-3 User's Guide* (Squires, Twombly, Bricker, & Potter, 2009).

[88] Both English and Spanish versions of the ASQ-3 questionnaire are available. The Spanish version of the questionnaire was field-tested in the United States with Spanish-speaking parents. The cutoff points used in this analysis are the same regardless of which version of the instrument is used since different cutoffs have not been tested. The *ASQ-3 User's Guide* states that "differential item functional analyses indicate that for the most part, English and Spanish items function similarly for young children in both languages" (Squires et al., 2009, p. 21).

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 weekday 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 focus on whether long-term medical conditions that affect how the child eats, physical activity, sedentary time, and sleep patterns of interest are associated with the study's key sociodemographic characteristics (see Section 1.8.2 for a list of key sociodemographic variables). 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 Federal Poverty Guidelines (FPG), or WIC participation status, values reported at the 48-month interview are used.[89] It is important to note that bivariate associations do not account for potential confounders.

Because school readiness is of interest around the time children turn 5 years old, composite problem-solving scale scores are analyzed. For analysis of problem-solving scores, study children's composite scale scores are grouped into three categories as described above in Section 6.3.3. Subsequent bivariate analyses explore the relationship between both problem-solving ability categories and BMI outcomes and key sociodemographic characteristics.

For BMI analyses, weight status categories are those described in Section 6.3.2. Bivariate analyses explore the relationship between interview responses and growth outcomes, including weight status categories and BMI.

For the bivariate analyses, chi-square tests of association are frequently 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 are used to determine which pairwise subgroup differences are statistically significant. Subgroup differences discussed in the chapter are

[89] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

limited to those that are large in magnitude,[90] 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. This bivariate approach, along with input from the scientific literature, lays the groundwork for more nuanced multivariable analyses.

6.4 Prevalence of Health Conditions That Affect Eating

The analyses start by examining the prevalence of health conditions that affect the child's eating in order to contextualize findings associated with outcomes of interest. For example, a medical condition that affects the child's eating may influence the child's BMI trajectory. The prevalence of these conditions within the WIC ITFPS-2 population is limited. Based on maternal report at 54 months, only 5 percent of study children have a medical condition that affects eating. While the study does ask the caregiver to report what specific health condition(s) their child has, the responses reported are too diverse to meaningfully categorize.

There are only two statistically significant associations between key sociodemographic characteristics and reporting a health condition that affects eating; however, the difference in the percentages reporting is not 3 percentage points, the cutoff used in this report for reporting results.[91] Given the small magnitude and only two significant associations among the key sociodemographic variables used in this study, the prevalence of health conditions that affect eating likely has a very limited influence on results reported in this chapter.

6.5 Physical Activity, Sedentary Time, and Sleep at 54 Months

To better understand the lifestyles of study children, the study examines children's physical activity, sedentary time, and sleep patterns, as these are commonly understood to influence children's

[90] 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).

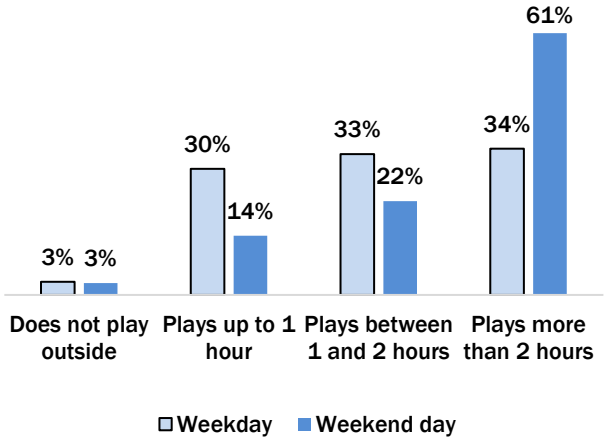
[91] Report of a health condition that affects eating is significantly associated with maternal educational attainment and participation in non-WIC benefit programs.

development and health. Because it was not feasible to directly measure children's physical activity, caregiver reports of children's usual amount of outdoor playtime are used as a proxy. 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 Physical Activity and 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 advocate using 3 hours a day of physical activity as a reasonable target for children ages 3 to 5 years (HHS, 2018). This target amount includes all intensities of activity: light, moderate, and vigorous. Research has found 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 6-1. Percentage of study children by parental report of typical outdoor playtime, weekday and weekend day, at 54 months[a]



[a] For weekdays, unweighted *n*=2,551 and weighted *n*=439,563. For weekend days, unweighted *n*=2,549 and weighted *n*=439,261.

Figure 6-1 shows the distribution of study children by reported amounts of outdoor playtime on weekdays and weekend days (Appendix Table B2e-1 offers additional detail). About 34 percent of study children play outside more than 2 hours per weekday, a finding that aligns with a 2012 study which reported that 37.5 percent of children in the Head Start program played outside at home more than 2 hours per weekday (Marino, Fletcher, Whitaker, & Anderson, 2012). Additionally, the current study found that 61 percent of children play outside more

than 2 hours per weekend day.[92] Median outdoor play time is 1.9 hours on weekdays and 2.7 hours on weekend days. The findings suggest that for the typical (i.e., median) study child, 63 percent of the recommended amount of total daily physical activity is met by outdoor playtime on weekdays and about 90 percent of the recommended amount is met by outdoor playtime on weekend days. However, there are a few (3%) study children who do not spend any time playing outside on weekdays or weekend days.

Median weekly outdoor playtime is 15.7 hours, or slightly more than 2 hours per day on average. Bivariate analysis of weekly outdoor playtime (at/below or above the population median hours) and key sociodemographic variables indicate a statistically significant association between being above median weekly outdoor playtime and race, household food security, parity, and timing of WIC enrollment. Table 6-3 presents the percentage of children who play outdoors more than the population median number of hours per week by significantly associated key sociodemographic characteristics.

Table 6-3. Percentage of study children who play outside more than the population median number of hours (15.7) per week at 54 months by select key sociodemographic characteristics

Key sociodemographic characteristic	Plays outdoors more than median (15.7) hours per week % (standard error)	Unweighted *n*	Weighted *n*
Race			
African American	42.7 (3.0)[a,b]	741	95,754
White	56.0 (2.3)[a]	1,443	259,677
All Other	54.0 (3.8)[b]	377	85,388
Household food security			
High or marginal	51.6 (1.7)[a]	1,951	338,083
Low	52.7 (3.0)	328	56,804
Very low	61.4 (3.5)[a]	282	45,932
Parity			
Firstborn	49.2 (2.2)[a]	1,066	187,300
Second born	57.0 (2.5)[a]	702	118,169
Third or subsequent born	53.9 (2.4)	793	135,350
Timing of WIC enrollment			
First trimester	57.5 (2.7)[a,b]	830	138,921
Second trimester	58.7 (2.3)[c,d]	1,044	173,760
Third trimester	45.6 (2.8)[a,c,e]	363	68,489
Postnatal	32.7 (3.9)[b,d,e]	324	59,649

[a,b,c,d,e] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between the percentages within a sociodemographic category.

[92] The survey item used for this analysis does not specify whether outdoor playtime is at home on weekdays or weekend days.

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 play time. Therefore, significant bivariate associations should be interpreted with caution.

6.5.2 Sedentary Time and Screen Time

Because WIC ITFPS-2 does not objectively measure children's daily activity levels, it relies on caregivers' reports of time spent watching television and playing video games (i.e., screen time) to approximate children's sedentary time.[93] The American Academy of Pediatrics (AAP) recommends that caregivers limit screen time of children ages 2 to 5 years to 1 hour per day of high-quality programs.[94] On a weekly basis, only 20 percent of study participants report that their children spend up to 7 hours per week viewing television or playing video games. The vast majority (80%) spend more than 7 hours per week watching television and playing video games. Less than 1 percent of study children do not spend any time watching television or playing video games. Median weekly screen time (television and video game time) is 13.9 hours.

Bivariate analyses of sedentary time and the key sociodemographic variables indicate that more than 7 hours of screen time per week is significantly associated with race, ethnicity, participation in non-WIC benefit programs, and WIC participation status at 48 months. Table 6-4 presents the percentage of children by the significantly associated key sociodemographic characteristics. Of note,

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[93] 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.

[94] AAP recommends no more than 1 hour per day of high-quality screen time for children ages 2-5. Available at: https://publications.aap.org/pediatrics/article/138/5/e20162591/60503/Media-and-Young-Minds. Retrieved on January 10, 2022.

children in families that did not participate in WIC at 48 months are more likely (83%) than children in families that did participate (78%) to have screen time exceed 7 hours per week.

Table 6-4. Percentage of study children who spend more than 7 hours per week watching television (TV) and playing video games at 54 months by select key sociodemographic characteristics

Key sociodemographic characteristic	More than 7 hours per week of TV/video game time % (standard error)	Unweighted *n*	Weighted *n*
Race			
African American	90.7 (1.1)[a,b]	741	95,754
White	76.4 (1.4)[a]	1,443	259,677
All Other	80.0 (2.3)[b]	377	85,388
Ethnicity			
Hispanic or Latino	76.3 (1.5)[a]	955	205,731
Not Hispanic or Latino	83.7 (1.5)[a]	1,606	235,088
Participation in non-WIC benefit programs			
Does not participate in other programs[c]	79.9 (2.3)	468	80,346
Participates in Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[c]	82.4 (1.4)[a]	1,191	205,087
Participates in other programs[c] excluding SNAP	77.4 (1.5)[a]	902	155,385
WIC participation status at 48 months			
Receiving WIC	78.2 (1.5)[a]	1,310	234,568
Not receiving WIC	82.5 (1.3)[a]	1,251	206,251

[a,b] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between the percentages within a sociodemographic category.

[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).

6.5.3 Sleep Duration

The American Academy of Sleep Medicine (AASM) recommends that children ages 3 to 5 years regularly sleep between 10 and 13 hours per 24 hours, including naps.[95] The AAP endorses this recommendation.[96] Based on caregiver report, the median number of hours that WIC ITFPS-2 study children sleep at night, but not including naps, at 54 months is 10.4 hours. Whether a study child usually sleeps less or more than 10 hours per night is only significantly associated with race (Table 6-5).

[95] American Academy of Sleep Medicine. (2016). Available at: https://aasm.org/recharge-with-sleep-pediatric-sleep-recommendations-promoting-optimal-health/. Retrieved on May 1, 2019.

[96] American Academy of Pediatrics. (2016). Available at: https://pediatrics.aappublications.org/content/early/2016/07/21/peds.2016-1601. Retrieved on December 8, 2020.

Table 6-5. Percentage of study children who usually sleep at least 10 hours per night at 54 months by select key sociodemographic characteristics

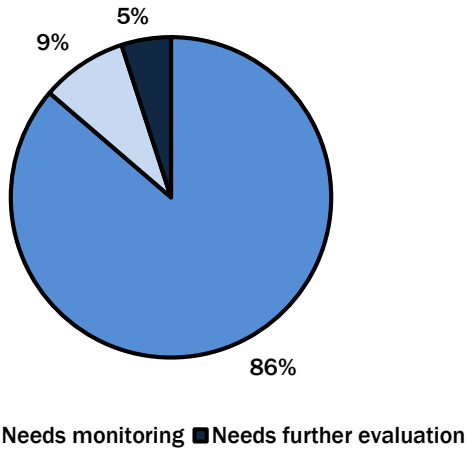
Key sociodemographic characteristic	Typically sleeps at least 10 hours per night % (standard error)	Unweighted *n*	Weighted *n*
Race			
African American	76.1 (1.4)[a,b]	739	95,463
White	83.5 (1.6)[a]	1,440	258,859
All Other	83.7 (2.9)[b]	376	84,902

[a,b] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between the percentages.

