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WIC Infant and Toddler Feeding Practices Study-2

Fourth Year Report

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1. Study Overview

1.1 Background

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to safeguard the health of low-income pregnant women and infants who are at nutritional risk. The program was established 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] The program provides nutrition assistance to pregnant, postpartum, and breastfeeding women and their infants and children up to age 5. Participants must meet the income guidelines and have a household income at or below 185 percent of the Federal poverty guideline[2] ($45,510 for a family of four in 2016[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 90 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 agencies (e.g., health departments, community centers, hospitals) that provide services to WIC participants at local service sites or clinics.

The WIC Infant and Toddler Feeding Practices Study-2 (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, 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 on WIC.

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[1] USDA FNS. (2013, October 10). *About WIC-WIC's Mission*. Retrieved from http://www.fns.usda.gov/wic/about-wic-wics-mission on July 11, 2019.

[2] U.S. Federal Poverty Guidelines Used to Determine Financial Eligibility for Certain Federal Programs. Retrieved from https://aspe.hhs.gov/poverty-guidelines on December 20, 2018.

[3] The income poverty variable used for analysis in this report is based on the 2016 values.

The study is heavily predicated on the design used for the 1997 Food and Consumer Service's[4] longitudinal WIC Infant Feeding Practices Study (WIC IFPS-1) (Baydar, McCann, Williams, & Vesper, 1997). WIC ITFPS-2 also makes comparisons to some studies that did not focus specifically on the WIC population. The U.S. Food and Drug Administration's (FDA's) Infant Feeding Practices Study II (FDA 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. Building on past longitudinal work maximizes the comparability between current study data and past work, which facilitates assessing changes over time. The study also makes comparisons to the Gerber/Nestle Feeding Infants and Toddlers Studies (FITS) conducted in 2016 to address nutrition and feeding practices of children from 36-47.9 months old (Welker, Jacquier, Catellier, Anater, & Story, 2018). Additionally, in developing and revising the instruments, the study team leveraged many of the approaches used in previous studies, such as rotating question modules, to minimize respondent burden and ensure study efficiency.

The primary research questions for the WIC ITFPS-2 at age 4 years include:

- 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 at age 4 years is designed to address the three topics, as well as answer 15 research questions specified by FNS. These research questions are listed in Appendix A, Table A-1. Study findings from the prenatal period, the infant year, the second year, and third year have been released previously by FNS (May et al., 2015; May et al., 2017; Borger et al., 2018; Weinfield et al., 2019).

The WIC ITFPS-2 methodology remains unchanged from the aforementioned previous reports. For brevity, this chapter provides a high-level overview of the methodology with emphasis on components specific to this report. For more methodologic details, please refer to Chapter 1 of the *Infant Year Report*, *Second Year Report*, and *Third Year Report*.

[4] In 1998, the Food and Consumer Service was renamed as the Food and Nutrition Service.

1.2 Study Design

This observational study follows 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. The core longitudinal sample of women and their infants was 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). The children are followed 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. The supplemental sample was also recruited as the women and their infants enrolled in WIC. This sample is interviewed at 11 key time periods (1 or 3, 7, 13, 24, 30, 36, 42, 48, 54, 60, and 72 months).[6] To become eligible for inclusion in the analysis sample, participants must complete either a 1-month or 3-month interview, i.e., their first postnatal interview depending on the age of the infant at enrollment. This report focuses on data from the 42- and 48-month interviews, which include both the core and supplemental samples.

1.3 Sample Selection

The goal of the WIC ITFPS-2 is to collect data from a national sample of participants who enroll in WIC prior to 3 months of age. This includes both those who enroll while the mother was pregnant, and those who first enroll as infants. 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.

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 exists, a summary file at the level of the unit (either local agency or service site/clinic)

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

[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.

reported by each SA in the census of April 2010 (the WIC Program and Participant Characteristics 2010, or PC 2010) [7] was used as the sampling frame. This census resulted in a file with one record for each participant being served by WIC in that month. Because SAs had flexibility for 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 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 small sites that were expected, on average, to enroll fewer than 30 new pregnant women/newborns per month. As a result, the study only sampled from WIC sites that had relatively high monthly participant enrollment. Thus, study findings may not be generalizable to participants who first enrolled at smaller WIC sites.

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 are actually features of the WIC SA Plan and were included because they may be associated with key survey outcomes related to breastfeeding and nutrition. The characteristics included:

- **Peer Counseling Program.** Whether the SA has a breastfeeding peer counseling program in place.[8]
- **Trained Paraprofessionals.** Whether SA policy allows for trained paraprofessionals to provide nutrition education (versus requiring that staff members that provide nutrition education have professional training or credentials).

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[7] USDA FNS (2011, December 1), *WIC Participant and Program Characteristics 2010*. Retrieved from https://www.fns.usda.gov/wic/wic-participant-and-program-characteristics-2010 on September 3, 2019.

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

- **Policy to Provide Formula.** Whether SA policy permits providing one can of formula for breastfeeding infants during the first 30 days of life.

- **Percent 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 percent of children and the percent of mothers 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 pre-specified 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 consecutive string of 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 pre-determined 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

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[9] For children (12 months or older), "high weight for height" is 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 24 months and older, it is defined as higher than the 95th percentile of body mass index (BMI) for age. For children 12 to 24 months, it is defined as at risk of being overweight by virtue of having a mother or father who is obese (BMI of 30 or greater). For mothers, the criterion is a reported pregravid BMI of 25 kg/m^2 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.

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 compared to sites with a lower 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]

Core and Supplemental Samples. Two samples were selected at each WIC site: a core longitudinal and supplemental cross-sectional sample. The core sample was originally designed to be an equal probability sample of all new enrollees. The supplemental sample was designed to 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 at enrollment or the first postnatal interview.

1.4 Data Sources and Interview Content

During the 7-year data collection period that began in July 2013,[13] the study is collecting data from numerous sources. The main source is a series of follow-up telephone interviews with the study child's mother. Other key information such as child's weight and length is being obtained periodically through measurements taken at WIC sites or clinics or with qualified health care providers; and contextual information about the WIC sites and State policies is obtained from clinic and WIC program staff.[14] The data sources include:

- Screening and enrollment interviews with recruited WIC enrollees;

[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 later than that.

[13] The study collects data over a 6-year period in the children's lives, but the length of time a mother is a participant is dependent on when she was recruited. Mothers recruited when they were 1-month pregnant are participants for 6.8 years, whereas mothers enrolled when their baby was 2.5 months old are in the study for about 5.8 years.

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

- Telephone follow-up interviews with study participants conducted prenatally and when their children are 1, 3, 5, 7, 9, 11, 13, 15, 18, 24, 30, 36, 42, 48, 54, 60, and 72 months of age;
- Measurements taken at WIC sites or by health care providers for height and weight measurements when the babies are born and around 6, 12, 24, 36, 48, 60, and 72 months of age;
- WIC administrative records for WIC food packages provided to mothers and infants;[15]
- At baseline (2013), site visits to participating WIC sites and key informant interviews that profile state and local policies and practices; and
- At baseline (2013), a WIC site staff survey that collects information on local WIC programs and the training and experience of the staff.

Table 1-1 presents an overview of the information obtained from each data source. Key domains include socio-demographic characteristics, knowledge, and lifestyle; feeding practices and experiences; childrearing practices; and weight and length outcomes. The participant surveys that are the primary focus for this report are those during the fourth year of life, the 42- and 48-month interviews, as well as the WIC administrative data on child weight and height around the time of the study child's fourth birthday. The 42-month interview focuses broadly on WIC program utilization and delves more deeply into mothers' reported reasons for leaving and continuing with WIC. In addition, the 42-month interview captures lifestyle and feeding practices, and specific child developmental milestones. The 48-month interview focuses more specifically on the child's dietary intake.

Socio-demographic characteristics from baseline (for static characteristics) or 36 months (for most changing characteristics) are used in the report to examine the association between characteristics of study families and outcomes of interest during the fourth year. The standard set of socio-demographic characteristics used in this report include:

- Mother's race;
- Mother's ethnicity;
- Age of mother (at the birth of child);

[15] 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.

- Mother's marital status at 36 months;
- Household food security at 36 months;
- Participation[16] in non-WIC benefit programs at 36 months;
- Parity;
- Weight status of mother at 30 months;
- Income poverty at 36 months;
- Timing of WIC enrollment; and
- WIC participation status at 36 months.

These characteristics are referred to throughout the report and in Table 1-1 as key socio-demographic characteristics. They are more fully described in Appendix B1. Bivariate associations explored are not limited to these key socio-demographic characteristics but typically include them.

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

Table 1-1. Domains by source of data

Domain	Source of data																					
		WIC participant survey interview																				
	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	WIC Admin. data	Staff survey/ key informant interviews
Socio-demographic 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[b]														✓	✓		✓		✓	✓	✓	
WIC food package type[c]																					✓	
Contact updates			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
New caregiver characteristics				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

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

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

[c] Maternal food package data are collected at prenatal and postnatal certifications as applicable and at 6 months. Infant food package data are collected at initial infant certification, 6-month mid-certification, and 11 months. Food package data are not collected after 11 months because there is only one nonmedical food package for children ages 1-4 years.

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

1.5 Data Collection Procedures

The study is using multiple modes of data collection to obtain the necessary information to support the study objectives. Study mothers were recruited in-person at WIC sites, and surveys are administered in regular follow-up interviews by telephone. In addition, study staff periodically submit requests to SAs for data on the mother and child from WIC administrative records (e.g., length and weight data and food package data); however, for purposes of this *Fourth Year Report*, SA data was only requested when length and weight data could not be obtained from study participants. For prior reports, the study collected data from WIC site staff using a web survey and from State and local agencies staff using a mix of in-person and telephone interviews.

1.5.1 Recruiting WIC Participants

Recruitment activities were rolled out over a 12-week period in the 80 sampled sites, with recruitment starting July 1, 2013 and ending November 18, 2013.

In all but three of the 80 sites, an on-site Westat field recruiter was responsible for screening and enrolling eligible participants into the study.[17] 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 cash incentives for completing each telephone interview and submitting their child's anthropometric measurements. 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).

1.5.2 Interviewing Study Participants

The study is conducting follow-up interviews in English or Spanish with study participants over a 7-year period, beginning in July 2013 and ending in July 2020. During the first two years, study participants assigned to the core sample are interviewed more frequently than those in the supplemental sample. As shown in Table 1-2, study participants in the core sample who enrolled

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

prenatally are contacted to be interviewed 18 times over approximately a 7-year period, and women who enrolled in WIC after giving birth participate in 16 or 17 interviews (depending on the age of their child when they enroll). If their baby is less than 6 weeks old, they start with the 1-month interview; however, if their baby is between 6 weeks and 2.5 months old, they start with the 3-month interview. In the supplemental sample, participants either receive a 1-month or a 3-month interview, but not both. Those who enrolled prenatally or before their child was 6 weeks old receive a 1-month interview, whereas those enrolled after the baby is 6 weeks old receive a 3-month interview. All participants in the supplemental sample are interviewed at 10 additional time points.

The prenatal interviews were all completed within 60 days of enrollment. The follow-up interviews are scheduled based on the child's birthday; the window for conducting the follow-up interview starts 14 days before the child turns the age of the interview (e.g., 14 days before the child is 1 month old, 3 months old, etc.) and closes 28 days after the child turns that age.

Table 1-2. Frequency of interviews for core and supplemental samples

Status of pregnancy at time of WIC enrollment	Interview schedule																		Total interviews
	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	
Core sample																			
Prenatal	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	18
Infant <6 weeks		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	17
Infant 6 weeks – 2.5 months			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	16
Supplemental sample																			
Prenatal		✓			✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	11
Infant <6 weeks		✓			✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	11
Infant 6 weeks – 2.5 months			✓		✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	11

Because women could enroll in WIC at any stage in their pregnancy and many participants were recruited after the baby was already born, the length of time each follow-up interview is in the field is about 15 months.

All post-birth interviews except the 30-, 42-, and 54-month interviews include a 24-hour dietary recall using the USDA's Automated Multi-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). For each time point, one dietary intake interview is collected on all study participants within a six-week window, spanning 14 days prior to the interview date to 28 days after the date of the interview date. Subsequently, 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 to use in estimating "usual" intake of energy and nutrients for all respondents.[18] The interview data are then coded and analyzed for nutrient and food group content.[19]

1.5.3 Collecting Height and Weight Data

The study collects weight and length/height measurements of the children at birth and around ages 6 months, 12 months, 24 months, 36 months, 48 months, 60 months, and 72 months. As part of regular clinic visits, WIC sites collect these data for most enrolled participants and report the information to the State. The study then requests these measurements from the State's WIC administrative data. Through 24 months, for participants who are in the core sample and have left WIC, the study attempts to collect weight and length information from the child's health care provider. For those who do not have a health care provider, study staff arrange for a local home health agency to obtain weight and length measurements. After 24 months, the study asks all participants who are no longer receiving WIC to return to the WIC site to be measured or visit their health care provider for measurement.[20] Caregiver reports of a recent child weight and height measurement are also sought during telephone interview at ages 30, 36, 48, 60, and 72 months.[21]

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[18] See Appendix B3 for details of the computation of usual intake using the NCI Method.

[19] Nutrient content of breastmilk is listed in the USDA Food and Nutrient Database for Dietary Studies (Ahuja et al., 2012) used to determine nutrient content of all AMPM reported foods.

[20] Originally, home health agency visits were offered for those no longer receiving WIC at their 6- and 12-month interviews, but the take-up rate was exceptionally low (less than five cases). At the 24-month interview, visits were offered if the mother indicated she wanted one. Beginning with the 36-month interview, home health visits were no longer offered; however, this decision has had a minimal impact on response rates.

[21] Caregivers are asked to provide recent height and weight measurements, the date of measurement, and whether the measurement was taken at home, at WIC, or by a health care provider. For analyses in the current report, interview reports of height and weight were excluded to ensure consistency in the measurement techniques.

Measurements taken within four months of the child's fourth birthday (i.e., between 44 and 52 months) are the focus of analyses in this report.

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

The data are weighted to support national estimates. The weights inflate the sample to represent the study-eligible population and compensate for both the unequal sampling rates and nonresponse. For WIC ITFPS-2, the sample is weighted to represent the national population of infants enrolled in WIC for the first time either while the mother is pregnant or postnatally before the child is 3 months of age, whose mothers are at least 16 years old, speak either English or Spanish, and enroll in WIC initially at a site expected to enroll at least 30 new pregnant women or infants per month. All study findings represent the characteristics, views, behaviors, and experiences of this population. 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 also affects variance estimation. Replicate weights that facilitate accurately estimating the variances given the sample design are provided. Additionally, although almost all study participants have answered all questions regarding key socio-demographic characteristics, there are a few cases of item nonresponse for these variables. As these variables are used repeatedly in the analysis, missing information has been imputed. Appendix B1 offers additional detail on weighting and imputation.

1.7 Sample Characteristics

As shown in Table 1-3, 4,489 new WIC enrollees were eligible to participate in the study and of those, 4,367 (97%) were enrolled. Across all the sampling groups, 3,777 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 depending the age of the child at WIC enrollment) and were therefore eligible to continue in the study. These 3,777 individuals comprise the main analysis sample. By the 48-month interview, 68 percent of those eligible responded to the interview.

Over the course of the study thus far, a total of 1,260 of the 4,367 enrolled participants no longer participate with the study. This total reflects both those who were eligible to continue participating and those who were not eligible.[22]

Table 1-3. 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 48-month interview % (N)
Total sample	4,489	4,367	3,777	68.1% (2,572)
Core sample	3,605	3,503	3,020	67.0% (2,022)
Prenatal core sample	3,122	3,037	2,596	68.8% (1,787)
Postnatal core sample	483	466	424	55.4% (235)
Supplemental sample	884	864	757	72.7% (550)
Prenatal supplemental sample	688	678	589	75.6% (445)
Postnatal supplemental sample	196	186	168	62.5% (105)

Because women are both recruited into the study and have their babies over a long time window, their interviews are occurring at different times. Table 1-4 shows the percentage of the main analysis sample that has completed interviews through 48 months postpartum. In addition, Table 1-4 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 1-5 shows the percentage of participants in the main analysis sample for whom the study received weight/length and food package data.

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

Table 1-4. 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)	Core sample (N=3,020)	Supplemental sample[a] (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)	81.8% (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)	65.9% (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	69.7% (2,636)	68.6% (2,072)	74.5% (564)
Month 48	68.1% (2,572)	67.0% (2,022)	72.7% (550)

[a] Supplemental sample is interviewed at either 1 month or 3 months, but not both.

NA denotes not applicable.

Table 1-5. Unweighted counts and percentage of analysis sample respondents for whom the study received weight and length data, and food package data

Weight/length and food package data	Number received	Percent received[a]
Weight and length measurements		
6-month measurements	2,568	68.0%
12-month measurements	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%
Infant food package prescriptions[b]		
Initial infant certification	3,199	84.7%
6 month	3,047	80.7%
11 month	2,979	78.9%

[a] The percentage is of the analysis sample n=3,777.

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

Table 1-6 provides a summary of select, unweighted socio-demographic characteristics of the main analysis sample. The data in this table are based on the 3,777 women in the analysis sample, i.e., those who completed their first postnatal interview. When the 36-month interview is referenced, key socio-demographic characteristics are imputed if the participant did not complete the 36-month interview (see Appendix B1 for details). The table also presents the 42-month or 48-month frequency of the variables, where relevant, to facilitate comparison. The 42- and 48-month data are

not imputed, so the number of cases includes only those participants who answered the question at the indicated interview.

Table 1-6. Unweighted socio-demographic characteristics of main analysis sample

Socio-demographic characteristics[a]	Percentage of main analysis sample (count)[b]
Race of mother/caregiver	
African American	25.6 (965)
White	58.7 (2,218)
All Other	15.7 (594)
Ethnicity of mother/caregiver	
Hispanic or Latino	38.3 (1,445)
Not Hispanic or Latino	61.7 (2,332)
Maternal/caregiver marital status at 36 months	
Married	35.9 (1,355)
Not married (including divorced and widowed)	64.1 (2,422)
Maternal/caregiver marital status at 48 months	
Married	37.6 (965)
Not married (including divorced and widowed)	62.4 (1,603)
Household food security (measured using 6-item module) at 36 months	
High or Marginal Food Security	72.4 (2,733)
Low Food Security	16.5 (622)
Very Low Food Security	11.2 (422)
Household food security (measured using 6-item module) at 48 months	
High or Marginal Food Security	75.6 (1,944)
Low Food Security	12.9 (332)
Very Low Food Security	11.4 (294)
Participation in non-WIC programs at 36 months[c]	
Does not participate in other programs	20.9 (791)
Participates in SNAP or in SNAP and other programs	46.2 (1,743)
Participates in other programs excluding SNAP	32.9 (1,243)
Participation in non-WIC programs at 48 months	
Does not participate in other programs	17.9 (460)
Participates in SNAP or in SNAP and other programs	46.8 (1,200)
Participates in other programs excluding SNAP	35.3 (905)
Timing of WIC enrollment	
1st trimester	29.6 (1,118)
2nd trimester	38.9 (1,471)
3rd trimester	16.1 (608)
Postnatal	15.4 (580)
Weight status of mother at 30 months[d]	
Normal or underweight	34.7 (1,312)
Overweight	29.8 (1,125)
Obese	35.5 (1,340)
Weight status of mother at 42 months[d]	
Normal or underweight	31.0 (789)
Overweight	30.6 (778)
Obese	38.4 (977)

Table 1-6. Unweighted socio-demographic characteristics of main analysis sample (continued)

Socio-demographic characteristics[a]	Percentage of main analysis sample (count)[b]
Poverty level at 36 months	
75% of poverty guideline or below	44.3 (1,672)
Above 75% but ≤ 130% of poverty guideline	31.6 (1,192)
Above 130% of poverty guideline	24.2 (913)
Poverty level at 48 months	
75% of poverty guideline or below	44.4 (1,082)
Above 75% but ≤ 130% of poverty guideline	29.8 (727)
Above 130% of poverty guideline	25.8 (628)
Age of mother or caregiver at child birth	
16-19 years	11.8 (446)
20-25 years	41.5 (1,569)
26 years or older	46.7 (1,762)
Parity	
First born	41.7 (1,576)
Second born	27.0 (1,018)
Third born	31.3 (1,183)
WIC participation status at 36 months	
Receiving WIC at 36 months	55.5 (2,095)
No longer receiving WIC at 36 months	44.5 (1,682)
WIC participation status at 48 months	
Receiving WIC at 48 months	50.8 (1,306)
No longer receiving WIC at 48 months	49.2 (1,264)

[a] If the participant did not complete the 36-Month Interview, or the data are missing, data are imputed. 48-month variables are not imputed if missing, and include only those participants who answered the question at the 48-month interview.

[b] The main analysis sample includes 3,777 cases that have completed a 1- and/or 3-month interview. Counts may sum to less than 3,777 due to item or survey nonresponse.

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

[d] Data used to calculate maternal weight status were reported at the 30- and 42-month interviews, not at the 36- or 48-month interviews. For this report, the 30-month value is imputed if missing.

Data source: Interview questions SD1, SD2, SD3, SD4, SD14, SD15, SD18, SD19, SD21, SD31, SD36-40, MH1, and MH13.

The study examines outcomes of interest among subgroups of each key socio-demographic variable.[23] Of the 3,777 respondents, the majority are White (59%), unmarried (64%), report their families to be at high or marginal food security at 36 months (76%), and report receiving WIC at 36 months (56%). Approximately one-quarter (26%) are African American and almost 40 percent are of Hispanic or Latino ethnicity. Thirty-five percent of caregivers consider themselves normal weight or underweight at 30 months, and a similar percentage (36%) percent are obese. Most women (69%)

[23] The baseline/36-month socio-demographic variables are used for subgroup analyses instead of 48-month socio-demographic variables to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 42-month data by future (48-month) subgroup membership.

enrolled in WIC in their first or second trimester, and only a small number (about 15%) enrolled their baby in WIC postnatally without having enrolled during pregnancy. Under half (44%) are at or below 75 percent of the poverty guideline. Forty-seven percent of the families participate either in the Supplemental Nutrition Assistance Program (SNAP), or in SNAP plus other public assistance programs such as Temporary Assistance for Needy Families (TANF), Medicaid, or the National School Lunch Program (NSLP).

1.8 Analysis

The analysis addresses the research questions posed by FNS (See Appendix A). The focus of analyses in the current report is on outcomes reported during the fourth year of life (42- and 48-month interviews, and height and weight measurements around the fourth birthday), both for the study population as a whole and by key socio-demographic subgroups. Where relevant, WIC ITFPS-2 data from 36 months are also presented to provide longitudinal context for the current findings. Additionally, some analyses are conducted to replicate analyses from the Gerber/Nestle FITS 2016 study. This report therefore compares current findings to relevant findings from this study, to pertinent past work, and to current objectives and standards.

Many of the research questions can be answered by descriptive analyses that tabulate the responses to specific interview questions; however, a subset focuses on understanding the underlying population and program factors that may drive nutritional and weight outcomes. Behavioral models are used to answer these types of questions.

1.8.1 Descriptive Analyses

Descriptive statistics (e.g., counts, proportions, means, medians, and cross-tabulations) are used throughout the report to describe findings (e.g., the percentage of study participant receiving WIC benefits at 48 months). Subsequently, statistical tests (e.g., chi-square tests) are used to examine associations between the key socio-demographic characteristics and outcomes of interest.

1.8.2 Statistical Tests

When the outcome of interest is a categorical variable, a chi-square test, appropriately adjusted for the complex sample design, is used to determine if there is a statistically significant association between the outcome and the key socio-demographic 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 typically used to assess which differences between subgroups are statistically significant (e.g., whether participation is significantly different between White and African American caregivers).[24] 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. If the outcome of interest is a continuous variable, univariate regression, with appropriate adjustment for the complex sample design, is typically used to assess whether a statistically significant relationship between the key socio-demographic characteristic and the outcome exists. 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 any follow-up pairwise tests are described in the text.[25]

Chi-square tests indicate that many of the key socio-demographic characteristics used in this report are related. Table 1-7 summarizes statistically significant associations between the key socio-demographic characteristics using the main analysis sample.[26] Participation in non-WIC benefit programs is significantly associated with the most (eight) key socio-demographic characteristics. Ethnicity, timing of WIC enrollment, income poverty, and age of the mother at the child's birth are associated with seven of the key socio-demographic characteristics used in this study. These findings

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

[25] 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 [see Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* 2nd edition].

[26] The main analysis sample consists of those who responded to their first post-natal interview. The analysis uses the 48-month weight. Chi-square tests are appropriately adjusted for our complex sample design. Statistical significance is at the 95 percent confidence level.

suggest that several of the socio-demographic variables may, to some extent, be measuring the same phenomenon.[27]

Table 1-7. Significant[a] associations among key socio-demographic characteristics

Socio-demographic characteristic	Caregiver race	Caregiver ethnicity	Caregiver marital status	Household food security	Participation in non-WIC benefit programs	Parity	Timing of WIC enrollment	Caregiver weight at 30 months	Income poverty	Age of mother at child's birth	Child's WIC participation status at 36 months
Caregiver race		✓	✓		✓						✓
Caregiver ethnicity	✓			✓	✓		✓		✓	✓	✓
Caregiver marital status	✓				✓	✓	✓		✓	✓	
Household food security		✓					✓				
Participation in non-WIC benefit programs	✓	✓	✓			✓	✓		✓	✓	✓
Parity			✓		✓			✓	✓	✓	✓
Timing of WIC enrollment		✓	✓	✓	✓				✓	✓	✓
Caregiver weight at 30 months						✓				✓	
Income poverty		✓	✓		✓	✓	✓			✓	✓
Age of mother at child's birth		✓	✓		✓	✓	✓	✓	✓		
Child's WIC participation status at 36 months	✓	✓			✓	✓	✓		✓		

[a] Check marks indicate statistically significant correlations at $p \leq 0.05$.

Data source: Interview questions SD2, SD3, SD4, SD14, SD15, SD18, SD19, SD21, SD36 – 40, MH1, MH2, MH29, KA2, and KA6.

1.8.3 Multivariate Models

For the subset of research questions that focus on identifying the factors that drive the outcomes and decisions observed, bivariate analyses alone are not sufficient to address the questions. For outcomes that are jointly determined by a variety of factors, multivariate analyses such as regression analysis[28] are used to explore how choices and characteristics influence outcomes. Multivariate analyses isolate the unique effects of individual variables on an outcome, while holding the influence of other variables constant. For example, multiple regression can be used to assess the association

[27] The caregiver's education level was not included among the key socio-demographic characteristics used in this study. However, it is significantly associated with several key socio-demographic characteristics, including ethnicity, participation in non-WIC benefit programs, parity, income poverty, the mother's age at birth, and WIC participation status at 36 months.

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

between food security and child diet quality, independent of the influence of the caregiver's marital status. As compared to bivariate analyses, multivariate analysis typically finds a more limited set of variables have a statistically significant association with the outcome.

1.8.4 Missing Item Data

Item nonresponse is reflected in the total number of observations available for analysis. Responses of "Don't Know" are typically considered item nonresponse and are, therefore, treated as missing for the purposes of analysis. The one exception involves statements of belief or intention. In such cases, the response of "Don't Know" is included as a valid response.

Missing responses for key socio-demographic 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:

- **Fifty-eight percent of study mothers with 42-month old children have work and/or school commitments. About half (53%) 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.**
- **Fifty-three percent of study children are in a regular non-parental child care arrangement at 42-months of age. For children in regular child care, child care providers provide most of the food for 45 percent of study children while they are in care.**
- **About half (53%) of study children and/or mothers participate in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) when the study child is 4 years old. In nearly one-quarter (24%) of study families, another child in the family is also receiving WIC at this time.**
- **When the study child is 4 years old, 46 percent of study families participate in the Supplemental Food and Nutrition Program (SNAP), and 41 percent of study families have a child participating in the National School Lunch Program (NSLP), School Breakfast Program (SBP), or Summer Food Service Program (SFSP).**
- **Almost one-fifth (19%) of study families live in areas with limited food access, sometimes referred to as food deserts.**
- **Nearly 90 percent of study mothers report that fresh fruits and vegetables are available and plentiful in their communities; however, about one-quarter (27%) of study mothers report that cost is a barrier to purchasing fresh fruits and vegetables.**

2.1 Overview

This chapter focuses on the personal and household characteristics of the WIC ITFPS-2 families including their engagement with work, school, and child care, 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: [29]

- How do feeding practices vary with working and family care/child care/preschool circumstances?
- What are the main barriers to eating healthy?
- Does continued participation in WIC have a positive corollary effect on access to healthcare and continuity of care?

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

Data for this chapter are primarily drawn from interviews conducted at child age 42 and 48 months, although data from child age 30 and 36 months are sometimes provided for context. Interview questions on work, child care, fruit and vegetable access, and child's medical home and well visits are asked at 42 months. Interview questions on Federal program participation, including WIC, SNAP, Medicaid, and school and summer meals, are asked at both 42 and 48 months. Consequently, analyses reference different time points depending on the specific content.[30]

2.2 Background

As maternal employment has become more commonplace, nonparental child care has become a topic of research. The 2016 National Household Education Survey found that 73 percent of U.S. children between 3 and 5 years of age spend time each week in nonparental care, with single parents more likely to use child care than two-parent households (Corcoran & Steinley, 2017). Use of center-based care increases after the first birthday, with 45 percent of children 1 to 2 years old and 82 percent of those 3 to 5 years old participating in day care centers, Head Start, preschool, prekindergarten and other early childhood programs (Corcoran & Steinley, 2017). Research indicates that choice of child care setting is associated with socio-economic factors including race and ethnicity (Caldera & Hart, 2004; Child Trends, 2016; Laughlin, 2013; Liang, Fuller, and Singer, 2000); age of the child (Burstein & Layzer, 2007; Kim & Fram, 2009; Rose & Elicker, 2008); composition of the household (Burstein & Layzer, 2007; Chaudry 2004); and mother's level of education and family income (Kim & Fram, 2009; Wolfe & Scrivner, 2004; Blau, 2001; Kimmel, 2006). The analyses in this chapter build on this work, exploring the associations between child care setting and key socio-demographic characteristics of WIC ITFPS-2 families.

Depending on the type of child care, providers may be responsible for providing the food for children's consumption while in care. Most child care centers, Head Start programs, and family daycare homes approved or licensed to provide child care are eligible to participate in the Federal Child and Adult Care Food Program (CACFP), a Federal program that provides funds for nutritious snack and meals to eligible participants.[31] According to an analysis conducted using 2017

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

[31] U.S. Department of Agriculture. (2013, July 13). *Why CACFP Is Important*. Retrieved from https://www.fns.usda.gov/cacfp/why-cacfp-important on May 1, 2019.

administrative data from FNS, 4.4 million children in nearly 64,000 child care centers and over 100,000 family daycare homes nationwide received nutritious meals through CACFP (Food Research and Action Center, 2018). Consequently, regular, nonparental child care has become an important contextual factor in shaping and understanding children's dietary intakes and health outcomes. This chapter explores how the provision of food differs by type of child care provider in order to better understand expanding influences on the child's dietary intake.

Participation in Federal nutrition assistance programs may also influence children's dietary intakes and health outcomes (Leung et al., 2013). According to the WIC Participant and Program Characteristics 2016 report, 33 percent of WIC participants also participate in SNAP (Thorn et al., 2018). This chapter describes WIC ITFPS-2 families' participation in Federal nutrition assistance programs, including SNAP, NSLP, SBP, and SFSP, as background for understanding program influence on WIC ITFPS-2 families.

Additional factors that may influence dietary intakes and health outcomes include the neighborhoods in which families live. Using data on distances to grocery stores and levels of income, the U.S. Department of Agriculture's (USDA's) Economic Research Service (ERS) has identified some areas of the country as food deserts, or areas where it is difficult to access nutritious foods such as fruits and vegetables. Inadequate access to high quality, affordable, and convenient fruits and vegetables has been identified as a barrier to healthy eating (Kamphius et al., 2006); making healthy foods available in the home is associated with increased acceptance by young children of new foods and healthier dietary intake (Ventura & Birch, 2008; Wyse, Campbell, Nathan, & Wolfenden, 2011; Wyse, Wolfenden, & Biscuera, 2015). The chapter presents the percentage of WIC ITFSP-2 families living in food deserts.

One of WIC's core benefits is screening and referrals to other health, welfare, and social services,[32] and research has shown that Medicaid-enrolled children who participate in WIC have greater use of health care 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

[32] U.S. Department of Agriculture. (2013, October 10). *About WIC – WIC at a Glance*. Retrieved from https://www.fns.usda.gov/wic/about-wic-wic-glance on May 1, 2019.

completing wellness visits. As such, this chapter concludes by examining whether WIC ITFPS-2 children have a medical home and participate in well visits.

2.3 Sample and Analysis Approach

2.3.1 Sample

The analyses in this chapter utilize data from 42- and 48-month interviews. Table 2-1 shows the number of respondents to those interviews.[33] 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.

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

Sample structure	42-month interview	48-month interview
Core prenatal sample	1,837	1,787
Core postnatal sample	235	235
Supplemental prenatal sample	456	445
Supplemental postnatal sample	108	105
Total	**2,636**	**2,572**

2.3.2 Analysis

The analyses in this chapter examine a wide array of topics in order to provide a rich picture of WIC ITFPS-2 families. Topics discussed include work, school, child care, and provision of food in child care; fresh fruit and vegetable access; participation in Federal nutrition assistance programs;[34] and engagement with medical care. Analyses explore whether key socio-demographic subgroups of participants differ on outcomes of interest (Section 1.4 lists key socio-demographic variables). Non-modifiable socio-demographic characteristics are measured at the time of the first interview. However, for characteristics that may change over time, such as food security, income relative to the

[33] 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.

[34] Analyses of program participation are based on self-report and are not verified by administrative data.

Federal poverty guidelines, or WIC participation status, values reported at the 36-month interview are used.[35]

For the majority of bivariate analyses, chi-square tests of association are used to examine associations between key socio-demographic characteristics and outcomes of interest. 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 questions, and are large in magnitude, to avoid focusing on findings that, while statistically significant, may have little practical importance.[36] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

2.4 Working and Going to School

The following analyses explore the engagement of WIC ITFPS-2 mothers[37] 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 42 Months

At the 42-month interview, more than half of mothers (58%) are working, going to school, or doing both (Figure 2-1; Appendix Tables B2a-1 and B2a-2 offer more detail). Twenty-nine percent of study mothers reported working full-time and not attending school, and 17 percent reported working part-time and not attending school. While the majority of mothers who reported working were not in school, about 7 percent of those who work are also attending school. A small percentage (5%) of mothers reported attending school and not working for pay.

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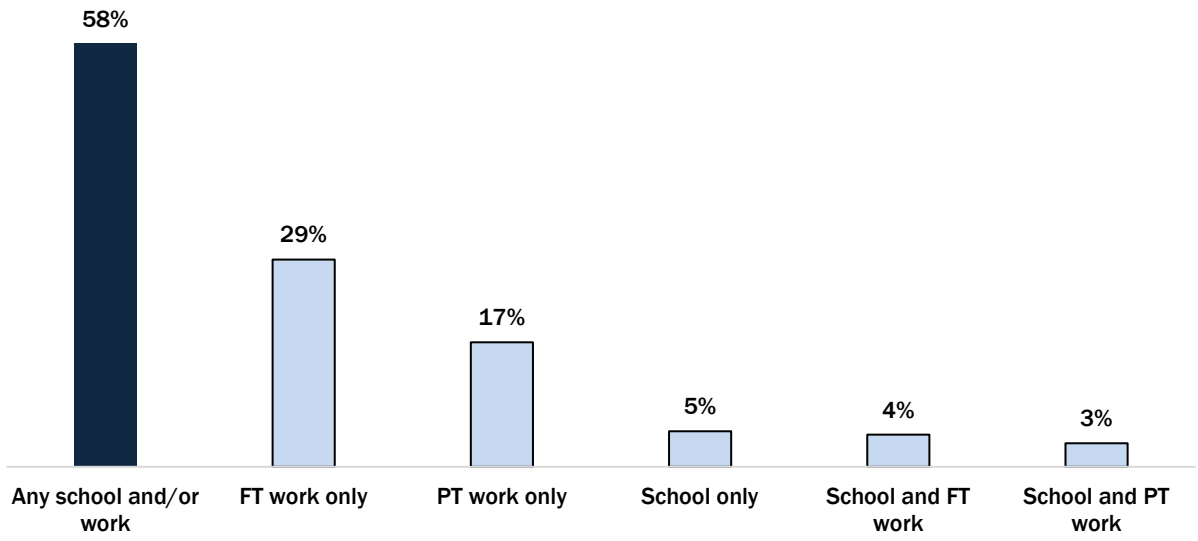
[35] The 36-month socio-demographic variables are used for subgroup analyses to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 42-month data by future (48-month) subgroup membership. Weight status of the study mother is reported at 30 months.

[36] 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 details.

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

Figure 2-1. Percentage of WIC ITFPS-2 mothers working and going to school at 42 months



At the 42-month interview, more than half (53%) of study mothers report working for pay. This total is similar to the finding at 30 months, when 49 percent of study mothers reported working. Figure 2-2 presents the total percentage of caregivers working at 30 and 42 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.

At 42 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. Between the 30-month interview and 42-month interview, the percentage of mothers in school remains relatively stable.

Figure 2-2. Percentage of WIC ITFPS-2 mothers working by school status at 30 and 42 months

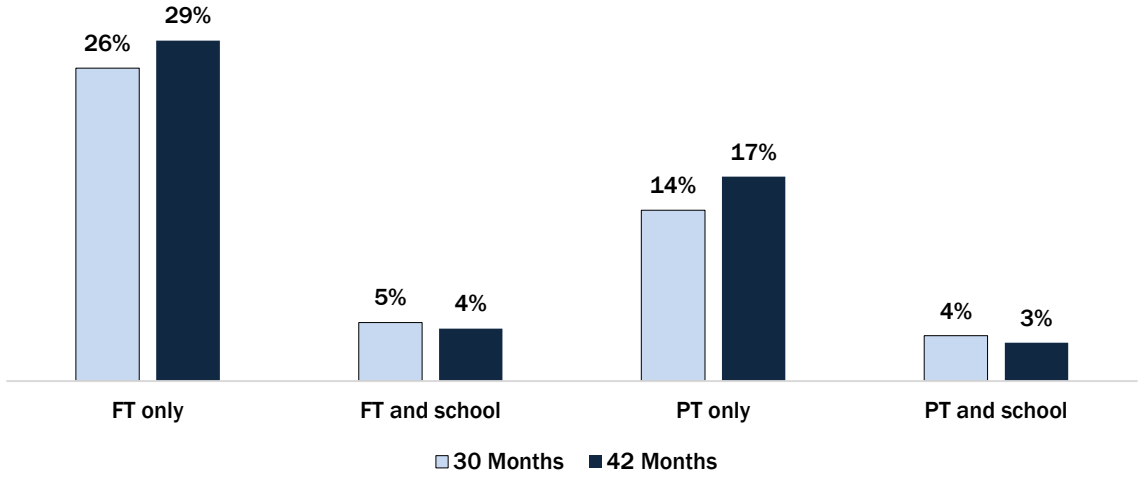
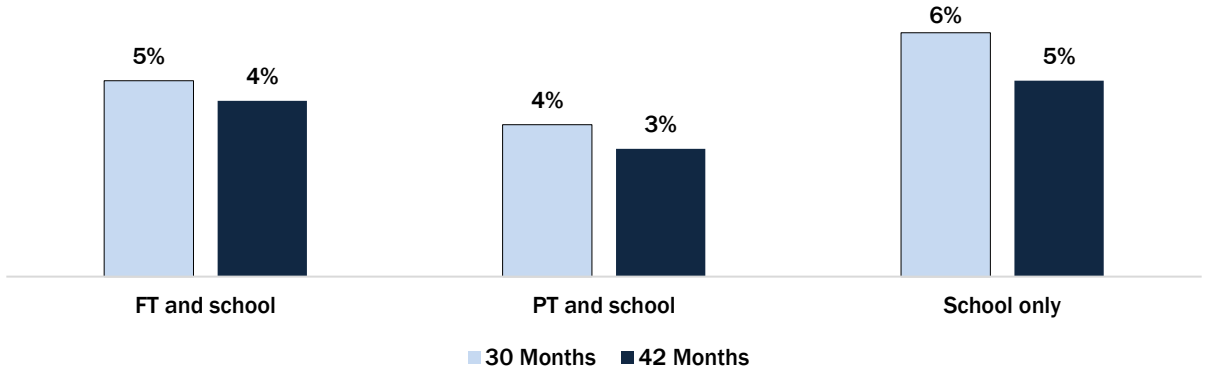


Figure 2-3. Percentage of WIC ITFPS-2 mothers who attend school by work status at 30 and 42 months



2.4.2 Characteristics of Those Working and/or Going to School at 42 Months

At 42 months, chi-square tests yield statistically significant associations between working and/or going to school and several key socio-demographic characteristics: race, ethnicity, marital status, participation in non-WIC benefit programs, parity, income poverty, and WIC participation status. Follow-up pairwise t-tests indicate that African American study mothers are more likely (71%) to work and/or go to school than are White mothers (55%) and mothers categorized in the Other racial category (55%). Non-Hispanic mothers are more likely (63%) to be working and/or going to school than Hispanic mothers (52%). Unmarried mothers are more likely (64%) to work and/or go

to school than are their married counterparts (49%). Mothers whose households do not participate in other non-WIC benefit programs are more likely (67%) to work and/or go to school than are caregivers whose households participate in non-WIC benefit programs (58% excluding SNAP; 55% including SNAP). Those in the highest income-poverty subgroup (above 130% of the Federal poverty guidelines (FPG)) are more likely (74%) to be working and/or going to school than those in lower income-poverty subgroups (60% in the middle income-poverty subgroup and 49% in the lowest income-poverty subgroup). Mothers of children who did not receive WIC at 36 months are more likely (66%) to be working and/or going to school than mothers of children who received WIC at this time (53%). Because work increases income and reduces benefit eligibility, it is not surprising that those in the highest income subgroup and those who do not receive benefits from other programs are more likely to be working.

