

Appendix A

Study Research Questions

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Table A-1. Study research questions

Research question	Chapter
Background and Environmental Characteristics	
1. How do feeding practices vary with working and family care/childcare/preschool circumstances?	2,5
2. What are the main barriers to eating healthy?	2
3. What is the influence of parenting and broader environmental factors on early dietary behaviors that may affect child obesity?	5,6
4. What is the impact of participation in other Federal food benefit programs on feeding practices and health outcomes?	3,4,6
Nutrition and Health Outcomes	
5. What is the food and nutrient intake of 4–5 year olds, both overall and by subgroups of interest?	3,4
6. What are the meal and snack patterns, both overall and by subgroups of interest?	3
7. How do feeding practices impact children's weight and growth?	6
8. When do “unhealthy” eating habits typically begin and are there early warning signs that a change is occurring?	3
9. 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 4–5 years?	3,4,6,7
10. Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to weight trajectories or child overweight/obesity at ages 4–5 years?	6
Impact of WIC	
11. Does continued participation in WIC lead to better eating behaviors and health outcomes?	7
12. Does the nutrient intake of 4–5 year olds reflect nutrients provided in the WIC food package?	4
13. What is the impact of WIC experience on outcomes beyond nutrition and health such as developmental outcomes?	7
14. Does continued participation in WIC have a positive corollary effect on access to healthcare and continuity of care?	7
15. What factors lead to continued/discontinued/renewed participation in WIC through age 5?	7

Table A-2. Study Research Questions by Example Independent and Dependent Variables¹

Research question	Example Independent Variables	Example Dependent Variables	Chapter
Background and Environmental Characteristics			
1. How do feeding practices vary with working and family care/childcare/preschool circumstances?	a. Child care arrangement (informal vs. formal) b. Employment	a. Source of food at site of child care (child care provides food, mother provides food, equally divided) b. Number of times family eats together in a week	a. Section 2.5.2 b. Section 5.6.3
2. What are the main barriers to eating healthy?	a. Socio-demographic variables b. Household in food desert	a. Perceived cost of fresh fruits and vegetables; effort involved in preparation of fresh fruits and vegetables; dislike of fresh produce b. Access to fresh fruits and vegetables	a. Section 2.7.2 b. Section 2.7.1
3. What is the influence of parenting and broader environmental factors on early dietary behaviors that may affect child obesity?	a. Number of time family eats together in a week b. How often TV is on during meals	a. Healthy Eating Index-2015 b. Healthy Eating Index-2015	a. Section 5.6.4 b. Section 5.6.4
4. What is the impact of participation in other Federal food benefit programs on feeding practices and health outcomes?	a. Influence of participation in the Supplemental Nutrition Assistance Program (SNAP) b. Influence of SNAP participation c. Participation in non-WIC benefits programs	a. Likelihood of meeting the Dietary Guidelines for Americans recommendation on added sugars intake b. Energy intake (regression model) c. Belief that child should be allowed to eat sugary food; should be allowed to eat snack foods; should be allowed to drink sugary drinks	a. Section 3.7 b. Section 4.5 c. Section 5.4.1

Research question	Example Independent Variables	Example Dependent Variables	Chapter
Nutrition and Health Outcomes			
5. What is the food and nutrient intake of 4–5 year olds, both overall and by subgroups of interest?	a. Socio-demographic variables b. Socio-demographic variables	a. Food group intake b. Total daily energy and nutrient intake	a. Section 3.5 b. Section 4.4
6. What are the meal and snack patterns, both overall and by subgroups of interest?	a. Socio-demographic variables	a. Consumption of breakfast, lunch, dinner, and snacks (measured using 24 hour dietary recall)	a. Section 3.4
7. How do feeding practices impact children's weight and growth?	a. Keeping track of what the child eats b. Trying to get the child to finish his/her food c. Carefully controlling how much the child eats	a. BMI-for-age weight status at age 4 years b. BMI-for-age weight status at age 4 years c. BMI-for-age weight status at age 4 years	a. Section 6.7.2 b. Section 6.7.2 c. Section 6.7.2
8. When do “unhealthy” eating habits typically begin and are there early warning signs that a change is occurring?	a. Timing of introduction of sugar-sweetened beverages b. Age when sweet foods are introduced	a. Likelihood of meeting the Dietary Guidelines for Americans recommendation on added sugar intake b. Likelihood of meeting the Dietary Guidelines for Americans recommendation on added sugar intake	a. Section 4.5 b. Section 4.5
9. 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 4–5 years?	a. Solid food introduction prior to 4 months b. Age when sweet foods are introduced c. Healthy Eating Index-2015 score at 4 years d. Carefully control how much child eats e. Timing of introduction of sugar-sweetened beverages	a. BMI-for-age weight status at age 4 years b. Likelihood of meeting the Dietary Guidelines for Americans recommendation on added sugar intake c. BMI-for-age weight status at age 4 years d. Number of times introducing a new food before deciding child does not like it e. Total daily energy intake	a. Section 6.7.2 b. Section 3.7 c. Section 6.7.2 d. Section 5.5.4 e. Section 4.5