6.6 Problem-Solving Developmental Milestone

Using the six items from the ASQ-3, the study assesses children's problem-solving abilities and categorizes each child based on his or her total score (see Section 6.3.3 for more details on this method). Figure 6-2 presents the distribution of study children's total problem-solving scores using the three categories: typical, needs monitoring, and needs further evaluation (Appendix Table B2e-2 offers additional detail). Eighty-six percent of study children score within the range indicating typical development. Nine percent have scores indicating that they may need monitoring to ensure that development is appropriate. Five percent have scores indicating that they may benefit from further evaluation. The study does not ask respondents whether their children are being monitored or if they received a referral for further evaluation.

Figure 6-2. Distribution of study children by Ages & Stages Questionnaires Third Edition Problem-Solving Scale total score categories at 54 months[a]



[a] Unweighted *n*=2,562 and weighted *n*=441,078.

There are several significant associations between key sociodemographic characteristics and Problem-Solving Scale score categories. Table 6-6 presents the percentage of children in each scale score category by significantly associated key sociodemographic characteristics.

Table 6-6. Percentage of study children by key sociodemographic characteristics associated with Problem-Solving Scale scores at 54 months

Key sociodemographic characteristic	Problem-Solving Scale score range: Needs further evaluation % (standard error [SE])	Problem-Solving Scale score range: Needs monitoring % (SE)	Problem-Solving Scale score range: Typical % (SE)	Unweighted *n*	Weighted *n*
Ethnicity					
Hispanic or Latino	5.5 (0.8)	11.3 (1.2)[a]	83.1 (1.3)[b]	955	205,731
Not Hispanic or Latino	4.6 (0.7)	6.4 (0.9)[a]	89.0 (1.2)[b]	1,607	235,347
Marital status					
Married	4.4 (0.7)	6.2 (1.1)[a]	89.4 (1.4)[b]	951	172,615
Not married	5.4 (0.8)	10.3 (1.0)[a]	84.3 (1.1)[b]	1,611	268,463
Maternal education					
At most high school	6.5 (0.9)[a]	11.1 (1.3)[b]	82.4 (1.4)[c]	1,368	237,481
More than high school	3.3 (0.5)[a]	5.9 (0.9)[b]	90.8 (1.0)[c]	1,194	203,597
Parity					
Firstborn	4.8 (0.7)	7.2 (1.0)[a]	88.0 (1.2)[c]	1,067	187,559
Second born	4.8 (0.8)	6.7 (1.2)[b]	88.5 (1.4)[d]	702	118,169
Third or subsequent born	5.6 (1.0)	12.4 (1.6)[a,b]	82.0 (1.8)[c,d]	793	135,350
Household food security					
High or marginal	4.5 (0.5)	7.7 (0.9)	87.8 (1.0)	1,952	338,343
Low	5.5 (1.6)	14.3 (2.7)	80.2 (3.0)	328	56,804
Very low	8.7 (1.8)	8.7 (2.0)	82.6 (2.3)	282	45,932
Income poverty					
At or below 75% of the Federal Poverty Guidelines (FPG)	7.2 (0.9)[a]	11.0 (1.2)[b]	81.8 (1.3)[c,d]	1,136	195,621
Between 75% and 130% of the FPG	3.7 (1.0)	7.7 (1.3)	88.6 (1.7)[c]	783	141,897
Above 130% of the FPG	2.7 (0.7)[a]	5.6 (1.4)[b]	91.7 (1.6)[d]	643	103,560
Participation in non-WIC benefit programs					
Does not participate in other programs[e]	1.8 (0.7)[a]	5.8 (1.3)[c]	92.4 (1.5)[d]	468	80,346
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[e]	7.7 (1.0)[a,b]	10.5 (1.3)[c]	81.8 (1.3)[d,f]	1,191	205,087
Participates in other programs[e] excluding SNAP	3.2 (0.7)[b]	7.7 (1.0)	89.0 (1.0)[f]	903	155,645
Timing of WIC enrollment					
First trimester	4.0 (0.7)	11.2 (1.7)	84.8 (1.6)	830	138,921
Second trimester	5.9 (0.7)	8.8 (1.0)	85.3 (1.2)	1,045	174,019
Third trimester	5.4 (1.4)	6.3 (1.3)	88.3 (1.8)	363	68,489
Postnatal	4.4 (1.4)	5.2 (1.4)	90.4 (1.5)	324	59,649
WIC participation status at 48 months					
Receives WIC	6.2 (0.7)[a]	10.3 (1.3)[b]	83.5 (1.4)[c]	1,310	234,568
Does not receive WIC	3.7 (0.6)[a]	6.8 (1.0)[b]	89.4 (1.1)[c]	1,252	206,511

[a,b,c,d] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between the percentages within a sociodemographic category.

[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] Indicates a statistically significant pairwise difference at $p \leq 0.05$ between the percentages.

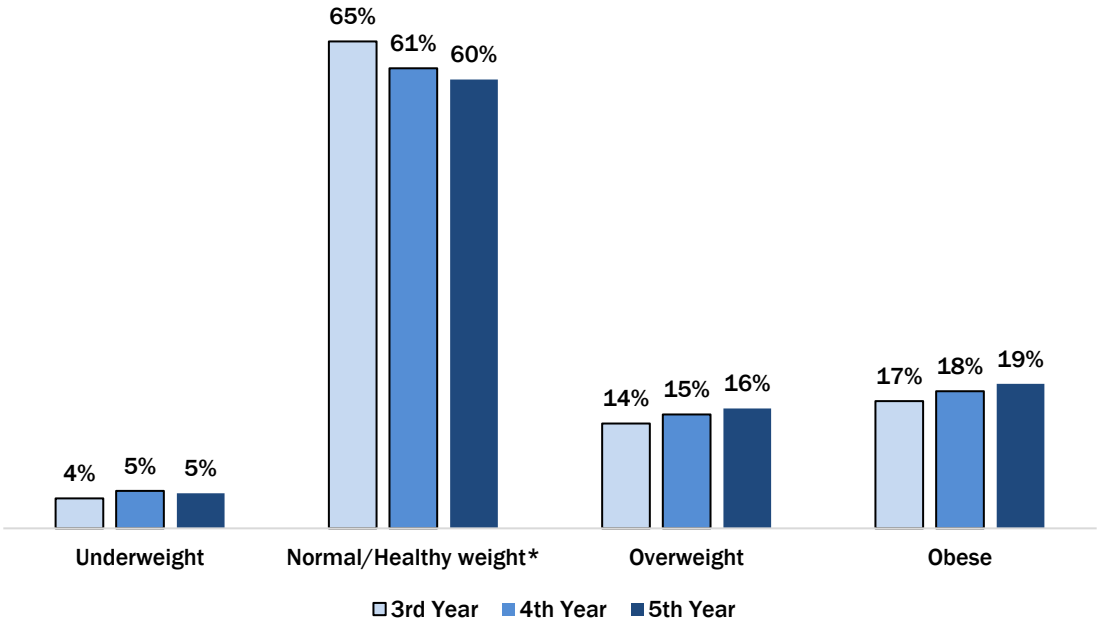
Significant differences in scores indicating a need for further evaluation are evident by maternal education level, income poverty, participation in non-WIC programs, and WIC participation status at 48 months. Children with caregivers who have at most a high school education are more likely (7%) than children whose caregivers have more than a high school education (3%) to score in the range indicating a need for further evaluation. Children in the lowest income-poverty subgroup are more likely (7%) than children in the highest income-poverty subgroup (3%) to score in the range indicating a need for further evaluation. Children in families that participate in non-WIC programs including the Supplemental Nutrition Assistance Program (SNAP) are more likely (8%) than children in families that participate in other programs excluding SNAP (3%) and children in families that do not participate in other non-WIC benefit programs (2%) to score in the range indicating a need for further evaluation. Children in families that participated with WIC at 48 months are more likely (6%) than children in families that did not participate with WIC at 48 months (4%) to score in the range indicating a need for further evaluation.

6.7 BMI at Age 5 Years

6.7.1 BMI Distribution

Figure 6-3 presents the percentage distribution of study children by third-, fourth-, and fifth-year weight status categories (Appendix Table B2e-3 offers additional details). Around age 5, 60 percent of study children have BMI percentiles in the normal/healthy weight status category. Five percent are in the underweight group. About 16 percent of study children are overweight, and 19 percent of study children are in the obese category. Pairwise t-tests indicate that the differences between the percentages in each weight status category at ages 4 and 5 years are not statistically significant; however, between age 3 and age 4 and between age 3 and age 5, there was a significant drop in the percentage of children with a healthy weight (Figure 6-3).

Figure 6-3. Percentage of study children by body mass index (BMI)-for-age categories around ages 3, 4, and 5 years[a]



[a] Around age 3 years, unweighted *n*=1,886 and weighted *n*=442,544. 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.

* Pairwise t-tests indicate that 65 percent is significantly different from 61 percent at $p \leq 0.05$; and 65 percent is significantly different from 60 percent at $p \leq 0.05$.

Note: Percentages may not sum to 100 due to rounding.

Estimates from the 2015-2016 NHANES for the entire U.S. population of 2- to 5-year-old children indicate that 12 percent have a BMI-for-age in the overweight range and 14 percent have BMI-for-age in the obese range (Skinner et al., 2018; Hales et al., 2018). Because the age ranges differ and the NHANES data include children from all income brackets, it is not surprising that NHANES estimates of the percentages of overweight and obese children differ from WIC ITFPS-2. A recent analysis of WIC PC data from 2018 indicates that among 2- to 4-year-old children receiving WIC in 2018, the overall prevalence of overweight was about 15.3 percent and the overall prevalence of obesity was about 14.4 percent (Kline, Thorn, Bellows, Wroblewska, & Wilcox-Cook, 2020). Differences between the WIC populations covered, timing of the data collections, and estimation methodology account for some of the discrepancy between WIC ITFPS-2 and WIC PC estimates.

Table 6-7 presents the percentages of study children that exhibit severe obesity, defined as at or above 120 percent of the 95th BMI-for-age percentile. The weighted average of 3 years of findings for study children is 3.9 percent, which is twice the estimated prevalence (1.8%, 95% Confidence

Interval [CI] 0.8, 3.4) of severe obesity for U.S. children 2 to 5 years old using data from 2015-2016 NHANES (Hales et al., 2018); however, WIC ITFPS-2 data were collected after the NHANES data, in 2018 and 2019, which should be considered when comparing the two sources. It is also important to note that the percentage of children exhibiting severe obesity in WIC ITFPS-2 doubled between the third- and fifth-year measurement periods.