2.5 Child Care and Feeding Practices

WIC ITFPS-2 continues to explore the use of child care at 42 months. The study defines regular child care 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. Analyses explore overall use of child care, types of child care used, and who provides food for children in regular child care arrangements.

2.5.1 Child Care Use at 42 Months

Figure 2-4. Percentage of study children in regular child care, currently and ever at 30 and 42 months

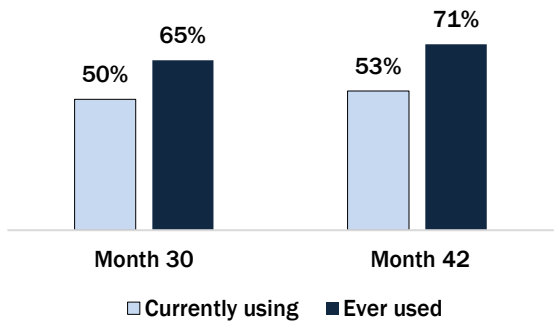


Figure 2-4 presents the percentage of study children currently in regular child care, and the percentage who have ever been in regular child care (Appendix Table B2a-3 offers more detail). At 42 months, about half (53%) of respondents currently use child care and 71 percent have used child care at some point. The percentage of children who have ever used child care changes between 30 and 42 months, rising from 65 percent to 71 percent. However, the percentage currently in child care remains relatively stable: 50 percent at 30 months and 53 percent at 42 months.

WIC ITFPS-2 asks caregivers who currently use regular child care to indicate the type of child care used. Response options include: child care centers, family day care homes, Head Start, preschool other than Head Start, someone cares for the child in the child care provider's home, someone cares for the child in the child's home, or another kind of unspecified arrangement. Table 2-2 presents the percentage distribution of study children currently in regular child care at each month, by type of child care arrangement.

Slightly more than half (53%) of respondents are currently using any type of regular child care at 42 months. The most commonly used regular child care settings are centers (12%), someone caring for the child in their home (11%), and someone caring for the child in the child's home (11%). Less frequently used regular child care arrangements included preschool other than Head Start (9%), Head Start (7%), and family day care homes (3%).

In order to facilitate analyses, types of child care may be understood as formal and informal. Table 2-2 indicates which types of care are in each category. Formal arrangements are types of care that may be licensed and regulated, may be eligible for food reimbursements through the CACFP, and may provide early education services. These formal arrangements include child care centers, family day care 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) child care settings. These definitions of child care are consistent with definitions presented in the *WIC ITFPS-2: Third Year Report*.

Table 2-2. Percentage of study children in regular child care by type of child care at 42 months

Type of child care	Study children % (SE)
Not currently in child care	**46.8 (1.7)**
Currently using any type of child care	**53.2 (1.7)**
Child care center (formal)	12.4 (1.7)
Someone cares for child in their home (informal)	11.4 (0.6)
Someone cares for child in the child's home (informal)	11.1 (0.9)
Preschool other than Head Start (formal)	8.5 (0.6)
Head Start (formal)	6.6 (0.8)
Family day care home (formal)	2.9 (0.4)
Other (informal)	0.4 (0.1)
Unweighted n	2,636
Weighted n	441,987

Chi-square testing indicates that at 42 months, there is a statistically significant association between current use of regular child care and several key socio-demographic characteristics: race, ethnicity, marital status, participation in non-WIC benefit programs, parity, income poverty, maternal age at the birth of the child, and child's WIC participation status at 36 months. Follow-up pairwise t-tests indicate that African American caregivers are more likely (66%) to be using regular child care than White caregivers (50%) or caregivers of all Other races (48%). Non-Hispanic study mothers are more likely (58%) than Hispanic study mothers (48%) to be using regular child care, as are unmarried study mothers (59%) compared to married study mothers (44%). Those who do not participate in other non-WIC benefit programs are more likely (60%) to be using regular child care than those who participate in SNAP or in SNAP and other non-WIC programs (50%). Caregivers for whom the study child is their first born are more likely (62%) to be using regular child care than those for whom the study child is a subsequently born child (second born, 50%; third or subsequent born, 44%). Caregivers with more income are more likely to be currently using child care. Those in the highest income-poverty subgroup (above 130% of the FPG) are more likely (68%) than those in the middle income-poverty subgroup (54% for those with income between 75% and 130% of the FPG) or those in the lowest income-poverty subgroup (45% for those with income less than 75% of the FPG). Those in the middle subgroup (between 75% and 130% of the FPG) are also more likely than those in the lowest subgroup (below 75% of the FPG). Study mothers whose children were not receiving WIC at 36 months are more likely (58%) to be using regular child care than those receiving WIC at 36 months (50%).

Chi-square testing also indicates some statistically significant associations between type of child care used at 42 months and socio-demographic characteristics.[38] The differences that are large in magnitude and statistically significant involve the regular use of child care centers. African American, non-Hispanic, and unmarried mothers are more likely to use child care centers than their counterparts (Table 2-3).

[38] There are significant bivariate associations between informal and formal care and key socio-demographic characteristics; however, none of the follow-up t-test indicated significant pairwise differences in percentages.

Table 2-3. Differences between select socio-demographic characteristics and use of center-based child care at 42 months

Socio-demographic characteristics	Study mothers using center-based child care % (SE)	Unweighted n	Weighted n
Race			
African American	20.2 (2.0)[a,b]	758	97,196
White	10.4 (1.3)[a]	1,472	257,871
Other	9.4 (1.9)[b]	406	86,920
Ethnicity			
Hispanic	8.0 (1.5)[c]	993	203,604
Non-Hispanic	16.1 (1.5)[c]	1,643	238,383
Marital Status			
Married	7.9 (1.1)[d]	987	170,086
Not Married	15.2 (1.8)[d]	1,649	271,900

[a] Statistically significant difference between African American and White caregivers.

[b] Statistically significant difference between African American and caregivers of Other races.

[c] Statistically significant difference between Hispanic and non-Hispanic caregivers.

[d] Statistically significant difference between married and not married caregivers.

2.5.2 Source of Foods Consumed While in Child Care

Because children in regular child care may consume many of their meals and snacks in that setting, analyses explore who provides the foods children eat while in child care.

Food provided to children in regular child care may come from the child care provider, the child's mother, or both the provider and the child's mother (Table 2-4). Among mothers who report using regular child care when their children are 42 months old, 45 percent report that the child care provider is responsible for most of the food, 33 percent of mothers report they provide most of the food themselves; and 22 percent report they and the providers equally split the provision of food. This pattern has remained largely unchanged since the 30-month interview.

Table 2-4. Among study children in regular child care, percentage of children by source of food at interview months 30 and 42

Source of food	Interview	
	Month 30 % (SE)	Month 42 % (SE)
Child care provider	42.4 (2.7)	45.2 (1.8)
Mother	31.9 (1.4)	32.8 (1.6)
Equally divided	25.7 (2.1)	21.9 (1.3)
Unweighted n	1,143	1,424
Weighted n	185,094	229,002

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

The prevalence with which child care providers provide most of the food differs by the type of child care arrangement. Among children in formal child care arrangements, 69 percent of study mothers report that the child care 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 child care provider is responsible for providing most of the food eaten during care.

There are several significant bivariate associations between key socio-demographic characteristics and who provides of food in formal child care settings. Among the 53 percent of mothers using regular child care at 42 months, 57 percent of mothers have their children in formal child care settings.[39] Within this group of caregivers, provision of food is significantly associated with marital status, participation in non-WIC benefit programs, weight status of the mother at 30 months, income poverty, and age of the mother at the child's birth. Follow-up pairwise tests indicate that caregivers are more likely to provide most of the food in formal settings if they are married (20%) compared to unmarried (13%), do not participate in any other Federal programs (24%) compared to those who participate SNAP (11%, including or excluding other non-WIC benefit programs), are normal weight or underweight (21%) compared to overweight (9%), are in the highest income subgroup (23%) compared to those in middle subgroup (9%), or are among the oldest study participants at the child's birth (20%) compared to those who were the youngest (6%).

There are also significant associations between key socio-demographic characteristics and who provides the food in informal child care settings. Among those using regular child care at 42 months, 43 of mothers have their children in informal child care settings.[40] Within this group of caregivers, food provision is associated with non-WIC benefit program participation, income poverty, and the child's WIC participation status at 36 months. Follow-up pairwise tests indicate that mothers in households that participate in SNAP (including or excluding other non-WIC benefits programs) are more likely (65%) to provide most of the food than mothers who participate in non-WIC benefits programs excluding SNAP (50%), and caregivers who received WIC at 36 months are more likely (61%) to provide the food than caregivers who did not receive WIC at this time (51%).

[39] This is about 30 percent of all study mothers.

[40] This is about 22 percent of all study mothers.

In contrast, study mothers in the highest income-poverty subgroup are less likely (47%) to provide the food than those in the middle income-poverty subgroup (65%).

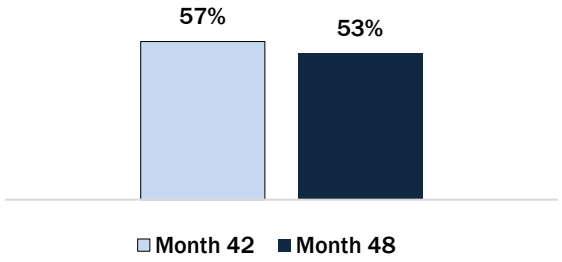
2.6 Participation in Federal Programs during the Fourth Year

Participants in WIC ITFPS-2 were all low-income at the time of enrollment, and by age 4, 74 percent report household incomes at or below 130 percent of the FPG. Analyses explore participation in WIC by the study child or mother, participation in WIC for another child in the household other than the study child, and participation of the household in other Federal nutrition assistance programs including SNAP, NSLP, SBP, and SFSP. Receipt of TANF is also explored. Program participation questions are asked during interviews at both 42 and 48 months; thus, results are reported at both time points. Analyses also explore whether there are differences in program participation by key socio-demographic subgroups.

2.6.1 WIC Participation

At 42 and 48 months, more than half of study mothers report that either they or the study child is receiving WIC: 57 percent at 42 months and 53 at 48 months (Figure 2-5; Appendix Table B2a-4 offers additional detail). In nearly one-quarter of study families, another child in the family is also receiving WIC: 23 percent at 42 months and 24 percent at 48 months.

Figure 2-5. Percentage of WIC ITFPS-2 mothers reporting they receive WIC for themselves or the study child at 42 and 48 months



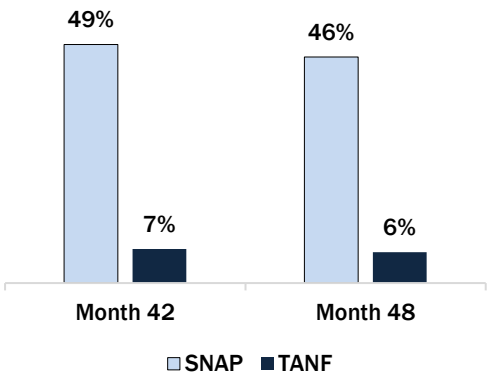
At both 42 and 48 months, chi-square analyses yield several significant associations between key socio-demographic characteristics and WIC participation. The following discussion focuses only on significant findings that are evident at both the 42- and 48-month interview. Hispanic caregivers are more likely to participate in WIC at both interview months than non-Hispanic caregivers. Follow-up pairwise t-tests indicate those who participate in SNAP or in SNAP and other non-WIC programs are more likely to participate at both interview months than those who do not participate in other non-WIC benefit programs, as are

caregivers with three or more children compared to those who have only one child. In contrast, caregivers who did not participate in WIC at 36 months are less likely than their respective counterparts to participate in WIC at both 42 and 48 months, as are those in the highest income-poverty subgroup (above 130% of the FPG) at 36 months compared to those in lower income-poverty subgroups.

As mentioned, in addition to participating in WIC with the study child, families may participate in WIC with another child. During the study child's fourth year (i.e., at the 42- and 48-month interviews), about one-quarter (23% at 42 months and 24% at 48 months) of WIC ITFPS-2 mothers indicate that they participate in WIC with a child other than the study child. Participating with another child is significantly associated with three key socio-demographic characteristics: participation in non-WIC benefit programs, WIC participation status at 36 months, and income poverty. Those who participate in other non-WIC benefit programs (including or excluding SNAP) are more likely to participate in WIC with another child during the study child's fourth year than those who do not participate in other non-WIC programs. Similarly, those who participated in WIC with the study child at 36 months are more likely to participate with another child during the study child's fourth year than those who did not participate with the study child at 36 months. In contrast, those in the highest income-poverty subgroup incomes are less likely to participate in WIC with another child during the study child's fourth year than those in the middle and lowest income-poverty subgroups.

2.6.2 SNAP and TANF Participation

Figure 2-6. Percentage of WIC ITFPS-2 mothers reporting they participate in SNAP and TANF at 42 and 48 months



At both 42 and 48 months, roughly half of WIC ITFPS-2 mothers report participating in SNAP (49% at 42 months and 46% at 48 months; Figure 2-6; Appendix Table B2a-5 offers additional detail). Among all WIC ITFPS-2 participants, less than 10 percent receive Temporary Assistance for Needy Families (TANF) at either the 42- or 48-month interview (7% at 42 months and 6% at 48 months).

At 42 and 48 months, chi-square analyses indicate significant associations between SNAP participation and several key socio-demographic characteristics, including race, marital status at 36 months, income poverty, parity, and participation in WIC at 36 months. African American study mothers and unmarried study mothers are more likely than their counterparts to participate in SNAP at both 42 and 48 months. Study mothers in the lowest income-poverty subgroup (below 75% of the FPG) are more likely to participate in SNAP at both interview months than those with higher incomes. Those in the middle subgroup (between 75% and 130% of the FPG) are also more likely to participate in SNAP at both interview months than those in the highest income-poverty subgroup (above 130% of the FPG). Mothers with three or more children are also more likely than those with fewer children to participate at both interview months, as are those who participated in WIC at 36 months compared to those who did not.

Chi-square analyses also yielded significant associations between TANF participation at both 42 and 48 months and several socio-demographic subgroup characteristics, including marital status, household food security, parity, weight status of the mother at 30 months, income poverty, and participation in WIC at 36 months. Characteristics associated with higher likelihood of TANF participation at both interview months included being unmarried compared to married, being in the lowest income-poverty subgroup compared to either of the higher two subgroups, and having received WIC at 36 months compared to not having received it. Despite the significant associations, follow-up t-tests indicated that there were no statistically significant pairwise differences between

subgroups by level of household food security or parity, and weight status of the mother exhibited only one significant pairwise difference at 42 months.

2.6.3 Household Participation in School and Summer Food Programs

At both 42 and 48 months, the interview probes whether any children in the household are participating in the NSLP, SBP, or SFSP. At both periods, 41 percent of study mothers reported that a child in the household was getting food from one or more of these programs.[41]

Key socio-demographic characteristics significantly associated with participation in any of these programs at both 42 and 48 months include household food security, parity, income poverty, age of mother at the birth of the child, and WIC participation status at 36 months. Caregivers with very low household food security are more likely than caregivers with high or marginal food security to have children participate in the NSLP, SBP, or SFSP at both interview months. Similarly, caregivers with more than one child are more likely than caregivers with one child to participate in these programs at both interview months. In contrast, caregivers in the highest income-poverty subgroup (above 130 of the FPG) are less likely to participate than those in the lower two income-poverty subgroups. Mothers in the youngest age subgroup are less likely than those in the older two subgroups to have children participate, as are those who did not receive WIC at 36 months compared to those who did receive WIC at 36 months.

2.7 Food Access

To examine food access, the current study uses the respondent's physical home address to assess whether respondents live in a food desert, an area lacking stores that carry affordable and nutritious food at the 42- and 48-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.[42]

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

[42] U.S. Department of Agriculture Economic Research Service. (2011). Mapping Food Deserts in the United States. Retrieved from https://www.ers.usda.gov/amber-waves/2011/december/data-feature-mapping-food-deserts-in-the-us/ on May 7, 2019.

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."[43]

Data from the 42-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 socio-demographic characteristics, the bivariate analyses explore whether perceptions of access and barriers are associated with living in a food desert.

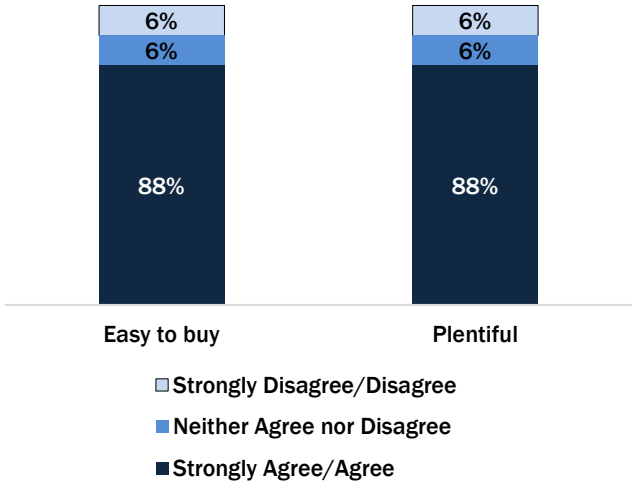
2.7.1 Households Living in a Food Desert

At the 42- and 48-month interviews, one in five (19%) study mothers live in food deserts, or areas with low food access. Chi-square tests reveal that one key socio-demographic characteristic, race, is significantly associated with living in a food desert at both 42 and 48 months. White caregivers and African American caregivers are more likely (23% and 22%, respectively) to live in food deserts than caregivers in the Other race category (9%).

[43] Ibid.

2.7.2 Availability of Fresh Fruits and Vegetables

Figure 2-7. Percentage of study mothers agreeing that fruits and vegetables are easy to buy and plentiful in their communities at 42 months

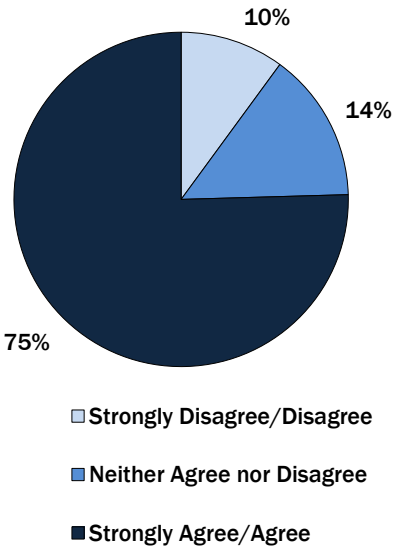


Note: Percentages may not sum to 100 because of rounding.

At 42 months, the majority of study mothers (88%) *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 6 percent *strongly disagree* or *disagree* with this statement. Similarly, 88 percent of study mothers *strongly agree* or *agree* that fruit and vegetables are plentiful in their communities, and only 6 percent of mothers *strongly disagree* or *disagree*.

However, responses are more varied when study mothers are asked about the quality of the fresh fruits and vegetables available to them. Seventy-five percent of mothers *strongly agree* or *agree* that the fresh fruits and vegetables available to them are of high quality, and 10 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 42 months



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

Living in a food desert is not associated with study mothers' perceptions of access at 42 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. There are few socio-demographic variables that are significantly associated

with all three survey items assessing perceived access. One key socio-demographic characteristic that is associated with the three items assessing perceived access is household food security. Table 2-5 presents the findings.

Table 2-5. Percentages of respondents agreeing with items used to assess food access by food security

Food access items	Household Food Security		
	High or Marginal Food Security % (SE)	Low Food Security % (SE)	Very Low Food Security % (SE)
It is easy to buy fresh fruits and vegetables in my community			
Strongly Agree/Agree	89.8 (1.0)[a]	84.2 (2.1)	81.0 (2.8)[a]
Neither Agree nor Disagree	5.4 (0.6)	6.6 (1.4)	10.1 (2.2)
Strongly Disagree/Disagree	4.9 (0.7)[b]	9.2 (1.6)[b]	8.9 (1.9)
There are a lot of fresh fruits and vegetables in my community			
Strongly Agree/Agree	89.8 (0.9)[a,c]	81.7 (1.8)[c]	81.4 (2.6)[a]
Neither Agree nor Disagree	5.7 (0.6)	6.9 (1.5)	7.2 (1.6)
Strongly Disagree/Disagree	4.5 (0.6)[b,d]	11.5 (1.5)[b]	11.4 (2.6)[d]
The fresh fruits and vegetables in my community are of high quality			
Strongly Agree/Agree	78.6 (1.2)[a]	71.1 (3.0)[e]	58.3 (3.6)[a,e]
Neither Agree nor Disagree	12.8 (0.6)[f]	17.0 (2.6)	22.1 (2.9)[f]
Strongly Disagree/Disagree	8.6 (1.0)[d]	11.9 (1.6)	19.7 (2.7)[d]
Unweighted n[a]	1,920	424	280
Weighted n	325,556	70,476	43,334

[a] Statistically significant difference at $p \leq 0.05$ between percentages that strongly agree/agree for high or marginal food security and very low food security.

[b] Statistically significant difference at $p \leq 0.05$ between percentages that strongly disagree/disagree for high or marginal food security and low food security.

[c] Statistically significant difference at $p \leq 0.05$ between percentages that strongly agree/agree for high or marginal food security and low food security.

[d] Statistically significant difference at $p \leq 0.05$ between percentages that strongly disagree/disagree for high or marginal food security and very low food security.

[e] Statistically significant difference at $p \leq 0.05$ between percentages that strongly agree/agree for low food security and very low food security.

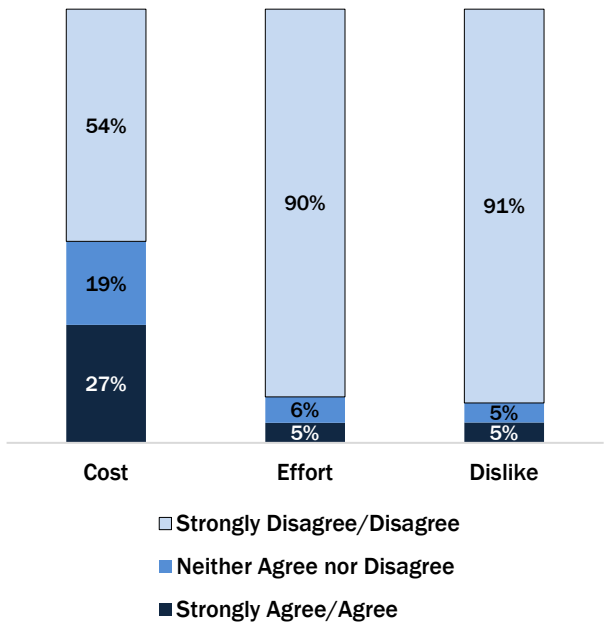
[f] Statistically significant difference at $p \leq 0.05$ between percentages that neither agree nor disagree for high or marginal food security and very low food security.

Caregivers whose households have very low food security are less likely to *strongly agree* or *agree* that fresh fruits and vegetables are easy to buy (81%) compared to caregivers living in households with high or marginal food security (90%). Similarly, those in households with very low food security are less likely to *strongly agree* or *agree* that fresh fruits and vegetables are plentiful (81%) compared to those in households with high or marginal food security (90%). Caregivers whose households have

very low food security are also less likely to *strongly agree* or *agree* that fresh fruits and vegetables are of high quality (58%) compared to those living in households with high marginal food security (79%) or households living with low food security (71%).

2.7.3 Perceived Barriers to Consuming Fresh Fruits and Vegetables

Figure 2-9. Percentage of study mothers agreeing with select barriers to consumption of fresh fruits and vegetables at 42 months



During the 42-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. Slightly more than a quarter (27%) of study mothers, however, *strongly agree* or *agree* that cost is a barrier to consuming fresh fruits and vegetables.

There are several key socio-demographic variables significantly associated with cost as a barrier to fresh fruit and vegetable consumption. These include race, household food security, participation in non-WIC benefit programs, the mother's weight status at 30 months, and the age of the mother at birth. Follow-up pairwise t-tests indicate statistically significant differences between subgroups within most of these key socio-demographic characteristics. Caregivers classified in the Other racial category are less likely to *strongly agree* or *agree* (21%) than White caregivers (30%) that fresh fruits and vegetables cost too much. Caregivers in households with high or marginal food security are less likely to *strongly agree* or *agree* (21%) that cost is a barrier than caregivers in households with low (42%) or very low food security (47%). Caregivers who were in the youngest age group at the time of the child's birth are also less likely to *strongly agree* or *agree* (16%) than caregivers in the older age groups (20-25 years, 26%; 26 years or older, 31%).

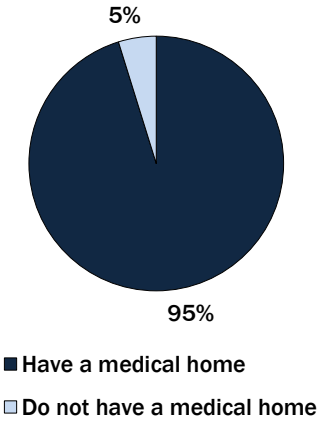
2.8 Medical Care

An important benefit of WIC is providing participants with referrals to other services, including medical care.[44] At 42 months, WIC ITFPS-2 asks whether study children have a medical home for regular care, whether the children had a well-child doctor's visit around the time of their third birthday, and whether anyone in the household receives Medicaid.

2.8.1 Medical Home at 42 Months

At 42 months, nearly all study mothers (95%) reported that their children have a doctor's office, health clinic, or other medical facility that they visit for routine physical examinations or well-child check-ups (Figure 2-10; Appendix Table B2a8 offers additional detail).

Figure 2-10. Percentage of study children who have a medical home at 42 months

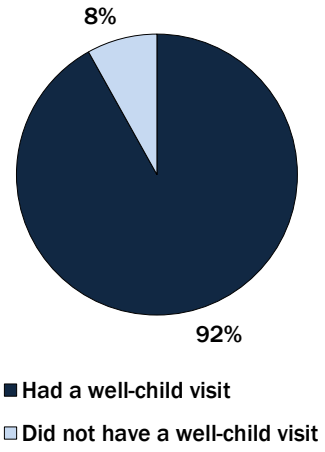


Income poverty is the only key socio-demographic characteristics significantly associated with having a medical home. Though the difference is relatively small, those in the highest income-poverty subgroup are more likely (97%) than those in the lowest income poverty subgroup (94%) to report that their child has a medical home. Additional bivariate analyses included WIC status as 42 months, but the association with WIC status at this time was not significant.

[44] U.S. Department of Agriculture. (2013, October 10). *About WIC – WIC at a Glance*. Retrieved from https://www.fns.usda.gov/wic/about-wic-wic-glance on May 1, 2019.

2.8.2 Well-Child Visits at Last Birthday (Age 3)

Figure 2-11. Percentage of study children who had a well-child visit at age 3



At 42 months nearly all mothers (92%) reported that the study child had a physical examination or a well-child visit around his or her third birthday[45] (Figure 2-11; Appendix Table B2a-8 offers additional detail).

Chi-square analyses yielded significant associations between whether the study child had a physical examination or a well-child visit around the time of his or her third birthday and household food security and WIC participation status at 36 months. Mothers in households with high or marginal household food security were more likely (94%) to indicate that their child had a well-child visit around the third birthday than mothers in households with low food security (87%) or households with very low food security (88%). Additionally, though the magnitude of the difference is not large, children receiving WIC at 36 months were more likely (93%) to have a well-child visit around their third birthday than children who were not receiving WIC at 36 months (90%).

2.8.3 Household Medicaid Participation

At 42 and 48 months, study mothers are asked whether anyone in the household is participating in Medicaid. At 42 months, 76 percent of households include someone who is receiving Medicaid; at 48 months, 73 percent of households include someone who is receiving Medicaid. These two percentages are not significantly different.

There are several key socio-demographic characteristics associated with household Medicaid participation at both the 42- and 48-month interview. These include marital status, parity, timing of WIC enrollment, income poverty, and WIC participation status at 36 months. Mothers who are

[45] Analyses focus on a well visit around the time of the child's third birthday because the 48-month interview takes place within a short window of time around the child's fourth birthday, and not all caregivers will have had time to schedule a fourth-year well visit.

unmarried, whose incomes are in lower income-poverty subgroups, or were participating in WIC at 36 months are more likely than their counterparts to indicate household Medicaid participation at both 42 and 48 months. Mothers who enrolled in WIC during their first or second trimester of pregnancy for the study child are also more likely to participate in Medicaid than those who enrolled in postnatally. Some of these key socio-demographic characteristics are indicators of income eligibility for this program.

2.9 Summary

Fifty-eight percent of study mothers with 42-month old children have work and/or school commitments. More than half (53%) 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. Over half of study children (53%) are in child care at age 42 months. The most common type of arrangement is a child care center.

For children in regular child care, 45 percent of mothers indicate that the child care provider provides most of the food while their children are in care, and one-third (33%) of mothers indicate they provide most of the food themselves. For children in formal types of care (center-based, family daycare homes, preschool, and Head Start), 69 percent of mothers indicate that the provider is responsible for all food consumed while in care. For children in informal types of child care, 15 percent of mothers indicate that the provider is responsible for all food consumed while in care. These findings highlight the important role that nonfamilial sources play in determining study children's dietary intake.

At the 48-month interview, more than half (53%) of study participants report receiving WIC benefits. Just under half (46%) of WIC ITFPS-2 families participate in SNAP at 48 months, and approximately 41 percent have a child who participates in NSLP, SBP, or SFSP. Less than 10 percent are receiving TANF.

Almost one-fifth (19%) of study families live in food deserts, areas with limited food access. Despite this, at 42 months, nearly 90 percent of mothers agree that fresh fruits and vegetables are easy to purchase and plentiful in their communities. The primary barrier to purchasing fresh fruits and vegetables is cost, with about one-quarter (27%) of mothers agreeing that fresh fruits and vegetables cost too much.

Nearly all study children are receiving health care. More than 95 percent of study mothers report that their children have a medical home at 42 months, and more than 90 percent had a well-child visit around the third birthday. Study households are also accessing resources to help with healthcare costs, as 76 of study mothers report that someone in the household is receiving Medicaid at 42-months.

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

Key Findings:

On a given day at 48 months:

- Nearly two-thirds (64%) of study children consume a vegetable, including 100 percent vegetable juice.
- Most (88%) study children consume a fruit (fruit or 100 percent fruit juice) on any given day at 48 months; 72 percent consume fruit (excluding 100 percent juice) and 65 percent consume 100 percent fruit juice. The percentage consuming 100 percent fruit juice (65%) at 48 months is significantly lower than it was at 36 months (69%).
- Almost all (98%) study children consume a grain on any given day at 48 months; however, less than half (44%) consume a whole grain.
- Most (82%) children consume some type of dessert, candy, sugar-sweetened beverage (SSB), or other sweet on any given day at 48 months

With regard to diet quality:

- Study children's average total score on the 2015 Healthy Eating Index (HEI-2015) is 59 out of 100. This score is similar to the mean score (60) from a nationally representative sample of children ages 2 to 5 years, but still indicates a need for improvement.
- At 48 months, about 54 percent of study children meet the Dietary Guidelines for Americans (DGA) recommendation to consume less than 10 percent of calories from added sugars. This is down from 71 percent meeting this recommendation at 36 months. Participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) at 48 months is significantly associated with greater likelihood of meeting the DGA recommendation for added sugars.

3.1 Overview

Using dietary intake data collected from study children at 4 years, this chapter focuses on food intake and meal and snack patterns. Where applicable, data from 36 months 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 4-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 4 years?

3.2 Background

Fruits, vegetables, and whole grains are excellent sources of nutrients such as potassium, folate, fiber, vitamin A, vitamin C, vitamin K, and various phytochemicals (Nebeling, 2002; U.S. Department of Health and Human Services (DHHS) and U.S. Department of Agriculture (USDA), 2015). Yet, most children in the U.S. do not consume sufficient amounts of these food groups (National Cancer Institute, 2018a; Kim et al., 2014). There are well-known health benefits to consuming fruit, vegetables, and whole grains (He, Nowson, & MacGregor, 2006; He, Nowson, Lucas, & MacGregor, 2007; Montonen, Knekt, Järvinen, & Reunanen, 2004; World Cancer Research Fund, 2007). A USDA analysis of National Health and Nutrition Examination Survey (NHANES) 24-hour dietary recalls from 2005-2008 reported that intakes of various food groups differed between WIC participants, income-eligible nonparticipants, and higher income nonparticipants, suggesting that program participation and income status may influence dietary intake of various foods and food groups (Condon et al., 2015).

Studies of nationally representative samples highlight substantial increases in childhood snacking from 1977 to 2006, with children ages 2 to 6 having almost three eating occasions defined as snacks per day (Piernas & Popkin, 2010). With the increase in the number of snack occasions, intake of salty snacks and sweets has also significantly increased, as desserts and sweetened beverages are a primary source of calories consumed at snack occasions (Piernas & Popkin, 2010). Snacks contribute nearly one-third of total calories and over one-third of added sugar to the diets of young children (Shriver et al., 2018). Consumption of SSBs typically starts during the preschool years and increases with age (Wang, Bleich, & Gortmaker, 2008). In 2011-2014, U.S. children 2 to 5 years old consumed an average of about 60 calories per day (or 4% of total daily calories) from SSBs (Rosinger et al., 2017.)

Total HEI-2015 scores provide a comprehensive measure of diet quality beyond assessing individual food groups or nutrients (Thomson, Tussing-Humprhreys, Goodman, & Landry, 2019). HEI-2015 is the most up-to-date version of the HEI and can be used to evaluate diet quality of children taking into account total calorie intake (National Cancer Institute, 2018). A study evaluating HEI scores in

children assessed changes in the HEI-2010 scores for children aged 2 to 18 years from multiple NHANES cycles (1999-2012) and use of Federal nutrition assistance programs. Mean total HEI-2010 scores for children aged 2 to 5 years increased significantly, from 47.0 in 1999-2000 cycle to 55.3 in the 2011-2012 cycle. A similar trend was seen in children participating in WIC, with a significant linear increase in total HEI-2010 score across the NHANES cycles (46.1 in 1999-2000, 55.8 in 2011-2012). The improvement in total HEI-2010 scores for children ages 2 to 5 years was due mainly to an improvement in the score for empty calories; scores for all other components showed only small changes. Intakes for dairy, total protein foods, refined grains, sodium, and empty calories were above half the maximum scores; intakes of greens and beans and fatty acids were the lowest. (Gu and Tucker, 2017). In more recent analysis of NHANES data from 2009-2014, the total HEI-2015 score (updated to reflect the 2015-2020 DGAs) for children 2 to 5 years old was 60.1 (Thomson et al., 2019).

3.3 Sample and Analysis Approach

3.3.1 Sample

The analyses in this chapter utilize dietary intake data from the 36- and 48-month interviews. Both the core and supplemental WIC ITFPS-2 samples were eligible for these interviews. Table 3-1 shows the unweighted number of respondents by sample and interview. In analyses, the responses to each interview are weighted so that findings reflect the WIC population as described in Chapter 1.

Table 3-1. Unweighted number of respondents by interview month

Sample structure	36-month interview	48-month interview
Core prenatal sample	1,813	1,787
Core postnatal sample	231	235
Supplemental prenatal sample	460	445
Supplemental postnatal sample	104	105
Total	**2,608**	**2,572**

3.3.2 Analysis

This chapter examines meal and snack patterns, food intake, and diet quality at age 48 months using data from a 24-hour dietary recall.[46] Analyses explore key socio-demographic characteristics associated with these patterns of intake (see Chapter 1.4 for a list of key socio-demographic characteristics). Key socio-demographic characteristics are typically measured at the time of the first interview. For characteristics that may change over time, such as food security or income relative to the Federal poverty guidelines (income poverty), socio-demographic characteristics are updated to values reported at the 36-month interview.[47]

Analyses include bivariate chi-square tests to examine whether an outcome of interest is associated with a key socio-demographic characteristic. 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 is applied in order to avoid focusing on findings that, while statistically significant, may have little practical importance.[48] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

When available and comparable, results from the Gerber/Nestle Feeding Infants and Toddlers Studies (FITS) from 2016 (Anater et al., 2018; Welker, Jacquier, Catellier, Anater, & Story, 2018) are presented alongside current findings to examine differences and similarities between studies. The FITS 2016 is the latest in a well-known series of national studies examining infant and toddler feeding practices, and it includes both WIC participant and nonparticipant children. Like WIC ITFPS-2, FITS collects 24-hour dietary recall data,[49] with replicate dietary recalls on a portion of the

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[46] Food group intake is adjusted for usual intake (Appendix B3 offers details). Usual intake is used in HEI and DGA analyses as well. In contrast, meal and snack patterns, and consumption of individual food items, represent intake on a given day.

[47] The baseline/36-month socio-demographic variables are used for subgroup analyses instead of 48-month socio-demographic variables to allow lagged influences of context on behaviors to emerge in the data.

[48] 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.

[49] The methodology for coding dietary intakes differs slightly between FITS 2016 and WIC ITFPS-2: FITS 2016 was coded using the University of Minnesota Nutrient Database System for Research, while WIC ITFPS-2 was coded using the USDA Food and Nutrient Database for Dietary Studies. The result is that some of the changes observed when comparing food groups or nutrient intakes over time may be due in part to the codes applied to the various foods and the food grouping scheme used to classify foods. See Welker et al. (2018) for details of the differences in coding between FITS 2008 and 2016.

study cases to allow for estimation of usual intake (Welker et al., 2018). The FITS studies are cross-sectional; FITS 2016 includes children from birth to 47.9 months. Because FITS 2016 is a cross-sectional study covering a range of ages, their findings reported by age groups, whereas the current study reports findings at a specific age (i.e., dietary intake at 48 months). Comparisons between WIC ITFPS-2 and FITS data therefore match the WIC ITFPS-2 month to the closest relevant FITS age bands: WIC ITPFS-2 data at 48 months to 2016 FITS findings at 36-47.9 months. The lack of complete alignment between child age in the two studies, and the fact that WIC ITFPS-2 is a low-income sample whereas FITS 2016 includes both low income and higher income families, could lead to differences in findings between the two studies. Differences between FITS 2016 and WIC ITFPS-2 in methodology, as well as limits in the availability of data from other studies on which to conduct analyses, prevent making direct statistical comparisons between the studies. Consequently, comparisons focus on the magnitude of differences between the studies, rather than the statistical significance of differences.

In WIC ITFPS-2, all post-birth 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 Multi-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. The interviewer records all information, and trained coders then code and analyze the data for food group and nutrient content. Intakes after the 11-month interview are adjusted statistically for day-to-day variation using the National Cancer Institute's (NCI's) method for estimating usual intake of food groups, energy, and nutrients (Tooze, 2006; Tooze, 2010). 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, and this data is used in estimating usual intake of food groups, energy, and nutrients for all study children. Analyses in this chapter also use specific individual food groups, and eating occasion (e.g., breakfast, lunch, dinner, snack), to describe food intake and meal and snack patterns as a snapshot of consumption on the day of the 24-hour dietary recall (i.e., on a given day).