Research question	Example Independent Variables	Example Dependent Variables	Chapter
10. Do early feeding practices, meal/snack patterns, or food and nutrient intakes relate to weight trajectories or child overweight/obesity at ages 4–5 years?	a. Breastfeeding duration b. Energy consumption top quartile	a. BMI-for-age weight status at age 4 years b. BMI-for-age weight status at age 4 years	a. Section 6.7.2, 6.8.2 b. Section 6.7.2
Impact of WIC			
11. Does continued participation in WIC lead to better eating behaviors and health outcomes?	a. WIC retention	a. Healthy Eating Index-2015, total and component scores	a. Section 7.7
12. Does the nutrient intake of 4–5 year olds reflect nutrients provided in the WIC food package?	a. WIC participation status	a. Total daily energy and nutrient intake	a. Section 4.4.3
13. What is the impact of WIC experience on outcomes beyond nutrition and health such as developmental outcomes?	a. WIC retention	a. Personal-social and social development as measured by personal-social development scale scores	a. Section 7.7
14. Does continued participation in WIC have a positive corollary effect on access to healthcare and continuity of care?	a. WIC status at 36 months b. WIC retention	a. Child has a well visit at age 3 b. Child has a medical home in the fourth year or a well visit at age 3	a. Section 2.8.2 b. Section 7.7
15. What factors lead to continued/discontinued/renewed participation in WIC through age 5?	a. Socio-demographic variables b. Caregiver's prior WIC experience	a. WIC retention category (six retention categories at age 4 years) b. WIC retention category (six retention categories at age 4 years)	a. Section 7.6 b. Section 7.6

¹ The independent and dependent variables presented in this table are example of the analyses conducted in order to answer the designated research questions. This table is not an exhaustive list of all analyses conducted.