Table 6-7. Prevalence of severe obesity[a] among WIC ITFPS-2 study children around ages 3, 4, and 5 years

Measurement period	Severe obesity % (standard error)	Unweighted *n*	Weighted *n*
Third year	2.5 (0.5)[b,c]	1,885	442,274
Fourth year	4.3 (0.6)[b]	2,115	442,085
Fifth year	5.0 (0.6)[c]	1,825	441,932

[a] Severe is defined as body mass index (BMI) ≥ 120 percent of the 95th percentile.

[b,c] Indicates a statistically significant difference at $p \leq 0.05$ between percentages.

6.7.2 Characteristics Associated with Children's Weight Status Category around Age 5 Years

Chi-square analyses indicated that only a few key sociodemographic characteristics are associated with children's weight status categories around age 5 years (Table 6-8). Healthy or underweight mothers are more likely (65%) than obese mothers (56%) to have healthy weight children and less likely to have obese children (14% compared to 24%, respectively). Children in families that are in the highest income-poverty subgroup (above 130% of the FPG) are more likely (68%) than children in families that are in either of the two lower subgroups (59%, at or below 75% of the FPG; 55%, between 75% and 130% of the FPG) to be healthy weight and less likely to be obese (12% compared to 20% and 24%, respectively). Children with mothers who were 20-25 years old at the time of the study child's birth are more likely (64%) than children with mothers who were 16-19 years old at the time of the study child's birth to be healthy weight (46%). In addition, the youngest mothers at the time of the child's birth are more likely (32%) than mothers in the middle age group (15%, 20-25 years) to have obese children, and mothers in the oldest subgroup (26 years or older) are more likely (20%) than mothers in the middle subgroup (15%, 20-25 years) to have obese children. These bivariate analyses focus on one factor at a time and do not control for the influence of multiple factors that may affect children's weight status categories.

Table 6-8. Percentage of study children in weight status categories by associated key sociodemographic characteristics

Key sociodemographic characteristic	Child's weight status category around age 5 years				Unweighted *n*	Weighted *n*
	Underweight % (standard error [SE])	Normal/ Healthy weight % (SE)	Overweight % (SE)	Obese % (SE)		
Maternal weight status at 42 months						
Normal or underweight	5.8 (1.0)	64.5 (2.4)[a]	15.4 (2.0)	14.3 (1.7)[b]	557	134,545
Overweight	3.5 (0.7)	60.3 (3.3)	18.0 (2.8)	18.1 (2.4)	543	140,110
Obese	4.9 (1.0)	55.9 (2.3)[a]	14.9 (1.6)	24.4 (2.3)[b]	725	167,276
Income poverty						
At or below 75% of the Federal Poverty Guidelines (FPG)	5.1 (0.9)	59.1 (2.1)[a]	16.1 (1.8)	19.8 (1.6)[c]	799	200,472
Between 75% and 130% of the FPG	5.1 (1.0)	55.4 (2.9)[b]	15.6 (1.8)	23.9 (2.7)[d]	583	141,662
Above 130% of the FPG	3.6 (0.9)	67.9 (2.6)[a,b]	16.5 (2.4)	12.0 (1.8)[c,d]	443	99,798
Maternal age at study child's birth						
16-19 years	2.4 (0.8)[a,b]	46.3 (5.7)[c]	19.3 (5.3)	32.0 (5.7)[d]	161	52,376
20-25 years	5.3 (0.9)[a]	64.0 (1.8)[c]	16.1 (1.7)	14.6 (1.6)[d,e]	699	177,631
26 years or older	4.9 (0.6)[b]	59.8 (2.1)	15.2 (1.4)	20.1 (1.4)[e]	965	211,924

[a,b,c,d,e] Pairs of matching superscripts within a sociodemographic category indicate that there is a statistically significant difference at $p \leq 0.05$ between the percentages.

6.7.3 Characteristics Associated with Children's Absolute BMI around Age 5 Years

In addition to exploring associations with key sociodemographic characteristics, the bivariate analyses explored several lifestyle and dietary characteristics that may be associated with children's absolute BMI. Because BMI is a continuous variable, a separate univariate regression was run to explore each association (Table 6-9). Among the factors analyzed, four feeding practices were associated with children's BMI: breastfeeding duration; trying to get the child to eat even if he or she seems not hungry; carefully controlling how much the child eats; and being very careful not to feed the child too much. WIC participation at 54 months and receipt of Medicaid at 48 months were also associated with absolute BMI at 60 months.

Table 6-9. Summary of bivariate exploratory analyses of lifestyle and dietary characteristics associated with absolute body mass index (BMI)

Characteristic	Significant association with BMI around age 5 years	
	Yes	No
Characteristics of the child's lifestyle and dietary intake during the fifth year		
Health condition that affects eating (categorical: yes/no)		✓
Sleep duration at night greater/less than 10 hours (categorical: yes/no)		✓
Weekly outdoor playtime greater/less than 15.7 hours (categorical: yes/no)		✓
Healthy Eating Index-2015 (HEI-2015) total score on a given day at 60 months (continuous: score)[a]		✓
Energy consumption on a given day at 60 months (continuous: kcal)[a]		✓
Participation with WIC at 54 months (categorical: yes/no)	✓	
Early feeding practices and 54-month feeding beliefs		
Breastfeeding duration (continuous: days through 13-month interview)	✓	
Solid foods introduced prior to 4 months (categorical: yes/no)		✓
Timing of sugar-sweetened beverage introduction (categorical: in first year, in second year, not introduced in first 2 years)		✓
Child should be allowed to eat fast food (categorical: occasionally and whenever compared to never)		✓
Child should be allowed to eat sugary foods (categorical: occasionally and whenever compared to never)		✓
Child should be allowed to eat snack foods (categorical: occasionally and whenever compared to never)		✓
Child should be allowed to drink sugary drinks (categorical: occasionally and whenever compared to never)		✓
I keep track of *what* food {CHILD} eats (categorical: always/usually compared to never)		✓
Try to get {CHILD} to finish his or her food (categorical: always/usually compared to never)		✓
Try to get {CHILD} to eat even if he or she seems not hungry (categorical: always/usually compared to never)	✓	
Carefully control how much {CHILD} eats (categorical: always/usually compared to never)	✓	
Very careful not to feed {CHILD} too much (categorical: always/usually compared to never)	✓	
Use mealtimes to teach {CHILD} about healthy eating (categorical: always/usually compared to never)		✓
Ask {CHILD} to help me prepare food (categorical: always/usually compared to never)		✓
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: always/usually compared to never)		✓
Frequency of television viewing during meals (categorical: most of the time, sometimes, and rarely compared to never)		✓
Frequency of family eating together in a week (categorical: 5 times or more compared to less than 5 times)		✓
Program participation at 48 months		
Participation with WIC (categorical: yes/no)		✓
Supplemental Nutrition Assistance Program (SNAP) receipt (categorical: yes/no)		✓
Temporary Assistance for Needy Families (TANF) receipt (categorical: yes/no)		✓
National School Lunch Program (NSLP) participation (categorical: yes/no)		✓
Medicaid receipt (categorical: yes/no)	✓	

[a] Intake estimates are based on 1 day of dietary recall data.

Results of univariate regression presented in Table 6-10 indicate that there is a negative association between breastfeeding duration and BMI; that is, the longer a mother breastfed during the first 13 months of the child's life, the lower the child's absolute BMI, on average, at age 5 years. One 54-month feeding practice, trying to get the child to eat even if he or she seems not hungry, also exhibited an inverse relationship with absolute BMI: Children whose parents always or usually pressure the child to eat have lower BMIs, on average, than children whose parents never pressure to eat. Two 54-month feeding practices exhibited a positive relationship with BMI: carefully controlling how much the child eats and being very careful not to feed the child too much. When interpreting these findings, it is important to recognize that the relationship between the practices and BMI may not be causal as they may have been adopted in response to weight status or change. More research exploring the timing of adoption of feeding practices and weight status needs to be done. WIC participation at 54 months was positively associated with absolute BMI around age 5 years, as was Medicaid participation at 48 months. Because BMI is associated with many factors, research exploring whether these factors are independently associated with weight status through multivariable analysis is needed.

Table 6-10. Univariate regression results from characteristics associated with absolute body mass index (BMI) around age 5 years

Characteristic	Estimate	*p*-value	Unweighted *n*	Weighted *n*
Breastfeeding duration (continuous: days)	-0.001	0.001	1,789	433,708
Try to get the child to eat even if he or she seems not hungry (categorical: always/usually compared to never)	-0.594	0.007	1,108	266,622
Carefully control how much {CHILD} eats (categorical: always/usually compared to never)	0.738	<.0001	1,264	307,166
Very careful not to feed {CHILD} too much (categorical: always/usually compared to never)	0.900	<.0001	1,450	348,523
Participation with WIC at 54 months	0.397	0.030	1,759	423,883
Medicaid receipt at 48 months (categorical: yes/no)	0.322	0.028	1,736	420,231

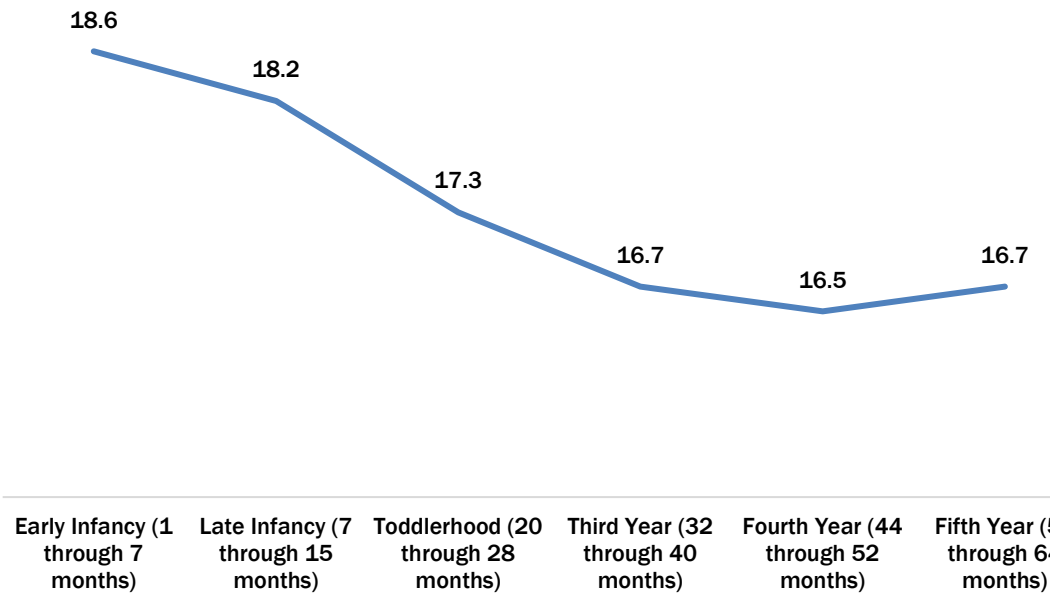
6.7.4 Change in Body Mass Index (BMI) over Time

As children develop, their BMIs change. Typically, BMI declines to a nadir between ages 5 and 7, after which it rebounds (Rolland-Cachera, Deheeger, Bellisle, Sempé, Guilloud-Bataille, & Patois, 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 6-4 presents the average BMI for study children at each point in time to highlight the general trend. Average BMI declines until about the third year when it begins flattening. It continues this relatively flat trajectory through the fifth-year measure. The early downward trend is consistent with a normal growth pattern in the population, and there is no clear upward turn around age 3 years in the general population. The nadir appears around age 4 years. Caution should be used when interpreting the general trend. Each time period listed on Figure 6-4 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.[97]

[97] 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.