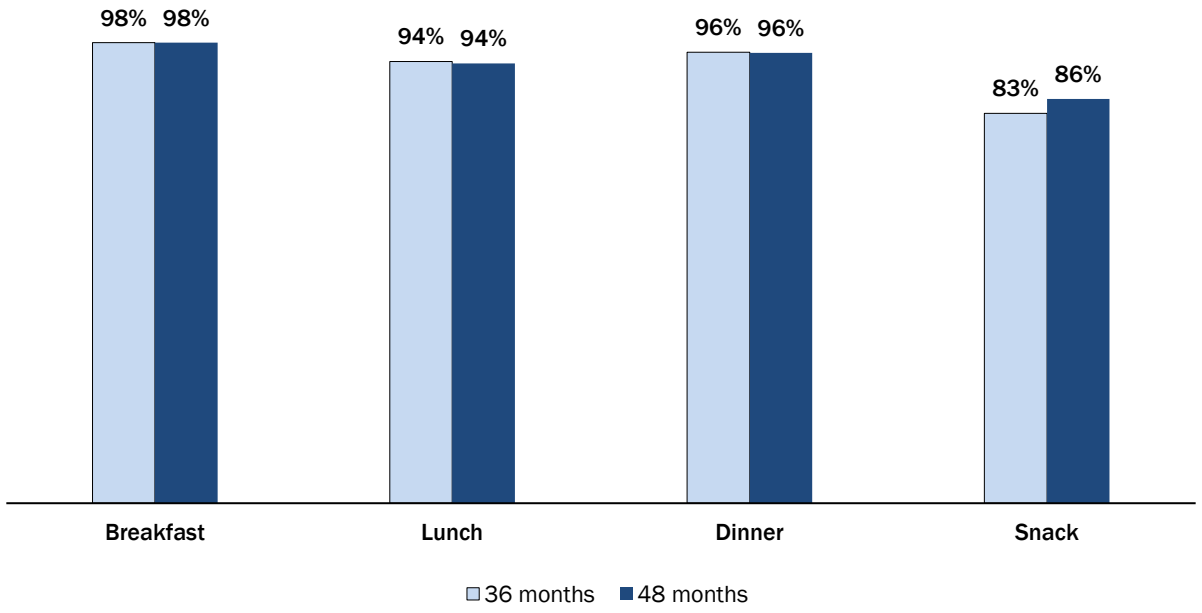
Because one of the goals of WIC ITFPS-2 is to enable comparisons to previous studies, particularly the FITS studies, the current report uses the same food group classifications as FITS 2016, which were originally developed for FITS 2008 (Fox, Pac, Devaney, & Jankowski, 2004). These

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. The use of these classifications is necessary to allow comparisons to the previous work. Appendix B3 offers additional information on dietary coding procedures.

3.4 Meal and Snack Patterns at 48 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 both 36 and 48 months, almost all children are eating breakfast (98%), lunch (94%) and dinner (96%) 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 changed slightly between 36 and 48 months, from 83 percent of children having at least one snack on a given day at 36 months to 86 percent at 48 months. On average, study children report 2.3 snack eating occasions on a given day at 36 months and 2.2 snacks on a given day at 48 months. At both 36 and 48 months, the distribution of the number of snacks per day are similar, with 36 and 39 percent of study children, respectively, reporting 2 snack occasions per day and 25 and 24 percent reporting 3 snack occasions per day, respectively. At 48 months less than 2 percent of children are skipping breakfast, although 6 percent do not consume lunch on a given day, and 4 percent do not consume dinner.

Figure 3-1. Percentage of study children consuming foods/beverages by eating occasion on a given day at 36 and 48 months



3.5 Food and Beverage Intake at 48 Months

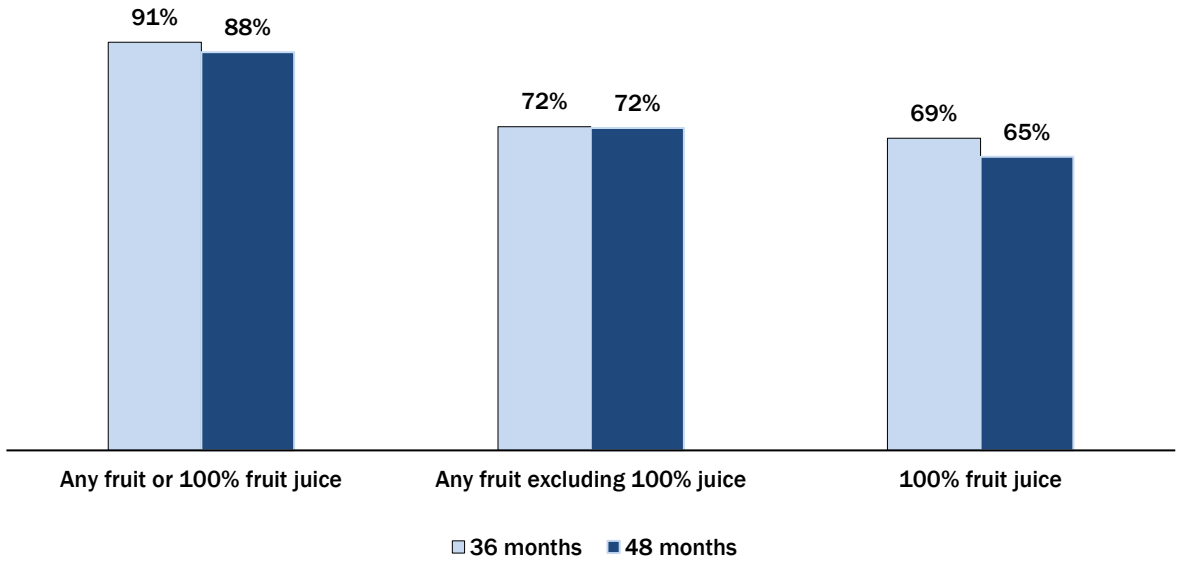
Knowing which foods and beverages children typically consume can inform recommendations for dietary improvements. Furthermore, this information can be leveraged to evaluate associations between diet and health outcomes. The following sections assess the foods and beverages consumed on a given day by the WIC ITFPS-2 children at 48 months, and the sections also explore children's meal and snack patterns. To provide context for the WIC ITFPS-2 findings, dietary intake findings from the current study are compared to the results from FITS 2016 (Welker et al., 2018).

Data presented in this report focus on the percentages of 48-month-olds consuming particular foods or food groups on a given day. Chapter 4 of the *WIC ITFPS-2: Third Year Report* (Weinfield et al., 2019) describes study children's dietary intakes during the third year of life; however, these data are also provided in this chapter for context. 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. Section 3.5 reports whether the food groups or foods are consumed, whereas Section 3.6 quantifies foods consumed.

3.5.1 Fruit Consumption

The percentage of WIC ITFPS-2 children consuming any fruit or 100 percent fruit juice on a given day declines significantly between 36 and 48 months (Figure 3-2; Appendix Table B2b-2 offers additional detail). The decline is driven by the significant change in consumption of 100 percent fruit juice between interviews: at 36 months, 69 percent of study children consume 100 percent fruit juice while at 48 months, 65 percent of study children do. The most common form of fruit (excluding juice) children consume at 48 months is fresh or frozen fruit (66%), followed by canned fruit (13%).

Figure 3-2. Percentage of study children consuming fruit on a given day by interview month



Two key socio-demographic characteristics are significantly associated with consumption of any fruit or 100 percent fruit juice consumption at 48 months: ethnicity and WIC participation status at 36 months. As compared to children with non-Hispanic caregivers, children with Hispanic caregivers are more likely to report consuming any fruit or 100 percent fruit juice on a given day (91% vs. 86%). Additionally, those who received WIC at 36 months are more likely (91%) to consume any fruit or 100 percent juice on a given day than those who did not receive WIC at 36 months (85%). This latter finding is driven by a significant difference in the consumption of 100 percent fruit juice: those who received WIC at 36 months are more likely (70%) consume 100 percent fruit juice at 48 months than those who did not receive WIC at 36 months are (59%).

Consumption of any fruit excluding 100 percent juice is assocatied with race, marital status, age of caregiver, and participation in non-WIC benefit programs. Children with married caregivers are more likely (77%) to consume fruit (excluding juice) than children with unmarried caregivers (68%). Follow-up pairwise t-tests indicate that children in households that participate in non-WIC benefit programs other than the Supplemental Nutrition Assistance Program (SNAP) are more likely (79%) to consume fruit (excluding juice) than children in households that participate in SNAP and other programs (66%). Follow-up pairwise t-tests did not find significant differences between subgroups by race or age at the time of the child's birth.

The top five most commonly consumed fruits on a given day at 36 and 48 months are shown in Table 3-2. The top five fruits remain the same across the two interviews, and the distribution only slightly changes.

The percentages of WIC ITFPS-2 children consuming any fruit (excluding 100% fruit juice) are similar at ages 3 and 4 (72%) to those in FITS 2016 (74%) (Welker et al., 2018).[50] One hundred percent fruit juice, in contrast, is consumed by a larger proportion of WIC ITFPS-2 children at age 4 years (65%) than children who participated in FITS 2016 (45%) (Figure 3-3).

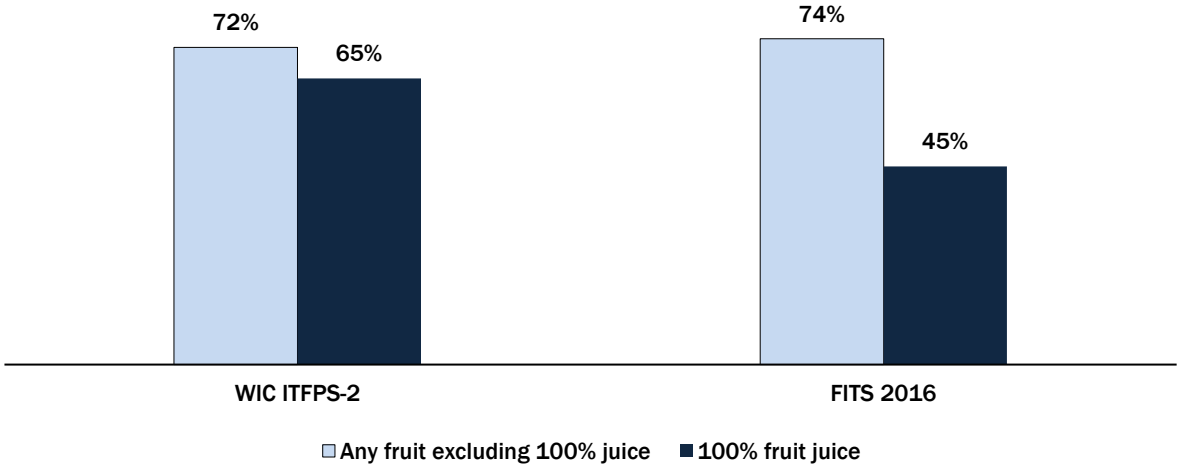
Table 3-2. Top five fruits consumed by study children on a given day by interview month

Top five fruits	Percent of study children who consumed the fruit on a given day
36 months	
Banana	29.6%
Apple	26.5
Grapes	13.7
Orange	11.2
Strawberries	9.7
Unweighted n	2,586
Weighted n	438,319
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

Note: One hundred percent fruit juice is excluded from this table.

[50] The FITS 2008 cross-sectional sample is divided into ranges including children ages 24-35.9 months (2 years), used for comparison to the WIC ITFPS-2 36-month interview, and 36-47.9 months (3 years) used for comparison to the WIC ITFPS-2 36- and 48-month interviews. Any fruit includes fresh, frozen, canned, or dried fruits, but excludes 100 percent fruit juice.

Figure 3-3. Percentages of 3- and 4-year-old children consuming fruit or 100% fruit juice on a given day in WIC ITFPS-2 and FITS 2016



Note: The FITS 2016 cross-sectional sample includes children ages 36-47.9 months in the age 3 group. The WIC ITFPS-2 data for 48 months, shown, were collected between child ages 47.5-48.9 months.

3.5.2 Vegetable Consumption

The percentage of WIC ITFPS-2 children consuming any type of vegetable, including 100 percent vegetable juice,[51] at 36 and 48 months remains steady (Figure 3-4; Appendix Table B2b-2 offers additional detail). Consumption of cooked vegetables appears to increase over the period but the difference is not significant.

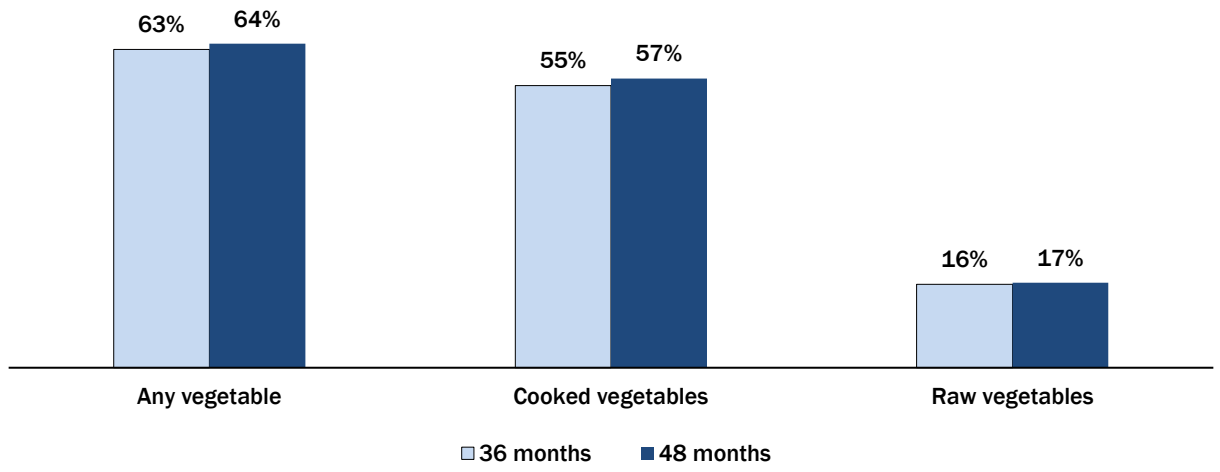
Several different FITS vegetable subgroups are examined, including dark green vegetables, deep yellow or orange vegetables, white potatoes (non-fried), French fries or other fried potatoes, other starchy vegetables, and other vegetables.[52] Consumption of most vegetables fall within 2 percentage points between the 36 and 48 month interviews (Table 3-3). On a given day at 48 months, only about 12 percent of study children consume dark green vegetables, and a similar percentage

[51] 100 percent vegetable juice, when reported, is coded as a cooked vegetable.

[52] The FITS vegetable subgroup names do not match the vegetable subgroups in the DGA because food groups are constructed to match the FITS 2008 study. 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; 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.

consume deep yellow or orange vegetables. As at 36 months, at 48 months the highest percentage of study children (35%) consume at least one vegetable from the other vegetables category, which includes both green beans and tomatoes that may be consumed as sauce.

Figure 3-4. Percentage of study children consuming vegetables on a given day by interview month (months 36 and 48)



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

Table 3-3. Percentage of study children consuming different types of vegetables on a given day by interview month (months 36 and 48)

Type of vegetable	Interview month	
	Month 36	Month 48
Dark green vegetables[a]	10.8%	12.2%
Deep yellow or orange vegetables[b]	13.3	12.4
White potatoes	13.0	13.5
French fries or other fried potatoes	16.9	18.4
Other starchy vegetables[c]	12.3	13.9
Other vegetables[d]	34.7	35.0
Unweighted n	2,586	2,562
Weighted n	438,319	439,736

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

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

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

[d] 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 48 months, race, ethnicity, and income poverty are each significantly associated with any vegetable consumption. Children with African American caregivers are more likely (68%) to eat any vegetable than children with caregivers classified in the Other racial category (58%), although there were no significant differences in the consumption of any individual vegetable subgroup. Children with non-Hispanic caregivers are significantly more likely (70%) to eat any vegetable than children with Hispanic caregivers (56%). The sources of this difference is consumption of white potatoes, fried potatoes and starchy vegetables, as well as other vegetables. With these bivariate analyses, it is not possible to distinguish if race and ethnicity is each independently associated with vegetable consumption. Children with caregivers whose incomes are in the highest income-poverty subgroup (above 130% of the Federal poverty guidelines (FPG)) are more likely (70%) to consume vegetables than children with caregivers with income in the middle subgroup (63% for those with incomes between 75 and 130 percent of the FPG) or the lowest income-poverty subgroup (60% for those with incomes below 75% of the FPG).

Table 3-4. Top five vegetables consumed by study children on a given day by interview month

Top five vegetables	Percent of study children who consumed the vegetable on a given day
36 months	
Tomatoes	19.0%
French fries or other fried potatoes	16.9
Carrots	9.4
Green beans	8.9
Mashed potatoes	8.5
Unweighted n	2,763
Weighted n	434,035
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

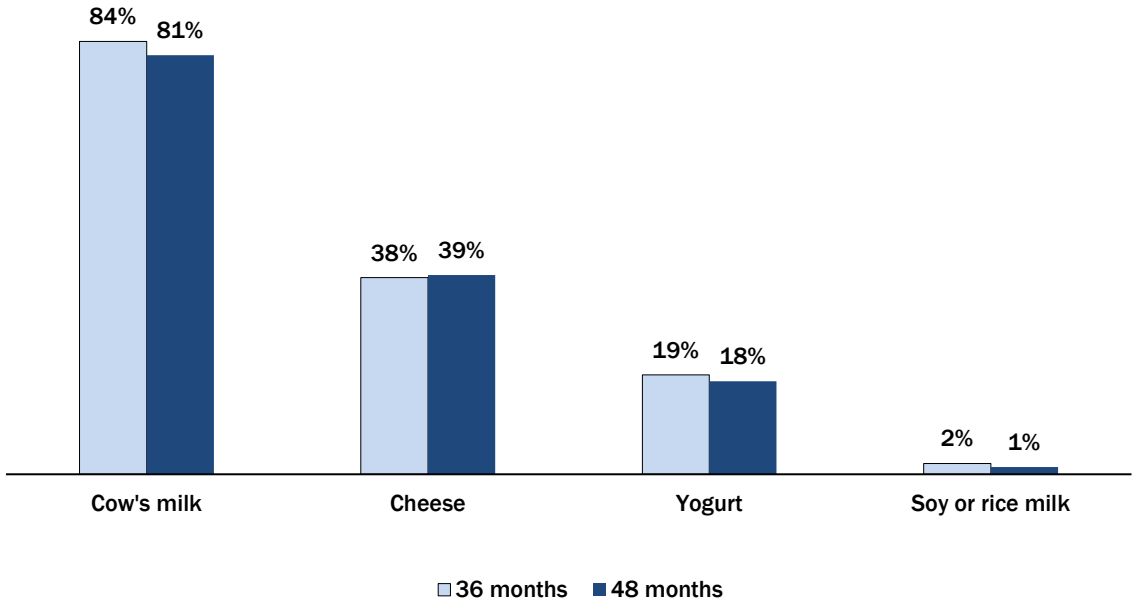
The top five vegetables consumed on a given day show slight shifts between 36 and 48 months (Table 3-4). At both interview months, the top three vegetables are tomatoes, which may be cooked in sauces, French fries or other fried potatoes, and carrots. Broccoli enters the top- five list at 48 months while green beans drop out, and mashed potatoes remain in the top-five list for both ages.

The percentage of WIC ITFPS-2 children consuming any vegetable on a given day (64%) is lower than the percentage in the FITS 2016 sample (73%) (Welker et al., 2018).

3.5.3 Dairy, Meats, and Other Protein Sources Consumption

The percentage of WIC ITFPS-2 children consuming dairy products on a given day at 36 and 48 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 (84% at 36 months and 81% at 48 months), cheese is consumed by slightly more than one-third of children (38% at 36 months and 39% at 48 months), and yogurt is consumed by about one-fifth of children (18% at 36 months and 19% at 48 months). At both 36 and 48 months, very small percentages of the study children consume nondairy milks such as soy milk or rice milk.

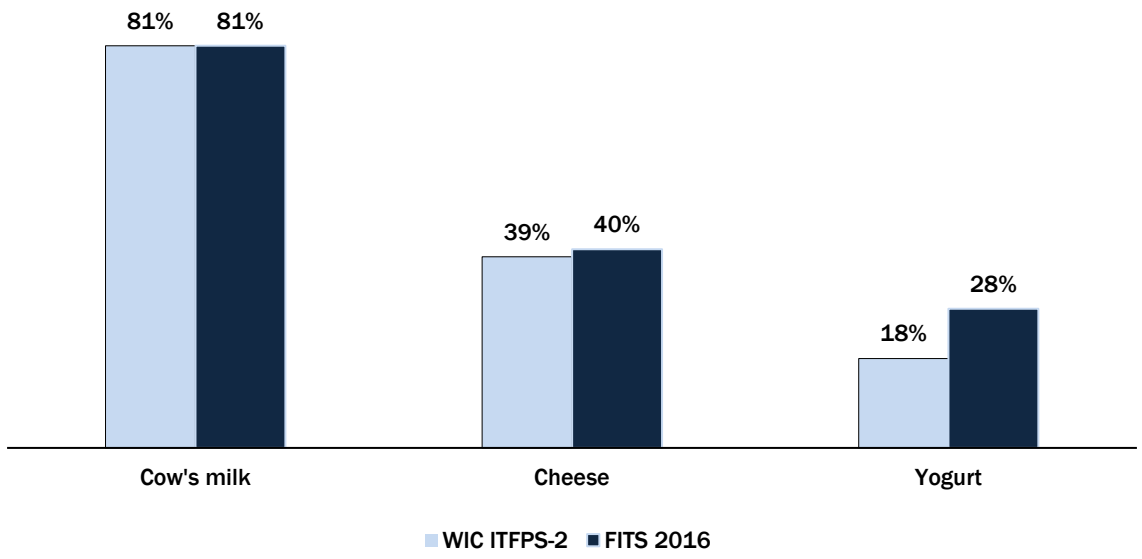
Figure 3-5. Percentage of study children consuming dairy or milk substitutes on a given day by interview month



The percentages of WIC ITFPS-2 children and FITS 2016 consuming cow's milk and cheese are similar (Figure3-6). In both studies, 81 percent of study children consume cow's milk. About 40 percent of FITS 2016 children and 39 percent of WIC ITFPS-2 children consume cheese on a given day. Yogurt consumption, in contrast, does seem to differ slightly across the two studies (28% of FITS children vs. 18% of WIC ITPFS-2 children) (Welker et al., 2018). When comparing findings

from these studies, it is important to remember that the age ranges of study participants for the WIC ITFPS-2 and FITS 2016 are not identical.[53]

Figure 3-6. Percentages of 3- and 4-year-old children consuming select dairy foods on a given day in WIC ITFPS-2 and FITS 2016



Note: The FITS 2016 cross-sectional sample includes children ages 36-47.9 months in the age 3 group. The WIC ITFPS-2 data for 48 months, shown, were collected between child ages 47.5-48.9 months.

Analysis of types of cow's milk WIC ITFPS-2 children are consuming on a given day at 48 months indicates that 28 percent are consuming whole milk, 28 percent are consuming low-fat milk (1% milk fat), and 26 percent are consuming reduced-fat milk (2% milk fat). An estimated 2 percent are consuming skim (nonfat) milk.

There is a significant bivariate association between type of milk consumed at 48 months and WIC status at 36 months. Children who did not receive WIC at 36 months are more likely to consume whole milk (36%) or reduced-fat milk (29%) at 48 months than are children who received WIC at 36 months (whole milk, 22%; reduced-fat 24%). Children who received WIC at 36 months are more likely (39%) to consume low-fat milk than children who did not receive WIC at 36 months (13%). This is consistent with the 2014 final rule for the contents of children's food package for WIC,

[53] The FITS 2016 cross-sectional sample includes children ages 36-47.9 months in the age 3 group. The WIC ITFPS-2 data for 48 months, shown, were collected between child ages 47.5-48.9 months.

which typically provides low fat milk[54] and aligns with the DGA recommendations (DHHS and USDA, 2015).

On a given day at both 36 months and 48 months, nearly all (97%) WIC ITFPS-2 children are consuming a meat or other protein sources.[55] The most commonly consumed types of meat at 48 months are chicken including fried chicken (56%) and hot dogs, sausages, or cold cuts (30%). Common other protein sources include cheese (39%), protein sources in mixed dishes[56] (33%), and eggs (31%). Children with African American caregivers are less likely (77%) to consume other (non-meat) protein sources than are children with White (84%) or Other race (87%) caregivers. Children with Hispanic caregivers are more likely (88%) to consume other (non-meat) protein sources than children of non-Hispanic caregivers (79%). Children with married caregivers are more likely (86%) consume other protein sources than children with married caregivers (81%).

3.5.4 Grain Consumption

Most WIC ITFPS-2 children are consuming a grain product on a given day at both 36 and 48 months (98%). The most commonly consumed types of grains are breakfast cereals, breads and rolls, crackers, pretzels, or rice cakes, rice and pasta, or grains in mixed dishes (Figure 3-7; Appendix Table B2b-2 offers additional detail). The percentage of children consuming breakfast cereals remains essentially the same between 36 months (59%) and 48 months (58%).

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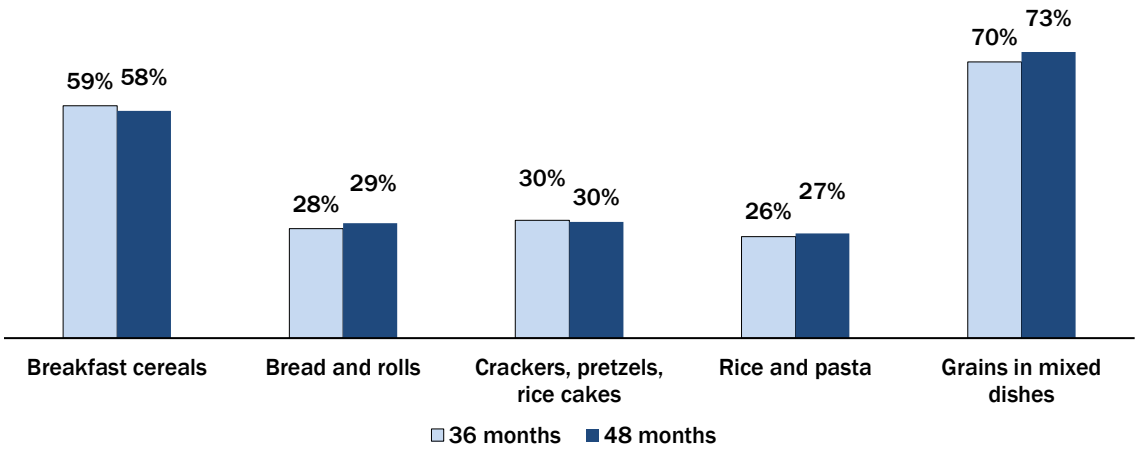
[54] *Special Supplemental Nutrition Program for Women, Infants and Children (WIC): Revisions in the WIC food packages; Final rule*, 7 CFR Part 246, Volume 79 Federal Register Number 42, Section 246.10 Supplemental Foods. March 4, 2014.

[55] Other protein sources include dried beans or peas; vegetarian meat substitutes; eggs; peanut butter, nuts, and seeds; cheese; yogurt; and, protein sources in mixed dishes such as: beans and rice, chili, and other bean mixtures; 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.

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

Figure 3-7. Percentage of study children consuming different types of grains on a given day by interview month

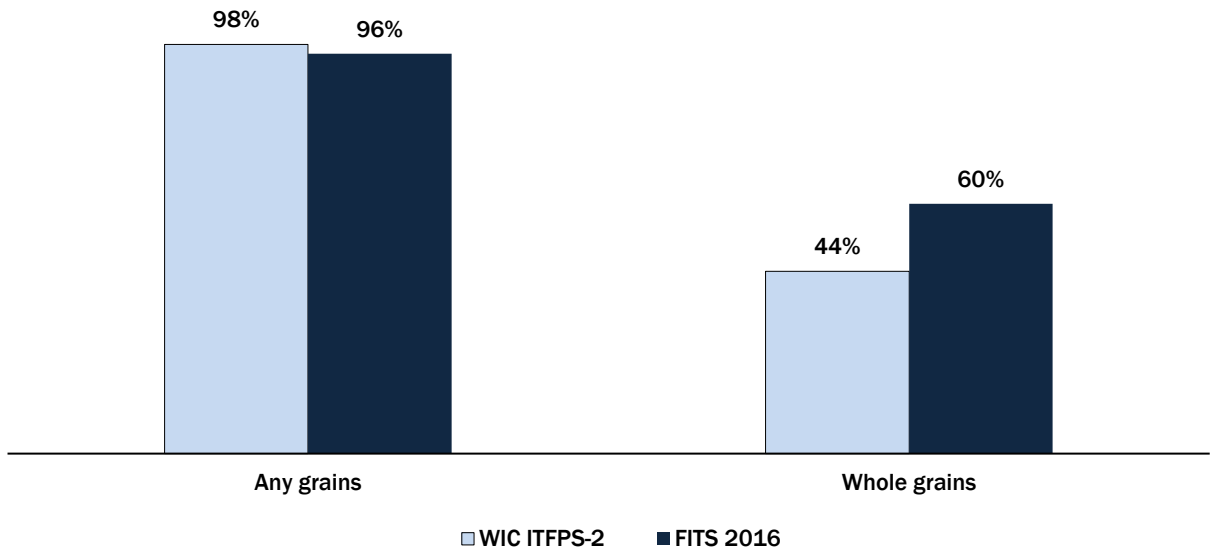


There are few key socio-demographic characteristics associated with consumption of any grains. WIC participation status at 36 months is one. Those who participated at 36 months are less likely (98%) to consume any grains than those who did not participate (99%), but the difference is very small. Examination of the underlying causes for the association reveal differences in types of foods consumed. Children who received WIC at 36 months are less likely (29%) to consume presweetened breakfast cereal than children who did not participate in WIC at 36 months (35%). Analysis of presweetened breakfast cereal consumption also reveals that children with African American caregivers are more likely (42%) to consume presweetened breakfast cereal than children with White (29%) or Other race (28%) caregivers, as are children with non-Hispanic caregivers (36%) compared to children with Hispanic caregivers (27%) and children with unmarried caregivers (34%) compared to married caregivers (28%). Noteworthy other statistically significant pairwise differences between subgroups include children in households participating in SNAP or in SNAP and other programs being more likely (25%) to consume non-whole grain breakfast cereal than children who do not participate in any other non-WIC benefit programs (16%).

Less than half (44%) of study children are consuming a whole grain on a given day at 48 months. Most are whole grain breakfast cereals (many of which are available through the WIC food package): 38 percent of study children are consuming whole grain breakfast cereals, 1 percent are consuming whole grain bread and rolls, and 7 percent are consuming whole grain salty snacks.

Comparing the WIC ITFPS-2 data at 48 months to findings from FITS 2016 (Welker et al., 2018) at ages 36 to 47.9 months, both studies show that most children consume a grain on a given day. However, 44 percent of WIC ITFPS-2 children consume a whole grain on a given day compared to 60 percent of children who participated in FITS 2016 (60%) (Figure 3-8).

Figure 3-8. Percentages of 3- and 4-year-old children any grains and whole grains on a given day in WIC ITFPS-2 and FITS 2016

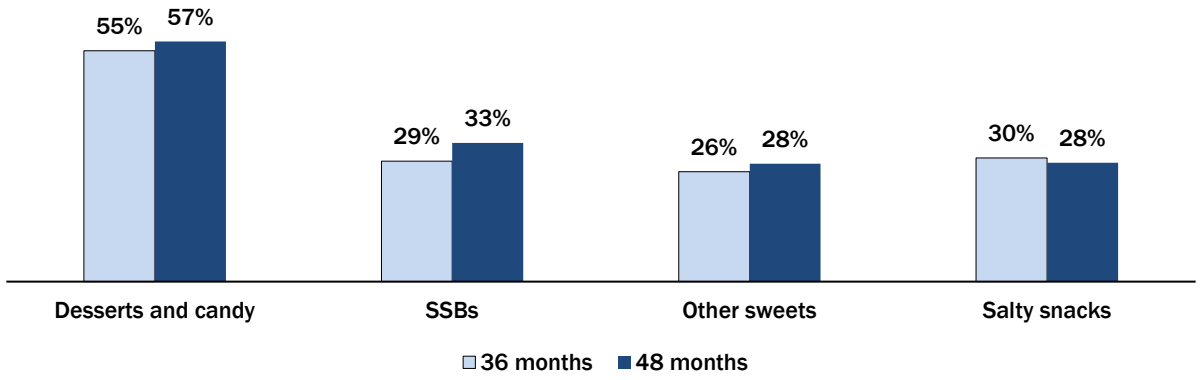


Note: The FITS 2016 cross-sectional sample includes children ages 36-47.9 months in the age 3 group. The WIC ITFPS-2 data for 48 months, shown, were collected between child ages 47.5-48.9 months.

3.5.5 Desserts and Sweets, SSBs, and Salty Snacks Consumption

Most (82%) WIC ITFPS-2 children consume some type of dessert, candy, SSB, or other sweet on a given day at 48 months. This percentage is essentially unchanged from 36 months. Additionally, consumption of most of the food subgroups within this larger group shows little change between 36 and 48 months (Figure 3-9; Appendix Table B2b-2 offers additional detail). However, the increase in SSB consumption between these time points is statistically significant.

Figure 3-9. Percentage of study children consuming desserts and candy, SSB, and salty snacks on a given day (months 36 and 48)



Note: Consistent with FITS, SSBs include all fruit drinks and ades, carbonated beverages, instant tea and coffee mixes with sweetener, and sweetened water. They exclude beverages with artificial sweetener, unsweetened tea, coffee, and water.

A majority (57%) of study children consume a dessert or candy on a given day at 48 months. Within this subgroup, cakes, pies, cookies, and pastries are the most commonly consumed dessert items (35%). Candy is the next most commonly consumed item within this subgroup (19%).

About one-third (33%) of study children consume some type of SSB on a given day at 48 months. This percentage is significantly different from the percentage at 36 months (29%). Within this subgroup, fruit flavored drinks are the most frequently (22%) consumed with carbonated soda in second place (7%).

Other sweets are consumed by more than a quarter (28%) of study children. Sugar, syrup, and preserves (27%) and milk flavorings (2%) are included in this subgroup.

Chi-square analyses yield few significant associations between key socio-demographic characteristics and consumption desserts, candy, SSBs, or other sweets at 48 months. They include race, ethnicity, and WIC participation status at 36 months. Children with African American caregivers are more likely (88%) than children with White (81%) or Other race (76%) caregivers to consume dessert, candy, SSBs, or other sweets. Children with non-Hispanic caregivers are more likely (87%) than children with Hispanic caregivers (76%) to consume these foods. In contrast, children participating

in WIC at 36 months are less likely (79%) than children who did not participate at 36 months (86%) to consume desserts, candy, SSBs, or other sweets.

At a more granular level, children with non-Hispanic caregivers are more likely (60%) to consume desserts and candy than children of Hispanic caregivers (54%). Children with caregivers of Other races are less likely (26%) than children of African American or White caregivers (38% and 34%, respectively) to consume SSBs. Children receiving WIC at 36 months are also less likely (31%) than those not receiving WIC (36%) to consume SSBs.

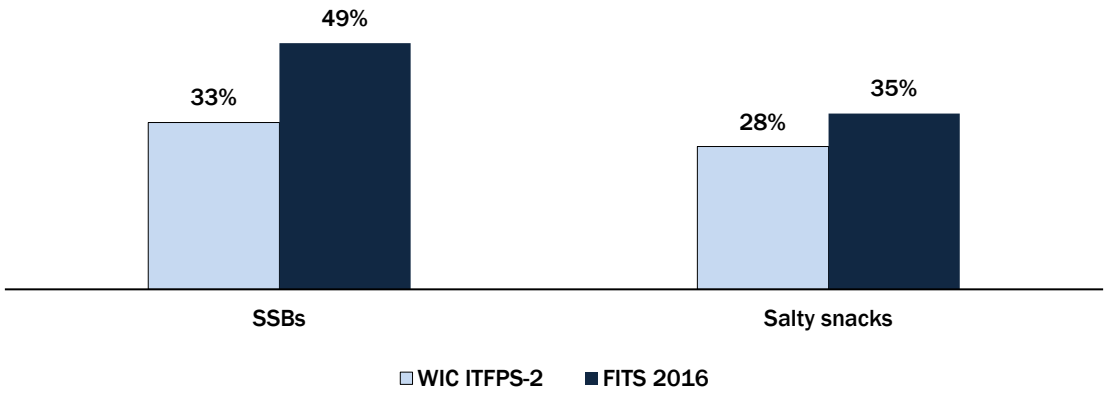
Consumption of salty snacks (e.g., potato chips, popcorn, cheese curls/puffs, tortilla chips, and other types of chips and salty snacks) remains largely unchanged between the 36- and 48-month interviews (30% and 28%, respectively).[57] Children with African American caregivers are more likely (40%) than children with White caregivers (27%) or caregivers of Other races (20%) to consume salty snacks, and children with White caregivers are more likely to consume them than children with caregivers of Other races. Children with non-Hispanic caregivers are more likely (34%) than children with Hispanic caregivers (22%) to consume salty snacks.

Comparing these findings to those for 3-year-old children in the FITS 2016 study (Welker et al., 2018), the data suggest that a lower percentage of WIC ITFPS-2 children are consuming SSBs, and to a lesser degree, salty snacks (Figure 3-10).[58] Though this may signal a trend toward fewer unhealthy choices among children receiving WIC, it is important to remember that the FITS and WIC ITFPS-2 age groups do not perfectly align.

[57] The difference is not statistically significant.

[58] The FITS 2016 data do not break out desserts and candy in a way that permits direct comparison.

Figure 3-10. Percentages of WIC ITFPS-2 4-year-old children and FITS 2016 children consuming SSBs and salty snacks on a given day



Note: The FITS 2016 cross-sectional sample includes children ages 36-47.9 months in the age 3 group. The WIC ITFPS-2 data for 48 months, shown, were collected between child ages 47.5-48.9 months

3.6 Indicators of Diet Quality at 48 Months

Knowing whether children consume foods and beverages on a given day is somewhat informative; however, consumption must be quantified 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 HEI-2015 scores can range from 0-100, with higher scores indicating better diet quality and better alignment with recommendations from the 2015-2020 DGA (Krebs-Smith, 2018).

3.6.1 Healthy Eating Index-2015 Scores

The HEI-2015 is a standard measure of diet quality for age 2 years and older that conforms to the DGA (Krebs-Smith, 2018). Using data from a 24-hour dietary recall, the HEI-2015 produces scores for 13 individual dietary components, as well as a total score. Total scores of 100 on the HEI-2015 indicate that the individual is fully meeting the DGA. In the current study, HEI-2015 scores are

calculated using usual intakes and the population ratio method (National Cancer Institute, 2017). Average HEI-2015 component and total scores for 36 and 48 months appear in Table 3-5.

Table 3-5. Average Healthy Eating Index (HEI-2015) scores for study children (months 36 and 48)

HEI component	Maximum score	Standard for maximum score[a]	36 months mean score	48 months mean score
Adequacy				
Total Fruits	5	≥0.8 cup equiv. per 1,000 kcal	4.8	4.6
Whole Fruits	5	≥0.4 cup equiv. per 1,000 kcal	4.2	3.7
Total Vegetables	5	≥1.1 cup equiv. per 1,000 kcal	2.6	2.3
Greens and Beans	5	≥0.2 cup equiv. per 1,000 kcal	1.9	1.3
Whole Grains	10	≥1.5 oz equiv. per 1,000 kcal	3.5	3.6
Dairy	10	≥1.3 cup equiv. per 1,000 kcal	9.1	8.6
Total Protein Foods	5	≥2.5 oz equiv. per 1,000 kcal	4.5	4.6
Seafood and Plant Proteins	5	≥0.8 oz equiv. per 1,000 kcal	1.6	1.0
Fatty Acids[b]	10	(PUFAs + MUFAs)/SFAs ≥2.5	2.9	3.9
Moderation				
Refined Grains	10	≤1.8 oz equiv. per 1,000 kcal	6.5	5.9
Sodium	10	≤1.1 gram per 1,000 kcal	5.0	4.8
Added Sugars	10	≤6.5% of energy	8.7	8.3
Saturated Fats	10	≤8% of energy	6.2	6.5
Total HEI-2015 score	100		61.4	58.9
Unweighted n			2,586	2,562
Weighted n			438,319	439,736

[a] Scoring criteria for HEI-2015 can be found at https://epi.grants.cancer.gov/hei/developing.html, accessed May 13, 2019.

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

The average total HEI-2015 score for study children, 58.9, 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). In other words, on average, the diet quality of WIC ITFPS-2 children is similar to that of a nationally representative sample of U.S. children.

The decrease in the average total HEI score between 36 and 48 months is mainly due to decreases in the scores for whole fruit, greens and beans, dairy, seafood and plan protein, refined grains, and added sugars, all of which decreased by 0.4 to 0.6 points. These decreases are offset by increased scores for fatty acids and saturated fat; nonetheless, the net result is a decrease in the average total HEI-2015 score of 2.5 points.

At 48 months, the average component scores that are furthest below the maximum score are those for 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 48 months (4.8 out of 10). These findings are consistent with findings from a national sample of children 2 to 5 years (Thomson et al., 2019).