Appendix B1

Details of Sampling and Weighting Procedures and Attrition

Appendix B1

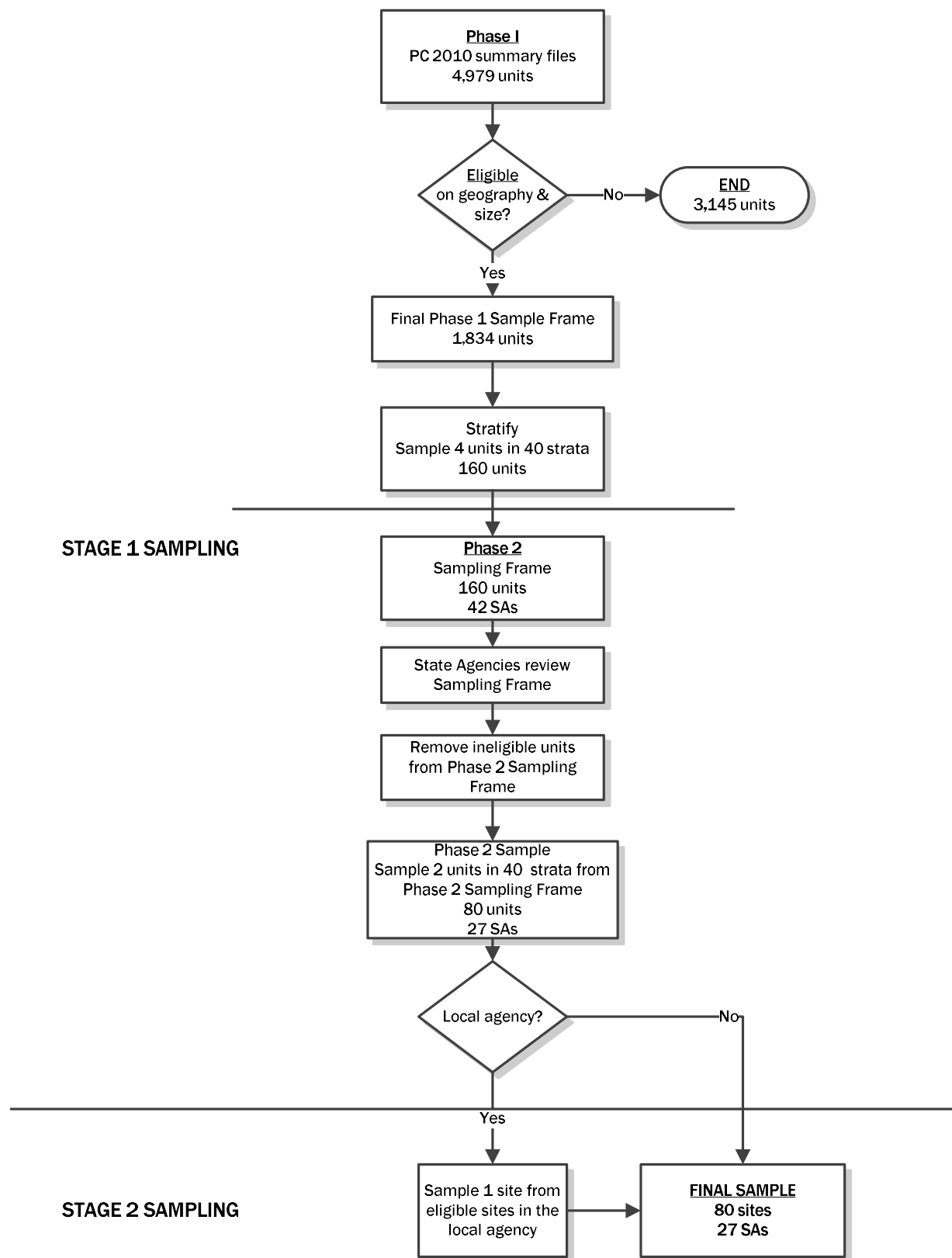
Details of Sampling and Weighting Procedures

B1.1 Selection of WIC Sites

The WIC service sites were selected using a stratified two-stage sampling approach. Because no national list of service sites exists, we used, as a sampling frame, a summary file at the level of the unit reported by each State Agency (SA) in the census of April 2010 (the WIC Program and Participant Characteristics 2010, or PC2010). This census resulted in a file with one record for each participant being served by WIC in that month. Because State agencies had flexibility for PC2010 for reporting service location identifiers, the IDs provided in the records by the State agencies varied; some State agencies provided the site ID in addition to a local agency code, whereas other State agencies included only a local agency code. As a result, two stages of selection were used to sample sites. The first stage involved the sampling of “PC2010 tabulation units”—the units for which IDs were provided in the PC2010 data. The second stage involved the sampling of sites for situations in which the sampled tabulation unit was a local agency. (For the remainder of this report, these tabulation units will be referred to, using standard statistical terminology, as “first-stage” sampling units.) Additionally, because the information needed to determine final eligibility of sites (namely, current enrollment information and whether the site was expected to be operational during the study recruitment period) was not available in the PC2010 data, the first-stage sample was selected in two phases in order to contact SAs to obtain additional eligibility information about the sites. The ultimate goal was the selection of 80 WIC sites. Figure B1-1 is a flowchart that gives a general overview of the WIC site sampling process.

As shown in Figure B1-1, Phase 1 of Stage 1 involved the selection of four first-stage sampling units in each of 40 strata to create a Phase 2 sampling frame of 160 units. Stratification involved partitioning the sampling frame into four homogeneous groups and was used to improve the precision of estimates and to ensure representation in the sample of different types of sites. In Phase 2 of Stage 1, we contacted SAs to determine the eligibility of each of the units sampled in the first phase and then sampled two units from among the eligible first-stage sampling units in each stratum for a total of 80 units. In Stage 2, we sampled the services sites within the sampled units that were local agencies (rather than service sites) and selected one site from each local agency.