Figure 6-4. Average body mass index (BMI) (kg/m²) of study children across the first 5 years of life[a,b,c]



[a] These estimates are based on a growth model cohort that included all study children who met the following criteria: at least two measurements including the 60-month measurement; the case is in the longitudinal cohort; the child's race, ethnicity, gender, and birth weight are not missing; maternal education at baseline is not missing; father's weight status at baseline is not missing; full breastfeeding duration is not missing; introduction of sugary beverages and introduction of sweets by 24 months is not missing; age when complementary foods were introduced by 24 months is not missing; and Healthy Eating Index-2015 total scores are not missing at 24, 36, and 48 months.

[b] For the early infancy estimate, unweighted *n*=372 and weighted *n*=284,891. For the late infancy estimate, unweighted *n*=405 and weighted *n*=304,586. For the toddlerhood estimate, unweighted *n*=396 and weighted *n*=307,414. For the third year estimate, unweighted *n*=438 and weighted *n*=322,423. For the fourth year estimate, unweighted *n*=526 and weighted *n*=392,549. For the fifth year estimate, unweighted *n*=587 and weighted *n*=441,289.

[c] This analysis uses a longitudinal weight for the anthropometric data. The trend is similar if the cross-sectional weights are used.

7. WIC Participation and Program Experience

Key Findings:

- **Over half (51%) of study participants remained with the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) from enrollment to the study child's fifth year, though many reported taking a break at some point.**
- **Among study families receiving WIC at 54 months, the three most frequently cited reasons for staying on WIC were nutrition education (95%), food benefits (93%), and the supportive environment that WIC staff provide by listening to parental concerns about the child's health (92%). The vast majority (92%) indicate that the food and education they receive through WIC are equally important.**
- **Among those who participated in WIC during the child's fifth year, 82 percent indicate that they made a change in how they feed themselves or their families because of something they learned at WIC.**
- **When compared to children who participate consistently with WIC over the first 5 years of life, children who only participate in WIC through the second or third years of life have significantly lower diet quality scores, on average, at age 5 years, as measured by Healthy Eating Index-2015 (HEI-2015) total scores on a given day, based on multivariable regression results.**

7.1 Overview

This chapter focuses on Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participation, both respondents' perceptions of the program as well as its effects on caregivers and children. Given the emphasis on outcomes obtained during the fifth year of life, the majority of analyses draw on data from the 54- and 60-month interviews; however, when examining effects over time, data from interviews spanning 1 month through 60 months, as well as weight and length/height measurement data collected over the course of the study, are used. The research questions addressed in this chapter are:

- What is the impact of WIC experience on outcomes beyond nutrition and health, such as developmental outcomes?
- Does continued participation in WIC have a positive corollary effect on access to healthcare and continuity of care?
- Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to feeding practices, meal/snack patterns, food and nutrient intakes, and health status at age 5 years?
- Does continued participation in WIC lead to better eating behaviors and health outcomes?

7.2 Background

As discussed in the *Fourth Year Report*, most research to date on factors associated with WIC participation beyond infancy is limited to the child's first 2 years. Factors associated with ongoing WIC participation in the second year of life include longer breastfeeding duration, lower household income, and maternal report of making a change in how they feed their families or themselves based on something they learned from WIC (Jacknowitz & Tiehen, 2010; Whaley, Whaley, Au, Gurzo, & Ritchie, 2017; Whaley, Koleilat, Leonard, & Whaley, 2017; Whaley, Martinez, Paolicelli, Ritchie, & Weinfield, 2020).

Most recently, attention has turned to examining the influence of WIC participation on participants' dietary outcomes. Weinfield et al. (2020) demonstrated that WIC Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) infants with the highest WIC exposure during the first 2 years of life exhibited better diet quality than infants with the lowest exposure to WIC in the first 2 years. Borger, Paolicelli, & Sun (2022) have demonstrated that WIC participation into the child's third year is associated with higher diet quality scores, and emerging work also suggests that participation into the child's fifth year of life is associated with better diet quality scores (Anderson, Martinez, Ritchie, Paolicelli, Reat, Borger, & Whaley, 2022 [manuscript submitted for publication]).

This chapter presents findings from WIC ITFPS-2 data that build upon the foundation laid by previous researchers, extending analyses of WIC participation through age 5 years. It examines reasons why mothers may discontinue receiving WIC benefits during all 5 years of the study, and why families stay with WIC. Associations between health and dietary outcomes, including developmental outcomes, and WIC participation are examined.

7.3 Sample and Analysis Approach

7.3.1 Sample

The analyses in this chapter use data through the 60-month interview, but the focus is on activities and outcomes during the child's fifth year. Table 2-1 shows the number of respondents to the 54- and 60-month interviews. Both the core and supplemental samples were eligible for these interviews. In analyses, the responses to each interview are weighted so that findings reflect the WIC population as described in Chapter 1.

When growth outcomes are analyzed, measurement data from around the time of the child's fifth birthday (56 through 64 months of age) are used. For convenience, growth outcomes are referred to as occurring at 5 years despite the time window of data collection. During the fifth year, the study collects these data from participants after they visit their healthcare provider or WIC clinic. Table 6-1 displays the number of records received from each source.[98]

7.3.2 Derived Patterns of WIC Participation

The chapter begins by exploring participation and engagement with the WIC program and subsequently moves to examine the association between outcomes of interest and reported duration of WIC benefit receipt. Data used to quantify duration or patterns of WIC participation are drawn from self-reported program participation at the time of each of the study interviews. At every interview, study respondents are asked about their ongoing participation in WIC with the following question:[99] "Are you currently getting WIC food or checks for yourself or {CHILD}?" Respondents may continue with the study regardless of whether they continue to receive WIC benefits, but based on responses to this question, respondents can be categorized according to whether they receive WIC or not at any given interview month. Close examination of responses over time permits categorization of respondents by the approximate number of study years for which they received WIC for themselves or the study child. Table 7-1 displays the criteria for determining length or type of participation with WIC. The groups are mutually exclusive.

It is important to note that receiving WIC in a given year does not necessarily mean that the respondent received WIC benefits at the time of the final interview in that year. For example, respondents may be categorized as receiving WIC in Year 2 even if they did not indicate receiving benefits at 24 months. In other words, they received WIC in Year 2 but did not necessarily receive WIC through the end of Year 2. It is also important to note that the group intermittently receiving WIC differs from the other groups. The intermittent group includes those who indicated that they receive WIC benefits for any number of interviews but receipt is inconsistent, and typically much

[98] Chapter 6 offers a more detailed discussion of the weight and length/height data collected over the course of the study.

[99] See item SD31 on the annotated instruments.

more limited, over the course of the study than for other groups.[100] The intermittent group, therefore, does not reflect a duration of participation.

Table 7-1. Criteria for determining patterns of participation in WIC

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

[a] Month 1 is not considered in order to give respondents sufficient time immediately after birth.

[b] The 60-month interview is excluded because the child may no longer be eligible for WIC (because he or she is older than 5 years) when the 60-month interview is administered.

In both univariate and multivariable regression analyses, the seven categories representing patterns of WIC participation are collapsed into five mutually exclusive categories: in Year 1 only, in Year 2 and Year 3 only, in Year 4 and Year 5 only, consistently, and intermittently. The category in Year 2 and Year 3 includes families who participated into the study child's second year and those who participated into the study child's third year of life. The category in Year 4 and Year 5 includes families who participated into the study child's fourth year of life and those who participated into the fifth year of life, but did not participate consistently with WIC through the first 5 years of the study child's life. The categories were collapsed for two reasons: parsimony of presentation and power analysis indicated that the power of the test would be improved by collapsing categories.

[100] 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.

Coverage data[101] guided collapsing the seven categories of WIC participation into the five categories chosen. Table 7-2 presents the distribution of this version of patterns of WIC participation. Because the variable is used as a covariate in regression analyses, any missingness was imputed.

Table 7-2. The percentage of study mothers and/or children by patterns of participation in WIC (collapsed categories)

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

[a] Categories of WIC receipt are mutually exclusive.

[b] Consistently indicates that the respondent indicated that either the mother or child was receiving WIC in Years 1 and 2 and all subsequent survey months through the 54-month interview.

7.3.3 Analytical Approach

Initially, analyses focus on whether key sociodemographic subgroups of participants differ on outcomes of interest during the fifth year (see Section 1.8.2 for a list of key sociodemographic characteristics). Outcomes of particular interest include WIC program participation and its association with children's diet quality. Nonmodifiable 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 Federal Poverty Guidelines (FPG), or WIC participation status, values reported at the 48-month interview are used.[102]

[101] Food and Nutrition Service, U.S. Department of Agriculture. (2019). *National and state level estimates of WIC eligibility and WIC program reach, 2017*. Available at: https://www.fns.usda.gov/wic/national-and-state-level-estimates-wic-eligibility-and-wic-program-reach-2017. Retrieved on: April 30, 2022.

[102] The 48-month sociodemographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data and to avoid analyzing 54-month data by future (60-month) subgroup membership. Weight status of the study mother and educational attainment of the study mother are exceptions. Each is reported at 54 months because these data are collected at this interview, not at the 48-month interview.

After describing an outcome, bivariate chi-square tests are used for categorical outcomes to examine whether the outcome of interest varies with key sociodemographic characteristics. Follow-up t-tests between all pairs of subgroups are used to determine which subgroups are statistically significantly different from each other. Subgroup differences discussed in the chapter are limited to those that form a pattern over time or across questions, and are large in magnitude (i.e., at least 3 percentage points) to avoid focusing on findings that, while statistically significant, may have little practical importance.[103] Statistical significance, when indicated, is at the level of $p \leq 0.05$. For outcomes of interest that are continuous, such as body mass index (BMI), BMI-for-age percentile, and Healthy Eating Index-2015 (HEI-2015) scores on a given day,[104] univariate regression analysis is used to explore associations.

Because a variety of factors may influence diet quality, multivariable regression analyses follow the bivariate analyses. Multivariable regression analyses isolate the unique effects of individual variables on an outcome, while holding the influence of other variables constant. In this chapter, multivariable regression is used to analyze factors associated with children's 60-month HEI-2015 total scores on a given day. The independent variable of primary interest is duration of WIC participation to examine whether shorter compared to longer participation with the WIC program is independently associated with diet quality after adjustment for factors associated with both duration of WIC participation and diet quality.

7.4 WIC Program Participation in the Fifth Year

Study caregivers and children do not need to be receiving WIC benefits to continue participating in this study. Thus, at each interview there is a subgroup of participants who indicate they are no longer receiving WIC benefits. These respondents may or may not return to WIC at a future interview. This section explores WIC participation, including the reasons cited for returning to WIC after a hiatus from the program. The analyses also explore the effects of longer term WIC participation using the derived WIC participation pattern variable discussed in Section 7.3.2.