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, 48-month-old males 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. Forty-eight-month-old females need 1,200 calories per day if they are sedentary, and 1,400 calories per day if they are moderately active or active. The DGA then recommends that individuals at the various calorie levels (e.g., 1,200, 1,400, and 1,600 calories) consume a specified amount of food from each food group, and these amounts are derived from the Healthy U.S.-Style Eating Pattern.[59] Table 3-6 presents the DGA recommendations for sedentary, moderately active, and active 4-year-old males and females; then Table 3-7a provides the mean and median intakes of study children at 36 and 48 months in cup- or ounce-equivalents per day. At 48 months, mean and median intakes of fruit are above the DGA range for 4 year olds. For grains, mean intake is slightly above and median intake is at the upper end of the range, and on average, 16 percent of the grains consumed were whole grains. Mean and median intake from the protein food group falls within the DGA range. Mean and median intakes of vegetables and dairy all fall below the DGA range. Because the added sugars recommendation is tied to actual caloric intake regardless of activity level, Table 3-7b presents the percentage of children meeting the DGA recommendation of less than 10 percent of calories from added sugars at 36 and 48 months, 71 percent and 54 percent, respectively, in addition to the mean and median percentages of calories from added sugars.

[59] Appendix 3 from the 2015-2020 Dietary Guidelines for Americans (https://health.gov/dietaryguidelines/2015/guidelines/appendix-3/)

Table 3-6. Recommended amounts of food from each food group at respective calorie levels for 48-month-old males and females

Food Group	Males			Females		
	Sedentary (1,200 calories per day)	Moderately Active (1,400 calories per day)	Active (1,600 calories per day)	Sedentary (1,200 calories per day	Moderately Active (1,400 calories per day)	Active (1,400 calories per day)
Vegetables	1.5 cup eq.	1.5 cup eq.	2 cup eq.	1.5 cup eq.	1.5 cup eq.	1.5 cup eq.
Fruits	1 cup eq.	1.5 cup eq.	1.5 cup eq.	1 cup eq.	1.5 cup eq.	1.5 cup eq.
Protein	3 oz. eq.	4 oz. eq.	5 oz. eq.	3 oz. eq.	4 oz. eq.	4 oz. eq.
Dairy	2.5 cup eq.	2.5 cup eq.	3 cup eq.	2.5 cup eq.	2.5 cup eq.	2.5 cup eq.
Grains	4 oz. eq.	5 oz. eq.	5 oz. eq.	4 oz. eq.	5 oz. eq.	5 oz. eq.
Whole Grains	2 oz. eq.	2.5 oz. eq.	2.5 oz. eq.	2 oz. eq.	2.5 oz. eq.	2.5 oz. eq.

Table 3-7a. Mean and median consumption by study children of DGA recommended food groups by interview month

Select food groups	36 months		48 months	
	DGA range[a]	Intake	DGA range[a]	Intake
Vegetables[b]				
Recommendation	1 - 1.5 cup eq.		1.5 - 2 cup eq.	
Mean intake (cup eq.)		0.8		0.7
Median intake (cup eq.)		0.8		0.7
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.)		1.8		1.8
Protein[b]				
Recommendation	2 - 4 oz. eq.		3 - 5 oz. eq.	
Mean intake (ounce eq.)		3.5		3.6
Median intake (ounce eq.)		3.5		3.6
Dairy				
Recommendation	2 - 2.5 cup eq.		2.5 – 3 cup eq.	
Mean intake (cup eq.)		2.1		2.0
Median intake (cup eq.)		2.1		1.9
Grains[d]				
Recommendation	3 - 5 oz. eq.		4 - 5 oz. eq.	
Mean intake (ounce eq.)		4.6		5.1
Median intake (ounce eq.)		4.5		5.0
Unweighted n[e]		2,586		2,429
Weighted n		438,319		415,186

[a] The recommended level depends on 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. On average, 16 percent of grains consumed by WIC ITFPS-2 children are from whole grains. Absolute mean and median intake of whole grains is 0.8 ounce-equivalents per day.

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

Table 3-7b. DGA recommended intake for added sugars and percentage of study children meeting the recommendation at 36 and 48 months

Food group	36 months		48 months	
	DGA standard	Intake	DGA standard	Intake
Added sugars (% total kcals)				
Percentage meeting DGA	<10% kcal	71.0%	<10% kcal	54.3%
Mean added sugar (% total kcal)		8.8		9.8
Median added sugar (% total kcal)		8.6		9.7
Unweighted n[a]		2,586		2,429
Weighted n		438,319		415,186

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

There are several socio-demographic characteristics associated with meeting the DGA recommendation for added sugars, including race, ethnicity, marital status, age of the caregiver at the child's birth, and WIC participation status at 36 months. All but marital status evidence statistically significant differences between subgroups. Children with African American caregivers are less likely (40%) to meet the recommendation than children with White caregivers (55%) or children with caregivers classified in Other races (67%), and children with White caregivers are less likely to meet the recommendation than children with caregivers of Other races. Children with non-Hispanic caregivers are less likely (47%) to meet the recommendation than children with Hispanic caregivers (63%). In contrast, children with the youngest caregivers (age 16-19 at the child's birth) are more likely (61%) to meet the recommendation than children with oldest caregivers (62%, age 26 or older at the child's birth). Those who participated in WIC at 36 months are also more likely (57%) to meet the recommendation than those that did not participate in WIC at 36 months (50%).

Table 3-8. Percentage of children receiving WIC at 42 months who report consuming WIC foods (42 months)[a]

Type of WIC food	Study mothers % (SE)
Breakfast cereal	96.9 (0.5)
Cheese	92.2 (1.3)
Eggs	95.3 (0.5)
Fruits	99.4 (0.2)
100% juice	98.1 (0.4)
Milk (including cow's milk, soy milk, or other milk)	97.0 (0.6)
Peanut butter	75.2 (2.7)
Vegetables	96.1 (0.7)
Whole grain bread or other whole grains	91.6 (1.2)
Other food[b]	39.3 (1.7)
Unweighted n	1,412
Weighted n	250,098

[a] Fifty-seven percent of study participants participate with WIC at the 42-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.

It is important to acknowledge the contribution of the WIC food package to the intake of participants who receive WIC benefits. Previous sections in this chapter detail the impact of WIC participation at 36 months on consumption of fruit, vegetable, protein sources, dairy, grains and whole grains, all of which the WIC food package provides. As shown in Table 3-8, 97 percent of caregivers of children receiving WIC at 42 months report that their child consumes the milk and 92 percent consume the cheese provided in the WIC food package. Nearly all caregivers of children receiving WIC at 42 months report that children are consuming the fruit and fruit juice (99 and 98 percent, respectively) provided in the WIC food package; 97 percent report their children consume the breakfast cereal provided by the WIC food package, and 92 percent consume the whole grain bread or other whole grains. Nearly all (96%) caregivers report that children receiving WIC at 42 months consume the vegetables provided in the WIC food package.

Among the 57 percent of study participant receiving WIC at 42 months, there are some significant associations between consuming foods available in the WIC food package and key socio-demographic factors. The following discussion focuses on percentage differences between subgroups greater than 3 percentage points. These include race, ethnicity, non-WIC benefit program participation, and parity. Children with African American caregivers are less likely (92%) to consume eggs provided in the WIC food package than children with either White (96%) or caregivers of Other races (96%). In contrast, children with Hispanic caregivers are more likely (97%) than those with non-Hispanic caregivers to consume eggs (93%). Children with Hispanic caregivers are also

more likely (94%) than children with non-Hispanic caregivers (89%) to consume a whole grain. Children with Hispanic caregivers are also significantly more likely (45%) to consume "other" (unspecified) food than children with non-Hispanic caregivers (32%). However, children with Hispanic caregivers are less likely (66%) than those who non-Hispanic caregivers (86%) to consume peanut butter. Those that do not participate in other non-WIC benefit programs are more likely (98%) than those participating in SNAP or SNAP and other programs (94%) to consume eggs. Children who are born third or subsequently are more likely (99%) to consume breakfast cereal than those born earlier (firstborn, 95%; second born, 96%).

In an attempt to assess the child's consumption of foods and beverages purchased with WIC benefits, WIC ITFPS-2 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" after each item. It is possible that the respondent did not realize that intent of the items was to assess whether the child consumed foods and beverages purchased with WIC benefits.

3.7 Relationship between Early Feeding Practices and Later Diet Quality

Between the 36-month interview and the 48-month interview, the percentage of study children meeting the DGA recommendation for added sugars fell from 71 percent to 54 percent. (Table 3-7b.) This means that at 48 months, nearly half (46%) of study children are consuming more than the recommended amount of added sugar. Most study children (82%) 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, multivariate logistic regression is used to explore the factors that increase the likelihood of WIC ITFPS-2 children meeting the DGA recommendation for added sugars at 48 months. In particular, the model examines how early feeding practices are independently associated with meeting the added sugars recommendation at age 4 years. 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 multivariate 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, and 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 multivariate logistic model uses a binary dependent variable: whether the child met the DGA recommendation for added sugars at 48 months or not. In addition to incorporating the early feeding practices mentioned, the model includes socio-demographic characteristics, and WIC and/or SNAP participation status. Table 3-9 presents the 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, changes in the likelihood of meeting the added sugars recommendation are inversely related to sugar consumption. In lay terms, an increase in the likelihood of meeting the recommendation for added sugars consumption means that the child likely consumes less added sugar; a decrease in the likelihood of meeting the recommendation means that the child likely consumes more added sugar at 48 months. All variables in the model are categorical except for the age of the mother at the child's birth and breastfeeding duration.

Table 3-9. Odds ratios and confidence intervals from multivariate logistic regression examining factors affecting the likelihood of meeting the DGA recommendation for added sugars at 48 months[a]

Covariate	Odds Ratio	95% Confidence Limit	
		Lower	Upper
Child gender: Female compared to male	0.935	0.745	1.174
Caregiver race: African American compared to White*	0.647	0.506	0.826
Caregiver race: All Other races compared to White*	1.659	1.152	2.389
Caregiver ethnicity: Hispanic compared to non-Hispanic*	1.556	1.164	2.080
Caregiver age at child's birth*[b]	0.974	0.953	0.995
Marital status: Not married compared to married	0.876	0.702	1.093
Parity: Firstborn compared to third or subsequent born	1.158	0.806	1.666
Parity: Second born compared to third or subsequent born	0.934	0.635	1.374
Breastfeeding duration[b]	1.000	0.999	1.001
Timing of SSB introduction: In child's first year compared to not introduced in first two years*	0.480	0.329	0.699
Timing of SSB introduction: In child's second year compared to not introduced in first two years*	0.627	0.414	0.949
Complementary foods introduced after four months compared to prior to four months	1.084	0.838	1.402
Age when sweet foods are introduced: Introduced in first year compared to not introduced in first two years*	0.514	0.331	0.799
Age when sweet foods are introduced: Introduced in second year compared to not introduced in first two years*	0.542	0.316	0.930
WIC & SNAP Status at 48 months: Receiving SNAP only compared to not receiving benefits from either program	1.256	0.933	1.691
WIC & SNAP status at 48 months: Receiving both WIC and SNAP compared to not receiving benefits from either program	1.152	0.889	1.493
WIC & SNAP status at 48 months: Receiving WIC only compared to not receiving benefits from either program	1.315	0.999	1.731

[a] Results are based on weighted data. Weighted n=441,621; unweighted n=2,173.

[b] Continuous variable.

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

After controlling for socio-demographic characteristics such as race, ethnicity, and age of the mother at the child's birth, model results suggest that the timing of the introduction of SSBs and the timing of the introduction to sweetened foods are independently associated with the likelihood of meeting the DGA recommendation for added sugars at 48 months. Introduction of either of these within the first 2 years of life decreases the likelihood that the DGA recommendation will be met at age 4 years. Breastfeeding duration and the timing of the introduction of complementary foods were not significant in the model.

Other significant variables include race, ethnicity, and age of the mother at the child's birth. Children with African American caregivers are less likely to meet the recommendation for added sugars at 48 months than children with White caregivers. Children with caregivers classified in the Other races

category are more likely to meet the recommendation than children with White caregivers. Similarly, children with Hispanic caregivers are more likely to meet the recommendation than children with non-Hispanic caregivers. Age of the mother at the child's birth is a continuous variable; as such, model results indicate that children of older mothers are less likely to meet the recommendation. It is not known if race, ethnicity, and age represent factors not measured in the study. The other factors in the model did not significantly affect the likelihood of meeting the DGA recommendation for added sugar at 48 months.

3.8 Summary

The consumption patterns for study children at 48 months follow the same basic trends seen in the FITS 2016 data for all children (Welker et al., 2016): the consumption rates of fruits, vegetables, grains, and cow's milk are similar across the two studies. However, on a given day, 33 percent of WIC ITFPS-2 children are consuming SSBs compared to 49 percent of FITS 2016 children, and 44 percent of WIC ITFPS-2 children are consuming whole grains compared to 60 percent of FITS 2016 children.

Fourth year WIC ITFPS-2 data suggest that the eating patterns of study children are similar to their peers nationally (Demmer et al., 2018). Like their peers, the diet quality of WIC ITFPS-2 children leaves room for improvement. The total average score on the HEI-2015 decreases from 61.4 at 36 months to 58.9 at 48 months, but consistent with 60.1 for U.S. children ages 2 to 5 years (Thomson et al., 2019). Mean and median vegetable and dairy intake is below the DGA recommended range for 48-month-olds. Furthermore, only 54 percent of study children are meeting the DGA recommendation for less than 10 percent of calories from added sugars.

These findings on food consumption and diet quality demonstrate that WIC ITFPS-2 study children are eating a variety of fruits, vegetables, dairy, and meats and proteins. The pattern of food consumed at 48 months is similar to the pattern at 36 months, although the significant increase in the percentage consuming SSBs from 29 percent to 33 percent is concerning. Introduction of SSBs and sweet foods during infancy and between 12 and 24 months of age was significantly associated with a lower likelihood of meeting the DGA recommendation for added sugar at 48 months of age. While the average diet quality of study children is consistent with other research on all U.S. children, scores indicate a need for improvement, particularly for vegetables and dairy.

4. Energy and Nutrient Intake

Key Findings

- As expected, median energy intakes of study children increase between 36 and 48 months.
- Median macronutrient intakes meet or exceed recommended levels at 48 months, and fall within acceptable levels as percentages of total daily energy intake.
- Median intakes of most micronutrients meet or exceed recommended levels at 48 months; median intakes of vitamins K and D and potassium, however, are below recommended levels. Nearly 84 percent of study children had inadequate intake of vitamin D.
- While the median intakes of calcium and vitamin E exceed recommended levels, the prevalence of inadequate intake exceeds 25 percent for both micronutrients. The prevalence of inadequate calcium intake increased from less than one percent at 36 months to 27 percent at 48 months.
- Median sodium intake exceeds the newly developed Chronic Disease Risk Reduction (CDRR) level and is 1.3 times the tolerable upper intake level.
- Multivariate regression analysis indicates that participation in the special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is independently associated with reduced, though satisfactory, total energy consumption compared to those who participate in neither WIC nor the Supplemental Nutrition Assistance Program (SNAP).

4.1 Overview

This chapter focuses on energy and nutrient intake at 48 months, the interview during which WIC Infant Toddler Feeding Practices Study - 2 (ITFPS-2) collected dietary recall data for age 4 years. Throughout the chapter, data from 36 months are included, where applicable, to provide context. Examples of research questions addressed are:

- What is the food and nutrient intake of 4-year-olds, both overall and by subgroups of interest?
- Does the nutrient intake of 4-year-olds reflect nutrients provided in the WIC food package?
- 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 ages 4 years?

4.2 Background

Children need sufficient amounts of total energy, macronutrients, and micronutrients for healthy growth and development. The nutrient intakes of groups of children at age 48 months can be

evaluated using Dietary Reference Intakes (DRIs). DRIs are nutrient standards (Institute of Medicine, 2000; National Academies of Science, Engineering, and Medicine, 2019) that can be used as a point of comparison to estimate the prevalence of inadequate or excessive intakes. The 2015-2020 Dietary Guidelines for Americans (DGA) can also be used for children age 48 months as standards for a healthy, nutritionally adequate diet (Department of Health and Human Services [DHHS] and U.S. Department of Agriculture [USDA], 2015).

4.2.1 Energy and Nutrient Intake

To examine dietary intake comprehensively, the total energy (as measured in kilocalories), macronutrient, and micronutrient contents of individuals' diets are typically estimated and, when appropriate, compared to existing standards or references. For total 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 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 fourth birthday (i.e., between 44 and 52 months of age), measurements were not obtained on the same day as the dietary recall was conducted. As such, individual-level EERs could not be determined for each study child, and comparisons between median energy intake and EERs are not appropriate for the WIC ITFPS-2 data.[60]

Comprehensive dietary evaluations also examine the macronutrient and micronutrient contents 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.

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

The National Academies of Science, Engineering and Medicine (formerly the Institute of Medicine) has established various standards, or DRIs, for essential nutrients,[61] which can be used to estimate the prevalence of inadequate or excessive intakes. Examples of these standards include Recommended Dietary Allowances (RDAs), Estimated Average Requirement (EARs), Adequate Intakes (AIs), and Tolerable Upper Intake Levels (ULs). RDAs represent levels of daily intake sufficient to meet the needs of the majority of 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. EARs can be used as a cut point for most nutrients (i.e., those that are normally distributed); 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 sizeable proportion of a group has intakes above the UL, it may be appropriate to reduce intakes (Murphy et al., 2006). In 2017, the National Academies recommended expanding the DRIs to include a new category based on chronic disease, called the Chronic Disease Risk Reduction Intakes (CDRRs). However, CDRRs have not been established for nutrients other than sodium.

In addition to DRIs, macronutrients can also be expressed as percentages of total daily energy intake. For example, when assessing daily carbohydrate intake, dietary intakes can be expressed in absolute amounts (measured in grams) or as a percentage of total energy. The latter is then compared with a range known as the Acceptable Macronutrient Distribution Range (AMDR). Like

[61] Dietary Reference Intakes for phosphorous, magnesium and fluoride (1997); Dietary Reference Intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline (1998); Dietary Reference Intakes for vitamin C, vitamin E, selenium, and carotenoids(2000); Dietary Reference Intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc (2001); Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (2002/2005); Dietary Reference Intakes for calcium and vitamin D (2011); and Dietary Reference Intakes for sodium and potassium (2019). Retrieved from http://nationalacademies.org/HMD/Activities/Nutrition/SummaryDRIs/DRI-Tables.aspx on May 1, 2019.

other DRIs, the AMDR is based on the ideal range necessary to promote health and growth while reducing chronic disease risk.

When evaluating nutrient intake of young children, it is important to consider the intake of several micronutrients that are essential for growth and development, including iron, zinc, vitamin D, calcium, sodium, and potassium. Iron and iodine deficiency are implicated in neurodevelopment (Baker & Greer, 2010; Micronutrient Initiative, 2009), and inadequate zinc intake may be associated with compromised cognitive development (Salgueiro et al., 2002), as well as growth faltering, and impaired immune and gastro-intestinal tract function (Wessells & Brown, 2012; Krebs, Miller, & Michael Hambidge, 2014). Inadequate vitamin D in childhood can cause rickets and suboptimal bone mass (Del Valle, Yaktine, Taylor, & Ross, 2011; Holick, 2006). Similarly, inadequate calcium intake contributes to decreased 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). Excessive sodium intake is associated with increased risk of cardiovascular disease and hypertension (National Academies, 2019).

4.3 Sample and Analysis Approach

4.3.1 Sample

The analyses in this chapter focus on the dietary intake interviews at 36 and 48 months. Results from recalls obtained at 36 months were previously reported (Weinfield et al., 2019); however, they are presented in this report to provide context and identify trends. Table 4-1 shows the number of respondents to these two interviews. Both the core and supplemental samples participated in these interviews. In analyses, the responses to each interview are weighted so that findings reflect the WIC population as described in Chapter 1.

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

Sample structure	36-month interview	48-month interview
Core prenatal sample	1,813	1,787
Core postnatal sample	231	235
Supplemental prenatal sample	460	445
Supplemental postnatal sample	104	105
Total	**2,608**	**2,572**

4.3.2 Analysis

The analyses in this chapter examine energy and nutrient intake at 48 months. All energy and nutrient intakes for the group of WIC ITFPS-2 children are reported as median intakes, rather than as mean intakes, to reduce the influence of extreme values in the summary statistics. Additional analyses are conducted to explore whether socio-demographic characteristics are associated with these intakes (see Section 1.4 for a list of key socio-demographic variables). Socio-demographic characteristics are typically measured at the time of the first study interview (prenatal, 1-, or 3-month interview). For characteristics that may change over time, such as food security or income poverty, socio-demographic characteristics are updated to values reported at the 36-month interview.

When possible, data are compared to FITS 2016 (Anater et al., 2018; Bailey et al., 2018), which is described in more detail in Chapter 3, Section 3.3.2. Differences between FITS 2016 and WIC ITFPS-2 in methodology, as well as limits in the availability of data on which to conduct comparative analyses, prevent making direct statistical comparisons of the studies. Consequently, comparisons in this chapter focus on the magnitude and patterns of differences between the studies, rather than statistical significance of the differences.

All post-birth 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 Multi-Pass Method (AMPM) (Raper, Perloff, Ingwersen, Steinfeldt, & Anand, 2004), as described in Chapter 1. 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. The interviewer records all information, and trained coders then code and analyze the data for nutrient content. Intakes after 11 months of age are adjusted statistically for expected day-to-day variation. 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 to use in estimating "usual" intake of energy and nutrients for all study children. Analyses in this chapter use energy and nutrient content of reported foods, beverages, and dietary supplements, and eating occasion, to describe estimated usual intake.

In this chapter, dietary recall data are compared to the various DRIs for macronutrients and micronutrients. Data from the 36 month interview are compared to the DRI standard for children ages 1 to 3 years old. Data from the 48 month interview may have been collected up to two weeks

before and four weeks after the child's fourth birthday; thus data from this interview are compared to the DRIs for 4 to 8 year olds. Data from the FITS series of studies typically use the DRIs for 1 to 3 year olds as a point of comparison given that their data was collected 36 and 47.9 months.

4.4 Energy and Nutrient Intake at 48 Months

Chapter 3 focused on foods and food groups consumed, and diet quality of WIC ITFPS-2 children. Analyses in this chapter quantify and examine energy intake, macronutrient intake, and micronutrient intake at 48 months. Data are also presented on energy and nutrient intake at 36 months to provide context.

4.4.1 Energy Intake

Data from WIC ITFPS-2 suggest that young children's median energy intakes continue to increase for both males and females as the children age (Figure 4-1). This is consistent with the increased calorie needs children experience as they grow. Between ages 36 and 48 months, the DGA recommended[62] level for median energy intake increases by 17 percent for moderately active female children, though it remains steady for moderately active male children. At 48 months, moderately active males and females have the same DGA recommended energy requirements, though energy requirements for active males are higher than that of active female children (1,600kcal/day for active males and 1,400kcal/day for active females).

[62] The DGA recommendation for moderately active children is 1200 kcal/day for female 3 year olds and 1400 kcal for male 3 year olds; and 1400 kcal/day for both female and male 4 year olds.

Figure 4-1. Study children's median energy intake by gender at 36 and 48 months

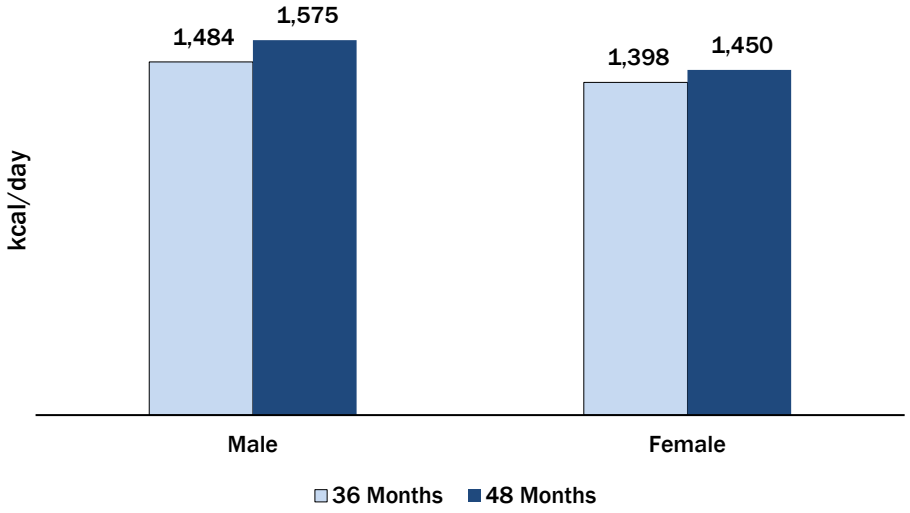


Table 4-2 presents statistically significant socio-demographic differences in median energy intake at 48 months that are consistent across both male and female children. Median energy intake differs by race, such that children of African American caregivers, as compared to children of White caregivers, are more likely to have higher energy intake. Median energy intake also differs by ethnicity, with children of Hispanic caregivers more likely to have lower energy intake levels than children of non-Hispanic caregivers. Children are also more likely to have higher energy intake if their mothers are unmarried. Median energy intake also differs by the age of the mother at the child's birth, with children whose mothers were 26 years or older at the child's birth more likely to have lower energy intake than children whose mothers were 20-25 years of age when they gave birth the child. Though not all pairwise comparisons by age of the mother at the child's birth are significantly different, the apparent pattern of declining median intake level as the age of the mother at birth rises is striking.

Table 4-2. Statistically significant socio-demographic differences in median energy intake at 48 months

Socio-demographic characteristics	Median energy intake	
	Male children	Female children
Race of mother/caregiver		
African American	1,661.1[a]	1,524.2[b]
White	1,548.2[a]	1,424.0[b]
All Other	1,516.5	1,446.8
Ethnicity of mother/caregiver		
Hispanic or Latino	1,478.2[a]	1,355.6[b]
Not Hispanic or Latino	1,645.0[a]	1,537.4[b]
Maternal/caregiver marital status at 36 months		
Married	1,495.3[a]	1,390.5[b]
Not married (including divorced and widowed)	1,636.4[a]	1,498.6[b]
Age of mother or caregiver at child's birth		
16-19 years	1,645.3	1,686.6[b,c]
20-25 years	1,620.6[a]	1,471.9[b]
26 years or older	1,516.8[a]	1,388.8[c]
Unweighted n	1,256	1,173
Weighted n	215,351	199,835

[a] For male children, the difference in the designated percentages in the socio-demographic category is statistically significant at $p \leq 0.05$.

[b] For female children, the difference in the designated percentages in the socio-demographic category is statistically significant at $p \leq 0.05$.

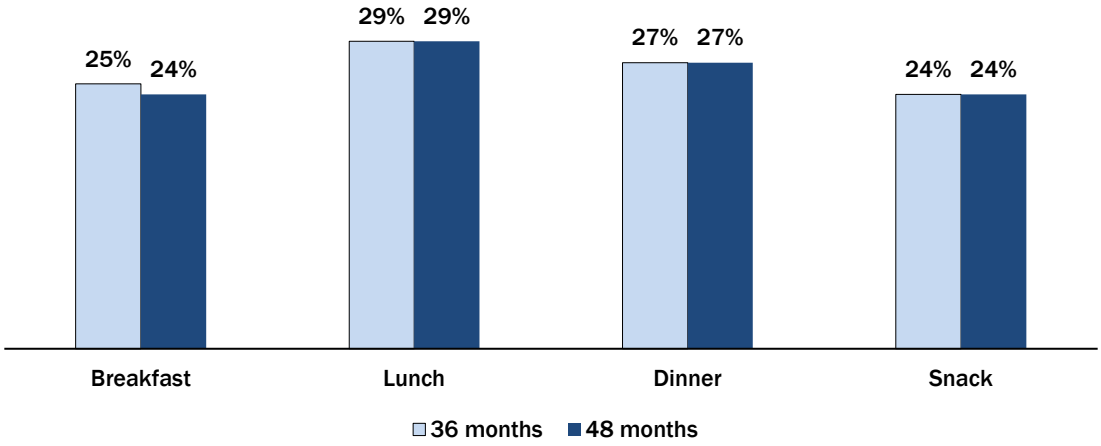
[c] For female children, the difference in the designated percentages in the socio-demographic category is statistically significant at $p \leq 0.05$.

Median energy intake of 1,512 kcal/day at 48 months among WIC ITFPS-2 children is higher than the median level reported for children ages 36 to 47.9 months in FITS 2016, which is 1,370 kcal/d (combined across child gender). According to the *Dietary Reference Intakes 2002/2005*, the recommended daily caloric intake ranges from 1,215 kcal/day for sedentary 4-year-old boys to 1,566 kcal/day for active 4-year-old boys, and from 1,133 kcal/day for sedentary 4-year-old girls to 1,475 kcal/day for active 4-year-old girls (Institute of Medicine, 2005).[63] Because no relevant measure of activity level is available for WIC ITFPS-2 children and measurements of body size on the day of the dietary intake are not available, it is not possible to compare the median energy intakes for study children to DRIs for energy.

[63] Dietary Reference Intakes (DRIs) for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (2002/2005). Based on a reference weight and height for boys of 35.7 pounds and 40.2 inches, and reference weight and height for girls of 34.8 pounds and 39.8 inches. Retrieved from https://www.nal.usda.gov/sites/default/files/fnic_uploads/energy_full_report.pdf on May 2.

Another way to examine energy intake is to look at the median percentage of daily energy intake contributed by each eating occasion (see Figure 4-2; Appendix Table B2c-1 offers additional detail). The median percentage of daily energy contributed by each eating occasion did not differ much between 36 and 48 months. Lunch contributes about 29 percent of daily energy at 36 and 48 months. Dinner contributes about 27 percent of total energy at both time points. The median percentage of energy accounted for by breakfast and snacks also remained fairly constant, with each accounting for about one-quarter (24%) of total energy intake at both 36 and 48 months.

Figure 4-2. Median percentage of total energy intake contributed by each eating occasion at 36 and 48 months



Note: The sum of the median percentages across eating occasions is not expected total 100 percent.[64]

4.4.2 Macronutrient Intake

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

At 36 and 48 months EARs are available for carbohydrate, thus the cut point method is used to estimate prevalence of inadequate intakes. The cut point method for estimating the prevalence of inadequate intakes in a group (Murphy et al., 2006) involves examining the distribution of intakes to

[64] The percentage of total energy by eating occasion = (sum of energy for foods reported at the eating occasion)/(total energy for the day)*100. The median percentage of energy intake for each eating occasion is the point at which half the WIC ITFPS-2 children fall at a lower percentage contribution of that eating occasion to total daily energy, and half fall at a higher percentage. Because of the way it is calculated, the sum of the median percentages is not expected to sum to 100 percent.

determine the proportion that falls below the EAR. At 36 months, 0.1 percent of WIC ITFPS-2 children fall below the EAR for carbohydrate. By 48 months, only 0.03 percent of the children fall below the EAR for carbohydrate. 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[65] at both 36 and 48 months, with median intake increasing slightly from 36 to 48 months (Table 4-3).

Table 4-3. Median macronutrient intake of study children compared to recommendations and to FITS 2016 (months 36 and 48)

Macronutrients	Median Intake		
	WIC ITFPS-2		FITS 2016
	36 months	48 months	36-47.9 months
Intake			
Fat (g/d)	49.2	52.9	48
AI[a]	ND	ND	*ND*
Carbohydrate (g/d)	198.6	208.6	186
EAR	100	100	*100*
Protein (g/d)	55.6	57.2	51
RDA[b]	13	19	*13*
Intake as a median percentage of energy intake[c]			
Fat	31.0%	31.3%	31%
AMDR[d]	30-40	25-35	30-40
Carbohydrate	55.3	55.3	53
AMDR[d]	45-65	45-65	45-65
Protein	15.4	15.3	15
AMDR[d]	5-20	10-30	5-20
Unweighted n	2,586	2,429	295
Weighted n	438,319	415,186	

[a] Adequate Intake. Previous WIC ITFPS-2 reports used AI as a point of comparison for children ages 0 to 12 months because there is no EAR or RDA for fat but there is an AI for this age range. As noted in this table, AI for older children has not been determined.

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

[c] Median percentages are not expected to sum to 100 percent.

[d] Acceptable Macronutrient Distribution Range, measured as calories from macronutrient as a percent of total energy

ND indicates not determined for this age.

[65] Recommended dietary allowance 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.

Estimates of the median percentage of total energy intake for dietary fat, carbohydrate, and protein are within their respective AMDRs at both 36 and 48 months. Across all three macronutrients, the median percentages of macronutrient intakes are similar to those reported in FITS 2016 (Bailey et al., 2018).); however, the intakes of WIC ITFPS-2 children at 48 months are 10 to 12 percent higher than FITS 2016 (Table 4-3).

4.4.3 Micronutrient Intake

With the exception of vitamins K and D[66] and potassium, median intake levels of WIC ITFPS-2 study children meet or exceed the AI or EAR and have low estimates of inadequate intake based on the EAR [67] at 48 months (see Table 4-4). There are no notable socio-demographic differences in meeting the DRIs.

The estimate of the prevalence of inadequate intakes for vitamin D is 83.6 percent at 48 months, rising 1.5 percentage points from the estimate of 82.1 percent inadequate intakes at 36 months. Because the study does not measure children's sun exposure, it is unclear what the actual prevalence of vitamin D deficiency is; nonetheless, food intake is not typically a sufficient source for most children (Ross, et al., 2011). The estimated prevalence of inadequate intakes for vitamin E at 48 months is 36.3 percent, rising by nearly 9.2 percentage points from the estimate of 27.1 percent at 36 months. Despite the median intake of calcium meeting the EAR, the estimate of the prevalence of inadequate intakes for calcium is 26.9 percent at 48 months, compared to less than 1 percent at 36 months.

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[66] DRIs for vitamin D are based on an assumption of minimal sun exposure (IOM 2011). Individuals with higher exposure to sunlight will have higher serum 25-hydroxyvitamin D concentrations, a marker of vitamin D status. (Ross et al., 2011).

[67] DRIs for calcium, phosphorous, magnesium, vitamin D, 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); and DRIs for calcium and vitamin d (2011). Retrieved from http://www.nationalacademies.org/hmd/~/media/Files/Activity%20Files/Nutrition/DRI-Tables/5Summary%20TableTables%2014.pdf?la=en on June 5, 2018.

Table 4-4. Median micronutrient intake of study children compared to recommendations (months 36 and 48)

Micronutrients	AI/EAR for children 1-3 years	Median intake Month 36	AI/EAR for children 4-8 years	Median intake Month 48	Percent inadequate intakes[d] Month 36	Percent inadequate intakes[d] Month 48
Antioxidants						
Vitamin C (mg/d)	13[b]	94.2	22[b]	93.6	0.0%	0.0%
Vitamin E (mg/d)	5[b]	6.0	6[b]	6.8	27.1	36.3
B vitamins						
Thiamin (mg/d)	0.4[b]	1.4	0.5[b]	1.5	0.0	0.0
Riboflavin (mg/d)	0.4[b]	2.0	0.5[b]	2.0	0.0	0.0
Niacin (mg/d)	5[b]	18.3	6[b]	20.2	0.0	0.0
Vitamin B-6 (mg/d)	0.4[b]	1.8	0.5[b]	1.9	0.0	0.0
Folate (µg/d)	120[b]	370.3	160[b]	403.2	0.0	0.0
Vitamin B-12 (µg/d)	0.7[b]	5.0	1.0[b]	5.1	0.0	0.0
Bone-related nutrients						
Calcium (mg/d)	500[b]	981.5	800[b]	944.8	0.7%	26.9%
Phosphorus (mg/d)	380[b]	1,090	405[b]	1,101	0.0	0.1
Magnesium (mg/d)	65[b]	208.8	110[b]	212.4	0.0	0.6
Vitamin D (µg/d)	10[b]	7.8	10[b]	7.6	82.1%	83.6%
Other micronutrients						
Vitamin A (µg RAE/d)	210[b]	663.3	275[b]	669.4	0.0	0.0
Vitamin K (µg/d)	30[a]	42.8	55[a]	45.1	NA	NA
Iron (mg/d)	3.0[b]	13.1	4.1[b]	14.3	0.0	0.0
Zinc (mg/d)	2.5[b]	8.9	4.0[b]	9.6	0.0	0.1
Sodium (mg/d)	800[a,d]	2,220	1,000[a,c]	2,386	NA	NA
Potassium (mg/d)	2,000[a,c]	2,125	2,300[a,c]	2,077	NA	NA
Unweighted n		2,586		2,429	2,586	2,429
Weighted n		438,319		415,186	438,319	415,186

[a] Adequate Intake (AI)

[b] Estimated Average Requirement (EAR)

[c] AIs for sodium and potassium revised in 2019; previous values for sodium were 1000 mg (ages 1-3 years) and 1200 mg (ages 4-8 years); previous values for potassium were 3000 mg (ages 1-3 years) and 3800 mg (ages 4-8 years)

[d] Prevalence of inadequate intakes is estimated as the percentage of the group falling below the EAR, NA indicates no EAR is available.

The DRIs for potassium and sodium were revised and new values released in March 2019 (Institute of Medicine, 2019). As shown in Table 4-4, the new, lower AIs for potassium result in the median intake at 36 months exceeding the new AI, and the median intake of potassium at 48 months falling roughly 10 percent below the new AI. As there are no EARs for potassium, there is no standard from which to estimate the exact prevalence of inadequate intake. When the new sodium DRIs were released, the reduction in the AI for sodium was smaller than the reduction in the potassium AI. As such, the median intake of sodium continues to exceed the AI at both 36 and 48 months. For comparison, Table 4-5 presents the 2005 and 2019 DRIs for sodium and potassium and the median intake of both nutrients by study children at 36 and 48 months. As shown in the table, the median

intake of study children at both 36 and 48 months exceeds the AI for both the 2005 and 2019 DRIs, while the median intake of potassium falls below the AI for the 2005 DRI for both 36 and 48 months, exceeds the AI for the 2019 DRI at 36 months, and provides approximately 90 percent of the AI at 48 months.

Table 4-5. Median sodium and potassium intake of study children compared to old and new DRIs (months 36 and 48)

Micro-nutrients	2005 AI for children	2005 UL for children	2019 AI for children	2019 CDRR for children	Median intake of WIC ITFPS-2 children
Children aged 1-3 years					**Month 36**
Sodium (mg/d)	1,000	1,500	800	Reduce intakes above 1200 mg/day	2,220
Potassium (mg/d)	3,000	ND	2,000	ND	2,125
Unweighted n					2,586
Weighted n					438,319
Children aged 4-8 years					**Month 48**
Sodium (mg/d)	1,200	1,900	1,000	Reduce intakes above 1500 mg/day	2,386
Potassium (mg/d)	3,800	ND	2,300	ND	2,077
Unweighted n					2,429
Weighted n					415,186

At 48 months, all other median levels of micronutrients are above the AI or EAR, and have estimates of the prevalence of inadequate intake below 1 percent. FITS 2016 children (ages 36-47.9 months) show similar levels of median intake of micronutrients (Bailey et al., 2018), although WIC ITFPS-2 children have somewhat higher median intake (relative to the EAR and AI for age) for vitamin D, and slightly lower median intakes for vitamin E and potassium. Estimates of prevalence of inadequate intakes for vitamins D and E are also similar across the two studies, though the prevalence of inadequate intakes for calcium is much greater in WIC ITFPS-2 (26.9%) compared to FITS 2016 (7.9%) (Table 4-6). This jump in inadequate intakes is primarily due to the EAR rising from 500 mg at 36 months to 800 mg at 48 months, and intakes failing to keep up with this 60 percent increase in the calcium requirement.

The 2019 release of new DRI values for sodium include the removal of an UL for sodium, and the addition of a CDRR, a level above which intake reduction is expected to reduce chronic disease risk within a healthy population (Institute of Medicine, 2019). The median intake of 2,220 mg/d of sodium by study children at 36 months is about 1.5 times the previous UL (1,500 mg/day), and

1.85 times the newly issued CDRR (1,200 mg/day). Similarly, the median intake of 2,386 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 sodium of 1,955 mg/d in the FITS 2016 data also exceeds the UL (Bailey et al., 2018).