Figure B1-1. Overview of WIC site sampling process



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

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

B1.2 Construction of the Sampling Frame

The sampling frame was constructed from the WIC PC2010 dataset. PC2010 data were provided through a total of 90 individual SAS data files—one for each State WIC Agency. The PC2010 was obtained from FNS in October 2011. Once received, Westat’s subcontractor, Altarum, merged all 90 files into a single analytic file. Altarum thoroughly reviewed the PC2010 Guidance document to better understand each field that is included in the PC2010 database and to identify fields that would be required to develop the first-stage sampling frame file, including the following variables that Altarum derived from information provided in the PC2010 database:

- Unit (i.e., a unique identifier for the PC2010 tabulation unit described in Section B1.1, which was either the WIC site or the local agency);
- Unit Source;
- Number of Exclusively Breastfeeding Women;
- Number of Postpartum Women, Not Breastfeeding;
- Number of Prenatal Women Enrolled in April 2010 (PC2010 reference month);
- Number of Infants Under Age 3 Months Enrolled in April 2010;
- Total Number of Infants Enrolled in April 2010;
- Percent of Infants Enrolled in April 2010 Who Were Under Age 3 Months;
- Total Number of Participants (all Categories);

- Number of Women Participants Under Age 18 Years in April 2010;
- Number of Women Participants Under Age 16 Years in April 2010;
- Percent of Women With High Weight for Height Risk Code; and
- Percent of Children With High Weight for Height Risk Code.

B1.3 Stage 1 Sampling: Selection of the Phase 1 Sample

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

B1.3.1 Measure of Size Computation

The sample design involved sampling sites with probabilities proportional to an MOS (i.e., probability proportional to size [PPS] sampling). For the Phase 1 sample, the MOS was the expected number of eligible enrollees for the first-stage sampling unit, based on the April 2010 enrollment counts from the PC2010. That is, the MOS was calculated for each first-stage sampling unit by summing the total prenatal enrollment and 20 percent of the total enrollment of infants less than 3 months.¹ Based on the aforementioned eligibility considerations, units with a value less than 30 for this MOS (i.e., less than 1.5 enrollees per day, assuming 20 enrollment days per month) were considered ineligible.