[103] 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.

[104] HEI-2015 scores on a given day use 1 day of recall information. Chapters 1 and 4 discuss the differences between usual intake estimates and estimates of intake on a given day.

7.4.1 Reasons for Leaving and Staying with WIC

The first time a respondent indicates that she is no longer receiving WIC benefits for herself or the study child, she is asked to indicate the reason she is no longer receiving benefits. A respondent may indicate one or more specified reasons for leaving WIC. In addition, she also has the option to select an "other" unspecified reasons category when applicable. Table 7-3 presents the distribution of caregivers by their reason for leaving WIC the first time, offering a comparison of motivations for those who left WIC prior to the study child's fifth year (through the 48-month interview) and those who left during the child's fifth year (at the 54-month interview[105]). Because respondents may indicate one or more reasons for leaving WIC, percentages do not sum to 100 percent across reasons. It is important to note that respondents who left WIC for the first time early in the study may have returned to WIC.

Table 7-3. Among caregivers who left WIC, the percentage of caregivers by reason they left WIC and by when they left WIC for the first time

Reasons for leaving WIC	Left WIC for the first time prior to the fifth year[a] % (standard error)	Left WIC for the first time during the fifth year (at the 54-month interview)[a] % (standard error)
No longer qualify for WIC	22.9 (2.6)	17.7 (7.3)
Inconvenient	39.4 (2.2)	35.2 (11.3)
No longer need WIC	25.7 (2.2)	19.6 (7.8)
Other reasons[b]		
Dislike items in food package	8.4 (1.9)	3.5 (3.6)
Dissatisfied with program	3.7 (1.3)	25.4 (20.9)
Documents needed	4.3 (1.8)	0
Medical condition	3.0 (1.4)	0
Missed appointment	18.5 (2.7)	25.6 (16.7)
Moved/trouble finding new clinic	17.2 (2.7)	9.5 (9.2)
Not able to make appointment	1.5 (0.8)	0
Time constraints	6.5 (1.9)	1.3 (1.5)
Time constraints and dissatisfied with program	0.7 (0.7)	0
Transportation	11.4 (2.6)	9.3 (9.2)
Work/school conflict	11.4 (2.3)	13.1 (8.0)
Miscellaneous	13.5 (2.4)	12.3 (11.7)
Unweighted *n*	607	31
Weighted *n*	247,271	12,194

[a] Respondents were allowed to mark all reasons that apply, so percentages do not sum to 100 percent.

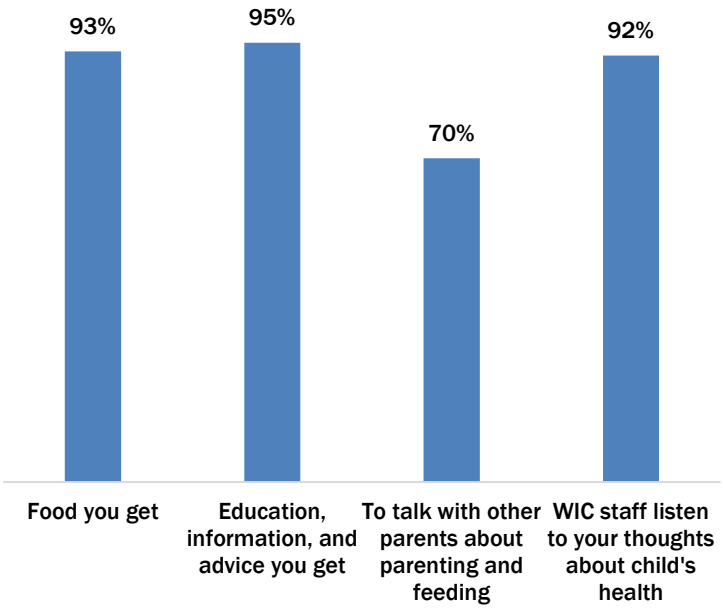
[b] These have been coded from reasons that the respondent gave when indicating that she left WIC for the first time for "other" reasons. Miscellaneous denotes a catchall category of other reasons that respondents provided.

[105] The 60-month interview is excluded from analysis because many of these interviews took place after the child's fifth birthday (i.e., when the study child was no longer eligible for WIC benefits).

The most frequently cited reason for leaving WIC for the first time, either prior to 54 months or at 54 months, is inconvenience. For those who left for the first time at the 54-month interview, inconvenience is the only reason significantly associated with a key sociodemographic characteristic: age of the mother at the study child's birth. However, only a small number of study participants left for the first time when the child was 54 months old (unweighted *n*=31; weighted *n*=12,194), and none were 16-19 years old when the study child was born. Most (63%) were 26 years or older.

For those indicating that they are receiving WIC at the 54-month interview, the study asks why they stay with WIC. Figure 7-1 displays the percentage of caregivers by the reasons cited (Appendix Table B2f-1 offers additional detail). Respondents could mark all that apply. More than 90 percent of caregivers cite three reasons: the food they receive (93%); the education, information, and advice they get (95%); and because WIC staff listen to their thoughts about their children's health and what their children are eating (92%). Over two-thirds (70%) of caregivers indicate that they stay with WIC because it affords them the opportunity to talk with other parents about parenting and feeding their children.

Figure 7-1. Among those participating in WIC at 54 months, reasons why participants stay with WIC[a]



[a] Unweighted *n*=1,251 and weighted *n*=228,288.

There are several significant associations with key sociodemographic characteristics, but ethnicity and maternal educational attainment are the only key sociodemographic characteristic significantly associated with each of the four reasons for continued participation. Table 7-4 presents the findings. Pairwise tests indicate that Hispanic caregivers are more likely to select each reason than non-Hispanic caregivers. Caregivers with at most a high school education are more likely than caregivers with more than a high school education to cite education, information, and advice you get, as well as talking with other parents about parenting and feeding.

Table 7-4. Among those participating with WIC at 54 months, the percentage of study mothers by reason for continuing with WIC and associated key sociodemographic characteristics

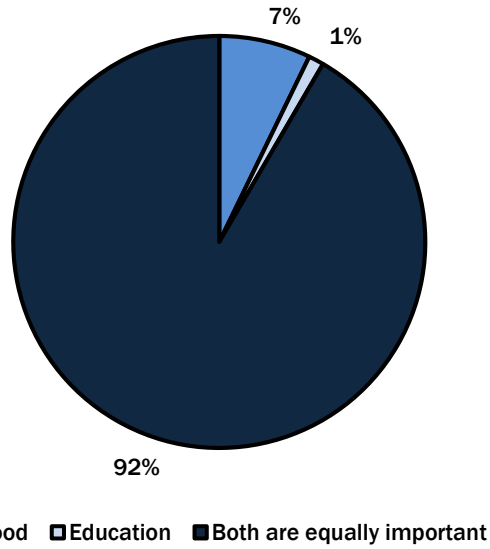
Key sociodemographic characteristic	Among those participating with WIC at 54 months, reasons why they stay: Food you get % (standard error [SE])	Education, information, and advice you get % (SE)	To talk with other parents about parenting and feeding % (SE)	WIC staff listen to your thoughts about child's health % (SE)	Unweighted *n*	Weighted *n*
Ethnicity						
Hispanic or Latino	95.2 (1.1)[a]	98.5 (0.6)[b]	73.7 (2.4)[c]	95.0 (1.0)[d]	568	124,122
Not Hispanic or Latino	90.5 (1.3)[a]	90.9 (1.2)[b]	65.6 (2.3)[c]	88.9 (1.6)[d]	683	104,166
Maternal education						
High school or less	91.2 (1.1)[a]	97.3 (0.8)[b]	75.7 (2.4)[c]	94.0 (1.1)	739	136,810
More than high school	95.8 (0.9)[a]	91.7 (1.4)[b]	61.4 (3.0)[c]	89.6 (1.9)	512	91,478

[a,b,c,d] Indicates a statistically significant pairwise difference at $p \leq 0.05$ within the sociodemographic group.

7.5 Influences of WIC Participation in the Fifth Year

7.5.1 Nutrition Education and Food

Figure 7-2. Among those currently participating in WIC at 54 months, the percentage reporting the most important of select benefits[a]



[a] Unweighted *n*=1,280 and weighted *n*=232,414.

Study participants currently receiving WIC benefits at 54 months—whether for the mother, the study child, or another child—are asked which benefit, food or education, is more important to them or if the food and education are equally important. Figure 7-2 displays the distribution of responses for those currently receiving WIC benefits (Appendix Table B2f-2 offers additional detail). Ninety-two percent indicate that the food and education they receive are equally important. Responses are significantly associated with the following key sociodemographic characteristics: ethnicity, marital status, and maternal educational attainment. Table 7-5 presents the

percentage of study participants by their indication of the most important benefit WIC provides and key sociodemographic categories that are significantly associated with participants' responses.

Table 7-5. Among those participating in WIC at 54 months, the percentage of study mothers by most important reason for continuing with WIC and associated key sociodemographic characteristics

Key sociodemographic characteristic	Among those participating with WIC at 54 months, the importance of select WIC benefits			Unweighted *n*	Weighted *n*
	Food only % (standard error [SE])	Education only % (SE)	Both are equally important % (SE)		
Ethnicity					
Hispanic or Latino	3.5 (0.9)[a]	0.9 (0.4)	95.7 (0.9)[b]	574	125,029
Not Hispanic or Latino	11.5 (1.8)[a]	1.7 (0.6)	86.8 (1.8)[b]	706	107,385
Marital status					
Married	10.7 (1.9)[a]	0.9 (0.5)	88.5 (1.9)[b]	463	90,098
Not married	5.0 (0.9)[a]	1.5 (0.5)	93.5 (1.0)[b]	817	142,316
Education					
High school or less	4.7 (1.1)[a]	1.3 (0.4)	94.0 (1.1)[b]	760	139,756
More than high school	11.0 (2.4)[a]	1.2 (0.5)	87.8 (2.4)[b]	520	92,659

[a,b] Indicates a statistically significant pairwise difference at $p \leq 0.05$ within the sociodemographic group.

7.5.2 Changes Made Due to WIC

At 54 months, about 73 percent of all caregivers and 82 percent of those receiving WIC for themselves or the study child at this interview indicate that they made a change in how they feed themselves or their families because of something they learned at WIC. Responses of all caregivers are significantly associated with ethnicity, non-WIC benefit program participation, parity, weight status of the mother at 42 months, income poverty, and the child's WIC participation status at 48 months. Table 7-6 displays the percentages of all respondents by subgroups within these significantly associated key sociodemographic characteristics. Non-Hispanic mothers are less likely (66%) than Hispanic mothers (81%) to indicate that they made a change in their feeding practices due to something that they learned at WIC. Those who do not participate in any other benefit programs are less likely (63%) than those who participate in other programs (73%, including the Supplemental Nutrition Assistance Program [SNAP]; 77%, excluding SNAP) to indicate that they made a change due to something that they learned at WIC. Those with study children who were the firstborn child are less likely (69%) than those whose study child was the third or subsequently born child (78%) to indicate that they made a change. Mothers who are normal weight or underweight are

less likely (67%) than mothers who are overweight (76%) or obese (76%) to indicate that they made a change. Mothers in households with income that exceeds 130 percent of the FPG are less likely (65%) than mothers in households with lower incomes (78% between 75% and 130% of the FPG; 73% at or below 75% of the FPG) to indicate that they made a change. Mothers in families that did not participate with WIC at 48 months are less likely (64%) than mothers who did participate with WIC at this time (81%) to indicate that they made a change.