Table 4-6. Median micronutrient intake of WIC ITFPS-2 and FITS 2016 study children compared to recommendations

Micronutrients	AI/EAR for children 4-8 years	Median intake WIC ITFPS-2 48 months	AI/EAR for children 1-3 years	Median intake FITS 2016 36-47.9 months	Percent inadequate intakes[c] WIC ITFPS-2 48 months	Percent inadequate intakes[c] FITS 2016 36-47.9 months
Antioxidants						
Vitamin C (mg/d)	22[b]	93.6	13[b]	90.0	0.0%	0.0%
Vitamin E (mg/d)	6[b]	6.8	5[b]	8.5	36.3	30
B vitamins						
Thiamin (mg/d)	0.5[b]	1.5	0.4[b]	1.3	0.0	0.2
Riboflavin (mg/d)	0.5[b]	2.0	0.4[b]	1.7	0.0	0.1
Niacin (mg/d)	6[b]	20.2	5[b]	16	0.0	0.3
Vitamin B-6 (mg/d)	0.5[b]	1.9	0.4[b]	1.7	0.0	0.1
Folate (µg/d)	160[b]	403.2	120[b]	422.0	0.0	0.2
Vitamin B-12 (µg/d)	1.0[b]	5.1	0.7[b]	5.0	0.0	0.2
Bone-related nutrients						
Calcium (mg/d)	800[b]	944.8	500[b]	845.0	26.9%	9.2
Phosphorus (mg/d)	405[b]	1,101	380[b]	943.0	0.1	0.8
Magnesium (mg/d)	110[b]	212.4	65[b]	184.0	0.6	0.6
Vitamin D (µg/d)	10[b]	7.6	10[b]	6.6	83.6	79
Other micronutrients						
Vitamin A (µg RAE/d)	275[b]	669.4	210[b]	558.0	0.0	0.8
Vitamin K (µg/d)	55[a]	45.1	30[a]	40.0	NA	NA
Iron (mg/d)	4.1[b]	14.3	3.0[b]	10.0	0.0	3.0
Zinc (mg/d)	4.0[b]	9.6	2.5[b]	8.4	0.1	0.3
Sodium (mg/d)	1,000[a,d]	2,386	800[a,d]	1,955	NA	NA
Potassium (mg/d)	2,300[a,d]	2,077	2,000[a,d]	1,751	NA	NA
Unweighted n		2,429		295	2,429	295
Weighted n		415,186			415,186	

[a] Adequate Intake (AI)

[b] Estimated Average Requirement (EAR)

[c] Prevalence of inadequate intakes is estimated as the percentage of the group falling below the EAR, NA indicates no EAR is available. For WIC ITFPS-2, the AI/EARs for 4 to 8 year olds were used as the reference when calculating prevalence of inadequate intakes. For FITS 2016, the AI/EARs for 1 to 3 year olds were used as the reference.

[d] Adequate Intake from the 2019 Dietary Reference Intakes for sodium and potassium.

Overall, at 48 months of age, most median micronutrient intakes exceed the EARs or AIs, and have low prevalence of inadequate intakes based on the EARs. Prevalence of inadequate intake of calcium and vitamins E and D increase between 36 and 48 months. Of particular concern is the rise in the prevalence of inadequate intake of calcium, increasing from less than 1 percent at 36 months to about 27 percent at 48 months. This is due, in large part, to the requirement increasing by 300 mg/d between 36 and 48 months.

Though the absence of an EAR for vitamin K prohibits estimating the prevalence of inadequate intake of this nutrient among WIC ITFPS-2 children, the increase in the requirement from 30 μg/d at age 3 to 55 μg/d at age 4, may explain why median intake at 48 months is below the AI. Potassium intake remains below the AI at 48 months, as it was at 36 months. Sodium intake continues to exceed the CDRR at 48 months, though shows a slight decrease relative to the CDRR; median intake at 36 months was 1.85 times the CDRR, but was 1.6 times the CDRR at 48 months.

4.5 Relationship Between Early Feeding Practices and Later Intakes

Bivariate analyses explored association between nutrients with median intakes that failed to meet the DRIs (vitamin D, sodium, and potassium) and early feeding practices, including breastfeeding duration, early (prior to 4 months) introduction of solid foods, and the timing of the introduction of sugar sweetened beverages (SSBs). There was one significant association between vitamin D intakes above or below the EAR and the timing of the introduction of SSBs; however, follow-up pairwise t-tests did not reveal any significant differences in percentages by timing of SSB introduction. Consequently, these relationships are not pursued in multivariate analyses.

Because excess energy intake is associated with obesity, the analysis explores the relationship between early feeding practices and total energy intake at 48 months. Using multivariate regression analysis, the work examines whether early feeding practices—breastfeeding duration, the timing of introduction of SSBs, the age when sweet foods (excluding SSBs) are introduced, and the early (prior to 4 months) introduction of solid foods—are independently associated with the level of energy consumption at 48 months. In addition to incorporating early feeding practices, the model includes socio-demographic characteristics, the caregiver's weight status at 30 months, the amount of time children spend playing outdoors in a week, and a WIC and/or SNAP participation status indicator

since WIC ITFPS-2 participants may participate in both, one, or neither of these two Federal feeding programs. Outdoor playtime is a proxy for children's activity levels. Along with body mass index (BMI), outdoor play addresses differences in children's needs for energy. Whether child's nighttime sleep duration is short of the recommended amount[68] is also included. Table 4-7 summarizes the model's findings (detailed model results are presented in Appendix Table B2c-2). The vast majority of the independent variables are categorical; however, the age of the caregiver at the child's birth, the child's BMI-for-age percentile, and breastfeeding duration are continuous measures.

Although the model only explains a small share of the variation in energy consumption at 48 months,[69] it suggests that at least one early feeding practice is associated with total energy intake at 48 months. Specifically, the introduction of SSBs in the first year of life is associated with higher total energy intake at 48 months. Breastfeeding duration, the early introduction of solid foods, and the age when sweet food are introduced are not significant in the model.

[68] Section 6.5.3 offers more information on nighttime sleep duration of WIC ITFPS-2 children. The variable used here is an indicator of whether the child's nighttime sleep duration met the minimum put forward by the American Academy of Sleep Medicine for children age 4 years, 10 hours per day. The variable does not include time spent napping.

[69] R-square=0.17.

Table 4-7. Model results[a] from regression of total energy intake at 48 months on covariates including early feeding practices

Independent variable	Effect size	*p*-value
Intercept	1,891.96	<.0001
Child gender: Female compared to male*	-103.98	0.0001
Caregiver race: African American compared to White	-14.15	0.5010
Caregiver race: All Other races compared to White	40.95	0.2839
Caregiver ethnicity: Hispanic compared to non-Hispanic*	-127.69	<.0001
Caregiver weight status at 30 months: Obese compared to normal/underweight	-30.50	0.1665
Caregiver weight status at 30 months: Overweight compared to normal/underweight	47.70	0.1024
Marital status: Not married compared to married*	98.55	<.0001
Age of caregiver at child's birth[b,*]	-10.27	<.0001
Child's BMI-for-age percentile around 4 years[b]	-0.43	0.2003
Outdoor playtime in a typical week: 14 hours or less compared to more than 14 hours*	-46.33	0.0323
Sleep duration at night: Sleeps for less than 10 hours usually compared to sleeps for at least 10 hours usually	32.92	0.1104
Breastfeeding duration[b]	-0.10	0.1931
Timing of SSB introduction: In child's first year compared to not introduced in first 2 years*	93.62	0.0047
Timing of SSB introduction: In child's second year compared to not introduced in first 2 Years	41.04	0.2594
Complementary foods introduced after 4 months compared to prior to 4 months	-20.36	0.4176
Age when sweet foods are introduced: Introduced in the first year compared to not introduced in the first 2 years	5.28	0.9059
Age when sweet foods are introduced: Introduced in the second year compared to not introduced in the first 2 years	-8.34	0.8443
WIC & SNAP status at 48 months: Receiving SNAP only compared to not receiving benefits from either program	58.91	0.1021
WIC & SNAP status at 48 months: Receiving both WIC and SNAP compared to not receiving benefits from either program	-43.82	0.1326
WIC & SNAP status at 48 months: Receiving WIC only compared to not receiving benefits from either program*	-67.85	0.0349

[a] Results are based on weighted data. Weighted n=288,022; unweighted n=1,677. R-square=0.17. Additional detail on model results is available in Appendix Table B2c-2.

[b] Continuous variable.

* Indicates significance at $p \leq 0.05$

There are several other variables, in addition to early feeding practices, that are significant in the model: gender, ethnicity, marital status, age of the caregiver at birth, outdoor playtime, and participation in WIC and/or SNAP. Model results indicate that, all else equal, female children consume less total energy than male children; children with Hispanic caregivers consume less total

energy than children with non-Hispanic caregivers; children with older caregivers consume less total energy; children who play outside more than 14 hours in a week consume less total energy than those who play outside less than 14 hours; and children in families that receive WIC only (and not SNAP) consume less total energy at 48 months than to those who receive neither WIC nor SNAP. In contrast, all else equal, children with unmarried caregivers consume more total energy than children with married caregivers.

4.6 Summary

As expected, the median energy intakes of WIC ITFPS-2 children vary by gender, and increase between 36 and 48 months. At 48 months, the gender-specific median daily energy intake of WIC ITFPS-2 children exceed and are significantly different from the recommended amounts for moderately active 4-year-olds as noted in the current DGA. Median energy intakes vary by race, ethnicity, maternal marital status, and maternal age at the child's birth, indicating that socio-demographic factors are relevant for total energy intake at this age. Multivariate regression model results confirm the independent effects of many of these factors and indicate that the timing of SSB introduction is independently associated with higher total energy intake at 48 months, while WIC only participation is associated with reduced, though satisfactory, total energy consumption compared to those who participate in neither WIC nor SNAP.

Research has found that single proxy 24-hour dietary recalls on very young children 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 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.

WIC ITFPS-2 children's median micronutrient intakes generally meet or exceed AIs or EARs during the fourth year. Intake of vitamin D continues to fall below the EAR at both 36 and 48 months. Estimates of inadequate intakes of vitamin D increase slightly between 36 and 48 months as median intake decreases. Defining vitamin D intake adequacy is an active area of research that may continue to evolve as researchers debate how best to incorporate the contribution of all sources of vitamin D including skin synthesis (Ross et al., 2011). Median vitamin E intake improves between 36 and

48 months, but the increase does not keep pace with the increased EAR, resulting in an increase in the prevalence of inadequate intakes. Potassium continues to have median intake levels below the DRIs as well, though the recently updated AI for potassium results in a smaller gap between median intake and the AI. Although the median intake of calcium exceeds the EAR, the prevalence of inadequate intakes increased from less than 1 percent at 36 months to 27 percent at 48 months. WIC ITFPS-2 children are exceeding the new CDRR for sodium, which increases between 36 and 48 months. These findings underscore the importance of continuing to educate WIC participants on appropriate sources of vitamins D, E, calcium, and potassium as children get older, including foods available in the WIC food package that are rich in these nutrients. Furthermore, nutrition messages focused on avoiding adding salt when cooking for children, and reducing intake of processed foods that contain high levels of sodium, could be prioritized.

Data on nutrient intake indicate the WIC ITFPS-2 children are having most of their nutritional needs met at 48 months. These patterns of nutrient intake follow the same trends, and are of comparable levels, to those reported in FITS 2016, suggesting that WIC ITFPS-2 children have similar intakes at 48 months to children from samples that contain both low-income and higher income children.

5. Feeding Beliefs and Practices

Key Findings

- **Roughly half of study households have their televisions on during meals at least some of the time; having the television on during meals is inversely associated with diet quality as measured by the 2015 Healthy Eating Index (HEI-2015).**
- **Study families in which the caregiver works full-time eat together as a family less frequently than families in which the caregiver does not work for pay, and there is a positive association between the number of times the family eats together and diet quality as measured by the HEI-2015.**

5.1 Overview

This chapter focuses on caregivers' beliefs and practices for child feeding. The data in this chapter are primarily drawn from the 42-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 (ITFPS-2), this chapter addresses the following research questions:[70]

- 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 child care circumstances?

5.2 Background

Studies show that there is an association between parental feeding styles and children's food intakes, particularly fruit and vegetable intakes (O'Connor et al., 2010; Vereecken, Rovner, & Maes, 2010; Bourcier, Bowen, Meischke, & Moinpour, 2003; Fisher, Mitchell, Smiciklas-Wright & Birch, 2002; Galloway, Fiorito, Lee, & Birch, 2005; Patrick, Nicklas, Hughes, & Morales, 2005). A feeding style that balances structure and flexibility appears to be the most protective against child obesity (Vollmer & Mobley, 2013). Parents who follow this kind of feeding style tend to monitor what their children eat and respond appropriately to children's signals of hunger and satiety. This feeding style aligns with responsive feeding, and supporting parents to practice responsive feeding practices has

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

resulted in improved child dietary intake and weight status (Matvienko-Sikar, 2018; Wilson et al., 2019).

Research has linked some feeding styles to risk of the child obesity (Birch & Fisher, 1998; Spruijt-Metz, Lindquist, Birch, Fisher, & Goran, 2002; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002). Less optimal feeding styles include parental behaviors such as using food to soothe a child or as a reward for desired behavior (Collins, Duncanson, & Burrows, 2014) or exerting rigid control of children's diets, such as overly pressuring children to eat (Yavuz & Selcuk, 2018) and restricting consumption of less healthy foods. These less-optimal feeding practices can result in unintended outcomes: children's reduced ability to self-regulate how much is consumed, and increased preference for less healthy over more healthy foods (Johnson & Birch, 1994; Thompson, 2010).

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 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 Style Questionnaire (IFSQ) (Thompson et al., 2009) and were asked in previous interviews (15-month, 24-month, and 30-month). The IFSQ addresses similar beliefs and behaviors to those in other child feeding questionnaires but is focused on feeding infants and young children and was developed specifically for use with low-income families.

Because WIC ITFPS-2 is interested in practices that put children at risk for obesity, the beliefs and practices selected focus primarily on those that emphasize parental control and may interfere with young children learning to self-regulate eating in response to feelings of hunger and satiety. Controlling feeding beliefs and practices can take two forms: pressuring and restricting (Thompson et al., 2009). Controlling/pressuring beliefs and practices involve pressuring the child to eat in response to cues other than hunger, such as eating all the food on a plate, eating when not hungry, or soothing a child with food. Controlling/restrictive beliefs and practices involve strictly limiting child consumption to more nutritious foods and limiting the quantity of foods a child eats.

This chapter also examines broader aspects of the child's food environment including regularly eating family meals together and limiting TV and other screens at meals. These aspects were selected because 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).

Many parents characterize their children as picky or fussy eaters. Research indicates that picky-eating is related to diet quality and body weight (Brown et al., 2018; Dubois, Farmer, Girard, & Peterson, 2007a; Dubois, Farmer, Girard, Peterson, & Tatone-Tokuda, 2007b). 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). Engaging children in food preparation may also encourage them to try new foods (Worobey, 2008).

Recent work on the relationship between diet quality and Federal food program participation suggests that exposure to WIC and the Supplemental Nutrition Assistance Program (SNAP) may have differential dietary effects (Gu & Tucker, 2017; Liu, Kuo, Jiang, Robles, & Whaley, 2017). Though mechanisms by which this occurs are not yet well articulated, one of the ways in which participation in Federal nutrition programs may influence feeding practices is by expanding a family's food resources, allowing them to offer young children unfamiliar, healthy foods that may be rejected several times.

5.3 Sample and Analysis Approach

5.3.1 Sample

The analyses in this chapter primarily use interview data from the 42-month interview, when questions related to feeding beliefs and practices are asked. Table 5-1 shows the unweighted number of respondents to that interview. Both the core and supplemental samples were eligible for the 42-month interview. Table 5-1 also includes the number of respondents to the 48-month interview, as dietary recall information from that interview is used to examine the impact of feeding beliefs and practices on diet quality as measured by HEI-2015 total scores. Both the core and supplemental samples were eligible for the 48-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	42-month interview	48-month interview	48-month interview and dietary recall
Core prenatal sample	1,837	1,787	1,780
Core postnatal sample	235	235	234
Supplemental prenatal sample	456	445	444
Supplemental postnatal sample	108	105	104
Total	**2,636**	**2,572**	**2,562**

5.3.2 Analysis

The initial focus of analyses is caregiver beliefs and practices for child feeding at 42 months. Analyses begin by exploring whether key socio-demographic subgroups of participants differ in their feeding beliefs and practices. Subsequently, the analyses explore whether there are associations between these beliefs and diet quality, as measured by HEI-2015 scores based on the 48-month dietary recall data. In addition, associations between the child's broader food environment and diet quality are examined.

Key socio-demographic characteristics used in this chapter are typically measured at the time of the first interview. However, for characteristics that may change over time, such as household food security, income relative to the Federal poverty guidelines, and WIC status, socio-demographic characteristics are updated to values reported at the 36-month interview.[71]

Analyses include descriptive analyses of outcomes of interest, bivariate chi-square tests to examine associations between key socio-demographic 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 focusing on findings that, while statistically significant, may have little practical importance.[72] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

[71] The baseline/36-month socio-demographic variables are used for subgroup analyses instead of 42-month socio-demographic variables to allow lagged influences of context on behaviors to emerge in the data. Weight status of the mother is at 30 months.

[72] 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).

5.4 Feeding Beliefs and Practices at 42 Months

Survey items involving feeding beliefs probe how strongly parents 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. For beliefs involving 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.

Items involving feeding practices probe what parents actually do, the actions that they take. Table 5-2 also includes a list of the feeding practices probed in the 42-month interview. Study mothers 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*.

Table 5-2. Interview items probing feeding beliefs and practices at 42 months

Feeding Belief Item	Pressuring (P) or Restricting (R) or Neither (N)	Author Thompson (T) or O'Connor (O)[1]
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/her favorite foods as a reward.	N	O
It is important for the child to finish all the food on his/her plate.	P	T
Response options: Whenever they want to = 1; Occasionally = 2; Never = 3		
Children should be allowed to eat fast food. [2,6]	R	T
Children should be allowed to eat sugary foods. [3,6]	R	T
Children should be allowed to eat snack foods.[4,6]	R	T
Children should be allowed to drink sugary drinks.[5,6]	R	N/A
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/her food.	P	T
I try to get {CHILD} to eat even if she/he 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/she has to try at least a couple of bits of new foods, but doesn't have to eat it all.	N	O

[1] Thompson et al., 2009 or O'Connor et al., 2010.

[2] Exact wording is "A toddler should never eat fast food."

[3] Exact wording is "A toddler should never eat sugary food like cookies."

[4] Exact wording is "A toddler should never eat junk food like chips."

[5] New development for WIC ITFPS-2; hence, the item is not applicable (N/A) for categorization.

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

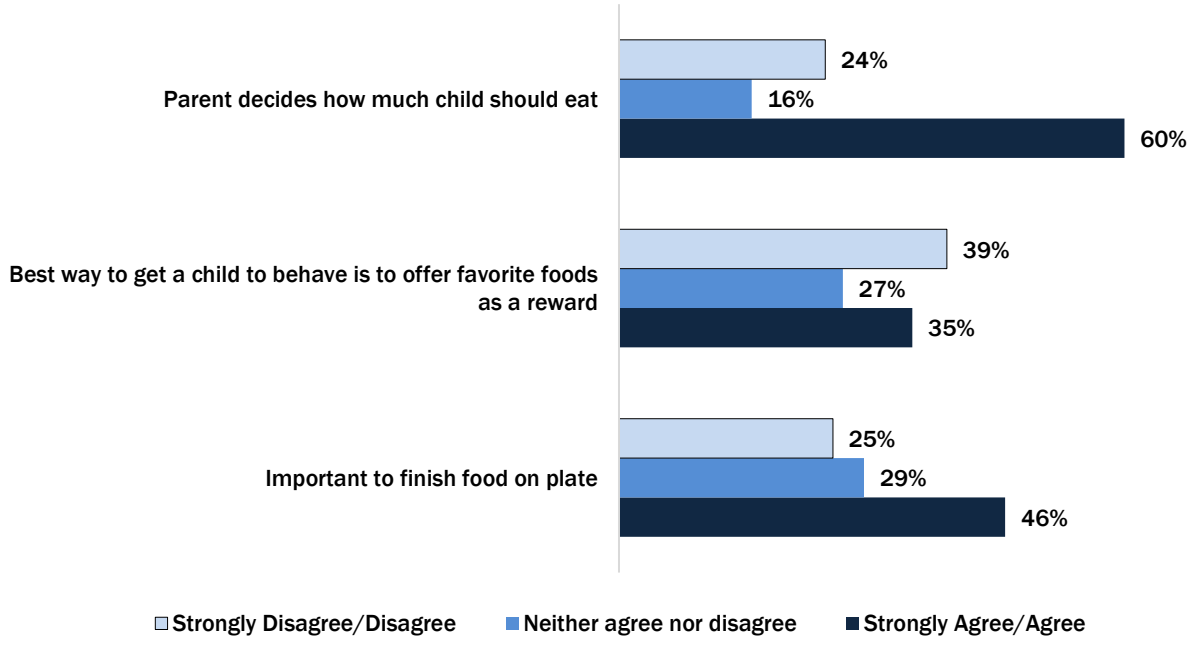
In the literature on parental feeding styles, authors use various combinations of feeding beliefs, and practices to assess parental feeding styles. Some researchers employ scales that combine beliefs and practices (Thompson et al., 2009) while others rely on individual practices to reflect parental approaches to feeding children. Because the current study explores the association between parental feeding and increased child risk for obesity, this research focuses on beliefs and practices that may be associated with restrictive or pressuring feeding practices as indicated in Table 5-2. Whether the parent's belief or practice is restrictive or pressuring may depend on her 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.

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). 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.

A majority of study mothers (60%) *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, significant percentages of study mothers hold opposing positions on using favorite food as a reward for behavior: 39 percent *strongly disagree* or *disagree* and 35 percent *strongly agree* or *agree*. Only 18 percent of mothers *strongly agree* or *agree* with all three of these belief statements (not shown).

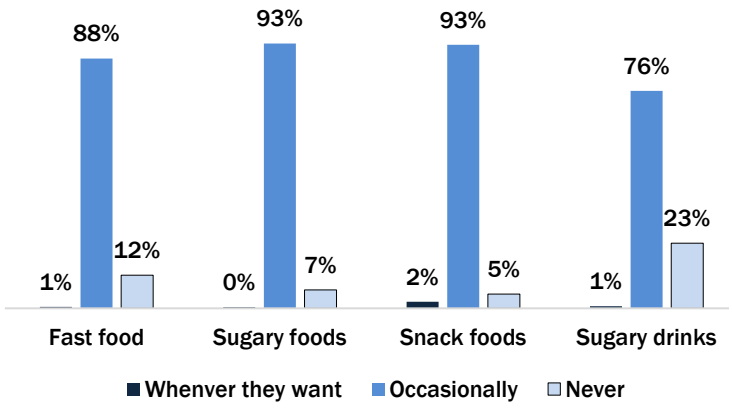
Figure 5-1. Percentage of study mothers indicating what they believe about feeding practices at 42 months



Several key socio-demographic characteristics are consistently associated with all three caregiver's beliefs about controlling feeding practices: race, ethnicity, and income poverty. Follow-up pairwise t-tests indicate that White mothers are less likely to *strongly agree* or *agree* with each of the three feeding belief statements than African American mothers. In contrast, Hispanic mothers are more likely than non-Hispanic mothers to *strongly agree* or *agree* with each of the three statements. Those with incomes in the lowest income-poverty subgroup (less than 75 percent or below the Federal poverty guidelines (FPG) are also more likely to *strongly agree* or *agree* with each of the three statements than those with incomes in the highest income-poverty subgroup (above 130% of the FPG).

A second set of feeding beliefs probed for restrictions on children's access to select unhealthy 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, 0 percent sugary foods, 2 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, 88%; sugary foods, 93%; snack foods, 93%; sugary drinks 76%).

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 42 months



There are several statistically significant bivariate associations between these beliefs and key socio-demographic characteristics. WIC participation status at 36 months is associated with the greatest number of different beliefs including whether children should be allowed to eat sugary foods, should be allowed to eat snack foods, and should be allowed to drink sugary drinks. Table 5-3 presents the percentages of caregivers by feeding beliefs significantly associated with WIC participation status at 36 months.

Table 5-3. Percentage of caregivers by feeding beliefs significantly associated with WIC participation status at 36 months

Feeding belief at 42 months	WIC status at 36 months	
	Receiving WIC % (SE)	Not receiving WIC % (SE)
Should be allowed to eat sugary foods		
Whenever they want to	0.3 (0.2)	0.5 (0.3)
Occasionally	91.8 (0.9)[a]	95.1 (0.7)[a]
Never eat sugary foods	7.9 (0.8)[b]	4.5 (0.7)[b]
Should be allowed to east snack foods		
Whenever they want to	2.6 (0.5)	2.0 (0.5)
Occasionally	90.6 (0.9)[a]	95.5 (0.7)[a]
Never eat snack foods	6.9 (0.9)[b]	2.5 (0.5)[b]
Should be allowed to drink sugary drinks		
Whenever they want to	0.7 (0.2)	0.8 (0.3)
Occasionally	73.8 (1.7)[a]	80.1 (1.6)[a]
Never drink sugary drinks	25.5 (1.8)[b]	19.2 (1.6)[b]
Unweighted n	1,486	1,147
Weighted n	259,446	181,865

[a] Difference between the percentage responding *occasionally* is statistically significant at p≤0.05 for the belief.

[b] Difference between the percentages responding *never* is statistically significant at p≤0.05 for the belief.

Follow-up pairwise t-tests indicate that study participants whose children received WIC benefits at 36 months generally hold more restrictive beliefs surrounding their children's access to unhealthy foods than their peers who did not receive benefits at 36 months. Specifically, they are less likely to state that their children should *occasionally* have access to sugary foods (92%), savory snack foods (91%), or sugary drinks (74%) and more likely to state that their children should *never* have access to these foods (8%, 7%, and 26%, respectively) than study participants who did not receive WIC at 36 months (95% sugary foods occasionally; 96% savory snack foods occasionally; 80% sugary drinks occasionally; and 5%, 3%, and 19%, respectively, indicating *never* for these three foods).

5.4.2 Feeding Practices

Questions about feeding beliefs ask parents to indicate what they think parents *should do* in 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 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 feeding practices that aim to control their children's eating (Table 5-4). Two-thirds or more of caregivers report that they *always* or *usually* try to get the child to finish his or her food (73%) or are very careful not to feed the child too much (66%). More than half (58%) of study mothers report that they carefully control how much the child eats.

Caregivers' use of practices that encourage consumption of healthy foods is somewhat inconsistent. About 70 percent indicate that they *always* or *usually* tell the child to try, at least, a couple of bites of new foods. Slightly less than two-thirds (64%) of caregivers *always* or *usually* use mealtimes to teach about healthy eating. However, only about one-third (32%) of study mothers indicate that they *always* or *usually* ask the child to help prepare food, which may reflect, in part, the young age of WIC ITFPS-2 children.

Table 5-4. Percentage of study mothers reporting how often they follow select feeding practices at 42 months[a]

Feeding Practice	Always or usually	About half the time or occasionally	Never
Keep track of what the child eats	69.7 (1.6)	27.1 (1.5)	3.2 (0.4)
Practices that control consumption			
Try to get the child to finish her/his food	72.9 (1.2)	21.9 (1.0)	5.2 (0.5)
Try to get the child to eat even if she/he does not seem hungry	32.0 (1.3)	33.5 (1.2)	34.5 (1.3)
Carefully control how much the child eats	57.7 (1.6)	23.2 (1.3)	19.1 (0.9)
Very careful not to feed child too much	66.3 (0.9)	13.6 (0.7)	20.1 (0.8)
Practices that encourage consumption of new or unfamiliar foods			
Use mealtimes to teach child about healthy eating	64.3 (1.3)	32.7 (1.3)	3.0 (0.4)
Ask child to help me prepare food	32.3 (1.2)	46.2 (1.0)	21.4 (1.3)
Tell child she/he has to try at least of couple of bites of new foods, but doesn't have to eat it all	70.1 (1.2)	25.6 (1.1)	4.4 (0.5)

[a] Unweighted n=2,632; weighted n=441,384, where n is the number of mothers who completed items CF51a-h on the 42-month interview.

Using the collapsed categories in the table, the feeding practices associated with the greatest number of key socio-demographic characteristics are trying to get the child to finish her or his food and being careful not to feed the child too much. Marital status and age of the mother at the child's birth are the only two key socio-demographic characteristics significantly associated with each of these controlling feeding practices. Follow-up pairwise t-tests indicate that unmarried caregivers are more likely (76%) than married caregivers (67%) to *usually* or *always* try to get the child to finish food. Similarly, unmarried caregivers are more likely (70%) than married caregivers (61%) to *usually* or *always* be very careful not to feed the child too much. Caregivers who were 26 years or older at the child's birth are less likely (69%) than caregiver who were 20 to 25 years of age (76%) to try to get the child to finish food, while caregivers who were 16 to 19 years of age at the child's birth are more likely (77%) than their older counterparts (68% for 20- to 25-year-olds; 63% for those age 26 or older) to be very careful not to feed the child too much.

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 socio-demographic category. However, interest also lies in whether practices and beliefs are associated with eating behaviors that may affect childhood obesity. Since diet quality has been linked to

children's adiposity (Okubo, Crozier, Harvey, Godfrey, Inskip, Cooper, Robinson, 2015), this section begins to address the interest in the relationship between feeding practices/beliefs and obesity by examining whether there are significant associations between the feeding practices/beliefs listed in Table 5-2 (above) and diet quality as measured by total HEI-2105 scores. Two different approaches are taken for this analysis. The first follows the bivariate approach and examines whether each practice is associated with the child's score being above or below the average total HEI-2015 score for WIC ITFPS-2 children.[73] The second approach is more nuanced, using linear regression to examine whether there is a relationship between the feeding practice and continuous HEI-2015 scores.

Though all practices and beliefs listed in Table 5-2 were examined, only three exhibited significant association with HEI-2015 scores: carefully controlling how much the child eats, using mealtimes to teach about eating, and asking the child help prepare food. These practices are presented in Table 5-5 along with the percentage of children above or below the average HEI-2015 total score for WIC ITFPS-2 children.

The only controlling/restrictive feeding practice associated with diet quality, as measured by HEI-2015 scores, is carefully controlling how much the child eats. Follow-up pairwise t-tests of the percentages do not find any significant differences in the likelihood of being above (or below) average HEI-2015 score by response to this item; [74] however, the more nuanced linear regression approach indicates the nature of the relationship. The coefficient from the regression of continuous HEI-2015 on this feeding practice scores is positive and significant for the group that *always* or *usually* carefully controls how much the child eats compared to the group that *never* does (p=0.003; Appendix Table B2d-3 offers additional detail). In other words, children with caregivers who regularly carefully control how much the child eats have significantly better diet quality than children with caregivers who *never* use this practice.

The other two feeding practices associated with diet quality reflect ways to encourage children to eat healthy foods. For the practice of using mealtimes to teach children about healthy eating, follow-up

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[73] Less than eight percent of WIC study children have an HEI-2015 total score of 80 or greater (including those whose scores are rounded up from values between 79.5 and 79.9). Analysis of this small group may not be meaningful. Consequently, the bivariate approach did not use 80 as a cut-off for creating groups to analyze, although a score of 80 or above is considered a healthy diet.

[74] This may reflect the conservative approach taken to correcting for multiple comparisons, Bonferroni correction.

pairwise tests do not find any significant differences in the likelihood of being above (or below) average depending on response to this item;[75] however, the linear regression approach does indicate a the nature of the relationship. The coefficient from the regression of continuous HEI-2015 scores on this feeding practice is positive and significant for the group that *always* or *usually* uses this practice compared to the group that *never* does (p=0.017; Appendix Table B2d-4 offers additional detail). In other words, children with caregivers who regularly use mealtimes to teach children about healthy eating have significantly better diet quality than children with caregivers who *never* use this practice. For the practice of asking children to help prepare food, follow-up pairwise tests, do not find any significant differences in the likelihood of being above (or below) average depending on response; [76] however, the linear regression approach indicates the nature of the relationship. The coefficients from the regression of continuous HEI-2015 scores on this feeding practice is negative and significant for the group that employs this practice *about half the time* or *occasionally* compared to the group that *never* does (p=0.020) and for the group that *always* or *usually* employs this practice compared to the group that *never* does (p=0.020; Appendix Table B2d-5 offers additional detail). In other words, children with caregivers who ask children to help prepare food have significantly worse diet quality than children with caregivers who *never* use this practice. Given that the intent of the practice is to encourage children to eat healthy foods, this latter finding may be unexpected. However, results from other research have raised questioned about the applicability of recommended practices like this in low-income populations (Power, Hughes, Goodell, et al., 2015).

[75] Ibid.

[76] Ibid.

Table 5-5. Feeding practices and beliefs significantly associated HEI-2015 total score

Feeding Practice and HEI-2015 Total Score	Always or Usually %(SE)	About half the time or Occasionally %(SE)	Never %(SE)
Carefully control how much the child eats			
Below average HEI-2015 score	47.1 (3.0)	48.6 (3.3)	57.3 (3.1)
At or above average HEI-2015 score	52.9 (3.0)	51.4 (3.3)	42.7 (3.1)
Unweighted n	1,386	556	482
Weighted n	241,216	94,316	78,594
Use mealtimes to teach about health eating			
Below average HEI-2015 score	46.8 (2.7)	53.5 (3.2)	61.7 (7.1)
At or above average HEI-2015 score	53.2 (2.7)	46.5 (3.2)	38.3 (7.1)
Unweighted n	1,532	813	84
Weighted n	269,422	133,756	12,008
Ask child to help prepare food			
Below average HEI-2015 score	52.2 (2.6)	50.6 (3.1)	42.2 (4.0)
At or above average HEI-2015 score	47.8 (2.6)	49.4 (3.1)	57.8 (4.0)
Unweighted n	818	1,113	497
Weighted n	132,590	194,720	87,776

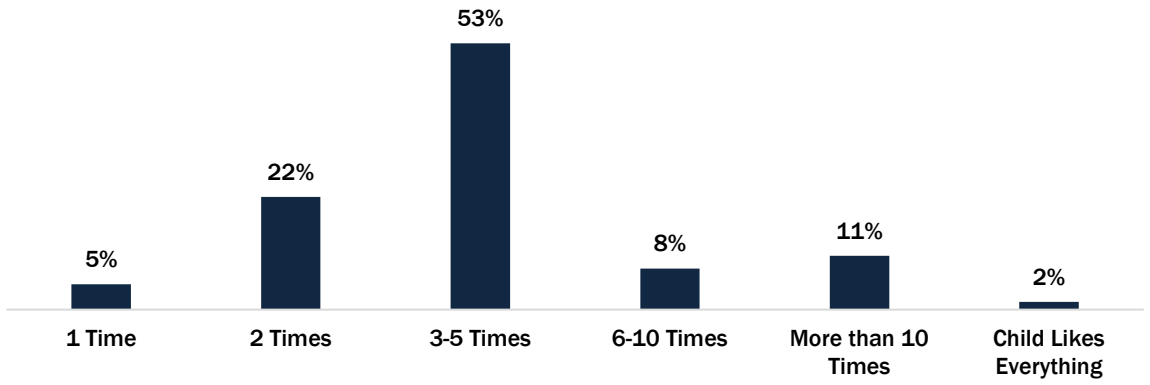
Note: Average HEI-2015 scores are based on WIC ITFPS-2 children's 48-month data.

5.5 Introducing New Foods and Picky Eating at 42 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 (Gibson & Cooke, 2017; Birch & Anzman-Frasca, 2011; Wardle et al., 2003). The 42-months 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. Fifty-three percent of caregivers report they introduce new foods three to five times before deciding the child does not like it, 8 percent introduce them six to 10 times, and 11 percent introduce them more than 10 times. Two percent of caregivers say that their children like all foods (Figure 5-3; Appendix Table B2d-6 offers additional detail).

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



Several key socio-demographic 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 characteristics of those who offer foods more than 10 times; however, this is a relatively small proportion of caregivers (11%).

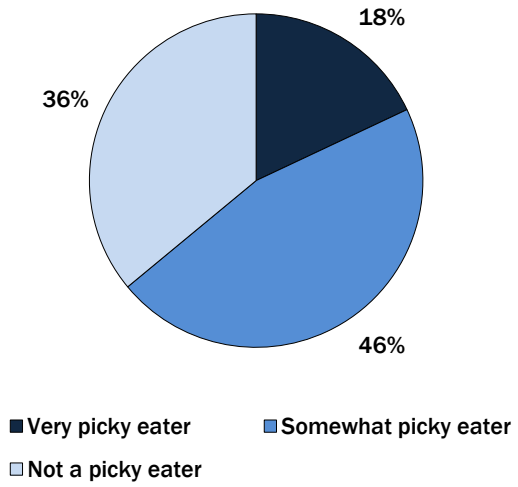
Married caregivers are more likely (15%) to offer foods more than 10 times before deciding compared to unmarried caregivers (8%). Those who do not participate in non-WIC benefit programs are more likely (15%) to offer foods more than 10 times compared to those who participate in SNAP or SNAP and other programs (7%). Those in the highest income-poverty subgroup are more likely (14%) to offer foods more than 10 times compared to those in the lowest subgroup (8%), and those who were 26 years or older at the child's birth are more likely (13%) than those who were younger (8% 20-25 years; 6% 16-19 years). In contrast, African American caregivers are less likely (5%) to offer foods more than 10 times than White (13%) caregivers or caregivers of Other races (9%).

5.5.2 Picky Eating

During the 42-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 (36%) of mothers report that their child is not a picky eater, while nearly half (46%) are somewhat picky eaters, and

18 percent are very picky eaters (Figure 5-4; Appendix Table B2d-7 offers additional detail). Results of pairwise t-tests indicate an uptick in the prevalence of very picky and somewhat picky eaters since the 30-month interview. At that interview, 14 percent of study children were considered very picky eaters, 42 percent were considered somewhat picky eaters, and 44 percent were considered not picky eaters.

Figure 5-4. Percentage of study mothers



Key socio-demographic characteristics associated with a caregiver reporting that her child is a picky eater include race, ethnicity, parity, and WIC participation status at 36 months. African American study mothers (24%) are more likely than White study mothers (17%) or study mothers of Other races (15%) to report that their children are very picky eaters. Non-Hispanic study mothers (21%) are more likely than Hispanic study mothers (15%) to report that their children are very picky eaters. Caregivers of firstborn children are more likely (22%) than caregivers of children born second (15%) to report their children are very picky eaters. In contrast, parents for whom the study child is not their firstborn child are more likely (42% second born; 40% third or subsequent born) than parents for whom the focal child is the first born (29%) to report that their children are not picky eaters. Though the difference is small, caregivers of children who received WIC benefits at 36 months are significantly more likely (38%) than caregivers of children who did not receive WIC benefits at 36 months (33%) to report that their children are not picky eaters. Hispanic study mothers are more likely (39%) than non-Hispanic study mothers (34%) to report that their children are not picky eaters, while African American study mothers are less likely (29%) than White (37%) study mothers and study mothers of Other races (41%) to report that their children are not picky eaters.

5.5.3 Associations Between Feeding Practices and Beliefs and Introduction of New Foods

The analyses here explore whether there is a relationship between feeding practices and beliefs and the number of introductions to new or unfamiliar foods. Because feeding practices and beliefs

probed in the 42-month interview are drawn from different sources and do not reflect a particular scale or feeding style, the analytical approach taken assigns numerical values to responses that range from *strongly agree* to *strongly disagree* and examines differences in mean responses by the number of times new or unfamiliar foods are offered before deciding the child does not like the food. For all but one item that is reverse coded, scoring is as follows: *strongly agree*=1, *agree*=2, *neither agree nor disagree*=3, *disagree*=4, and *strongly disagree*=5. Table 5-6 presents mean responses to feeding practice and belief items by number of introductions to an unfamiliar food before deciding a child does not like it. Though there are statistically significant differences in some means, the magnitudes of differences are small. Nonetheless, in general, those who offer more introductions to unfamiliar foods before deciding their child does not like them tend to have higher mean responses than those who introduce new foods once or twice before deciding. More specifically, those who offer more introductions to unfamiliar foods tend to disagree more often with items that Thompson et al. (2009) use to assess whether a parent has a pressuring or restrictive feeding style. Pressuring and restrictive feeding styles have been associated with unhealthy eating behaviors in children and increased risk for child overweight.

The analysis suggests that feeding practices, and beliefs are associated with the number of times new foods are offered before deciding the child does not like the food. However, the detailed nature of individual items can obscure relationships. A standard data reduction technique is to create an index of individual items that seek to measure a multifaceted construct like parental feeding.

Table 5-6. Mean responses to feeding practices and beliefs by the number of times new foods are introduced at 42 months

Feeding practices and beliefs	Number of time caregiver introduces new foods before deciding the child does not like it		
	1-2 times	3-5 times	6 or more times
Feeding practices			
I keep track of what {child} eats.	3.9	3.9	3.8
I try to get {child} to finish his/her food.	2.0[a]	2.0[b]	2.4[a,b]
I try to get {child] to eat even if she/he seems not hungry.	3.5	3.4	3.6
I carefully control how much {child} eats.	2.5[a]	2.6[b]	2.9[a,b]
I am very careful not to feed {child} too much.	2.2[a]	2.3[b]	2.8[a,b]
I use mealtimes to teach {child} about healthy eating.	2.4[a]	2.2	2.2[a]
I ask {child} to help me prepare food.	3.5[a]	3.3[b]	3.0[a,b]
I tell {child} he/she has to try at least a couple of bites of new foods, but doesn't have to eat all of it.	2.5[a,c]	2.1[c]	1.9[a]
Feeding beliefs			
It's important for a child to finish all the food on his or her plate.	2.6[d]	2.7[d]	3.1[d]
The best way to get a child to behave is to offer {his/her} favorite foods a reward for good behavior.	2.9[a]	3.1[b]	3.4[a,b]
It's important the parent decides how much a child should eat.	2.4[d]	2.6[d]	2.9[d]

[a] Difference between means for 1-2 times compared to 6 or more times is statistically significant for the practice or belief.