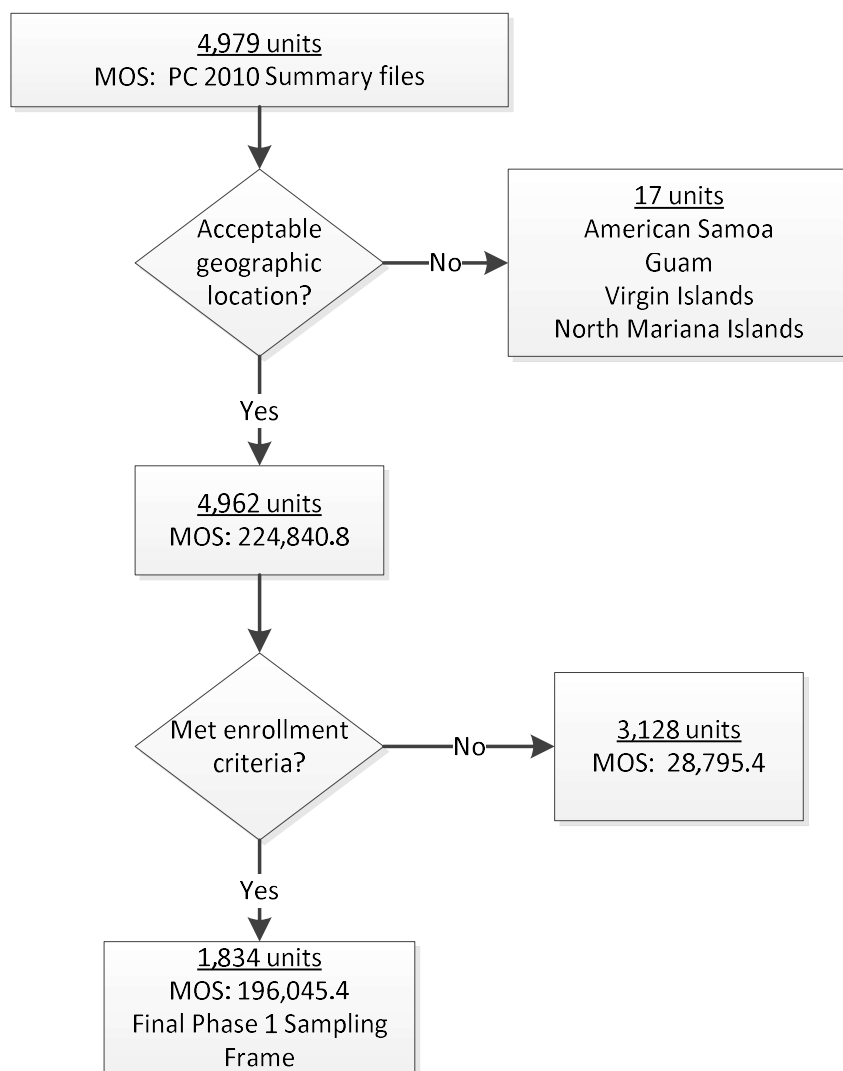
B1.3.2 Exclusion of Ineligible Units

As shown in Figure B1-2, a total of 4,979 units appeared on the PC2010 summary file that served as the basis for creating the sampling frame. Of these, a very small proportion (17 units) was dropped because of geographic location (American Samoa, Guam, Northern Mariana Islands, U.S. Virgin Islands). Since the units in these territories represented only 0.3 percent of the total sampling frame, this did not impact the representativeness of the frame. The remaining 4,962 units had a total MOS of 224,840.8. Of these, 3,128 units (with a total MOS of 28,795.4, about 12.8 percent of the total

¹ The 20 percent figure is based on an estimate from the Early Childhood Longitudinal Study-Birth Cohort that 20 percent of infants enrolled in WIC were not enrolled prenatally.

among geographically eligible units) were dropped because their MOS value was less than 30. As a result, the final Phase 1 sampling frame contained a total of 1,834 units, with a total MOS of 196,045.4.

Figure B1-2. Exclusion of ineligible from unit selection process



B1.3.3 Stratification and Selection of the Phase 1 Sample

As noted above, the sample was designed to yield 80 sampled service sites. To achieve this, a total of 40 strata were formed, and ultimately (after two phases of selection) two sites were sampled from each of these strata. Five characteristics of the first-stage sampling unit or its SA were used to form

the strata (note that the first three of these five characteristics are features of the State WIC Agency Plan that were used to group the WIC SA programs into categories):

- **Peer Counseling Program.** Whether the SA has a breastfeeding peer counseling program in place.²
- **Trained Paraprofessionals.** Whether SA policy allows for trained paraprofessionals to provide nutrition education (vs. requiring that staff that provide nutrition education have professional training or credentials).
- **Policy to Provide Formula.** Whether SA policy is to provide one can of formula for breastfeeding infants during the first 30 days of life.
- **Percent of Women Who Used Fully Breastfeeding Package.** This variable was an estimate of the percentage of women in the first-stage sampling unit who utilized the fully breastfeeding food package during the postpartum period. The PC2010 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 of 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 PC2010 data were used to estimate the percent’s of children and of mothers who are “high weight for height”³ at the first-stage sampling unit level, and these percentages were averaged together to get a measure of risk of being overweight for all participants at the first-stage sampling unit level.

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

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

² It turned out that there was no variation in this characteristic; all states reported offering a breastfeeding-peer counseling program.

³ For children (12 months or older), “high weight for height” is determined based on nutrition risk code 110. 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 pregravid BMI of 25 or higher.

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

Table B1-1 presents a tabulation of how the strata were defined. Specifically, each particular combination shown in the (1) cross-tabulation of the features of the WIC SA plan, (2) exclusively breastfeeding range, and (3) high weight for height range, constitutes a stratum. This tabulation shows, for each stratum, the total MOS, the number of units on the sampling frame, the number of units selected in the first phase, the number of sampled Phase 1 units that were eligible for Phase 2 selection, and the number of units sampled in the second phase. Each of the counts of units was broken down by local agencies and individual sites.