Table 7-6. Percentage of all caregivers who report at 54 months changing their feeding practices due to something they learned at WIC by associated key sociodemographic characteristics

Key sociodemographic characteristic	Percentage of caregivers who made a change due to WIC % (standard error)	Unweighted *n*	Weighted *n*
Ethnicity			
Hispanic or Latino	80.5 (1.4)[a]	953	205,255
Not Hispanic or Latino	66.1 (1.9)[a]	1,603	235,027
Participation in non-WIC benefit programs			
Does not participate in any other programs[b]	63.4 (3.6)[a,c]	468	80,346
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs[b]	73.4 (1.7)[a]	1,190	205,015
Participates in other programs[b] excluding SNAP	76.9 (2.2)[c]	898	154,920
Parity			
Firstborn	68.6 (2.2)[a]	1,065	187,137
Second born	74.1 (2.2)	699	117,962
Third or subsequent born	77.6 (1.9)[a]	792	135,182
Weight status of the mother at 42 months			
Underweight or normal weight	66.6 (2.2)[a,c]	810	138,451
Overweight	75.6 (2.0)[a]	772	137,758
Obese	75.7 (1.8)[c]	974	164,072
Income poverty			
75% of the Federal Poverty Guidelines (FPG)	73.1 (1.9)[a]	1,137	195,787
Above 75% but not more than 130% of the FPG	78.2 (1.7)[c]	781	141,322
Above 130% of the FPG	64.8 (2.7)[a,c]	638	103,173
WIC participation status at 48 months			
Receives WIC	80.7 (1.6)[a]	1,309	234,256
Does not receive WIC	63.8 (1.8)[a]	1,247	206,025

[a] Indicates a statistically significant pairwise difference at $p \leq 0.05$ within the sociodemographic group.

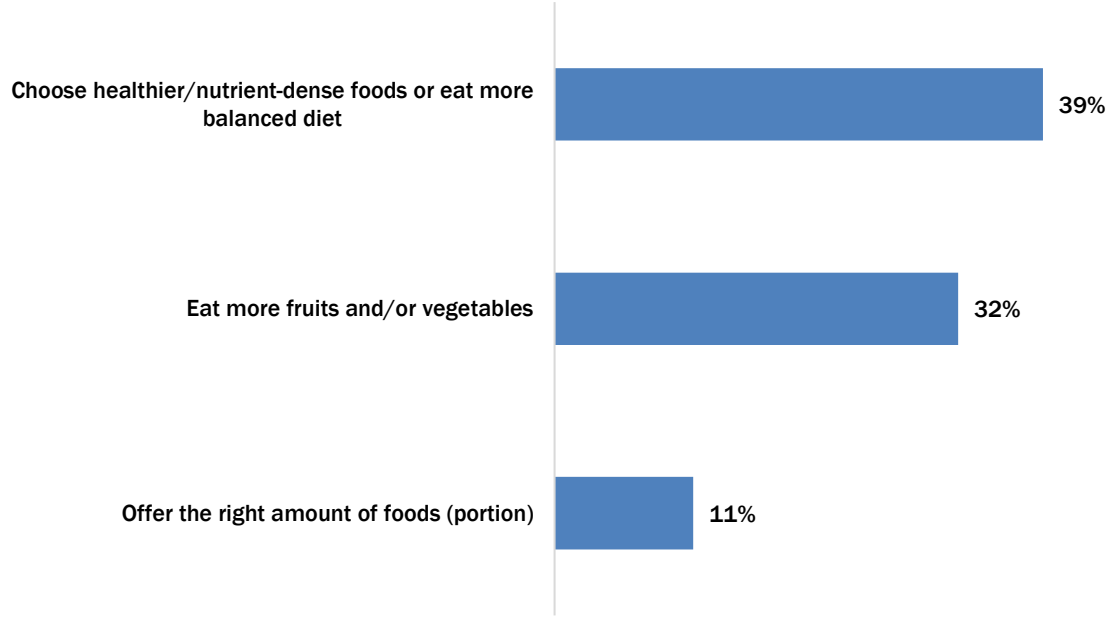
[b] Other programs include Temporary Assistance for Needy Families (TANF), Medicaid, or free/reduced price meals from the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).

[c] Indicates a statistically significant pairwise difference at $p \leq 0.05$ within the sociodemographic group.

All caregivers who indicate at the 54-month interview that they made a change in their feeding practices because of something learned from WIC are asked, "What is the most important change you have made based on education you received from WIC?" Figure 7-3 displays the percentage of

these caregivers by the most important change they made for responses reported by at least 10 percent of caregivers (Appendix Table B2f-3 offers additional detail). Among those who made a change in their feeding practices, 39 percent indicate that knowledge of how to choose more healthy foods for themselves and their families or choosing nutrient-dense foods or eating a more balanced diet was most important to them. This is the most frequently cited response. Eating more fruits and/or vegetables (32%) is second among the most important types of changes made, followed by offering the right portion size for children which was cited by 11 percent of respondents who made a change as the most important change that they made.

Figure 7-3. Among caregivers who reported at 54 months that they made a change in their feeding practice due to something they learned at WIC, the percentage by the most important change made[a]



[a] This figure reflects upcoded responses from the "other, specify" response option; consequently, the categories listed in this figure do not directly align with survey item WC22. Unweighted *n*=1,798; weighted *n*=319,410.

7.6 Patterns of WIC Participation

The percentage of study mothers reporting receipt of WIC benefits at a particular point in time does not necessarily capture the duration of program participation. To explore the effects of duration, analyses use a derived measure capturing WIC patterns of participation (described in Section 7.3.2). Excluding the intermittent participation category, the other five categories indicate increasingly

longer duration of WIC participation and, therefore, provide an additional lens by which to examine whether duration of program exposure is associated with outcomes. Table 7-7 presents the percentages of study participants—caregiver and/or child—in each WIC participation category.

Table 7-7. The percentage of caregivers by patterns of participation in WIC

Received WIC (WIC participation categories[a])	Study mother and/or child	
	% (standard error)	Unweighted *n*
In Year 1 only	9.2 (1.3)	99
In Years 1 and 2 only	9.6 (1.3)	116
In Years 1, 2, and 3 only	8.4 (1.2)	89
In Years 1, 2, 3, and 4 only	7.6 (1.0)	81
In Years 1, 2, 3, 4, and 5	7.6 (0.9)	76
Consistently[b]	43.6 (2.8)	461
Intermittently	14.0 (1.4)	149
Unweighted *n*[c]	1,071	1,071
Weighted *n*	439,747	439,747

[a] WIC participation categories are mutually exclusive.

[b] Status at the 60-month interview is not considered because the study child may be too old to participate in WIC.

[c] Sample includes those who answered the 1- or 3-month interview and all subsequent interviews through the 60-month interview.

Note: Historical numbers changed from the previous report due to use of a new weight that is based on participants who have answered the 1- or 3-month interview through the 60-month interview.

In each of the first 2 years of the study, slightly less than 10 percent of the study mothers report discontinuing and not returning to WIC. In Years 3 and 4, about 8 percent of study mothers leave WIC and do not return. About 8 percent of study mothers remain with WIC into the child's fifth year, but did not report participation in WIC at every previous interview. About 44 percent of study mothers consistently receive WIC; that is, they report receipt of WIC in Years 1 and 2 and at every interview subsequent to the 24-month interview through the 54-month interview. About 14 percent of study mothers report receiving WIC benefits intermittently between birth and age 5. For the intermittent group, there is no particular duration or pattern of participation. In total, over half (51%) of study families remain with WIC into the study child's fifth year.

Chi-square analyses between patterns of WIC participation and key sociodemographic characteristics find significant associations between the aforementioned participation patterns and ethnicity, participation in non-WIC benefit programs, timing of WIC enrollment, income poverty, maternal age, and maternal educational attainment. Table 7-8 presents the percentages of study mothers by patterns of WIC participation and significantly associated key sociodemographic characteristics.

Table 7-8. Percentage of caregivers by patterns of participation in WIC and associated key sociodemographic characteristics

Key sociodemographic characteristic	Receiving WIC in Year 1 only % (standard error [SE])	Receiving WIC in Years 1 & 2 only % (SE)	Receiving WIC in Years 1, 2, & 3 only % (SE)	Receiving WIC in Years 1, 2, 3, & 4 only % (SE)	Receiving WIC in Years 1, 2, 3, 4, & 5 % (SE)	Consistently receiving WIC % (SE)	Intermittently receiving WIC % (SE)	Unweighted *n*	Weighted *n*
Ethnicity									
Hispanic or Latino	6.4 (1.5)[a]	7.4 (1.9)	7.0 (1.8)	6.5 (1.6)	6.5 (1.3)	57.4 (3.4)[b]	8.9 (1.9)[c]	414	194,775
Not Hispanic or Latino	11.5 (1.5)[a]	11.3 (1.8)	9.5 (1.5)	8.4 (1.8)	8.5 (1.2)	32.7 (2.5)[b]	18.0 (2.0)[c]	657	244,972
Participation in non-WIC benefit programs									
Does not participate in any other programs	17.4 (2.7)[a,b]	19.4 (3.5)[c]	11.0 (2.6)	6.3 (2.6)	2.9 (1.7)[d]	23.7 (3.5)[e,f]	19.2 (3.4)	209	82,194
Participates in the Supplemental Nutrition Assistance Program (SNAP) or in SNAP and other programs	6.0 (1.2)[a]	4.8 (1.2)[c,g]	8.5 (1.8)	7.3 (1.5)	11.1 (1.4)[d,h]	51.1 (2.8)[e]	11.2 (1.8)	473	205,448
Participates in other programs excluding SNAP	9.3 (2.0)[b]	10.7 (2.1)[g]	6.9 (1.3)	8.6 (1.5)	5.4 (1.1)[h]	44.3 (4.1)[f]	14.8 (2.4)	389	152,104
Timing of WIC enrollment									
First trimester	5.1 (1.3)[a]	6.9 (1.4)	9.8 (1.5)	7.0 (1.2)	6.4 (1.3)	55.3 (3.2)[b,c]	9.6 (1.9)[g]	406	143,447
Second trimester	8.5 (1.8)	8.7 (1.9)	7.8 (2.0)	7.1 (1.4)	9.9 (1.9)	43.9 (4.0)	14.1 (1.7)[d]	420	169,829
Third trimester	12.8 (2.6)[a]	12.4 (3.1)	8.2 (3.2)	7.4 (3.0)	4.6 (1.8)	29.8 (4.5)[b]	24.8 (3.9)[d,g,h]	133	69,750
Postnatal	17.7 (4.4)	15.5 (4.1)	7.0 (2.4)	10.6 (3.8)	7.7 (2.8)	30.4 (5.0)[c]	11.0 (3.4)[h]	112	56,720