[b] Difference between means for 3-5 times compared to 6 or more times is statistically significant the practices or belief.

[c] Difference between means for 1-2 times compared to 3-5 times is statistically significant for the practice or belief.

[d] Each pairwise difference between means is statistically significant for the practice or belief.

Note: Responses to items are scored as follows: strongly agree=1, agree=2, neither agree nor disagree=3, disagree=4, and strongly disagree=5, except for "I keep track of what the child eats" which is reverse coded.

Using items that measure parental consistency in determining or limiting children's intake of food, the analysis creates an index that reflects the extent of parental consistency. Responses to items used in this index range from *always* to *never* on a 5-point scale. Substantial involvement in determining the child's intake is indicated by scores of 5 and negligible involvement in determining the child's intake is indicated by scores of 25. This index is the sum of the responses to the following five items:

- I keep track of what food the child eats.
- I try to get the child to finish his or her food.
- I try to get the child to eat even if she or he is not hungry.

- I carefully control how much the child eats.
- I am very careful not to feed the child too much.

Using the same data reduction approach to items that measure parental consistency in engaging children in the feeding process, the analysis creates a second index from three items:

- I use mealtimes to teach my child about healthy eating.
- I ask the child to help me prepare food.
- I tell the child he or she has to try at least a couple of bites of new foods, but does not have to eat it all.

This index ranges from 3 to 15, where 3 indicates the highest level of consistently trying to engage the child in the feeding process and 15 indicates the lowest level.

Table 5-7 presents mean scores of these two indexes by the number of times new foods are introduced. As expected from the analysis of means on individual items, the magnitude of mean differences are small. However, t-tests indicate that several differences are statistically significant. For the index measuring the consistency with which caregivers limit or determine the child's intake, the mean responses of those who offer foods six or more time (13.8) is significantly different from those who offer foods once or twice (12.3) or three to five times (12.3), with the higher mean scores indicating less consistent use of limiting practices. In other words, caregivers who are less consistent in determining children's intake, tend to offer new foods six or more times. For the index measuring the consistency with which caregivers engage child participation in the feeding process, all three mean differences are significantly different, indicating that the more frequently caregivers use encouraging beliefs, the more frequently they offer new foods before deciding that the child does not like it.

Table 5-7. Mean responses to summary measures of feeding practices by the number of times new foods are introduced at 42 months

Number of times new foods are introduced before deciding child does not like	Limiting practices Mean (SE)	Encouraging practices Mean (SE)
1-2 times	12.3 (0.2)[a]	8.3 (0.1)[c,d]
3-5 times	12.3 (0.2)[b]	7.6 (0.1)[e,d]
6 or more times	13.8 (0.3)[a,b]	7.0 (0.1)[c,e]
Unweighted n	2,565	2,580
Weighted n	431,300	434,141

[a] For limiting practices, the difference between the percentages for 1-2 and 6 or more times is statistically significant at $p \leq 0.05$.

[b] For limiting practices, the difference between the percentages for 3-5 and 6 or more times is statistically significant at $p \leq 0.05$.

[c] For encouraging practices, the difference between the percentages for 1-2 and 3-5 times is statistically significant at $p \leq 0.05$.

[d] For encouraging practices, the difference between the percentages for 1-2 and 6 or more times is statistically significant at $p \leq 0.05$.

[e] For encouraging practices, the difference between the percentages for 3-5 and 6 or more times is statistically significant at $p \leq 0.05$.

Note: Responses to items are scored as follows: strongly agree=1, agree=2, neither agree nor disagree=3, disagree=4, and strongly disagree=5. The measure for limiting practices ranges from 5 to 25, with higher scores indicating less consistent involvement; the measure for encouraging practices ranges from 3 to 15, with higher scores indicating less consistency in engagement.

5.5.4 Association Between Introduction of New Foods and Picky Eating

Research indicates that repeated exposure to foods children have previously rejected may promote acceptance (Gibson & Cooke, 2017). As mentioned above, 2 percent of caregivers report that their children like all foods at first taste. Among the 98 percent of caregivers whose children do not like all foods at first taste, there is an association between the number of introductions to new or unfamiliar foods before deciding a child does not like them and the characterization of the child as a picky eater. Table 5-8 presents the percentage of picky eaters by the number of introduction among children who do not like all foods at first taste. Caregivers who introduce foods six or more times are less likely (31%) to identify their children as picky eaters than those who introduce foods one to two times (40%). However, it is unclear whether the feeding practice pre-dates the determination that the child is a picky eater.

Table 5-8. Among children who do not like all foods at first taste, the percentage of picky eaters by the number of times new foods are introduced at 42 months

Number of times new or unfamiliar foods introduced	A very picky eater % (SE)	A somewhat picky eater % (SE)	Not a picky eater % (SE)	Unweighted n	Weighted n
1-2 times	15.1 (1.6)	45.0 (1.8)	40.0 (2.3)[a]	752	120,361
3-5 times	18.8 (1.4)	47.1 (1.6)	34.1 (1.9)	1,344	231,400
6 or more times	21.6 (2.4)	47.7 (2.9)	30.7 (2.5)[a]	484	82,593

[a] Difference between percentages is statistically significant at $p \leq 0.05$.

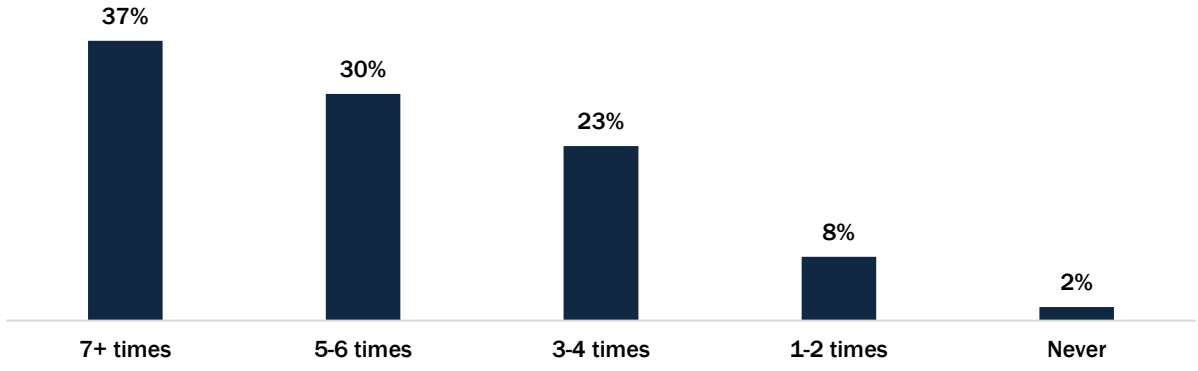
5.6 Family Feeding Practices at 42 Months

The environment in which children eat predicts better diet quality in young children. This section examines two feeding practices that the literature emphasizes: how frequently the family eats together in a typical week and how often the television in 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 42-month interview, caregivers are asked how often all or most of the family sat down together to eat a meal in the past week. Thirty-seven percent of mothers indicate that their family eats together seven or more times a week (Figure 5-5; Appendix Table B2d-8 offers additional detail). Only 2 percent of mothers report that their families never ate a meal together in the past week.

Figure 5-5. Frequency of families sitting down for meal together at 42 months



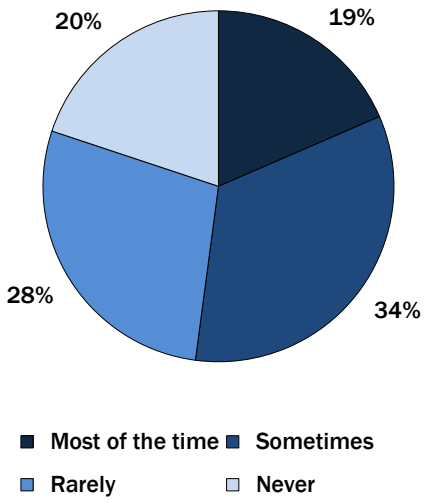
Key socio-demographic characteristics associated with the frequency of the family eating meals together include race, ethnicity, marital status, food security, and participation in non-WIC benefit programs. The discussion focuses on significant differences for eating seven or more times together. White study mothers (39%) and study mothers of Other races (41%) are more likely than African American (26%) study mothers to report sitting down for seven or more meals together. Married study mothers (43%) are also more likely than unmarried study mothers (33%) to report sitting down for seven or more meals. Subgroup differences by race, ethnicity, food security, and participation in non-WIC benefit programs were not statistically significant for eating seven or more meals together in a week.

5.6.2 Television During Meals

During the 42-month interview, study mothers are asked how often the television is on during meals (Figure 5-6; Appendix Table B2d-9 offers additional detail). When asked how often a television is on during meals, study mothers were almost evenly split between those who either *most of the time* or *sometimes* have the television on during meals (52%), and those who *rarely* or *never* have the television on during meals (48%). One-fifth of mothers report that the television is *never* on during meals. Similarly, one-fifth report that the television is on *most of the time*.

Race, ethnicity and marital status are associated with mothers' reports of having the television on most of the time during meals. Pairwise differences in subgroups who watch television *most of the time* are significant in all three key socio-demographic categories. African American study mothers (26%) are more likely to report that the television is on *most of the time* during meals as compared with White study mothers (16%) and study mothers of Other races (18%). Non-Hispanic study mothers are more likely (20%) than Hispanic study mothers (16%) to report having the television on *most of the time*.

Figure 5-6. Percentage of study mothers reporting how often the television is on during meals at 42 months



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

Unmarried study mothers (20%) are more likely than married study mothers (15%) to report that the television is on *most of the time* during meals.

5.6.3 Associations Between Working and Family Feeding Practices

The extent to which caregivers work for pay may affect feeding practices. Analyses examine whether there is an association between full-time work, part-time work, or not working for pay and feeding practices. Two feeding practices are examined—the number of times families eat together each week and how often the television is on during mealtimes. There is not a significant association between the caregiver's work status and how often the television is on during meals. There is a significant association between the caregivers' work status and how many times the family eats together during the week. Table 5-9a displays the percentage of study mothers by the number of times the family eats together.

Table 5-9a. Percentage of study mothers by the number of times their family eats together and work status at 42 months

Number of times family eats together each week	Working for pay at 42 months		
	Full-time % (SE)	Part-time % (SE)	Not at all % (SE)
7 or more times	33.7 (1.7)	36.0 (2.8)	39.8 (2.0)
5 to 6 times	27.2 (1.4)	29.5 (2.3)	31.5 (1.6)
3 to 4 times	28.3 (1.5)[a,b]	21.1 (2.1)[a]	20.2 (1.6)[b]
1 to 2 times	9.6 (1.2)	10.9 (2.3)	6.6 (0.9)
Never	1.2 (0.4)	2.6 (1.0)	2.0 (0.5)
Weighted n	909	539	1,177
Unweighted n	144,540	89,718	205,186

[a] Difference between the percentages full-time and part-time is statistically significant at $p \leq 0.05$.

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

For analysis, response options are collapsed into two ranges: zero to four times per week (includes never, one to two times, and three to four times) and five or more times (includes five to six times and seven or more times). This alternative version of the data is reported in Table 5-9b. The estimated mean number of times that families eat together in the zero to four times per week category is 2.8, and the estimated mean number of times that families eat together in the five or

more times per week is 6.6.[77] The statistically significant association between the collapsed categories of the number of times a family eats together and work status at 42 months remains. Follow-up pairwise t-tests indicate that families with caregivers working full-time are less likely (61%) to eat together five or more times per week than families with caregivers who do not work (71%) (Table 5-9b). Alternatively, families with caregivers working full-time are more likely (39%) to eat together four or fewer times per week than families with caregivers who do not work (29%).

Table 5-9b. Percentage of study mothers by the number of times their family eats together (collapsed categories) and work status at 42 months

Number of times family eats together each week	Working for pay at 42 months		
	Full time % (SE)	Part time % (SE)	Not at all % (SE)
0 to 4 times	39.1 (1.7)[a]	34.5 (3.0)	28.7 (2.0)[a]
5 or more times	60.9 (1.7)[b]	65.5 (3.0)	71.3 (2.0)[b]
Weighted n	909	539	1,177
Unweighted n	144,540	89,718	205,186

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

Because paid employment and child care are associated (i.e., working parents seek child care for their children while they are working), the study explored the association between feeding practices and child care status at 42 months. Table 5-10 presents the findings. Though there is a significant association between the number of times families eat together in a week and child care status at 42 months, follow-up pairwise tests did not find significant differences by child care subgroups.

[77] 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, and seven or more times was top-coded at 7.5 times per week.

Table 5-10. Percentage of study mothers by the number of times their family eats together (collapsed categories) and child care status at 42 months

Number of times family eats together each week	Child care status at 42 months	
	In regular child care % (SE)	Not in regular child care % (SE)
0 to 4 times	35.4 (1.7)	30.9 (1.9)
5 or more times	64.6 (1.7)	69.1 (1.9)
Weighted n	1,423	1,208
Unweighted n	228,820	212,205

5.6.4 Associations Between Family Feeding Practices and Diet Quality

Analyses examined associations between family feeding practices and diet quality, as measured by HEI-2015. Family feeding practices included the number of times that the family eats together each week and how often the television is on during mealtime. As done previously, two approaches to the analysis are undertaken: bivariate and linear regression. In the bivariate approach, diet quality is conceptualized as a categorical variable: above or below the average score for WIC ITFPS-2 children. In the linear regression approach, diet quality is measured continuously.

There is a significant association between diet quality and the number of times that the family eats together each week (Table 5-11). Families that eat together fewer times (zero to four times) are more likely (55%) to have below average HEI-2015 scores than families that eat together more frequently (five or more times, 47%). Results from linear regression analysis confirm the direction of the relationship: the coefficient from the regression of the number of times the family eats together is positive and significant for those who eat five or more times together compared to those who eat zero to four times together each week (p=0.002; Appendix Table B2d-10 offers additional detail). Though there is a significant relationship, the magnitude of the difference in scores is not large: the average HEI-2015 total score for those who eat together zero to four times is 57.9 and the average score for those who eat together five or more times is 59.3.

Table 5-11. Percentage of study mothers by the HEI-2015 scores and number of times the family eats together (collapsed categories) at 42 months

HEI-2015 score	Number of times family eats together in a week	
	0 to 4 times % (SE)	5 or more times % (SE)
Below average	55.2 (2.8)[a]	46.6 (2.9)[a]
At or above average	44.8 (2.8)[b]	53.4 (2.9)[b]
Weighted n	856	1,572
Unweighted n	134,576	280,444

[a] Difference between the percentages is statistically significant at $p \leq 0.05$ for those with below average HEI-2015 scores.

[b] Difference between the percentages is statistically significant at $p \leq 0.05$ for those with at or above average HEI-2015 scores.

There is also a significant association between diet quality and how often the family has the television on during mealtimes (Table 5-12). Follow-up pairwise t-tests indicate those who have the television on *most of the time* are more likely (57%) to have below average HEI-2015 scores than those who *never* have the television on during mealtimes (39%). Results from the linear regression of HEI-2015 on the frequency of television viewing during meals elaborate on the relationship. The coefficient for those who have television on *most of the time* compared to those who *never* have it on is negative and significant ($p<0.0001$; Appendix Table B2d-11 offers additional detail). In addition, the coefficient for those who have television on *sometimes* compared to those who *never* have it on is negative and significant ($p=0.001$).

Table 5-12. HEI-2015 total score at 48 months by TV on during meals at 42 months

HEI-2015 total score	TV on during meals			
	Most of the time % (SE)	Sometimes % (SE)	Rarely % (SE)	Never % (SE)
Below average	57.4 (3.6)[a]	50.3 (3.4)	50.3 (3.4)	39.3 (3.3)[a]
At or above average	42.6 (3.6)[b]	49.7 (3.4)	49.7 (3.4)	60.7 (3.3)[b]
Weighted n	464	823	634	508
Unweighted n	75,474	140,744	114,684	84,284

[a] Difference between percentages is statistically significant at $p \leq 0.05$ for those with below average HEI-2015 scores

[b] Difference between percentages is statistically significant $p \leq 0.05$ for those with at or above average HEI-2015 scores.

5.7 Summary

Findings show that while many study mothers agree with feeding beliefs that emphasize parental control over child food consumption, almost all study mothers report believing that children should be occasionally allowed to eat fast food, sugary foods, and savory snack foods. Moreover, WIC

ITFPS-2 mothers frequently use feeding practices aimed at encouraging their children to try new healthy foods. The prevalence of very picky eaters increases to about 18 percent at 42 months from 14 percent at 30 months; however, at 42 months, slightly more than one-third of study mothers (36%) indicate that their children are not picky eaters.

Families are eating meals together regularly, with approximately two-thirds of families eating at least five meals together during the week. However, 10 percent of families eat together less than three times in a week. Families of full-time working mothers eat together less frequently than families of nonworking mothers, and there is a negative association between diet quality and the number of times that the family eat together. About half (53%) of study mothers report that the television is on during most or some mealtimes. The frequency of television watching during meals is negatively associated with diet quality, as measured by HEI-2015 total scores.

6. Child Health, Development, and Weight

Key Findings:

- **Median outdoor weekly playtime for study children is 15.7 hours, slightly more than two hours per day on average.**
- **For most (83%) study children, screen time, as measured by watching TV or playing video games, exceeds the recommended 1 hour per day.**
- **Study children typically sleep 10.9 hours per night on average at 42 months, which meets the American Academy of Sleep Medicine (AASM) recommendation of 10 to 13 hours per day.**
- **Using Personal-Social Development Scale scores, 79 percent of study children's scores meet personal-social developmental milestones, 14 percent score in a range indicating that they may benefit from monitoring, and 7 percent score in a range indicating that they may benefit from referral for services.**
- **Around age 4 years, 61 percent of study children have a healthy weight status. Five percent of study children are underweight, 15 percent are overweight, and 18 percent are obese. The trend in average body mass index (BMI, defined as the weight in kilograms divided by height in meters squared) is consistent with a healthy, growth pattern through age 4 years.**

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 (ITFPS-2). The timeframe addressed runs from around 6 to 48 months,[78] but the emphasis is on development and growth around the time of the child's fourth birthday. 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[79]. The research questions this chapter addresses are:

- How do feeding practices impact children's weight and growth?

[78] The WIC ITFPS-2 48-month interview ended before 49 months, but data collection for children's weight and length permitted an age window from 44 to 52 months.

[79] 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.

- 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 4 years?
- Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to weight trajectories or child overweight/obesity at age 4 years?
- 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 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

Lifestyle characteristics, including physical activity, sedentary time, and sleep duration, are associated with health and developmental outcomes in children. Research finds lower BMI scores and lower risk of overweight and obesity in children who are physically active (Ansari, Pettit, and Gershoff, 2015; Chung, Skinner, Steiner, & Perrin, 2012; Trinh, Campbell, Ukoumunne, Gerner, & Wake, 2013; Basterfield et al., 2014). Many studies find an inverse association between sedentary time and body weight, BMI, and weight status (Tremblay et al., 2011). Short sleep duration is linked to risks of overweight and obesity in children (Cappuccio et al., 2008; Li, Zhang, Huang, & Chen, 2017). Longer sleep duration is associated with better diet quality and higher levels of physical activity (Khan, Chu, Kirk, & Veugelers, 2015). Sleep problems in preschoolers are linked to anxiety and depression within a couple years (Foley and Weintraub, 2017) and shorter sleep duration to poor cognitive performance (Touchette, Petit, Séguin, Boivin, Tremblay, & Montplaisir, 2007; Vriend, Davidson, Corkum, Rusak, Chambers, & McLaughlin, 2013).

Though the personal and social development of children is not part WIC's core mission, WIC staff may provide information and/or refer for services if developmental delay is suspected. The acquisition of age-appropriate personal and social skills necessary to interact productively with peers

is of particular concern because 4-year-old children may soon enter formal schooling (Ladd, Herald, & Kochel, 2006). Research finds that the ability of preschool children to engage in constructive relationships during play with peers is positively associated with school readiness (Fantuzzo & McWayne, 2002; Coolahan, Fantuzzo, Mendez, & McDermott, 2000). This chapter briefly examines the personal and social development of WIC ITFPS-2 children at age 4 years as an important ancillary outcome that WIC participation may influence.

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, two recent publications also using the NHANES data report a significant increase in obesity among 2- to 5-year-old U.S. children in 2015-2016 (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018; Hales, Fryar, Carroll, Freedman, & Ogden, 2018). This was not the finding in a census of children enrolled in WIC. An analysis of data from the WIC Participants and Program Characteristics census found a significant decrease in obesity among children ages 2 to 4 years between 2010 and 2016 (Pan, Freedman, Park, Galuska, Potter, and Blanck, 2019). Most WIC ITFPS-2 study children were turning 4 years old in 2018, when the majority of the weight and length data were collected.

6.3 Sample and Analysis Approach

6.3.1 Sample

The analyses in this chapter use interview data through the 48-month interview; however, the focus is on activities, personal-social development, and BMI around age 4 years. Table 6-1 shows the number of respondents to the 42- and 48-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.

Table 6-1. Unweighted number of respondents by interview month

Sample structure	42-month interview	48-month interview
Core prenatal sample	1,837	1,787
Core postnatal sample	235	235
Supplemental prenatal sample	456	445
Supplemental postnatal sample	108	105
Total	2,636	2,572

The study collects weight and length/height measurements of the children around five periods of time[80] through the end of the fourth year of life: 6 months, 12 months, 24 months, 36 months, and 48 months (see Table 6-2). As part of regular clinic visits, WIC sites collect these data for most enrolled participants and report the information to WIC State Agencies. Through the 24-month data, the study requests these measurements from State's WIC administrative data for study participants receiving WIC benefits. Beginning with the 36-month measurement data, the study asks the participants to have the child measured at a WIC clinic or a health care provider office and, subsequently, collects measurement records from participants. WIC administrative data is only sought for those that do not provide the record and report the study child or mother still receives WIC benefits.

Table 6-2. Unweighted number of analysis sample children[a] on whom the study received weight and length data, by source of measurement

Time period	Number received	Source of measurement		
		WIC administrative data	Health care 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

[a] The analysis sample constitutes all the cases used in analysis, n=3,777. 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 five age periods eligible for analysis: early infancy, late infancy, toddlerhood, third year, and fourth year. *Early infancy* ranges from 1 to less than 7 months; *late infancy* ranges from 7 through 15 months; *toddlerhood* ranges from 20 through 28 months; *third year* ranges

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

from 32 through 40 months; and ***fourth year*** ranges from 44 through 52 months. Table 6-3 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 and fourth year ranges are sometimes referred to as at age 3 years and at age 4 years, respectively.

Table 6-3. Number of study children with weight and length or height measurement data used for analysis by age group

Age period	Unweighted n	Weighted n
Early infancy (1 to <7 months)	2,014	349,824
Late infancy (7 to 15 months)	2,442	420,357
Toddlerhood (20 to 28 months)	1,731	442,713
Third year (32 to 40 months)	1,886	442,544
Fourth year (44 to 52 months)	2,115	442,085

6.3.2 Growth Standards

The Centers for Disease Control and Prevention (CDC) puts forward growth charts consisting of a series of percentile curves illustrating the distribution of BMI-for-age in the U.S. population.[81] Age- and sex-specific BMI-for-age percentiles (henceforth 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), allowing practitioners to rank the BMI-for-age of a child by indicating the percentage of the reference population the individual would equal or exceed.

Using the gender-specific CDC growth chart, children are classified as underweight if their BMI percentile less than the level at the 5th percentile, normal/healthy weight if their BMI percentile is between the 5th and 85th percentile, overweight if their BMI percentile is between 85th and 95th percentile, and obese if their BMI equals or exceeds the level at the 95th percentile.[82] The resulting BMI-for-age categories (henceforth, BMI categories) are those put forward by the CDC (CDC, 2018).

[81] CDC homepage, retrieved from https://www.cdc.gov/growthcharts/index.htm on May 1, 2019.

[82] 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.

In analysis of trends in children's BMI over time, the focus is on development over time. The CDC recommends using growth charts put forward by the World Health Organization (WHO) for children less than 24 months. For children 24 months of age and older, the CDC recommends using CDC growth reference charts to monitor growth of children in the United States. The analyses in this report follows these CDC recommendations.

6.3.3 Personal-Social Development Scale Scores

The study analyzes children's personal and social development at 42 months using items from the *Ages & Stages Questionnaires (ASQ-3™): A Parent Completed Child Monitoring System, Third Edition*. The ASQ-3 comprises a set of questionnaires that can identify infants or young children who may be at risk of developmental delay. The questionnaires cover five areas of development, one of which is personal-social development. Cut-off scores and ranges for monitoring zones are offered to allow screeners to determine whether the child is in need of further assessment or needs monitoring.

Items used to evaluate personal-social development at 42 months[83] include the following:

- When the child is looking in a mirror and you ask, "Who is in the mirror?" does the child say either "me" or his/her own name?
- Does the child put on a coat, jacket, or shirt by himself/herself?
- When you ask the child, "Are you a girl or a boy?" Does the child answer correctly?
- Does the child take turns by waiting while another child or adult takes a turn?
- Does the child serve himself/herself, taking food from one container to another using utensils? For example, does the child use a large spoon to scoop applesauce from a jar into a bowl?
- Does the child wash his/her hands using soap and water and dry off with a towel without help?

Each question has three response options: "Yes, regularly;" "Yes, sometimes," and "No, not yet." For scoring, a response of "Yes, regularly" receives 10 points; a response of "Yes, sometimes" receives 5 points; and a response of "No, not yet" receives 0 points. Responses to each question are weighted equally when aggregated to form Personal-Social Development Scale scores; thus, the

[83] The 42-month ASQ can be administered any times between 30 months and 0 days and 44 months and 30 days of age.

range is from 0 to 60. Total scores at or below 31.12 indicate that children may need a referral for further evaluation. Children may need monitoring if scores are between 31.12 and 41.25. Development is typical if scores are above 41.25.[84]

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 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 indicates that for the most part, English and Spanish items function similarly for young children in both languages [Squires, Twombly, Bricker, & Potter, 2009, p. 21]."

6.3.4 Analysis

Analyses begin by presenting the percentage of mothers who report that their children have a long-term medical condition that affects how their child eats. Subsequent analyses explore physical activity, sedentary time, and sleep patterns of study children at 42 months, as these activities are commonly understood to affect children's development. Bivariate analyses focus on whether these activities in the fourth year are associated with the key socio-demographic characteristics used in this study (see Section 1.4 for a list of key socio-demographic variables). Key socio-demographic characteristics are typically measured at the time of the first interview. However, for ones that that may change over time, such as food security or income poverty or WIC status, key socio-demographic characteristics are updated to status at the 36-month interview.[85]

After establishing activity and sleep patterns, the analyses move to examine personal-social development and BMI outcomes. For analysis of personal-social development, study children's composite scale scores are categorized according to whether they fall within the ranges that indicate the child may benefit from a referral for further evaluation, need monitoring to ensure appropriate development, or development is typical. Analyses subsequently explore the bivariate relationship between the distribution of categorized scores and the key socio-demographic characteristics. For BMI analyses, study children's weight and growth outcomes are categorized into the underweight,

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[84] The cut-off points were derived by subtracting to standard deviations from the mean score from testing. Two standard deviations was selected in order to minimize the percentages of children overidentified and underidentified.

[85] Weight status of the mother is at 30 months.

normal/healthy, overweight, and obese groups using BMI percentiles by gender and the CDC categorization scheme. Analyses, then, explore the relationship between interview responses that indicate or measure behaviors and BMI categories.

Chi-square tests of association are used to examine whether behaviors are associated with BMI categories. If a significant association is found, typically, two-tailed t-tests are used to determine which pairwise subgroup differences are statistically significant. For items reflecting feeding practices and beliefs that have Likert-type scale response options, median differences are examined to explore bivariate relationships. This bivariate approach lays the groundwork for more nuanced multivariate analyses. Subgroup differences discussed in the chapter are limited to those that are large in magnitude,[86] to avoid focusing on findings that, while statistically significant, may have little practical importance. Statistical significance, when indicated, is at the level of $p \leq 0.05$.

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 interests. The prevalence of these conditions within the WIC ITFPS-2 population is limited. At 42 months, study mothers reported 114 (unweighted) children with health conditions that affect their eating. When weighted, these cases represent 4 percent of the study population. Health conditions reported are too diverse to meaningfully categorize. However, there is a statistically significant association between reporting a health condition that affects eating and the caregiver's ethnicity: 3 percent of Hispanic or Latino caregivers report children with conditions that affect eating and 5 percent of non-Hispanic caregiver's report children with these conditions. Given the small magnitude and single association with a key socio-demographic variable, the prevalence of health conditions that affect eating has a very limited influence on results reported in this chapter.

[86] 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).

6.5 Physical Activity, Sedentary Time, and Sleep at 42 Months

The study examines children's physical activity, sedentary time, and sleep patterns. The data used for analyses of physical activity are caregiver reports of the child's usual amount of outdoor playtime. Reports of children's screen time, watching television or playing video games, underlie analysis of usual amounts of sedentary time. The data used for analysis of sleep duration are parental report of the time that the child usually goes to sleep at night and the time that the child usually wakes in the morning.[87]

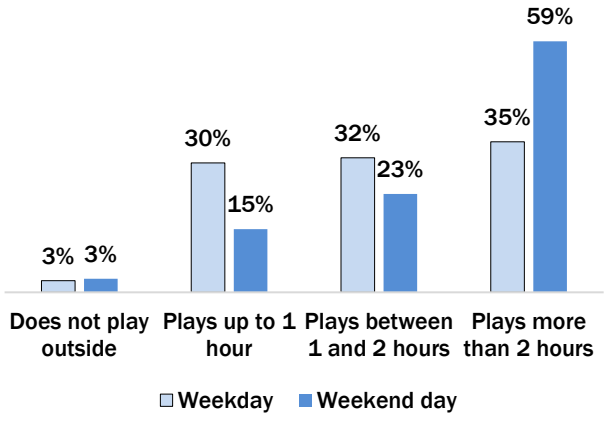
6.5.1 Physical Activity and Outdoor Playtime

Physical activity is important for children's optimal health and development. The U.S. Department of Health and Human Services Physical Activity Guidelines 2nd edition advocates using three hours a day of physical activity as a reasonable target for children ages 3 to 5 years (U.S. Department of Health and Human Services, 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 significantly, 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 parental report of outdoor playtime to explore the physical activity of study children.

[87] The times are not adjusted for the number of times that the child wakes during the night nor are nap times considered, as the latter are not reported.

The analyses of outdoor playtime begin by looking at daily playtime on weekdays and weekend days (See Figure 6-1; Appendix Table B2e-1 offers additional detail); however, for exploring significant correlations between outdoor playtime and key socio-demographic variables, weekly playtime is used as it better reflects the overall trend in physical activity. Marino, Fletcher, Whitaker, & Anderson (2015) found that 37.5 percent of children in the Head Start program played outside at home more than 2 hours per weekday. The findings from this study are similar. About 35 percent of study children play outside more than 2 hours per weekday and 59 percent play outside more than 2 hours per weekend day.[88] For study children, median outdoor play time is 1.9 hours on weekdays and 2.9 hours on weekend days. The findings suggest that for the median or typical study child, 63 percent of the recommended amount of total daily physical activity is met by outdoor playtime on weekdays and nearly all (97%) 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.

Figure 6-1. Percentage of study children by parental report of typical outdoor playtime, weekday and weekend day



Analysis of playtime over the course of a week reveals that about 54 percent of study children play outdoors more than 14 hours per week, i.e., more than 2 hour per day. Median outdoor playtime in a week is 15.7 hours or slightly more than 2 hours per day on average. Bivariate analysis of weekly outdoor playtime and key socio-demographic variables indicates there is a statistically significant association between weekly outdoor playtime of more than 14 hours per week and race, and timing of WIC enrollment. Table 6-4 presents the percentage of children who play outdoors more than 14 hours per week by the significantly associated key socio-demographic characteristics.

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

Table 6-4. Percentage of study children who play outside by select key socio-demographic characteristics

Key socio-demographic characteristic	Plays outdoors more than 14 hours per week % (SE)	Unweighted n	Weighted n
Race			
African American or Black	44.6 (2.5)[a,b]	758	97,196
White	57.9 (1.6)[a]*	1,471	257,578
Other	53.8 (3.3)[b]	406	86,920
Timing of WIC enrollment			
1st Trimester	55.8 (2.4)[c]	853	138,168
2nd Trimester	60.9 (2.4)[d]	1,058	176,831
3rd Trimester	49.1 (2.2)[e]	387	68,171
Postnatal	35.9 (3.7)[c,d,e]	337	58,524

[a] There is a statistically significant difference at p≤0.05 between the percentages of African American and White caregivers.

[b] There is a statistically significant difference at p≤0.05 between the percentages of African American caregivers and caregivers of Other races.

[c] There is a statistically significant difference at p≤0.05 between the percentages of who enrolled in their 1st trimester and who enrolled postnatally.

[d] There is a statistically significant difference at p≤0.05 between the percentages of who enrolled in their 2st trimester and who enrolled postnatally.

[e] There is a statistically significant difference at p≤0.05 between the percentages of who enrolled in their 3rd trimester and who enrolled postnatally.

Children with African American caregivers are less likely (45%) to play outdoors more than 14 hours per week than children with White (58%) or caregivers classified in all Other races (54%). Children of those who enrolled postnatally are less likely (36%) to play outside more than 14 hours in a typical week than to those who enrolled prenatally, regardless of trimester (1st trimester, 56%; 2nd trimester 61%; 3rd trimester 49%).

Additional bivariate analyses exploring associations between outdoor play at 4 years and early feeding practices including breastfeeding duration, early introduction of complementary foods, the timing of (SSB) introduction, and participation in Federal food programs did not find significant associations.

6.5.2 Sedentary Time and Screen Time

This study examined sedentary time by inquiring about the time children spend watching television and playing video games. 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.[89] On a weekly basis, only 26 percent of study children comply with this recommendation, spending up to 7 hours per week viewing television or playing video games. The vast majority (74%) spend more than 7 hours per week watching television and playing video games. Only 2 percent of study children do not spend any time watching television or playing video games. Median weekly screen time is 12.8 hours per week, which exceed the recommendation by about 1.8 times. Bivariate analyses of sedentary time and the key socio-demographic variables indicate that more than 7 hours of screen time per week is significantly associated with race, ethnicity, participation in non-WIC benefit programs, timing of WIC enrollment, and income poverty. Table 6-5 presents the percentage of children by the significantly associated key socio-demographic characteristics.

Children with African American or Black caregivers are more likely (84%) to spend more than 7 hours per week watching TV or playing video games than children with White (70%) caregiver or caregivers of Other races (74%). Children with non-Hispanic caregivers are more likely (77%) to have screen time exceed 7 hours per week than children with Hispanic caregivers (71%). Pairwise testing also indicates that children in families with income in the middle income-poverty subgroup (between 75% and 130% of the Federal poverty guidelines (FPG)) are less likely (71%) than children in families with income in the highest income-poverty subgroup (above 130% of the FPG, 78%) to spend more than 7 hours per week in front of TV or video game screens.

[89] AAP recommends no more than 1 hour per day of screen time for children ages 2-5. Retrieved from https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/American-Academy-of-Pediatrics-Announces-New-Recommendations-for-Childrens-Media-Use.aspx on May 1, 2019.

Table 6-5. Percentage of study children with more than 7 hours per week of screen time by select key socio-demographic characteristics

Key socio-demographic characteristic	More than 7 hours per week of screen time % (SE)	Unweighted n	Weighted n
Race			
African American or Black	84.0 (1.2)[a,b]	758	9,196
White	70.4 (1.6)[a]	1,471	257,578
Other	74.2 (2.9)[b]	406	86,920
Ethnicity			
Hispanic or Latino	71.3 (1.7)[c]	992	203,311
Not Hispanic or Latino	76.6 (1.4)[c]	1,643	238,383
Income Poverty			
75% of poverty guideline	74.8 (1.7)	1,146	192,015
Above 75% but not more than 130% of poverty guideline	70.9 (1.9)[d]	847	145,710
Above 130% of poverty guideline	77.5 (1.7)[d]	642	103,968

[a] There is a statistically significant difference at p≤0.05 between the percentages of children with African American and White caregivers.

[b] There is a statistically significant difference at p≤0.05 between the percentages of children with African American caregivers and caregivers classified in the Other racial category.

[c] There is a statistically significant difference at p≤0.05 between the percentages of children with Hispanic and non-Hispanic caregivers.

[d] There is a statistically significant difference at p≤0.05 between the percentages of children in families with income above 75% but not more than 130% of the poverty guideline and children in families with income above 130% of the poverty guideline.

Additional bivariate analyses exploring the association between screen time at 4 years and early feeding practices including breastfeeding duration, early introduction of complementary foods, the timing of SSB introduction, and participation in federal food programs did not find significant associations.

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.[90] The AAP endorses this recommendation.[91] The average number of hours that WIC ITFPS-2 study children sleep each night is 10.9 hours (median 10.8 hours). Being at the lower end of the recommended range may reflect, in

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

[91] American Academy of Pediatrics. (2016). Retrieved from https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/American-Academy-of-Pediatrics-Supports-Childhood-Sleep-Guidelines.aspx on May 1, 2019.

part, the fact that the study does not collect information on naps. Whether a study child usually sleeps less or more than 10 hours per night is significantly associated with race and WIC status at 36 months. Table 6-6 presents the percentage of study children who usually sleep at least 10 hours per night by these significantly associated key socio-demographic characteristics.

Table 6-6. Percentage of study children who usually sleep at least 10 hours per night by select key socio-demographic characteristics

Key socio-demographic characteristic	Typically sleeps at least 10 hours per night % (SE)	Unweighted n	Weighted n
Race			
African American or Black	79.6 (2.1)[a]	752	96,586
White	86.7 (1.2)[a]	1,467	256,850
Other	85.2 (1.7)	405	86,735
WIC participation status at 36 months			
Receives WIC	86.8 (1.2)[b]	1,478	258,473
Does not receive WIC	82.1 (1.7)[b]	1,146	181,699

[a] There is a statistically significant difference at p≤0.05 between the percentages of children with African American and White caregivers.

[b] There is a statistically significant difference at p≤0.05 between the percentages receiving and not receiving WIC at 36 months.

Children with African American or Black caregivers are less likely (80%) to sleep at least 10 hours per night than children with White caregivers (87%). Those who participated in WIC at 36 months are more likely (87%) than those who did not participate in at 36 months (82%) to sleep at least 10 hours a night.

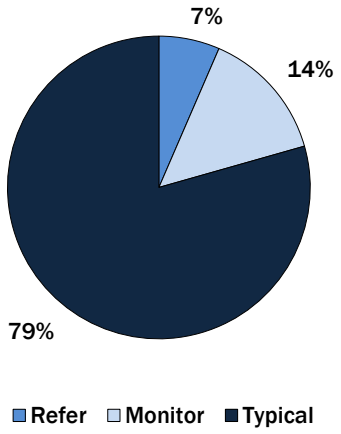
Additional bivariate analyses exploring associations between sleep patterns at 4 years and early feeding practices including breastfeeding duration, early introduction of complementary foods, the timing of SSB introduction, and participation in federal food programs did not find significant associations.

6.6 Personal and Social Developmental Milestones

The study analyzes children's personal and social development using items from the ASQ (see section 6.3.3. for questions). Items are individually scored and aggregated to form a total score. Total scores indicate that personal-social development is typical if scores are above 41.25.

Monitoring is recommended if scores are between 31.12 and 41.25. Children may need a referral for further evaluation if the total score is at or below 31.12. Figure 6-2 presents the distribution of study children's scores using these three categories: typical, monitor, and refer (Appendix Table B2e-2 offers additional detail). Seventy-nine percent of children score within the range indicating typical development. Fourteen percent have scores indicating that they may need monitoring to ensure that development is appropriate. Seven percent have scores indicating that they may benefit from a referral for further evaluation. The study does not ask respondents whether their child is being monitored or whether they received a referral for further evaluation.

Figure 6-2. Distribution of study children by Personal-Social Development Scale score categories



Bivariate analyses examined the association between scale scores and key socio-demographic characteristics using categorized scores. Table 6-7 presents the percentage of children in each scale score category by the significantly associated key socio-demographic characteristics.

Table 6-7. Percentage of study children by Personal-Social Development Scale score categories and by select key socio-demographic characteristics

Key socio-demographic characteristic	Personal-Social Development Scale score range			Unweighted n	Weighted n
	Refer % (SE)	Monitor % (SE)	Typical % (SE)		
Ethnicity					
Hispanic or Latino	7.3 (0.9)	16.9 (1.0)[a]	75.8 (1.4)[b]	992	203,311
Not Hispanic or Latino	5.8 (0.8)	11.7 (1.0)[a]	82.4 (1.1)[b]	1,642	238,346
Marital status					
Married	7.7 (1.1)	11.1 (1.1)[c]	81.3 (1.6)	987	170,086
Not married	5.8 (0.7)	16.0 (1.0)[c]	78.2 (1.1)	1,647	271,571
WIC participation status at 36 months					
Receives WIC	8.2 (0.8)[d]	14.1 (1.0)	77.7 (1.3)[e]	1,486	259,745
Does not receive WIC	4.1 (0.6)[d]	14.2 (1.4)	81.7 (1.3)[e]	1,148	181,912

[a] There is a statistically significant difference at p≤0.05 between the percentages of children with Hispanic and non-Hispanic caregivers in the range associated with a need for monitoring.