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

Table B1-1. Definitions of the strata used for site sampling and key sampling statistics by stratum

Stratum ID	Features of the state WIC program	% of women who used fully breastfeeding package	Children and mothers' high weight for height rates (%)	Total stratum measure of size	Number of											
					Units on frame			Phase 1 units sampled			Phase 2 units sampled			Phase 2 units sampled		
					Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites
101	Does the state operate a breastfeeding peer counseling program? YES	0-10.5691	0-36.7147	4,997.2	65	1	64	4	0	4	4	0	4	2	0	2
102		0-10.5691	36.7147-45.9689	4,952.0	62	0	62	4	0	4	3	0	3	2	0	2
103	Does the State require that general nutrition education be provided by a professional staff member, e.g., dietitian, nurse? NO	10.5691-14.4928	0-35.5971	4,994.0	61	4	57	4	0	4	4	0	4	2	0	2
104		10.5691-14.4928	35.5971-44.0943	5,000.0	49	3	46	4	0	4	3	0	3	2	0	2
105		14.4928-20.3863	0-33.5319	4,973.4	66	4	62	4	0	4	4	0	4	2	0	2
106		14.4928-20.3863	33.5319-44.3548	4,980.8	63	9	54	4	1	3	2	0	2	2	0	2
107	Is infant formula issued in the 1st month to partially breastfed infants? NO	20.3863-63.5838	0-30.7242	5,019.4	59	28	31	4	3	1	4	3	1	2	1	1
108		20.3863-63.5838	30.7242-33.0749	4,988.0	43	16	27	4	2	2	4	2	2	2	1	1
109		20.3863-63.5838	33.0749-35.2011	4,999.6	52	14	38	4	2	2	4	2	2	2	1	1
110		20.3863-63.5838	35.2011-52.7565	4,968.4	67	22	45	4	2	2	2	0	2	2	0	2
200	Does the state operate a breastfeeding peer counseling program? YES	0-100	0-100	6,340.4	1	1	0	1	1	0	1	1	0	1	1	0
201		0-14.2857	0-28.7699	4,874.6	64	14	50	4	1	3	4	1	3	2	0	2
202		0-14.2857	28.7699-30.9995	4,905.0	47	11	36	4	2	2	3	1	2	2	1	1
203	Does the State require that general nutrition education be provided by a professional staff member, e.g., dietitian, nurse? NO	0-14.2857	30.9995-33.0338	4,839.8	47	10	37	4	1	3	3	1	2	2	0	2
204		0-14.2857	33.0338-34.1299	4,913.8	45	14	31	4	3	1	4	3	1	2	1	1
205		0-14.2857	34.1299-35.0733	4,893.4	48	12	36	4	1	3	4	1	3	2	1	1
206		0-14.2857	35.0733-35.8987	4,853.8	45	17	28	4	2	2	3	2	1	2	1	1
207		0-14.2857	35.8987-36.6585	4,881.4	45	18	27	4	3	1	4	3	1	2	2	0
208		0-14.2857	36.6585-37.5487	4,868.6	40	18	22	4	4	0	4	4	0	2	2	0
209	Is infant formula issued in the 1st month to partially breastfed infants? YES	0-14.2857	37.5487-39.0369	4,961.8	39	18	21	4	1	3	4	1	3	2	0	2
210		0-14.2857	39.0369-40.9907	4,768.6	38	17	21	4	3	1	4	3	1	2	2	0
211		0-14.2857	40.9907-44.6064	4,982.6	53	21	32	4	3	1	4	3	1	2	1	1
212		0-14.2857	44.6064-61.7659	4,874.4	55	24	31	4	3	1	3	2	1	2	1	1
213		14.2857-20.9273	0-31.9917	4,934.6	36	9	27	4	2	2	4	2	2	2	2	0
214		14.2857-20.9273	31.9917-34.1434	4,837.4	45	7	38	4	1	3	4	1	3	2	1	1
215		14.2857-20.9273	34.1434-35.2664	5,028.0	29	10	19	4	1	3	3	1	2	2	1	1
216		14.2857-20.9273	35.2664-37.6706	4,989.8	47	19	28	4	2	2	3	2	1	2	1	1
217		14.2857-20.9273	37.6706-41.8135	4,935.6	49	17	32	4	2	2	4	2	2	2	2	0

Table B1-1. Definitions of the strata used for site sampling and key sampling statistics by stratum (continued)