Table 7-8. Percentage of caregivers by patterns of participation in WIC and associated key sociodemographic characteristics (continued)

Key sociodemographic characteristic	Receiving WIC in Year 1 only % (standard error [SE])	Receiving WIC in Years 1 & 2 only % (SE)	Receiving WIC in Years 1, 2, & 3 only % (SE)	Receiving WIC in Years 1, 2, 3, & 4 only % (SE)	Receiving WIC in Years 1, 2, 3, 4, & 5 % (SE)	Consistently receiving WIC % (SE)	Intermittently receiving WIC % (SE)	Unweighted *n*	Weighted *n*
Income poverty									
At or below 75% of the Federal Poverty Guidelines (FPG)	4.4 (1.3)[a]	7.1 (1.6)[c]	6.8 (1.7)	6.1 (1.5)	10.0 (1.3)[d]	52.2 (3.3)[h]	13.3 (2.1)	458	198,382
Above 75% but not more than 130% of the FPG	8.6 (2.0)[b]	7.0 (1.6)[g]	8.9 (1.7)	9.4 (2.1)	7.7 (1.7)	45.9 (3.3)[e]	12.6 (1.8)	358	143,299
Above 130% of the FPG	19.9 (3.1)[a,b]	18.4 (2.7)[c,g]	10.9 (2.5)	7.8 (2.3)	2.6 (1.0)[d]	23.1 (3.5)[e,h]	17.2 (2.5)	255	98,066
Mother's age at the study child's birth									
16-19 years	0.4 (0.4)[a,b]	11.3 (3.3)	8.5 (3.5)	7.3 (3.3)	6.2 (2.7)	42.7 (7.3)	23.5 (6.0)	86	42,365
20-25 years	11.7 (2.3)[a]	9.3 (1.8)	8.0 (1.4)	7.4 (1.7)	10.0 (1.9)	37.6 (4.1)	15.9 (1.8)	379	178,543
26 years or older	9.0 (1.5)[b]	9.5 (1.5)	8.7 (1.7)	7.7 (1.2)	5.9 (1.0)	48.7 (3.4)	10.5 (1.6)	606	218,840
Maternal educational attainment									
High school or less	8.1 (1.5)	6.0 (1.2)[a]	7.4 (1.7)	6.8 (1.3)	8.3 (1.4)	51.4 (3.2)[b]	12.0 (1.8)	546	228,788
More than high school	10.5 (1.6)	13.5 (2.2)[a]	9.5 (1.7)	8.4 (1.8)	6.9 (1.5)	35.2 (3.5)[b]	16.1 (2.3)	525	210,958

[a,b,c,d,e,f,g,h] Indicates a statistically significant pairwise difference at $p \leq 0.05$ within the sociodemographic group.

These associations are not adjusted for other factors that may confound or modify the observed associations. Those who participate with WIC consistently over the 5 years of the study, those who participate with WIC in Year 1 only, and those who participate intermittently over the 5 years of the study have the most statistically significant differences by key sociodemographic subgroups.

At the 30-, 36-, 42-, 48-, and 54-month interviews, study participants are asked whether they have another child participating with WIC. Table 7-9 presents the percentages of participants reporting that they have other children participating with WIC. Those who participated with WIC in Year 1 only or Years 1 and 2 only tend not to have other children who participate with WIC. About 30 percent of those who participated with WIC in Years 1, 2, and 3 only had another child receiving benefits when the study child was 30 months old, but this percentage fell as the study child aged. About 30 percent of those who participated with WIC in Years 1, 2, 3, and 4 only had another child participating when the study child was 30 months old. This percentage rose to nearly 40 percent when the study child was 42 months old and subsequently fell dramatically. Between 35 and 40 percent of those who participated with WIC into the study child's fifth year or consistently had another child participating with WIC at each of the interview months. It is important to note that this bivariate examination does not control for other important factors that may influence whether another child participates with WIC (e.g., household income).

Table 7-9. Percentage of caregivers with another (nonstudy) child participating in WIC at select interview months by patterns of WIC participation for the mother and/or study child

Patterns of WIC participation	Has another child receiving WIC at interview month					Unweighted *n*	Weighted *n*
	30 months % (standard error [SE])	36 months % (SE)	42 months % (SE)	48 months % (SE)	54 months % (SE)		
In Year 1 only	0.4 (0.4)	2.1 (1.7)	0	0	1.8 (1.8)	99	40,662
In Years 1 & 2 only	0.4 (0.4)	0	0	1.7 (1.5)	1.9 (1.6)	116	42,124
In Years 1, 2, & 3 only	29.3 (5.2)	12.2 (3.3)	1.6 (1.2)	0.4 (0.4)	1.6 (1.7)	89	36,912
In Years 1, 2, 3, & 4 only	28.6 (5.5)	35.2 (6.2)	39.3 (6.3)	19.8 (4.8)	2.5 (1.7)	81	33,225
In Years 1, 2, 3, 4, & 5	37.0 (7.1)	39.5 (7.4)	37.3 (6.5)	38.6 (6.6)	48.2 (7.1)	76	33,545
Consistently	36.9 (2.6)	37.0 (2.6)	36.5 (3.0)	37.6 (2.7)	39.3 (3.0)	461	191,883
Intermittently	8.7 (2.4)	9.8 (2.4)	23.5 (4.1)	30.6 (4.9)	36.4 (4.8)	149	61,396

7.7 Outcomes Associated with Patterns of WIC Participation

The analyses explored fifth-year outcomes associated with WIC participation categories as described in Section 7.3.2. For continuous measures, univariate regression was used to assess significant associations. As mentioned, five participation categories were used in regression analyses: in Year 1, in Year 2 and Year 3, in Year 4 and Year 5, consistently, and intermittently, and any missingness in this covariate was imputed. For categorical outcomes, chi-square analyses were used. Outcomes examined included the following:

- BMI-for-age categories of weight status at around age 5 years (categorical outcome);
- Change in BMI-for-age percentile between age 2 years and 5 years (continuous outcome);
- Access and continuity of healthcare as measured by whether the child has a medical home[106] in the fifth year (categorical outcome);
- Developmental progression as measured by Problem-Solving Scale score categories in the fifth year (categorical outcome); and
- HEI-2015 total and component scores on a given day when the child is 60 months old (continuous outcome).

Of these outcomes, only developmental progression as measured by Problem-Solving Scale scores and HEI-2015 scores on a given day were significantly associated with patterns of WIC participation (i.e., the patterns of WIC participation categories described in Table 7-7). Because WIC focuses on nutrition, the ensuing discussion focuses on HEI-2015 score outcomes. Appendix Table B2f-4 presents the findings for Problem-Solving Scale scores.

7.7.1 Associations between Patterns of WIC Participation and HEI-2015 Scores on a Given Day

By providing both nutritious supplemental foods and nutrition education, WIC participation may influence diet quality. Bivariate analyses explored this possibility using univariate regression because HEI-2015 is a continuous variable. Table 7-10 presents significant findings from the univariate regression of patterns of WIC participation on HEI-2015 total and component scores on a given

[106] See Chapter 2, Section 2.8 for background.

day at 60 months.[107] The bivariate work suggests that compared to those who participated consistently, children who participated for shorter durations generally exhibit lower HEI-2015 scores on a given day.

Table 7-10. Associations between 60-month diet quality scores and patterns of WIC participation for the study child based on univariate regression[a]

WIC participation and Healthy Eating Index-2015 (HEI-2015) total or component score on a given day	Estimated change in HEI-2015 score relative to consistent[b] participation in WIC compared to children who participated consistently	Standard error	*p*-value
Total score			
In Year 1 only	-4.19	1.44	<.006*
Into Years 2 and 3	-3.65	1.31	0.008*
Into Years 4 and 5	-1.03	1.46	0.486
Intermittently	-2.50	1.22	0.047*
Greens and beans			
In Year 1 only	-0.66	0.19	<.002*
Into Years 2 and 3	-0.41	0.16	0.012*
Into Years 4 and 5	-0.11	0.23	0.629
Intermittently	-0.16	0.32	0.611
Total fruits			
In Year 1 only	-0.13	0.27	0.626
Into Years 2 and 3	-0.37	0.18	0.039*
Into Years 4 and 5	-0.13	0.13	0.307
Intermittently	-0.14	0.13	0.303
Whole grain			
In Year 1 only	-0.82	0.38	0.037*
Into Years 2 and 3	-0.69	0.27	0.016*
Into Years 4 and 5	0.37	0.36	0.310
Intermittently	-0.32	0.35	0.367
Dairy			
In Year 1 only	-0.93	0.41	0.029*
Into Years 2 and 3	-0.38	0.30	0.221
Into Years 4 and 5	-0.34	0.33	0.305
Intermittently	-0.83	0.28	0.005*
Total protein foods			
In Year 1 only	-0.05	0.17	0.785
Into Years 2 and 3	-0.16	0.13	0.222
Into Years 4 and 5	-0.14	0.21	0.518
Intermittently	-0.31	0.14	0.040*
Total saturated fat			
In Year 1 only	-0.86	0.41	0.045*
Into Years 2 and 3	-1.22	0.40	0.004*
Into Years 4 and 5	-0.57	0.32	0.081
Intermittently	-0.92	0.34	0.011*

[a] Regression results used the core sample 1- or 3-month through 6-month longitudinal weights (WCM1_3_60LCOR). Unweighted n=1,060 and weighted n=435,729.

[b] Consistent participation means that the respondent indicated that either the mother or the study child was receiving WIC in Years 1 and 2 and at every subsequent interview age through the 54-month interview.

* Indicates statistically significant difference at $p \leq 0.05$ compared to the consistently receiving WIC reference group.

[107] Based on this bivariate approach, HEI-2015 component scores on a given day for Total Vegetables, Whole Fruit, Seafood and Plant Proteins, Fatty Acid, Sodium, Refined Grains, and Added Sugars were not significantly associated with patterns of WIC participation.

HEI-2015 total scores reflect WIC's holistic emphasis on healthy eating better than a single component of HEI-2015. Assessing overall diet quality is also consistent with the WIC food package that allows for purchasing many different foods. The multivariable regression, therefore, focuses on this dietary outcome, exploring factors that independently influence HEI-2015 total scores on a given day at 60 months.

Because many factors may influence WIC participation and HEI-2015 total scores, the regression model includes sociodemographic characteristics such as the child's gender, the caregiver's race, the caregiver's ethnicity, maternal educational attainment, and marital status. Early feeding practices are also incorporated. These include breastfeeding duration, the timing of the introduction of sugar-sweetened beverages (SSBs), early (prior to 4 months of age) introduction of complementary foods, and the timing of the introduction of sweet foods (excluding SSBs). The model also includes contemporary feeding practices (the frequency of television [TV] viewing during mealtimes and the frequency of meals eaten together as a family), whether duration of nighttime sleep meets the recommended level, and whether the child is in regular childcare, all as measured at age 54 months.