[b] There is a statistically significant difference at p≤0.05 between the percentages of children with Hispanic and non-Hispanic caregivers in the range associated with typical development.

[c] There is a statistically significant difference at p≤0.05 between the percentages of children with married and unmarried caregivers in the range associated with a need for monitoring.

[d] There is a statistically significant difference at p≤0.05 between the percentages receiving and not receiving WIC in the range associated with a need for referral.

[e] There is a statistically significant difference at p≤0.05 between the percentages receiving and not receiving WIC in the range associated with a typical development.

Follow-up pairwise tests indicate that children with Hispanic caregivers are more likely (17%) to score within the monitor range and are less likely (76%) to score in typical development range than children with non-Hispanic caregivers (12% and 82%, respectively). Children with married caregivers are less likely (11%) to score in the monitor range than children with unmarried caregivers (16%). There are also significant differences by WIC participation status at 36 months. Children receiving WIC at 36 months are more likely (8%) to score within the referral range and are less likely (78%) to score within the range indicating typical development than their peers who did not receive WIC at 36 months (4% and 82%, respectively).

Additional bivariate analyses exploring whether children's Personal-Social Development Scale score categories are associated with participation in other benefit programs, including Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), National School Lunch Program (NSLP), and Medicaid, did not find significant associations.

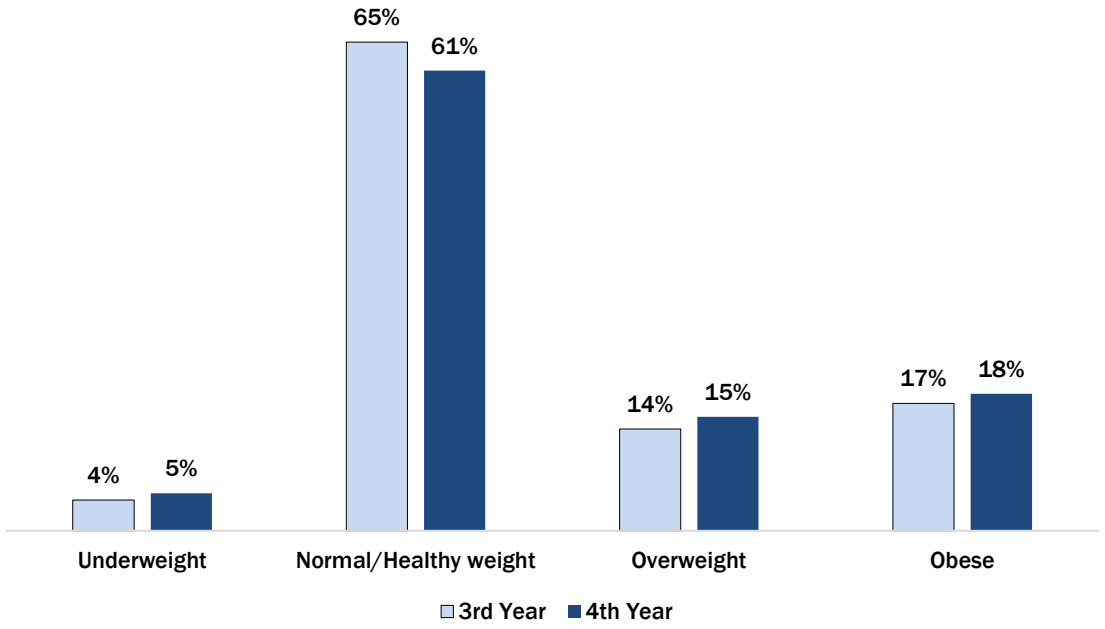
6.7 BMI at Age 4 Years

6.7.1 BMI Distributions

Figure 6-3 presents the percentage distribution of study children by third and fourth year BMI categories (Appendix Table B2e-3 offers additional details). Around age 4, 61 percent of study children have BMI percentiles in the normal/healthy weight status category. Five percent are in the underweight group. About 15 percent of study children are overweight. Eighteen percent of study children are in the obese category.

Among 4-year-olds, the percentages of study children categorized as overweight (15%) or obese (18%) is very similar to the percentages found among 3-year-olds. The association between BMI categories and age is not statistically significant.

Figure 6-3. Percentage of study children by BMI-for-age categories around ages 3 and 4 years



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

The finding for WIC ITFPS-2 4-year-olds are in line with findings from other research. Estimates from the 2015-2016 NHANES for the entire U.S. population of 2- to 5-year old children indicate that 12 percent have BMIs in the overweight range, and 14 percent have BMIs in the obese range (Skinner 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 the WIC ITFPS-2 ones. A recent analysis of WIC Participant and Program Characteristics (PC) data from 2010-2016 indicates that among children receiving WIC in 2016, the overall prevalence of overweight (excluding obesity) at age 4 years was about 15.9 percent, the overall prevalence of obesity was about 15.8 percent (Pan, Freedman, Park, Galuska, Potter, and Blanck, 2019). Differences between the WIC populations covered, timing of the data collections, and estimation methodology account for some of the differences between WIC ITFPS-2 and WIC PC estimates.

Though most obese children in the United States do not live below 130 percent of the poverty level, research has found an inverse relationship between the prevalence obesity and income in the United States (Rogers et. al, 2015; Ogden, Lamb, Carroll, & Flegal, 2010). Given that about 76 percent of the study sample had a household income below 130 percent of the poverty level, it is not surprising that a higher percentage of WIC ITFPS-2 children are overweight or obese than a nationally representative group of 2- to 5-year-old children.

6.7.2 Characteristics Associated With Child BMI Category at Age 4 Years

Key Socio-Demographic Characteristics Associated with BMI Category

Chi-square analyses exploring associations between fourth year BMI categories and key socio-demographic characteristics yield few statistically significant results. Only maternal BMI weight status group at the 30-month interview is significantly associated with the child's BMI category at age 4 years (see Table 6-8). Follow-up pairwise t-tests indicate that normal or underweight mothers are more likely (71%) than overweight (57%) or obese (56%) mothers to have children with healthy BMIs. Normal or underweight mothers are less likely (12%) than overweight (20%) or obese (23%) mothers to have obese children.

Table 6-8. Percentage of study children in BMI-for-age categories by maternal BMI at 30 months

Maternal BMI percentile group at 30 months	Child's BMI category around age 4 years				Unweighted n	Weighted n
	Underweight % (SE)	Normal/ Healthy weight % (SE)	Overweight % (SE)	Obese % (SE)		
Normal or Underweight	4.3 (0.7)	71.2 (2.1)[a,b]	12.9 (1.7)	11.5 (1.5)[c,d]	683	149,144
Overweight	4.7 (0.9)	57.0 (2.7)[a]	18.3 (2.3)	19.9 (1.9)[c]	637	134,651
Obese	6.0 (1.4)	55.9 (2.7)[b]	14.7 (1.4)	23.3 (1.8)[d]	795	158,290

[a] There is a statistically significant difference at p≤0.05 between the percentages of normal/healthy weight children with normal/healthy weight mothers and those with overweight mothers.

[b] There is a statistically significant difference at p≤0.05 between the percentages of normal/healthy weight children with normal/healthy weight mothers and those with obese mothers.

[c] There is a statistically significant difference at p≤0.05 between the percentages of obese children with normal/healthy weight mothers and those with overweight mothers.

[d] There is a statistically significant difference at p≤0.05 between the percentages of obese children with normal/healthy weight mothers and those with obese mothers.

Lifestyle Characteristics Associated with BMI Category

The bivariate chi-square analyses explored several other characteristics that previous research suggests may be associated with BMI categories. These included characteristics of the child's lifestyle and dietary intake, early feeding practices, and participation in other Federal programs. Table 6-9 presents the list of additional characteristics explored. For the bivariate analyses all continuous variables are conceptualized as categorical variables. For example, children's energy intake is first categorized according to whether the child is in top quartile of consumption given the child's gender and then the association with BMI categories explored. None of the variables explored in this manner were significantly associated with BMI categories.

Table 6-9. Summary of additional bivariate analyses of BMI-for-age weight status categories

Characteristic	Significant association with weight status around age 4 years	
	Yes	No
Characteristics of the child's lifestyle and dietary intake during the fourth year		
Health condition that affects eating (Yes/No)		✓
Sleep duration at night less than 10 hours		✓
Weekly outdoor playtime greater/less than 7 hours		✓
Healthy Eating Index (HEI) total score above/below mean		✓
Energy consumption top quartile (Yes/No)		✓
Early feeding practices		
Breastfeeding duration (never, less than 3 months, between 3 and 6 months, between 6 and 12 months, more than 12 months)		✓
Solid foods introduced prior to four months		✓
Timing of sugar sweetened beverage introduction (in first year, in second year, not introduced in first two years)		✓
Non-WIC program participation at 36 months		
Supplemental Nutrition Assistance Program (SNAP) receipt (Yes/No)		✓
Temporary Assistance for Needy Families (TANF) receipt (Yes/No)		✓
National School Lunch Program (NSLP) participation (Yes/No)		✓
Medicaid receipt (Yes/No)		✓

Feeding Beliefs and Practices Associated with BMI Category

As detailed in Chapter 5, the 42-month instrument probes a variety of feeding beliefs and practices that reflect different feeding styles. These styles have been associated with unhealthy eating patterns in children and increased risk of child overweight. This section explores whether the items probed (see Table 5-2) are associated with fourth year BMI categories.[92]

One set of feeding beliefs probe how frequently parents control children's behavior and consumption during meal and snack time (Thompson et al., 2009). These beliefs include whether parents should offer food as a reward, whether it is important for parents to decide how much children eat, and whether it is important for children to finish all the food on their plates. Study mothers are asked to rate the extent to which they agree or disagree with these beliefs on a 5-point scale, ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). Differences in the median values are analyzed. The bivariate focus in on the relationship between the median responses to feeding beliefs

[92] Feeding beliefs and practices were asked at the 42-month interview. Fourth year BMI was measured during a window between 44-52 months.

and BMI outcomes. Of the three beliefs examined, there is a single significant difference in median responses, and it is small in magnitude. The typical caregiver with a normal/healthy weight child agrees less strongly (median=1.8) than the typical caregiver with an overweight child (median=1.7) with the statement that it is important for a parent to decide how much a child should eat, but, again, the difference is small.

The analyses also explored the relationship between feeding practices or rules and BMI categories at age 4 years:

- Keeping track of what the child eats;
- 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;
- Carefully controlling how much the child eats;
- Being very careful not to feed the child too much;
- Using mealtimes to teach about healthy eating;
- Asking the child to help prepare foods; and
- Telling the child to try, at least, a couple bits of new foods.

Study mothers are asked to indicate how often they implement these practices using a five point scale, ranging from 1 (*Always*) to 5 (*Never*). Median responses are analyzed. There are several significant differences in medians but all are small in magnitude, 0.05 or less; thus, not practically meaningful (see Section 1.8.1 for more detail). In general, median scores for caregivers of normal/healthy weight children are slightly less restrictive (i.e., higher median) than score for caregivers of obese children when it comes to keeping track of what the child eats and carefully controlling how much the child eats. Additionally, caregivers of normal/healthy weight children are less restrictive than mothers of overweight or obese children when it comes to being very careful not to feed the child too much. Mothers of normal/healthy weight children are more consistently encouraging (i.e., lower median) than caregivers of overweight children when it comes to telling the child to try, at least a couple of bites of new foods. Caregivers of obese children are also more consistently encouraging in this practice than caregivers of overweight children. Finally, mothers of obese, overweight, and normal/healthy weight children are less consistently instructive (i.e., higher

median) than mothers of underweight children when it comes to using mealtimes to teach about healthy eating. All median scores are less than 2, however, indicating median responses for all groups that fall between *Always* (1) and *Usually* (2), and therefore limiting the practical implications of the differences. Also, these findings should be interpreted with some caution as it is possible that child weight status predate the practices.

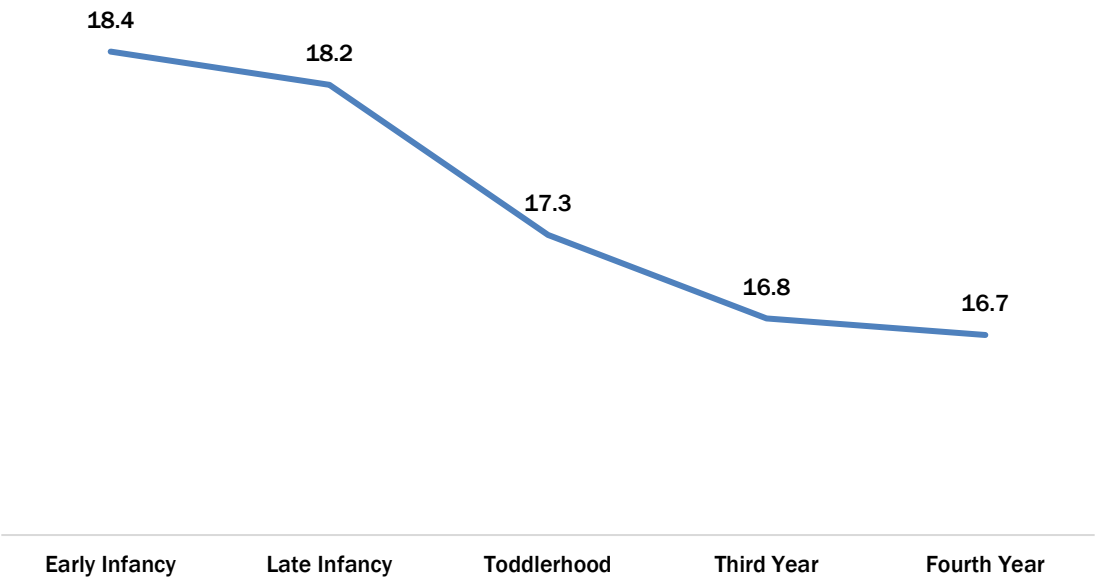
In summary, there are few statistically significant bivariate associations between children's BMI categories at 4 years and the key socio-demographic or behavioral variables used in this study. Maternal BMI category at 30 months is significantly associated with child BMI category at age 4 years, and median responses on a few parental beliefs and practices differ slightly.

6.8 Change in BMI Over Time

WIC ITFPS-2 collects height and weight information from study children as they age. Figure 6-4 presents the change in average BMI level for study children over time. On average, children's BMI continue to decline from toddlerhood through the fourth year. This downward trend is consistent with a healthy growth pattern. An adiposity rebound—where BMI levels off and subsequently —increases—is expected sometime between ages 3 years and 8 years. Early adiposity rebound has been associated with increased risk of later obesity (Rolland-Cachera, Deheeger, Bellisle, Guilloud-Bataille, & Patois, 1984; Whitaker, Pepe, Wright, Seidel, & Dietz, 1998).

Caution should be used when interpreting these findings. Each time period listed on Figure 6-4 spans multiple months. Moreover, measurements prior to age 2 years use the World Health Organization (WHO) growth charts (which are based on weight and *length*), and measurements from age 2 years onward use the CDC growth charts (which are based on weight and *height*). Because measures were taken at WIC clinics and doctors' offices during the transition from age 2 to 3 years when height instead of length is used, it is not clear if the length or height measures were taken consistently. Though the CDC recommends using WHO growth charts prior to age 2 years, it is important to acknowledge this potential inconsistency when examining the BMI pattern.

Figure 6-4. Study children's average BMI level over time



6.9 Summary

This chapter looks at development and growth outcomes in the fourth year. The typical WIC ITFPS-2 study child is playing outdoors about 2 hours per day and meeting sleep recommendations for his or her age group. The typical study child has more than the recommended about of screen time and exhibits social and personal skills that are appropriate for his or her age.

At age 4 years, 61 percent of study children fall into the normal/healthy range of BMI percentiles, few (5%) fall into the underweight range. About one-third, however, have BMI percentiles above the normal/healthy range, with 15 percent in the overweight range, and 18 percent in the obese range. Though the distribution is similar to the previous year's, the high rates of overweight and obesity at age 4 years are concerning. They appear in line but somewhat higher than rates seen for preschool-aged children in both in the national population and in WIC-specific research (Nobari, Whaley, Prelip, Crespi, & Wang, 2018; Skinner et al., 2018; Pan et al., 2019); however, those findings span a wider age range of children and the data used are not current through 2018.

There are few statistically significant bivariate associations between socio-demographic or behavioral characteristics and child BMI category at age 4 years. Maternal BMI category at 30 months is

significantly associated with child BMI category, perhaps speaking to a genetic component of child BMI (Kelly, Murrin, Viljoen, O'Brien, & Kelleher, 2014). Mothers of overweight and obese children tend to have modestly more restrictive feeding practices than mothers of normal/healthy weight children. Though 42-month feeding beliefs are measured temporally before fourth-year height and weight measures, it is not possible to ascertain direction of effect: these feeding styles may either contribute to, or result from, the child's weight status.

In bivariate analyses including various characteristics of the child's lifestyle, no significant associations with BMI category were found. It is possible that maternal report of outdoor playtime and sedentary time are subject to systematic misreporting, obscuring relationships that might be found through objective accounts of family practices.

The average BMI level of study children continues to decline through age 4 years. This is consistent with a healthy growth trajectory, but some caution in interpretation is warranted as each measurement period spans months.

7. WIC Participation, Retention, and Program Experience

Key Findings:

- Fifty-nine percent of study participants remained with WIC from enrollment to the child's fourth year, while approximately 10 percent of study participants left WIC in each of the previous three years of the study; 12 percent intermittently participated in WIC throughout the first four years of the study.
- The distribution of reasons for leaving WIC for the first time during the fourth year is similar to that from previous interviews, with inconvenience being cited most frequently by those leaving for the first time (42%).
- Among caregivers receiving WIC benefits at 42 months, about 20 percent report a hiatus in receiving WIC benefits during the study. Of this group, about two-thirds (68%) report a hiatus of 6 months or less.
- About three out of four (75%) caregivers who left WIC and returned, cite re-enrolling after a move as the reason for returning to WIC.
- Among those caregivers receiving WIC at 42 months, the three most frequently cited reasons for staying on WIC are nutrition education (94%), food benefits (93%), and the supportive environment that WIC staff provide by listening to parental concerns about the child's health (91%). The vast majority (92%) of caregivers receiving WIC at 42 months indicate that the food and education they receive through WIC are equally important.
- Children's diet quality, as measured by Healthy Eating Index (HEI-2015) scores, is positively associated with retention in the WIC program: children who participate with WIC over the first four years of the child's life have higher HEI-2015 total scores than those who leave WIC after the first year of life.

7.1 Overview

This chapter focuses on WIC participation and the effects of this on caregivers and children. Emphasis is on WIC program participation and outcomes occurring during the fourth year. The majority of analyses, therefore, draw on data from the 42- and 48-month interviews; however, when examining effects over time, data from interviews spanning 1 month through 48 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 factors lead to continued/discontinued/renewed participation in WIC through age 4 years?
- 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 4 years?
- Does continued participation in WIC lead to better eating behaviors and health outcomes?

7.2 Background

In the earliest studies of factors associated with continued WIC participation beyond infancy, logistical barriers, such as job conflicts, transportation problems, waiting too long at WIC appointments, and difficulties in bringing the infant or child to recertify, were identified as primary barriers to program continuation (Rosenberg, Alperen, & Chiasson, 2003; Woelfel, Abusabha, Pruzek, Stratton, Chen, & Edmunds, 2004). Recent research on factors associated with WIC participation beyond infancy is limited to the child's first 2 years. Jacknowitz & Tiehen (2010) found that households in which the mother breastfed for 6 months or longer were more likely to remain on WIC through age 2 years than households in which the mother breastfed for 6 months or less. The study also found that households with higher incomes, and households in which mothers were more educated and were employed after the child's birth, were less likely to continue participating in WIC at child age 2 years, even when the household remained income eligible for the program. Research conducted in Southern California identified a number of distinct predictors of WIC program retention into the second year (Whaley, Koleilat, Leonard, & Whaley, 2017). Similar to Jacknowitz & Tiehen (2010), breastfeeding emerged as a strong predictor of continued participation in WIC after the child's first birthday, with children fully breastfed from 6-12 months about 3 times more likely than fully formula fed children to be recertified on the program at age 1. Children who were mostly breastfed from 6-12 months were about twice as likely as fully formula fed children to be recertified at age 1. Other factors independently associated with continued participation at age 1 included household income at or below 100 percent of the Federal poverty guidelines (FPG), Medicaid participation, prenatal participation in WIC, consistent use and redemption of WIC benefits, more than one family member on WIC, and access to WIC nutrition education through an online format (compared to when education was delivered exclusively in person at WIC clinic visits).

An analysis of WIC ITFPS-2 data through age 2 (Whaley, Martinez, Paolicelli, Ritchie, & Weinfield, In Press) has found that infants in households with incomes at or below 100 percent of the FPG were more than twice as likely as those with incomes above 100 of the FPG to continue WIC participation. In addition, the odds of continued WIC participation was higher for infants fully breastfed 6 months or longer compared to infants fully formula-fed at 5 months. Infants in households where caregivers reported that they made a change in how they fed their family based on something they learned from WIC also had significantly higher odds of continued WIC participation than infants in households where caregivers did not report making a change. Finally, infants with the highest WIC exposure during the first two years exhibited higher 2015 Healthy Eating Index (HEI-2015) scores, an indicator of diet quality, than infants with the lowest exposure to WIC in the first 2 years (Weinfield, Borger, Au, Whaley, Berman, Ritchie, In Press).

To date, there are only a few studies that have addressed WIC's influence on developmental outcomes. One recent study found that children whose mothers participated in WIC while pregnant scored higher on assessments of mental development at age 2 years than similar children whose mothers did not participate, and they later performed better on reading assessments while in school (Jackson, 2015). Another study that focused on socioemotional rather than cognitive development in a small sample of Medicaid recipients found no association between WIC participation at 12 and 24 months and socioemotional competence and behavioral problems (Arons, Bolbocean, Bush, Tylavsky, & LeWinn, 2016).

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 4 years. It examines reasons why mothers may discontinue receiving WIC benefits during the first 4 years of the study; why some mothers return to WIC, and why families stay with WIC. Associations between health outcomes, including developmental outcomes, and WIC participation are explored.

7.3 Sample and Analysis Approach

7.3.1 Sample

The analyses in this chapter uses interview data through the 48-month interview, but the focus is on activities and outcomes during the fourth year. Table 7-1 shows the number of respondents to the

42- and 48-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.

Table 7-1. Unweighted number of respondents by interview month

Sample structure	42-month interview	48-month interview
Core prenatal sample	1,837	1,787
Core postnatal sample	235	235
Supplemental prenatal sample	456	445
Supplemental postnatal sample	108	105
Total	**2,636**	**2,572**

When growth outcomes are analyzed, measurement data from the fourth year (44 through 52 months of age) are used. (For convenience, growth outcomes are referred to as occurring at 4 years despite the time window of data collection.) During the fourth year, the study primarily collects these data from participants. However, if participants do not provide the information, the study seeks administrative records of height and weight. Table 7-2 displays the number of records received from each source.[93]

Table 7-2. Number of analysis sample children[a] on whom the study received weight and length data, by source of measurement

		Source of measurement		
Time period	Number received	WIC administrative data	Health care provider records	Caregiver report of provider measurement
48-month measurements	2,115	296	1,819	0

[a] The analysis sample constitutes all the cases used in analysis. To be in the analysis sample, the respondent must have responded to either the 1- or 3-month interview, i.e., her first post-natal interview.

7.3.2 Derived Measure of Retention

The chapter begins by exploring participation and engagement with the WIC program and, subsequently, moves to examine the association between outcomes of interest and duration of WIC benefit receipt. WIC retention is a longitudinal concept, reflecting duration of participation with the WIC program.

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

Data used to quantify WIC retention are drawn from self-reported program participation at the time of each of the participant interviews. At every interview, study participants are asked about their ongoing participation in WIC with the following question (question number SD31): "Are you currently getting WIC food or checks for yourself or {CHILD}?" Participants continue with the study regardless of whether they continue to receive WIC benefits, but based on responses to this question participants can be categorized according to whether they receive WIC or not at any given interview month. Close examination of responses over time, in conjunction with analysis of participant characteristics, permits categorization of respondents by the number of study years for which they received WIC for themselves or the study child. Table 7-3 displays the criteria for determining length or type of participation with WIC. The groups are mutually exclusive.

Table 7-3. Criteria for determining a respondent's duration of WIC participation

Category of respondent's duration 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 receiving WIC at 24 months or 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 but not both and not receiving WIC subsequently.
In years 1, 2, 3, and 4	Receiving WIC in years 1 and 2 (as above) and receiving WIC at 30 or 36 or both and receiving WIC at 42 or 48 months but not both.
Consistently	On WIC in years 1 and 2 (as above) and receiving WIC at every interview month subsequent to the 24-month interview.
Intermittently	Receiving WIC benefits sporadically throughout the 48 months of the study.

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

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 only 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 more limited, over the course of the study, than for other groups.[94] The intermittent group, therefore, does not reflect a duration of participation.

7.3.3 Analytical Approach

Initially, analyses focus on whether key socio-demographic subgroups of participants differ on outcomes of interest during the fourth year. (See Section 1.4 for a list of key socio-demographic characteristics.) Outcomes of particular interest include WIC program participation and its impact on diet quality. Key socio-demographic characteristics are typically measured at the time of the first interview. For key characteristics that may change over time, such as food security or income relative to the Federal poverty guidelines or WIC status, socio-demographic subgroups are updated to values reported at the 36-month interview.[95]

Bivariate chi-square tests are typically used to examine whether an outcome of interest varies with key socio-demographic 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, to avoid focusing on findings that, while statistically significant, may have little practical importance.[96] Statistical significance, when indicated, is at the level of $p \leq 0.05$.

Since a variety of factors may influence outcomes of interest, multivariate regression analyses follow the bivariate work. Multivariate regression analyses isolate the unique effects of individual variables on an outcome, while holding the influence of other variables constant. In this chapter, multivariate regression is used to analyze factors associated with children's 48-month HEI-2015 scores. The model focuses on whether longer participation with the WIC program is independently associated with diet quality.

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[94] 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.

[95] The 36-month socio-demographic variables are used to allow lagged influences of context on behaviors to emerge in the data, and to avoid analyzing 42-month data by future (48-month) subgroup membership. Weight status of the mother is at 30 months.

[96] 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.

7.4 WIC Program Participation in the Fourth Year

Study participants do not need to be receiving WIC benefits to continue participating in this study. 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 retention variable discussed in Section 7.3.2.

7.4.1 Leaving and Returning to WIC: Temporary Breaks in Participation

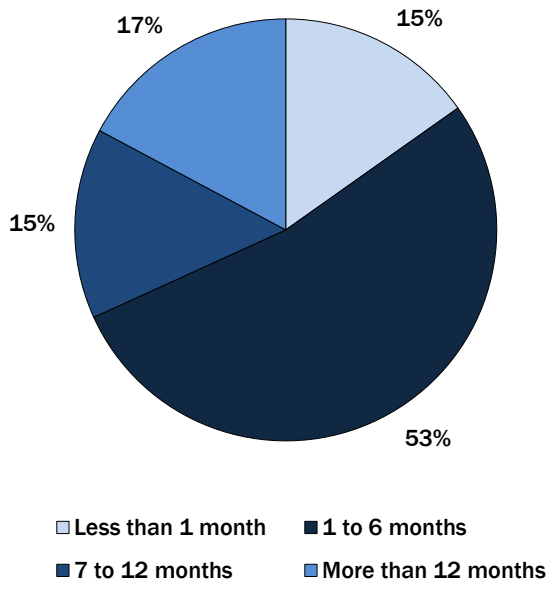
As detailed in Chapter 2, 57 percent of study participants indicate that they receive WIC benefits at 42 months and 53 percent indicate that they do at 48 months. These numbers do not reflect the fact that, over the course of the study, participants may have breaks in WIC participation, meaning they leave and return to the WIC program. About 20 percent of study mothers receiving WIC for themselves or the study child at 42 months indicate that there was a period of time over the 4-year study when they stopped receiving WIC benefits. For comparison purposes, about 24 percent of study mothers left WIC sometime prior to the 42-month interview and have not returned.

Temporary breaks in WIC participation are significantly associated with ethnicity, household food security, timing of WIC enrollment, income poverty, the age of the caregiver at birth, and WIC participation status at 36 months. Hispanic caregivers are less likely (14%) to experience a break in WIC participation than their non-Hispanic counterparts (27%). Those with high or marginal household food security are less likely (17%) to have a break in WIC participation than those with very low food security are (34%). Those in the lowest income-poverty subgroup (less than 75% of the FPG) are less likely (15%) to have a break in WIC participation than those in the highest income-poverty subgroup (above 130% of the FGP) are (28%). Those who indicate that they received WIC at 36 months are less likely (15%) to have a break in WIC participation than those who did not receive WIC at 36 months (60%). There were no significant pairwise differences between subgroups by timing of WIC enrollment or age of the caregiver at the child's birth. The finding that those with relatively high food security are less likely have a break in WIC participation is hard to interpret. It could be that uninterrupted WIC participation enhances food security; however, it could also be that food security is proxy for household resources and those with higher

food security are able to participate without interruption. The bivariate analyses cannot address this. The finding on income suggests that some of those least likely have a break in WIC participation are among the most vulnerable: the very poor.

Figure 7-1 displays the distribution of study mothers who experienced a temporary break in WIC participation by the length of time they did not participate (Appendix Table B2f-1 offers additional detail). About two-thirds (68%) of these caregivers had a break for 6 months or less, a relatively short period of time over the 4-year study period. Fifteen percent had a break for 7 to 12 months, and 17 percent experienced a break of more than a year.

Figure 7-1. Among caregivers who experienced a temporary break from WIC, the percentage by length of time they



Experiencing a temporary break in WIC participation is associated with marital status and child's WIC participation status at 36 months. Table 7-4 presents the findings for these two significantly associated key socio-demographic characteristics.

Because there are several response options, a pattern amidst the data in Table 7-4 is not immediately apparent. Collapsing responses into two categories—those who stop participating for 6 months or less and those who stop participating for more than 6 months—facilitates pattern recognition. Follow-up tests using these two categories (not shown) indicate that married caregivers are more likely (42%) than unmarried caregivers (25%) to experience longer breaks (i.e., more than 6 months). Similarly, those who did not receive WIC at 36 months are more likely (49%) than those who did receive WIC at 36 months (22%) to experience longer breaks.

Table 7-4. Among caregivers currently receiving WIC at 42 months who experienced a temporary break from WIC, the distribution by duration of time they did not participate and select socio-demographic characteristics

Key socio-demographic characteristic	Length of time not participating with WIC				Unweighted n	Weighted n
	Less than one month % (SE)	1 to 6 months % (SE)	7 to 12 months % (SE)	More than 12 months % (SE)		
Marital status						
Married	13.6 (4.2)	44.3 (4.9)[a]	13.1 (3.1)	29.0 (5.2)[b]	106	18,946
Not Married	16.3 (2.8)	58.4 (4.3)[a]	15.5 (2.5)	9.8 (2.1)[b]	185	30,562
WIC participation status at 36 months						
Receiving WIC	20.3 (3.1)[c]	57.5 (3.6)	10.7 (2.3)[d]	11.5 (2.4)[e]	191	32,151
Not Receiving WIC	5.8 (2.1)[c]	44.7 (6.0)	21.8 (4.2)[d]	27.7 (5.6)[e]	100	17,357

[a] The difference between the percentages of married and not married caregivers with a 1- to 6-month temporary break from WIC is significant at $p \leq 0.05$.

[b] The difference between the percentages of married and not married caregivers with more than a 12-month temporary break from WIC is significant at $p \leq 0.05$.

[c] The difference between the percentages of those receiving and not receiving WIC at 36 months with less than a 1-month temporary break from WIC is significant at $p \leq 0.05$.

[d] The difference between the percentages of those receiving and not receiving WIC at 36 months with a 7- to 12-month temporary break from WIC is significant at $p \leq 0.05$.

[e] The difference between the percentages of those receiving and not receiving WIC at 36 months with more than a 12-month temporary break from WIC is significant at $p \leq 0.05$.

7.4.2 Reasons for Leaving, Returning, and Staying on 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, and she also has the option to select an "other reasons" category when applicable. Table 7-5 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 fourth year (through the 36-month interview) and those who left during the fourth year (42- and 48-month interviews). Respondents could mark all reasons that apply, so percentages do not sum to 100 percent across reasons.

Table 7-5. Among caregivers receiving WIC at 42 months and indicating a previous break, the percentage of caregivers by reason they left WIC for the first time

Reasons for leaving WIC[a]	Left WIC for the first time prior to the fourth year % (SE)	Left WIC for the first time during the fourth year (42 or 48 month) % (SE)
No longer qualify for WIC	20.3 (2.5)	22.1 (5.0)
Inconvenient	39.6 (2.3)	42.2 (6.8)
No longer need WIC	25.0 (2.1)	29.5 (5.0)
Other reasons[b]	42.7 (2.6)	39.8 (7.5)
Unweighted n	543	98
Weighted n	208,340	40,110

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

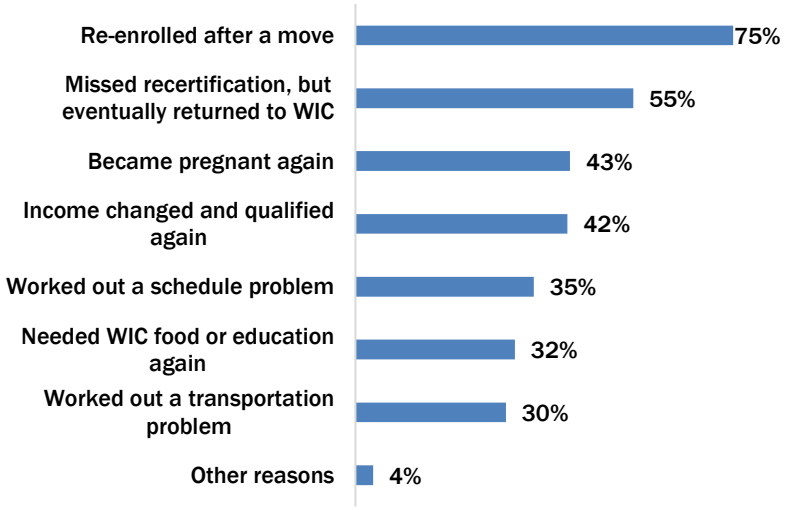
[b] Frequently cited "other" reasons include missing an appointment, moving to another location, and lack of transportation to appointments. Issues with the certification process and issues with the food package were also cited by several respondents.

Though the sample size is small for those leaving WIC for the first time during the fourth year, the distribution of reasons is relatively similar the distribution of responses to interviews through 36 months. About one in five participants (22%) leave because they believe they no longer qualify. About two in five participants (42%) leave because WIC is inconvenient. About 30 percent of participants leave during the fourth year because they no longer need WIC. About two in five participants (40%) leave for other reasons, which encompasses a variety of motivations.

Among those leaving for the first time during the fourth year, there are only a few significant associations between specific reasons for leaving WIC and key socio-demographic characteristics. Results from pairwise t-tests suggest the importance of alternative program participation. Those who do not participate in other benefit programs are more likely (77%) to cite no longer qualifying as a reason for leaving during the fourth year than those who participate in other programs (including or excluding the Supplemental Nutrition Assistance Program (SNAP), 12% and 18%, respectively). In contrast, those who do not participate in other programs are also less likely (9%) to cite inconvenience than those who participate in SNAP or SNAP and other programs (55%). Those with high or marginal food security are more likely (37%) to say that they no longer need WIC as a reason for leaving than those with very low food security (8%).

The study also asks those currently receiving WIC at 42 months who indicate a previous break, why they returned to WIC. Figure 7-2 displays the percentage of these caregivers by reasons they returned to WIC (Appendix Table B2f-2 offers additional detail). Respondents could mark all answers that apply so the percentages do not sum to 100 percent. Three-quarters (75%) of caregivers are re-enrolling after a move; over half (55%) indicate that they missed recertification but eventually returned. These findings suggest that most participants who return to WIC did not specifically plan to leave but circumstances interrupted participation.

Figure 7-2. Percentage of caregivers currently receiving WIC at 42 months by reason for return after a break from benefits

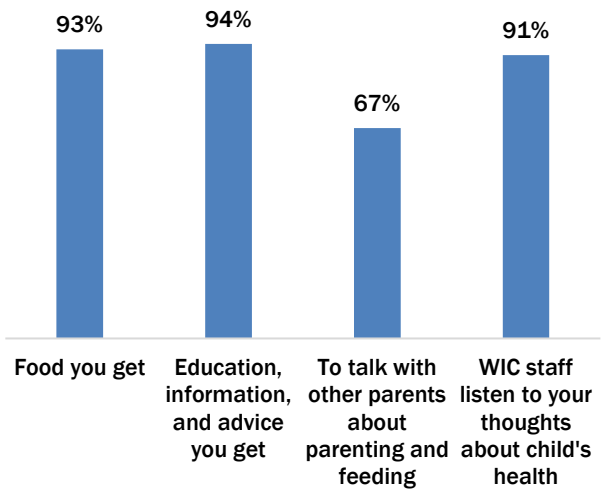


Though they are not the most frequently cited, factors that affect eligibility, e.g., another pregnancy and income changes, are important for 43 and 42 percent of caregivers who left and returned, respectively.

There are several key socio-demographic variables associated with reasons caregivers return to WIC. Race is associated with both returning after a move and needing the food. White caregiver (72%) and caregivers classified in the Other racial category (91%) are more likely than African American (65%) to be re-enrolling after a move. Caregivers classified in the Other racial category are more likely (53%) than their White counterparts (25%) to indicate that they returned because they needed WIC food or education again. Marital status is associated with logistical reasons, including missing re-certification, working out a scheduling problem, and working out a transportation problem. Married caregivers are less likely (44%, 20%, and 26%, respectively) to return to WIC for these reasons than their unmarried counterparts (62%, 36%, 41%, respectively), suggesting that married caregivers may have more resources at their disposal to address logistical issues associated with participation than unmarried caregivers. Working out a transportation problem is also associated with income poverty and non-WIC program participation. Those in the lowest income-poverty

subgroup (less than 75% of the FPG) are more likely (40%) to report solving a transportation problem than those in the highest income-poverty subgroup (above 130% of the FPG, 17%). Generally speaking, the findings suggest that the availability of personal support and financial resources plays an important roles in solving transportation problems that cause departure from the program.

Figure 7-3. Reasons why participants stay with WIC (42 month interview)



For those indicating that they are receiving WIC at the 42-month interview, the study asks why they stay with WIC. Figure 7-3 displays the percentage of caregivers by the reasons cited (Appendix Table B2f-3 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 (94%), and because WIC staff listen to their thoughts about their children's health and what their children are eating (91%). About two-thirds (67%) 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.

There are several significant associations with key socio-demographic characteristics, but ethnicity is the only key socio-demographic characteristic significantly associated with each of the four reasons for continued participation. Hispanic or Latino caregivers are more likely to report each of these reasons for continuing than caregivers who are not Hispanic or Latino: 95 percent of Hispanic caregivers compared to 90 percent of non-Hispanic caregivers indicate the food, 96 percent of Hispanic caregivers compared to 92 percent of non-Hispanic caregivers indicate the information and advice, 73 percent of Hispanic caregivers compared to 61 percent of non-Hispanic caregivers indicate talking with other parents, and 95 percent of Hispanic caregivers compared to 86 percent of non-Hispanic caregivers indicate the WIC staff.