Stratum ID	Features of the state WIC program	% of women who used fully breastfeeding package	Children and mothers' high weight for height rates (%)	Total stratum measure of size	Number of											
					Units on frame			Phase 1 units sampled			Phase units sampled eligible for phase 2			Phase 2 units sampled		
					Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites
218		14.2857-20.9273	41.8135-55.0665	4,860.4	49	19	30	4	2	2	3	2	1	2	2	0
219		20.9273-29.3196	0-32.3818	4,892.6	39	8	31	4	2	2	4	2	2	2	1	1
220		20.9273-29.3196	32.3818-36.7067	4,924.8	56	20	36	4	3	1	4	3	1	2	1	1
221		20.9273-29.3196	36.7067-38.5783	4,897.2	23	13	10	4	4	0	4	4	0	2	2	0
222		20.9273-29.3196	38.5783-52.1351	4,912.4	44	22	22	4	3	1	4	3	1	2	2	0
223		29.3196-35.9756	0-32.5106	4,823.4	30	18	12	4	4	0	3	3	0	2	2	0
224		29.3196-35.9756	32.5106-49.5159	4,706.6	36	20	16	4	2	2	4	2	2	2	1	1
225		35.9756-69.1358	0-32.6778	4,878.4	28	24	4	4	3	1	3	3	0	2	2	0
226		35.9756-69.1358	32.6778-47.0875	4,954.0	38	32	6	4	4	0	3	3	0	2	2	0
301	Does the state operate a breastfeeding peer counseling program? YES	0-7.6336	0-100	4,222.0	47	4	43	4	1	3	3	1	2	2	1	1
302		7.6336-33.3992	0-34.2542	4,262.8	37	10	27	4	3	1	3	2	1	2	2	0
303	Does the State require that general nutrition education be provided by a professional staff member, e.g., dietitian, nurse? YES	7.6336-33.3992	34.2542-50.2087	4,154.4	47	6	41	4	1	3	4	1	3	2	1	1
	Is infant formula issued in the 1st month to partially breastfed infants? N/A															
Total				196,045.4	1,834	554	1,280	157	78	79	139	70	69	79	42	37

B1.3.4 Stage 1 Sampling: Selection of the Phase 2 Sample

Following the selection of the Phase 1 sample of 160 first-stage units, further work was undertaken to enumerate individual service sites (when the first-stage unit was a local agency), ascertain each unit's eligibility, and select the final sample of sites. During April 2012, 42 SAs were sent an introductory letter and asked to review a list of local agencies in their State in the Phase 1 sampling frame of 160 units and provide information needed for Phase 2 of sampling. The 42 SAs were divided into two groups based on the information they reported for the PC2010 census. The 21 SAs in Group A reported their local agencies on the census, but not the service sites under the local agencies. The 21 SAs in Group B reported their local agencies but also reported IDs for the sites under the local agencies. Group A was sent a list of all their local agencies on the sampling frame, along with the names of the sites within each local agency, based on information we obtained from their State and local web sites. They were asked to review the list of local agencies and service sites, remove sites that were not operational, and add sites that were missing from the list. SAs in Group B were sent a list of local agencies and the ID numbers of service sites under the local agencies, and were asked to provide the name of the site corresponding to the site number(s), and indicate whether or not the site(s) was expected to continue as an operational site for the next 12 months.

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

The information SAs provided was used to determine eligibility for the Phase 2 sample. Sites that were not expected to continue in operations for the next 12 months and sites that did not meet the eligibility criteria (in terms of enrollment flow) were designated as ineligible. If the first-stage sampling unit was a local agency, that unit was designated as ineligible if all sites associated with the local agency were ineligible; otherwise, that unit was eligible.

Subsampling (second-phase selection) of eligible first-stage sampling units was done to arrive at the final sample of first-stage sampling units. In each of the 40 strata (the same strata used for the

Phase 1 sample) two first-stage units were sampled with equal probability from among the eligible units.

B1.4 Stage 2 Sampling

As shown in Figure B1-1, Stage 1 sampling units selected in the Phase 2 sample that were local agencies (i.e., consisted of more than one service site), went through a second stage of sampling to select one service site. For each first-stage sampling unit that was a local agency, the eligible service sites were listed. An MOS that reflected the expected average daily enrollment was obtained for each service site by summing the January 2012 prenatal enrollment and 20 percent of the January 2012 infant enrollment, and dividing this total by the number of enrollment days in January 2012. Within each local agency in the Phase 2 sample, exactly one service site was sampled from the eligible sites with probabilities proportional to this MOS. The final sample of service sites contained a total of 80 sites in 27 SAs.