Table 7-11 presents select findings from regressing HEI-2015 total scores at 60 months on covariates including the collapsed WIC participation categories. The model's explanatory power is relatively small,[108] which indicates that there are likely additional factors that affect HEI-2015 total scores on a given day that are not measured. However, given the model specified, duration of WIC participation was significantly associated with HEI-2015 total scores on a given day at 60 months. Compared to those who participate with WIC consistently over the first 5 years of the child's life, children who participate in WIC into their second or third years only had lower HEI-2015 total scores on average. Among the early feeding practices examined, the breastfeeding duration was positively associated with diet quality. Though the coefficient was small, the unit of measure was days so the accumulated effect over time could be notable. The child's feeding environment also exhibited an association with diet quality: Compared to children who rarely or never watched TV during meals, children who watched television sometimes or most of the time had lower HEI-2015 scores.

[108] R-square=0.09.

Table 7-11. Select model results[a] from regression of Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months on sociodemographic characteristics, early and contemporary feeding practices, lifestyle characteristics, and pattern of participation with WIC

Parameter	Estimated effect on HEI-2015	*p*-value
Regular childcare use at 54 months: Yes compared to no	1.32	0.161
Nighttime sleep duration at 54 months: Sleeps less than 10 hours usually compared to sleeps at least 10 hours usually	0.98	0.399
Frequency of having television on during meals at 54 months: Most or sometimes compared to rarely or never	-2.37	0.018*
Family eats meals together at 54 months: Five or more times compared to less than five times per week	0.54	0.634
Breastfeeding duration (days)[b]	0.01	0.017*
Timing of sugar-sweetened beverage (SSB) introduction: In the first year compared to not in the first 2 years	-2.54	0.057
Timing of SSB introduction: In the second year compared to not in the first 2 years	-1.92	0.135
Early introduction of complementary foods: Prior to 4 months of age compared to after 4 months	-0.23	0.862
Age of the introduction of sweet foods: In the first year compared to not in the first 2 years	-3.04	0.111
Age of the introduction of sweet foods: In the second year compared to not in the first 2 years	-1.89	0.365
Receiving Supplemental Nutrition Assistance Program at 60 months: Yes compared to no	-0.18	0.861
WIC participation: In the first year only (Year 1) compared to consistently	-2.64	0.087
WIC participation: Into the second and third years (Years 2 and 3) compared to consistently	-2.77	0.035*
WIC participation: Into the fourth and fifth years (Years 4 and 5) compared to consistently	-0.06	0.966
WIC participation: Intermittently compared to consistently	-0.93	0.454

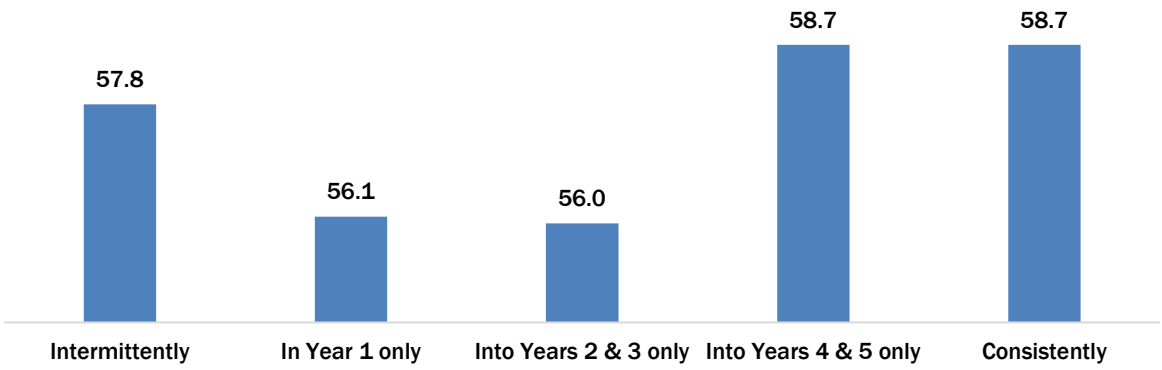
[a] Results are based on weighted data using the core sample 1- or 3-month through 60-month longitudinal weight (WCM1_3_60LCOR). Weighted *n*=425,317 and unweighted *n*=1,034. R-square=0.09. Appendix Table B2f-5 offers additional model detail.

[b] Continuous variable.

* Indicates statistical significance at $p \leq 0.05$.

Adjusted mean scores are average scores that take into account all factors used in a model. Figure 7-4 presents the adjusted mean HEI-2015 total scores by duration of WIC participation based on the multivariable model. The upward jump beginning after Years 2 and 3 is notable.

Figure 7-4. Adjusted mean Healthy Eating Index-2015 (HEI-2015) total scores on a given day at 60 months by patterns of participation with WIC



Note: Adjusted means are based on the multivariable model presented on Table 7-11.

8. Summary, Conclusions, and Interpreting the Data

8.1 Summary

Mothers who participated in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study-2 (WIC ITFPS-2) report that the WIC nutrition education is influencing their feeding practices during the child's fifth year. About 73 percent of all study mothers report having made, at least, one change due to something they learned from WIC. Among those who made a change, the most frequently cited (39%) important change made was knowing how to choose healthier foods for themselves and their families. Most study mothers (92%) receiving WIC at 54 months indicate that the nutrition education they receive is as important as the food they receive.

Analyses of patterns of WIC participation indicate that about half (51%) of study families stay with WIC into the study child's fifth year. Slightly less than 10 percent of study families discontinued WIC participation in each of the previous study years, and 14 percent participated intermittently across the child's first 5 years of life. Children's diet quality, as measured by Healthy Eating Index-2015 (HEI-2015) total scores, is independently and significantly associated with the duration of WIC participation: Study respondents who consistently participate with WIC over the first 5 years of life have higher HEI-2015 total scores than those who leave WIC in the first 3 years of the child's life or those who participate with WIC intermittently.

By the study child's fifth year, 61 percent of caregivers are working and/or going to school, and nearly two-thirds (64%) of study children are in regular, nonparental childcare. There was a move toward greater use of a formal care setting between 42 and 54 months, with preschool other than Head Start becoming the most frequently used type of care (21%) among those using childcare at 54 months. Among those children in childcare, providers supply the majority of the food for 52 percent of children while they are in care. Though many caregivers have less direct control over their children's dietary intakes, about two-thirds (66%) of the study families eat at least five meals together during the week.

Data from this study indicate that the diets of study children are similar to those of their peers nationally. The average diet quality score for WIC ITFPS-2 children at 60 months is 59 out of a possible 100 points, which is similar to the national average of 60 for young children. At 60 months, about 51 percent of study children meet the 2015-2020 Dietary Guidelines for Americans (DGA) recommendation to consume less than 10 percent of calories from added sugars. This is down slightly from 54 percent meeting this recommendation at 48 months. Participation in WIC at 54 months is significantly associated with greater likelihood of meeting the DGA recommendation for added sugars.

There are areas of concern about children's nutrient intakes in their fifth year. Nearly three-quarters (73%) of study children have inadequate intakes of vitamin D. In addition, about one-third (33%) of study children have inadequate intakes of vitamin E. Between the 48-month and 60-month interviews, there is a decrease in the prevalence of inadequate intake of calcium; nonetheless, the prevalence of inadequate calcium intake is about 13 percent at 60 months. Excessive sodium intake is also of concern. Median intake of 2,648 mg/d of sodium by study children at 60 months is about 1.8 times the level recommended to reduce the likelihood of chronic disease.

Although the majority (60%) of study children are in the normal/healthy range for body mass index (BMI)-for-age weight status category, about 35 percent are either overweight (16%) or obese (19%). Estimates of severe obesity among study children double between the third and fifth year, a significant change that warrants monitoring.

8.2 Interpreting the Data: Study Limitations

As with all research studies, design decisions and study-specific goals for 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 relations, generalizing beyond the population represented by our probability sample, comparing data to other national studies, and disentangling caregivers' perceptions of their experiences from their actual experiences.

8.2.1 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 adjust for usual intake. Consequently, estimates in analyses presented may differ from those in another study even if that study uses WIC ITFPS-2 data. In this report, key sociodemographic variables and cross-sectional weights were used in models to adjust for usual intake. However, other variables could have been chosen. Because early and contemporary feeding practices were not included in the usual intake models used to generate usual intake estimates in this report, multivariable regression analyses involving intakes with feeding practices as covariates (i.e., added sugars intake, sodium intake, HEI-2015 scores) were based on 1 day of recall. Further work is needed to incorporate feeding practices into usual intake analyses.

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 affect standard errors of estimates.

8.2.2 Establishing Causal and Direct Relationships

This is an observational study, which is a design well-suited to evaluating 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. 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. Further research using complex multivariable modeling will be useful in identifying unique predictors of the key outcome variables.

8.2.3 Generalizing Findings

The study team is also limited in generalization of the findings by the study eligibility rules and sample design. 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. WIC clinics that expected to serve small numbers of new participants each month were excluded from the sampling frame for operational purposes. The study team chose these eligibility characteristics to be inclusive of a large portion of the WIC population, but 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.[109] 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 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.

8.2.4 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 WIC Infant Feeding Practices Study (WIC IFPS-1), more than 20

[109] 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.

years ago, and 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 Toddlers Studies (FITS) 2016. Now that the WIC ITFPS-2 children are 5 years old, however, these studies no longer offer relevant benchmarks for this study. Consequently, findings from the National Health and Nutrition Examination Survey (NHANES) have been incorporated where relevant, but 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 Child and Adult Care Food Program (CACFP) participation. 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 provider addresses, would have been required to uniquely identify childcare providers that participate in the CACFP.

8.2.5 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 collects 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; 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 in this structure. Nonetheless, busy 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.

8.2.6 Scope of the Study

WIC ITFPS-2 currently plans to follow this national sample of study children until they turn 6 years old, with a follow-up survey at 9 years old. 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 5 years and may not even 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.

8.3 Next Steps

This *Fifth Year Report*, which follows the release of five previous WIC ITFPS-2 reports (May et al., 2015; May et al., 2017; Borger et al., 2018; Weinfield et al., 2019; Borger et al., 2020), is the sixth in what will be a series of reports from the ongoing WIC ITFPS-2. The *Sixth Year Report* will cover feeding practices, eating patterns, and nutrition outcomes around the child's sixth birthday, after WIC eligibility has ended. There are also plans to do a follow-up interview during children's ninth year of life.

The data from WIC ITFPS-2, which the Food and Nutrition Service will make publicly available, will also provide 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.

There are many research topics from this report that will be carried forward, and further explored, in subsequent WIC ITFPS-2 reports. Three that are particularly notable are:

- WIC ITFPS-2 will continue to track median energy and nutrient intake among children during the sixth and ninth years of life. During these times, study children are no longer eligible for WIC and may or may not be eligible for school meal programs. It is important to understand if there are changes in intakes at these two time points.
- WIC ITFPS-2 will track weight and height measurements of WIC children during the sixth and ninth years of life to better understand their growth trajectories.
- The sixth- and ninth-year reports will explore whether patterns of WIC participation in early childhood are associated with dietary behaviors and intakes after WIC eligibility ends.

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