Additional key socio-demographic characteristics significantly associated with reasons for staying include WIC participation status, race, income poverty, and marital status. WIC participation status

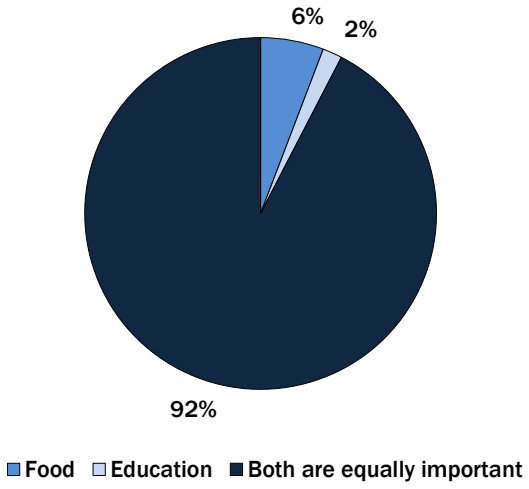
at 36 months is significantly associated with three reasons participants cite for staying with WIC: the food you get; the education, information and advice you get; and, talking with other parents than those who were not on WIC at 36 months. Those receiving WIC benefits at 36-months are more likely (93%) than those who did not receive benefits at this time (86%) to cite the food you get. They are also more likely (95% compared to 87%) to cite the education, information and advice, and more likely (69% compared to 53%) to cite talking with WIC staff than those who did not participate with WIC at 36 months. Race is associated with two reasons participants cite for staying with WIC: the food you get and education, information, and advice you get. Pairwise testing of racial subgroups indicates that African Americans are less likely (85%) than either White caregivers (94%) or caregivers of Other races (94%) to cite the food you get as a reason for staying with WIC. White caregivers are less likely (93%) than African American caregivers (97%) to cite the education, information, and advice you get as a reason to stay (97%). Income poverty is also associated with two reasons staying with WIC: talking with other parents and staff listening. Those with in the highest income-poverty subgroup (above 130% of the FPG) are less likely (50%) to cite talking with other parents than those in the lower income-poverty subgroups (65% for those with income between 75% and 130% of the FPG and 73% for those with income less than 75% of the FPG). The highest income subgroup was also less likely (80%) than the middle subgroup (91%) or lowest subgroup (93%) to indicate that WIC staff listening to concerns was a compelling reason to stay. Marital status is also associated with education, information and advice: married caregivers are less likely (92%) to report staying for the education, information, and advice than unmarried caregivers (96%).

7.5 Influences of WIC Participation in the Fourth Year

7.5.1 Nutrition Education and Food

Study participants currently receiving WIC benefits at 42 months—whether for 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 7-4 displays the distribution of responses for those currently receiving WIC benefits (Appendix Table B2f-4 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: race, ethnicity,

Figure 7-4. Among those currently receiving WIC benefit, the percentage reporting the importance of select benefits



marital status, household food security, and income poverty. Table 7-6 presents the percentage of study participants by their indication of the most important benefit WIC provides and key socio-demographic categories that are significantly associated with participants' responses. Though data for all the reasons are presented, the discussion focuses on follow-up pairwise tests where both subgroups have three or more percent of the population. Follow-up pairwise testing indicates that the majority of statistically significant differences are among those citing either food or education. African American caregivers are less likely (3%) to indicate food than their White counterparts (8%). Hispanic or Latino caregivers are less likely (3%) to indicate food than their counterparts who are not Hispanic or Latino (10%). Unmarried caregivers are less likely (5%) to indicate food than their married counterparts (8%). Those in the lowest income-poverty subgroup are less likely (4%) to cite food as their most important benefit than those in the highest income-poverty subgroup (14%). Hispanic caregivers are more likely (97%) than non-Hispanic caregivers (87%) to indicate that both food and education are equally important. Those in the lowest income-poverty subgroup are more likely (95%) to cite that both are equally important compared to those in the highest income-poverty subgroup (84%).

Table 7-6. Percentage of study participation by most important reason for continuing with WIC and key socio-demographic characteristics

Key socio-demographic characteristic	Importance of select WIC benefits			Unweighted n	Weighted n
	Food only	Education only	Both are equally important		
Race					
African American or Black	2.7 (1.0)[a]	5.1 (1.5)[b]	92.2 (2.0)	389	52,698
White	7.6 (1.2)[a]	0.8 (0.3)[b]	91.6 (1.2)	776	139,282
Other	4.5 (1.5)	1.2 (0.6)	94.3 (1.6)	273	62,153
Ethnicity					
Hispanic or Latino	2.7 (0.6)[c]	0.3 (0.2)[d]	97.0 (0.6)[e]	664	138,358
Not Hispanic or Latino	9.6 (1.3)[c]	3.5 (0.8)[d]	86.8 (1.4)[e]	774	115,775
Marital Status					
Married	8.0 (1.4)[f]	0.6 (0.3)[g]	91.3 (1.4)	531	98,778
Not married	4.5 (0.7)[f]	2.5 (0.6)[g]	93.0 (0.6)	907	155,355
Food Security					
High or marginal food security	4.5 (0.8)	1.9 (0.4)	93.6 (0.8)	1,056	190,399
Low food security	7.0 (1.9)	1.6 (1.0)	91.5 (2.1)	225	38,820
Very low food security	14.3 (3.9)	1.2 (0.9)	84.4 (3.8)	157	24,914
Income Poverty					
75% of poverty guideline	3.5 (0.9)[h]	1.6 (0.5)	94.9 (1.0)[i]	761	130,151
Above 75% but not more than 130% of poverty guideline	5.9 (1.2)	2.2 (0.5)	91.9 (1.3)	466	88,495
Above 130% of poverty guideline	14.2 (3.4)[h]	1.3 (0.7)	84.4 (3.4)[i]	211	35,486

[a] The difference between the percentages of African American and White caregivers indicating food only is significant at $p \leq 0.05$.

[b] The difference between the percentages of African American and White caregivers indicating education only is significant at $p \leq 0.05$.

[c] The difference between the percentages of Hispanic and non-Hispanic caregivers indicating food only is significant at $p \leq 0.05$.

[d] The difference between the percentages of Hispanic and non-Hispanic caregivers indicating education only is significant at $p \leq 0.05$.

[e] The difference between the percentages of Hispanic and non-Hispanic caregivers indicating both are equally important is significant at $p \leq 0.05$.

[f] The difference between the percentages of married and unmarried caregivers indicating food only is significant at $p \leq 0.05$.

[g] The difference between the percentages of married and unmarried caregivers indicating education only is significant at $p \leq 0.05$.

[h] The difference between the percentages of those with income at or below 75 percent of the poverty guideline and those above 130 percent of the poverty guideline indicating food only is significant at $p \leq 0.05$.

[i] The difference between the percentages of those with income at or below 75 percent of the poverty guideline and those above 130 percent of the poverty guideline indicating both are equally important is significant at $p \leq 0.05$.

7.5.2 Changes Made Due to WIC

At 42-months, about 70 percent of all caregivers and 78 percent of those on WIC 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, marital status, household food security, non-WIC program participation, parity, income poverty, and the child's WIC participation status at 36 months. Table 7-7 displays the percentages of women by subgroups within these significantly associated key socio-demographic characteristics. Hispanic caregivers (79%) are more likely to have made a change due to something they learned at WIC than their non-Hispanic counterparts (63%). Married caregivers (74%) are more likely to have made a change than those who are not married (68%). Caregivers who were participating with WIC at 36 months (78%) are also more likely to have made a change in their feeding practices than caregivers who were not participating at 36 months (60%). On the other hand, those with high or marginal food security (68%) are less likely to report making a change than those with low food security (77%). Those who do not participate in any other benefit programs (58%) are less likely to report making a change than those who participate in other programs including SNAP (72%) or excluding SNAP (75%). Those participating with their first born child (67%) are less likely than those participating with their third or subsequent child (76%) to make a change, as are those in the highest income-poverty subgroup (64%) compared with those in the middle income-poverty subgroup (75%). These findings suggest a variety of factors may be associated with caregiver report making of changes in feeding practices in response to nutrition education offered by WIC. Further research is needed to understand whether factors are independently associated with making changes due to WIC nutrition education and how factors may influence the application of WIC nutrition education. For example, if caregivers are more likely to apply nutrition education to practice after repeated messaging, then those who have heard the message several times with different children may be more capable of applying messages to dietary change than those who are exposed to nutrition information for the first time.

Table 7-7. Percentage of caregivers who report changing their feeding practices due to something they learned at WIC by select key socio-demographic characteristics

Key socio-demographic characteristic	Percentage of caregivers who made a change due to WIC % (SE)	Unweighted n	Weighted n
Ethnicity			
Hispanic or Latino	78.5 (1.3)[a]	991	203,259
Not Hispanic or Latino	63.2 (1.1)[a]	1,639	237,942
Marital Status			
Married	73.6 (1.7)[b]	985	169,830
Not married	68.2 (1.4)[b]	1,645	271,371
Food Security			
High or marginal food security	68.2 (1.5)[c]	1,922	326,776
Low food security	77.4 (3.0)[c]	428	71,020
Very low food security	74.2 (2.6)	280	43,404
Participation in non-WIC benefit programs			
Does not participate in any other programs	58.1 (2.3)[d,e]	499	85,634
Participates in SNAP or in SNAP and other programs	71.8 (1.7)[d]	1,288	213,782
Participate in other programs excluding SNAP	75.3 (1.9)[e]	843	141,785
Parity			
First born	66.8 (1.7)[f]	1,087	187,490
Second born	69.5 (2.3)	712	117,119
Third or subsequent born	75.7 (1.6)[f]	831	136,592
Income Poverty			
75% of poverty guideline	69.8 (1.7)	1,145	191,863
Above 75% but not more than 130% of poverty guideline	75.2 (1.8)[g]	845	145,608
Above 130% of poverty guideline	64.2 (2.2)[g]	640	103,730
WIC participation status at 36 months			
Receives WIC	77.7 (1.3)[h]	1,486	259,729
Does not receive WIC	59.6 (2.1)[h]	1,144	181,472

[a] The difference between the percentages of Hispanic and non-Hispanic caregivers is significant at $p \leq 0.05$.

[b] The difference between the percentages of married and unmarried caregivers is significant at $p \leq 0.05$.

[c] The difference between the percentages of those with high or marginal food security and those with low food security is significant at $p \leq 0.05$.

[d] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate in SNAP or SNAP and other non-WIC programs is significant at $p \leq 0.05$.

[e] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate other non-WIC programs excluding SNAP is significant at $p \leq 0.05$.

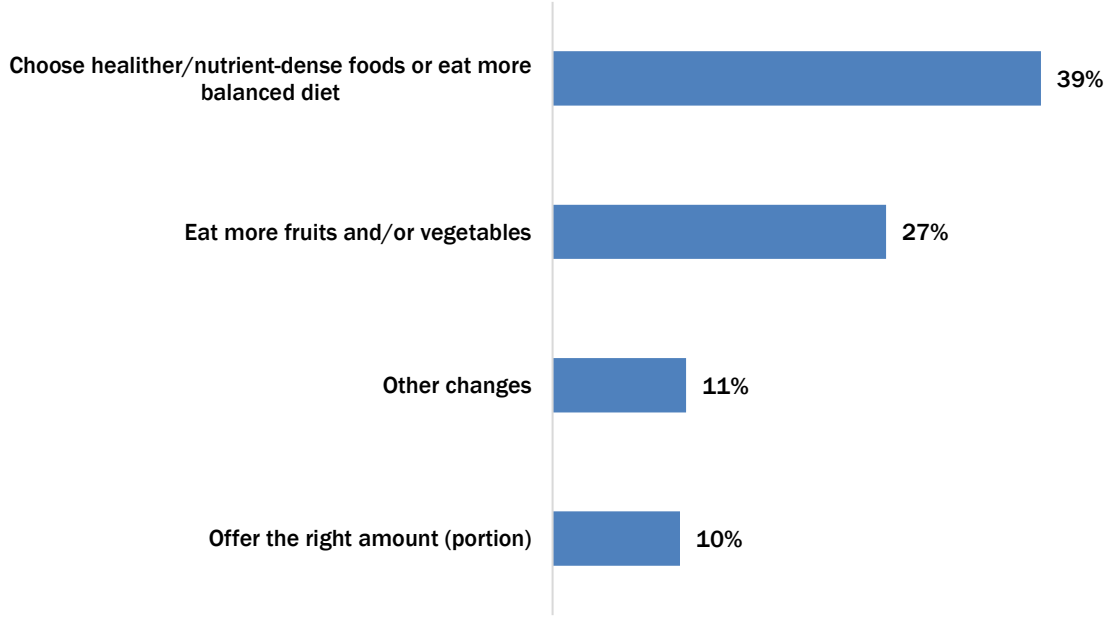
[f] The difference between the percentages of caregivers with firstborn and third or subsequent born children is significant at $p \leq 0.05$.

[g] The difference between the percentages of those with income above 75 percent of the poverty guideline but below 130 percent and those with income above 130 percent of the poverty guideline is significant at $p \leq 0.05$.

[h] The difference between the percentages of those receiving and not receiving WIC at 36 months is significant at $p \leq 0.05$.

Caregivers who indicate making 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 7-5 displays the percentage of these caregivers by the most important change they made for responses reported by at least 10 percent of caregivers. 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 (27%) is second among the most important types of changes made. Other changes, which is a catchall category, were specified by 11 percent; and offering the right portion size was cited by 10 percent of study participations. The most important change made is not associated with the key socio-demographic characteristics used in this study.

Figure 7-5. Among caregivers who made a change in their feeding practice due to something they learned at WIC, the percentage by the most important change made[a,b]



a. This figure reflects up-coded data from WC22OS, the "other specify" category; consequently, the response options listed may not exactly reflect response options to survey item WC22.

b. Other changes include, but are not limited to, unspecified changes to diet or eating habits, how or when to feed children various foods, introducing new foods, and multiple changes.

7.6 WIC Retention

Percentages of study mothers reporting receipt of WIC benefits at a particular point in time do not necessarily capture the duration of program participation. To explore the effects of duration with the WIC program, the analyses uses a derived measure of WIC retention. Detailed in Section 7.3.2, the retention variable has six categories: received WIC in year 1 only; received WIC in years 1 and 2 only; received WIC in years 1, 2, and 3 only; received WIC in years 1, 2, 3, and 4 but not consistently; consistently received WIC; and intermittently received WIC. The first five categories indicate increasingly longer duration of WIC participation and provide an additional lens by which to examine whether duration of exposure to the program has impacts. Table 7-8 presents the percentages of study participants in each category.

Table 7-8. The percentage of caregivers by duration receiving WIC benefits

Received WIC[a]	Study mothers % (SE)
In year 1 only	9.7 (1.3)
In years 1 and 2 only	10.2 (1.4)
In years 1, 2, and 3 only	9.7 (1.2)
In years 1, 2, 3, and 4	12.3 (1.2)
Consistently	46.4 (3.0)
Intermittently	11.7 (1.1)
Unweighted n	1,130
Weighted n	439,767

[a] Categories of WIC receipt are mutually exclusive.

In each of the first three years of the study, about 10 percent of the study mothers cease going to WIC and do not return. Subsequent to the 24-month interview, about 12 percent of study mothers did not answer at least one of the interviews necessary to be categorized as consistently receiving WIC. Forty-six percent of study mothers consistently receive WIC, that is, they receive WIC in years 1 and 2 and at every interview subsequent to the 24-month interview. When combined with the group that received WIC in years 1, 2, 3, and 4, a total of 59 percent of study mothers stay with WIC, at least, into the study child's fourth year. About 12 percent of study mothers receive WIC intermittently. For the intermittent group, there is no particular duration or pattern of participation.

Chi-square analysis of associations between WIC retention and key socio-demographic characteristics finds significant associations between retention and ethnicity, participation in non-WIC benefit programs, timing of WIC enrollment, income poverty, and age of the mother at the

birth of the study child. The majority of significant differences are between subgroups receiving WIC in year 1 only and receiving WIC consistently. Table 7-9 presents the percentage of study mothers by subgroups receiving WIC in year 1 only and receiving WIC consistently for the significantly associated key socio-demographic characteristics.

Table 7-9. Percentage of caregivers receiving WIC in year 1 only and caregivers consistently receiving WIC by select key socio-demographic characteristics

Key socio-demographic characteristic	Receiving WIC in year 1 only % (SE)	Consistently receiving WIC % (SE)	Unweighted n	Weighted n
Ethnicity				
Hispanic or Latino	6.3 (1.5)[a]	60.1 (3.5)[b]	440	193,526
Not Hispanic or Latino	12.4 (1.5)[a]	35.6 (2.6)[b]	690	246,241
Participation in non-WIC benefit programs				
Does not participate in any other programs	19.5 (2.9)[c,d]	25.3 (4.3)[e,f]	219	82,074
Participates in SNAP or in SNAP and other programs	5.6 (1.2)[c]	53.3 (3.3)[e]	532	211,142
Participate in other programs excluding SNAP	10.1 (2.1)[d]	48.3 (4.3)[f]	379	146,551
Timing of WIC enrollment				
1st Trimester	5.4 (1.4)[g]	58.8 (3.5)[h,i]	421	139,220
2nd Trimester	9.2 (1.8)	45.4 (4.1)	446	173,318
3rd Trimester	14.2 (2.7)[g]	31.9 (4.5)[h]	142	69,316
Postnatal	16.2 (4.1)	37.0 (6.7)[i]	121	57,913
Income Poverty				
75% of poverty guideline	5.9 (1.4)[j]	57.9 (3.6)[l]	486	194,810
Above 75% but not more than 130% of poverty guideline	8.0 (2.0)[k]	44.8 (3.6)[l]	364	145,774
Above 130% of poverty guideline	19.9 (3.1)[j,k]	26.2 (3.5)[l]	280	99,184
Age of mother at child's birth				
16-19 years	3.4 (2.3)[m]	22.0 (5.3)	93	41,801
20-25 years	12.6 (2.3)[m]	12.6 (1.7)	409	178,661
26 or more years	8.6 (1.3)	9.0 (1.5)	628	219,305

[a] The difference between the percentages of Hispanic and non-Hispanic caregivers receiving WIC in year 1 only is significant at $p \leq 0.05$.

[b] The difference between the percentages of Hispanic and non-Hispanic caregivers receiving WIC consistently is significant at $p \leq 0.05$.

[c] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate in SNAP or SNAP and other non-WIC programs receiving WIC in year 1 only is significant at $p \leq 0.05$.

[d] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate in other non-WIC programs excluding SNAP receiving WIC in year 1 only is significant at $p \leq 0.05$.

[e] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate in SNAP or SNAP and other non-WIC programs receiving WIC consistently is significant at $p \leq 0.05$.

[f] The difference between the percentages of those who do not participate in other non-WIC programs and those who participate in other non-WIC programs excluding SNAP receiving WIC consistently is significant at $p \leq 0.05$.

[g] The difference between the percentages who enrolled in WIC during their 1st trimester and those who enrolled postantally receiving WIC in year 1 only is significant at $p \leq 0.05$.

[h] The difference between the percentages of who enrolled in WIC during their 1st trimester and those who enrolled in their 3rd receiving WIC consistently is significant at $p \leq 0.05$.

[i] The difference between the percentages who enrolled in WIC during their 1st trimester and those who enrolled postantally receiving WIC consistently only is significant at $p \leq 0.05$.

[j] The difference between the percentages of those with income at or below 75 percent of the poverty guideline and those with income above 130 percent of the poverty guideline receiving WIC in year 1 only is significant at $p \leq 0.05$.

[k] The difference between the percentages of those with income above 75 percent of the poverty guideline but less than 130 percent of the poverty guideline and those with income above 130 percent of the poverty guideline receiving WIC in year 1 only is significant at $p \leq 0.05$.

[l] Pairwise differences between income subgroups for those receiving WIC consistently are significant at $p \leq 0.05$.

[m] The difference between the percentages of caregivers age 16-19 years at the child's birth and those age 20-25 years at the child's birth is significant at $p \leq 0.05$.

Non-Hispanic caregivers are more likely (12%) to be receiving WIC in year 1 only than Hispanic caregivers (6%), while Hispanic caregivers are more likely (60%) to participate in WIC consistently than non-Hispanic caregivers (36%). A similar inverse pattern is seen among subgroups by participation in non-WIC benefit programs, timing of WIC enrollment, and income poverty.

Two additional characteristics are explored by retention group: whether the participant has another child (other than the study child) participating in WIC and whether the participation has prior (for another child) experience with WIC.

At the 30-, 36-, 42-, and 48-month interviews, study participants are asked whether they have another child participating in WIC. Table 7-10a present the percentages of participants reporting that they have other children participating in WIC. Chi-square analysis of association indicates that there is a statistically significant association between WIC retention and participation with another child. Because comparisons between six categories can obscure patterns associated with duration of participation and those on WIC into their fourth year may only have received a small difference in the amount of WIC benefits or services, the six retention categories are collapsed into three: those participating for 3 years or less, those participating more than 3 years, and those participating intermittently. Table 7-10b presents percentage of study mothers by these collapsed categories of retention. Follow-up pairwise tests indicate that at 30 and 36 months, those who participate with WIC the longest (more than 3 years) are more likely to have another child receiving WIC than those whose participation ended earlier or is intermittent. At 42 and 48 months, the pattern shifts somewhat. Those participating with WIC the longest are not significantly more likely to have

another child receiving WIC than those who, thus far into the study, participate intermittently with WIC. The data suggest that those whose participation with WIC has been intermittent to this point in the study tend to have subsequent children on WIC later in the study compared to those who have ceased participation.

Table 7-10a. Percentage of caregivers with another child on WIC by WIC retention group

Receiving WIC	Has another child receiving WIC at interview month				Unweighted n	Weighted n
	30 months	36 months	42 months	48 months		
In year 1 only	0.3 (0.3)	1.8 (1.5)	1.9 (1.9)	4.0 (2.7)	111	42,779
In years 1 and 2 only	0.9 (0.6)	0	0	1.6 (1.4)	131	44,942
In years 1, 2, and 3 only	25.4 (4.6)	11.9 (3.3)	2.5 (1.4)	0.4 (0.4)	107	42,588
In years 1, 2, 3, and 4	31.7 (4.2)	37.7 (4.7)	39.3 (4.4)	25.6 (3.6)	130	54,023
Consistently	37.1 (2.4)	36.7 (2.2)	36.9 (2.5)	37.9 (2.4)	522	204,081
Intermittently	9.2 (2.8)	9.9 (2.8)	27.9 (4.9)	33.6 (5.4)	129	51,355

Table 7-10b. Percentage of caregivers with another child on WIC by collapsed categories of WIC retention

Receiving WIC	Has another child receiving WIC at interview month				Unweighted n	Weighted n
	30 months	36 months	42 months	48 months		
3 years or less	8.7 (1.7)[a]	4.5 (1.2)[c]	1.4 (0.8)[e,f]	2.0 (1.0)[g,h]	349	130,308
More than 3 years	36.0 (2.2)[a,b]	37.0 (2.0)[c,d]	37.4 (2.2)[e]	35.3 (2.1)[g]	652	258,104
Intermittently	9.2 (2.8)[b]	9.9 (2.8)[d]	27.9 (4.9)[f]	33.6 (5.4)[h]	129	51,355

[a] The difference between the percentages with another child on WIC at 30 months for those receiving WIC for 3 years or less and those receiving WIC for more than 3 years is significant at $p \leq 0.05$.

[b] The difference between the percentages with another child on WIC at 30 months for those receiving WIC for more than 3 years and those receiving WIC intermittently is significant at $p \leq 0.05$.

[c] The difference between the percentages with another child on WIC at 36 months for those receiving WIC for 3 years or less and those receiving WIC for more than 3 years is significant at $p \leq 0.05$.

[d] The difference between the percentages with another child on WIC at 36 months for those receiving WIC for more than 3 years and those receiving WIC intermittently is significant at $p \leq 0.05$.

[e] The difference between the percentages with another child on WIC at 42 months for those receiving WIC for 3 years or less and those receiving WIC for more than 3 years is significant at $p \leq 0.05$.

[f] The difference between the percentages with another child on WIC at 42 months for those receiving WIC for 3 years or less and those receiving WIC intermittently is significant at $p \leq 0.05$.

[g] The difference between the percentages with another child on WIC at 48 months for those receiving WIC for 3 years or less and those receiving WIC for more than 3 years is significant at $p \leq 0.05$.

[h] The difference between the percentages with another child on WIC at 48 months for those receiving WIC for 3 years or less and those receiving WIC intermittently is significant at $p \leq 0.05$.

Note: the category 3 years or less encompasses three retention categories: receiving WIC in years 1 only, receiving WIC in years 1 and 2 only, and receiving WIC in years 1, 2, and 3 only. The category more than 3 years encompasses two retention categories: receiving WIC in years 1, 2, 3, and 4 and receiving WIC consistently.

Tables 7-11a presents the percentages of WIC caregivers with prior WIC experience by retention group. For reasons cited above, categories are collapsed and the alternative presentation is in Table 7-11b. Follow-up pairwise t-tests indicate that there is a significant difference in the percentages with prior WIC experience. Those who have stayed with WIC for the study child the longest (more than 3 years) are more likely (63%) to have prior WIC experience (for a previous child) than who left WIC earlier (47%); those with intermittent experience are less likely (45%) to have prior WIC experience than those who have stayed with WIC the longest (63%).

Table 7-11a. Percentage of caregivers with prior WIC experience by WIC retention group

Received WIC	Caregivers with prior WIC experience % (SE)	Unweighted n	Weighted n
In year 1 only	51.9 (6.4)	111	42,779
In years 1 and 2 only	43.0 (6.0)	131	44,942
In years 1, 2, and 3 only	45.5 (5.4)	106	42,304
In years 1, 2, 3, and 4	64.1 (6.4)	130	54,023
Consistently	62.1 (2.3)	522	204,081
Intermittently	44.8 (5.5)	129	51,355

Table 7-11b. The percentage of caregivers with prior WIC experience by collapsed categories of WIC retention

Received WIC	Caregivers with prior WIC experience % (SE)	Unweighted n	Weighted n
3 years or less	46.7 (3.1)[a]	348	130,024
More than 3 years	62.5 (2.1)[a,b]	652	258,104
Intermittently	44.8 (5.5)[b]	129	51,355

[a] The difference between the percentages receiving WIC for 3 years or less and those receiving WIC for more than 3 years is significant at $p \leq 0.05$.

[b] The difference between the percentages receiving WIC for more than 3 years and those receiving WIC intermittently is significant at $p \leq 0.05$.

Note: the category 3 years or less encompasses three retention categories: receiving WIC in years 1 only, receiving WIC in years 1 and 2 only, and receiving WIC in years 1, 2, and 3 only. The category more than 3 years encompasses two retention categories: receiving WIC in years 1, 2, 3, and 4 and receiving WIC consistently.

7.7 Outcomes Associated With WIC Retention

The analyses explored fourth-year outcomes associated with WIC retention. Outcomes examined included:

- Body mass index (BMI)-for-age weight status categories at age four years,
- Change in BMI-for-age levels between age 2 years and 4 years,
- Access and continuity of health care as measured by whether the child has a medical home in the fourth year or a well visit at age three,
- Personal-social and social development as measured by personal-social development scale score categories in the fourth year, and
- HEI-2015 total score at 48 months.

Of the five aforementioned outcomes examined, HEI-2015 was significantly associated with WIC retention.

7.7.1 WIC Retention and HEI-2015

By providing both nutritious foods and nutrition education, WIC participation may influence diet quality. Analyses explored this possibility by examining associations between WIC retention and HEI-2015 scores, select nutrient intakes, and whether added sugars intake met the Dietary Guidelines for Americans (DGA). Table 7-12 presents select dietary measures significantly associated with WIC retention based on bivariate analyses.[97]

[97] Bivariate associations between WIC retention and HEI components for total vegetables, whole grains, total protein, fatty acid ratio, sodium, refined grains, and added sugars were not statistically significant. Bivariate associations between WIC retention and whether consumption of added sugars met the DGA recommendation or not and whether calcium, vitamin D, and sodium intakes met their respective EARs or not were also insignificant.

Table 7-12. Diet quality measures at 48-months significantly associated with WIC retention

Measure	WIC Retention Group					
	Year 1 Only % (SE)	Years 1 & 2 Only % (SE)	Years 1, 2, and 3 Only % (SE)	Years 1, 2, 3, and 4 % (SE)	Consistently % (SE)	Intermittently % (SE)
HEI Total Score at 48-Month Recall						
Below average	59.0 (4.2)	60.9 (4.8)	49.1 (5.4)	52.5 (5.9)	39.8 (3.2)	60.4 (5.3)
At or above average	41.0 (4.2)	39.1 (4.8)	50.9 (5.4)	47.5 (5.9)	60.2 (3.2)	39.6 (5.3)
HEI Greens and Beans at 48-Month Recall						
Below average	87.2 (3.9)	79.4 (4.8)	72.9 (5.5)	70.8 (5.4)	56.1 (5.2)	80.9 (5.1)
At or above average	12.8 (3.9)	20.6 (4.8)	27.1 (5.5)	29.2 (5.4)	43.9 (5.2)	19.1 (5.1)
HEI Total Fruit at 48-Month Recall						
Below average	24.7 (3.6)	24.2 (3.4)	18.5 (4.2)	20.7 (5.4)	15.7 (2.2)	34.1 (5.3)
At or above average	75.3 (3.6)	75.8 (3.4)	81.5 (4.2)	79.3 (5.4)	84.3 (2.2)	65.9 (5.3)
HEI Whole Fruit at 48-Month Recall						
Below average	31.4 (4.4)	32.6 (2.4)	22.4 (4.2)	27.6 (6.6)	21.6 (2.4)	44.5 (6.3)
At or above average	68.6 (4.4)	67.4 (2.4)	77.6 (4.2)	72.4 (6.6)	78.4 (2.4)	55.5 (6.3)
HEI Dairy at 48-Month Recall						
Below average	27.5 (5.3)	31.8 (4.8)	35.9 (6.5)	44.6 (4.7)	27.2 (2.1)	41.2 (5.1)
At or above average	72.5 (5.3)	68.2 (4.8)	64.1 (6.5)	55.4 (4.7)	72.8 (2.1)	58.8 (5.1)
HEI Seafood and Plant Protein at 48-Month Recall						
Below average	80.2 (4.1)	80.3 (5.5)	72.9 (5.8)	72.3 (5.1)	58.2 (5.3)	77.9 (5.8)
At or above average	19.8 (4.1)	19.7 (5.5)	27.1 (5.8)	27.7 (5.1)	41.8 (5.3)	22.1 (5.8)
HEI Saturated Fat at 48-Month Recall						
Below average	56.9 (6.2)	58.9 (5.5)	51.4 (6.7)	46.2 (4.9)	41.1 (2.7)	51.8 (6.1)
At or above average	43.1 (6.2)	41.1 (5.5)	48.6 (6.7)	53.8 (4.9)	58.9 (2.7)	48.2 (6.1)
Unweighted n	110	131	106	130	521	129
Weighted n	42,579	44,942	41,232	54,023	203,711	51,355

Among the measures considered in the bivariate analyses, HEI-2015 total scores reflect WIC's holistic emphasis on healthy eating better than a single component of HEI-2015. The multivariate regression, therefore, focuses on this measure as a continuous variable, exploring factors that independently influence this outcome at 48 months. Of particular interest is how WIC retention influences total scores. However, since many factors influence HEI-2015 total scores, the model also controls for socio-demographic characteristics and early feeding practices. These include the child's

gender, the caregiver's race, the caregiver's ethnicity, age of caregiver at birth, marital status, breastfeeding duration, the timing of the introduction of sugar-sweetened beverages (SSBs), early (prior to 4 months) introduction of complementary foods, and the timing of the introduction of sweet foods (excluding SSBs). The model also incorporates contemporary feeding practices (the frequency of television 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 child care.

Table 7-13 presents findings from regressing HEI-2015 total scores at 48 months on covariates including WIC retention. The model's explanatory power is relatively small;[98] which indicates that there are likely additional factors that affect HEI-2015 total scores. However, given the model specified, WIC retention is a significant predictor of HEI-2015 total scores at 48-months: children who participate in WIC for the first four years of life had significantly higher HEI-2015 scores at 48 months compared to children who participated in WIC in year 1 only. Additionally, being female is positively associated with HEI-2015 scores at 48 months, as is being Hispanic.

[98] R-square=0.23.

Table 7-13. Model results[a] from regression of HEI-2015 total scores at 48 months on covariates including WIC retention

Covariate	Effect size	p- value
Intercept	54.89	<.0001
Child gender: Female compared to male*	1.57	0.0156
Caregiver race: African American compared to White	1.24	0.2397
Caregiver race: all Other races compared to White	0.90	0.3126
Caregiver ethnicity: Hispanic compared to non-Hispanic*	6.20	<.0001
Caregiver's education level: High school or less compared to more than high school	0.40	0.5614
Marital status: Not married compared to married	-1.13	0.0732
Regular child care use: Yes compared to no	0.13	0.8262
Television on during meals: most or sometimes compared to rarely or never	-0.72	0.3224
Family eat together: 5 or more times compared to less than 5 times per week	0.56	0.2920
Sleep duration at night: Sleeps for less than 10 hours usually compared to sleeps for at least 10 hours usually	-1.07	0.1754
Breastfeeding duration[b]	0.004	0.0746
Timing of SSB introduction: In the first year compared to not in the first two years	-1.38	0.0973
Timing of SSB introduction: In the second year compared to not in the first two years	-1.14	0.1453
Early introduction of complementary foods	0.89	0.1368
Age of the introduction of sweet foods: In the first year compared to not in the first two years	-1.70	0.1416
Age of the introduction of sweet foods: In the second year compared to not in the first two years	-1.27	0.3280
WIC retention: Intermittently compared to Year 1 only	0.48	0.7039
WIC retention: Consistently compared to Year 1 only*	3.16	0.0002
WIC retention: In years 1, 2, 3, and 4 compared to Year 1 only*	2.46	0.0268
WIC retention: In years 1, 2, and 3 only compared to Year 1 only	1.72	0.1332
WIC retention: In years, 1 and 2 only compared to Year 1 only	0.68	0.4760

[a] Results are based on weighted data. Weighted n=190,001; unweighted n=1,114. R-square=0.23. Model details are presented in Appendix Table B2f-5.

[b] Continuous variable.

*Indicates significance at p≤0.05.

7.8 Summary

WIC ITFPS-2 collects information on study participants regardless of whether they participate in WIC. About 59 percent of study participants stay with WIC into the child's fourth year. Attrition is about 10 percent in each of the previous study years, and about 12 percent of study participants have patterns of WIC engagement that are best described as intermittent. Reasons for leaving WIC remain fairly steady over the course of the study. Among those who leave WIC for the first time in the fourth year, the most frequently cited reason for leaving is inconvenience (42%).

Examination of the reasons study participants return to WIC reveal that changes in personal circumstances are a primary reasons for returning. Three-quarters (75%) of caregivers who left (and returned) cite re-enrolling after a move as their reason for returning. Over half (55%) indicate that they missed re-certification but eventually re-enrolled. These reasons suggest that permanent departure from the program is not the initial intent for many study families.

Analysis indicates that those who stay with WIC do so for a variety of reasons. Over 90 percent of caregivers who remain with WIC cite reasons including the food they receive, the education and information they receive, and that WIC staff listen to their thoughts about the child's health.

Continuous WIC participation through age 4 years is associated with diet quality as measured by the HEI-2015 total scores. Multivariate analyses exploring the association indicates that consistent participation in WIC across the first four years of life is associated with better diet quality when compared with those who left WIC after the infant year. Because 92 percent of caregivers participating in WIC during the child's fourth year report they find value in both WIC nutrition education and the supplemental food package, it is plausible that these two benefits are contributing factors to the higher diet quality scores among continuous participants. Moreover, among those on WIC in the child's fourth year, 78 percent indicate that they made a change in how they feed themselves or their families because of something they learned at WIC, which could also lead to better diet quality scores.

8. Summary, Conclusions, and Interpreting the Data

8.1 Summary

Study mothers report that the Special Supplemental Nutrition Program for Woman, Infants, and Children (WIC) nutrition education is having an impact on their feeding practices. About 70 percent of study mothers report having made, at least, one change due to something they learned at WIC. Among those who made a change, the most frequently cited (39%) important change made was knowing how to choose more healthy foods for themselves and their families. Most study mothers (92%) receiving WIC at 42 months indicate that the nutrition education they receive is as important as the food they receive.

Retention in WIC is relatively high over the course of the study: 59 percent of study mothers remain with WIC into the child's fourth year with only about 10 percent attrition in each of the previous study years and 12 percent participating intermittently. Among study mothers receiving WIC at the 42-month interview, 20 percent report a temporary break in WIC participation, with most breaks (68%) lasting 6 months or less. Children's diet quality, as measured by Healthy Eating Index (HEI-2015) scores, is associated with retention in the WIC program: children who consistently participate with WIC over the first four years of life have higher HEI-2015 total scores than those who leave WIC after the child's first year of life.

By the child's fourth year, 58 percent of caregivers are working or going to school, and about half (53%) of study children are in regular, nonparental child care. Between 30 and 42 months, there is a move away from care in a home towards center-based care, where it is more likely that the child care provider will provide all the food while the child is in care. Many caregivers, therefore, have less direct control over their children's dietary intakes. Nonetheless, about two-thirds of the study families eat at least 5 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 HEI-2015 diet quality score for WIC ITFPS-2 children at 48 months is 59, which is similar to the national average of 60. At 48 months, about 54 percent of study children meet the Dietary Guidelines for Americans (DGA) recommendation to consume less than

10 percent of calories from added sugars. This is down from 71 percent meeting this recommendation at 36 months. Participation in WIC at 48 months is significantly associated with greater likelihood of meeting the DGA recommendation for added sugars.

There are three areas of emerging concern when it comes to children's nutrient intakes in the fourth year. Although median intake of calcium exceeds recommended levels at 48 months, there is a notable uptick in the prevalence of inadequate intake from less than 1 percent at 36 months to nearly 27 percent at 48 months. In large part, this is driven by the failure of intakes to keep up with the increased recommended intake. A similar pattern is seen with vitamin E. Though median intake of vitamin E meets the recommended level, there is an increase in the estimated prevalence of inadequate intake from 27 percent at 36 months to 36 percent at 48 months.

Finally, like their peers nationally, there is high prevalence of overweight and obesity at 48 months among children participating in the WIC ITFPS-2. Although the majority (61%) of study children are in the normal/healthy range for body mass index (BMI)-for-age weight status category, about 33 percent are either overweight (15%) or obese (18%).

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 establishing causal relations, generalizing beyond the population represented by our probability sample, comparing data to other national studies, and disentangling caregiver perceptions of her experiences from actual experiences.

8.2.1 Establishing Causal and Direct Relationships

This is an observational study, which is a design well-suited to studying the influences of 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 there is no naturally occurring large, well-matched, unbiased comparison group available. 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 socio-demographic 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 used in the analyses. Additional work is needed to explore other associations, including those with education level. Some bivariate relationships between socio-demographic variables and outcomes may mask other third-variable characteristics, circumstances, or experiences that actually underlie these associations. Further research using complex multivariate modeling will be useful in identifying unique predictors of the key outcome variables.

8.2.2 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 less than 3 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 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 Marina 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 Characteristics reporting units.[99] 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 3-months postpartum, or who receive services at small WIC clinics. Similarly, the weighted sample represents the infants from the population who enrolled in WIC during our

[99] 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.

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.

8.2.3 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 years ago, and to compare findings from WIC ITFPS-2 to other studies such as the Food and Drug Administration's Infant Feeding Practices Study II (FDA/CDC IFPS-II) and the Gerber/Nestle Feeding Infants and Toddler Studies (FITS) 2016. Now that the WIC ITFPS-2 children are 4 years old, however, both WIC IFPS-1 and FDA/CDC IFPS-II do not have a comparable cohort, as both stopped at 12 months of age. The FITS 2016 study does include children relatively closed in age for the WIC ITFPS-2 48-month dietary intake data. However, the FITS age 3 group extends only until 47.9 months, so it is not ideal. Although this report describes comparisons to FITS findings, these are comparisons of the magnitude of the findings, and not tests of the statistical significance of those differences. As the standard errors of the weighted estimates FITS 2016 are not consistently available for analysis, it is not possible to conduct valid statistical comparison between the studies. Additionally, the studies' methodologies, including timing of all interviews and populations included, would need to be more clearly aligned than is possible while still meeting other important goals of WIC ITFPS-2. To ensure that comparisons between WIC ITFPS-2 and other studies are robust, the study team focuses on describing differences that are large in magnitude, and that are comparable in nature and developmental stage.

8.2.4 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 health care 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 and its relation to child outcomes may contain error.

8.2.5 Scope of the Study

Finally, WIC ITFPS-2 will follow this national sample of study children until they turn 6 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 4, and may not even be apparent by age 6. 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 *Fourth Year Report*, which follows the release of four previous WIC ITFPS-2 reports (May et al., 2015; May et al., 2017; Borger et al., 2018; Weinfield et al., 2019), is the fifth in what will be a series of reports from the ongoing WIC ITFPS-2. Subsequent reports from the study will cover the ages 5 and 6 years, examining nutrition, health outcomes, and family feeding practices of WIC children. The data from WIC ITFPS-2, which the Food and Nutrition Service will make available, will also provide scientific researchers and the public with a landmark platform of data from which to pursue further analyses on nutrition and health in children of low-income families.

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 beyond the first 4 years of life. Given WIC's goal of safeguarding the health of low-income children by providing nutritious supplemental foods, it will be important to continue to examine the children's dietary intakes.

- WIC ITFPS-2 will continue to follow the weight and height of WIC children through age 6 years, to understand the future trajectory of overweight and obese children in this

population. Around the time of the fourth birthday, 15 percent of study children are overweight, and 18 percent are obese. Future reports will determine how weight status at age 4 relates to subsequent overweight or obesity status.

- As more WIC ITFP-2 children discontinue WIC participation, future reports will examine the relationship between continued WIC participation and key outcomes in greater depth.

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