B1.5 Site Replacements

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

B1.6 Sampling New WIC Enrollees

B1.6.1 Recruitment Windows

The sample included all prenatal mothers or their babies less than 2.5 months old who were newly enrolled into WIC at the sampled site during a pre-specified recruitment window. Mothers were eligible to participate even if they had enrolled in WIC for a previous pregnancy or previous child. The recruitment window was a consecutive string of days in which all new WIC enrollees in that site were designated to be screened for eligibility and recruited into WIC ITFPS-2. The length of the

recruitment window for each site was predetermined based on the estimated amount of time that would have been needed in July 2012⁴ to yield 98 new WIC enrollees per site (the target sample size for each site). Since the flow of new WIC enrollees into the 80 sampled sites was decidedly different, the window length was much shorter in clinics with a “high flow” of new enrollees compared with clinics with a “low flow.” The study screening and enrollment processes did not necessarily occur during the recruitment window, but the study participants must have enrolled in WIC at the service site during the recruitment period.

After notifying the sites of their selection into the study, we provided them enrollment data obtained from the WIC PC2010 dataset on their participation, prenatal and infant enrollment rates, and the site days of operation for January 2012. The sites were asked to identify any significant changes to the information (such as increases or decreases in participation or prenatal/infant enrollments between January and August), and to update the site schedule for enrolling new participants.

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

The 20-week recruitment period began July 1, 2013 and ended November 18, 2013. Before starting recruitment we increased the recruitment window for each site by 3 percent to serve as a buffer based on new enrollment data that suggested the WIC enrollment was declining. However, even with the 3 percent buffer, after 4 weeks into recruitment with 40 sites in the field (August 1, 2013), we projected we would only reach about 84 percent of the estimated number of eligible WIC

⁴ July 2012 was the month the sites provided updated enrollment counts and schedule information prior to calculating recruitment windows.

women relative to the expected numbers that were estimated in July 2012. As a result, all recruitment windows were extended by an additional 10 percent (with the exception of five sites where the full 10 percent extension could not be achieved while still ending recruitment on November 18).

B1.6.2 Core and Supplemental Samples

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

During recruitment, each pregnant client was asked if this was the first time she had enrolled for WIC during this pregnancy, and each mother of a newly enrolling infant was asked if she was enrolled in WIC during her pregnancy for the infant at hand. For both prenatal and postnatal enrollees, only first-time enrollees were eligible for the sample. With this approach, ineligible postpartum mothers and infants were immediately screened out of the sample. During recruitment, the sample was screened to determine race, ethnicity, trimester at enrollment, pre-pregnancy BMI, household composition, and income, and new enrollees not required to achieve the subgroup targets were subsampled from the supplemental sample. This approach was designed to drop approximately: 68 percent of White mothers; 81 percent of Hispanic mothers; 71 percent of mothers in their first trimester; 68 percent of mothers in their second or third trimester; 18 percent of mothers enrolling postnatally; 58 percent of obese mothers; 29 percent of overweight mothers; 71 percent of mother with low or normal pre-pregnancy BMI; 54 percent of mothers with income at or below 75 percent of poverty; 64 percent of mothers with income between 76-130 percent of poverty; and 69 percent of mothers with income above 130 percent of poverty. These rates were based on the sample sizes needed to support the precision requirements (power projections) and were determined by taking into account estimated population distributions.

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

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

B1.6.3 Multiple Births

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

B1.7 Details of the Weighting Procedures

B1.7.1 Computation of Survey Weights

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

- The prenatal respondents;
- The 1-month interview, 3-month interview, 5-month interview, 7-month interview, 9-month interview, 11-month interview, 13-month interview, 15-month interview, 18-month interview, 24-month interview, 30-month interview, 36-month interview, 42-month interview, and 48-month interview respondents (separately);
- A set of participants who responded to either the 1- or 3-month interview;

- A set of participants who responded to the prenatal interview, the 1-month interview, the 3-month interview, the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, and the 13-month interview;
- A set of participants who responded to the prenatal interview, the 1-month interview, the 3-month interview, the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the 18-month interview, and the 24-month interview;
- A set of participants who responded to either the 1-month or the 3-month interview, and also responded to the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the 18-month interview, and the 24-month interview;
- A set of participants who responded to either the 1-month or the 3-month interview, and also responded to the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the 18-month interview, the 24-month interview, the 30-month interview, and the 36-month interview;
- A set of participants who responded to either the 1-month or the 3-month interview, and also responded to the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the 18-month interview, the 24-month interview, the 30-month interview, the 36-month interview, the 42-month interview, and the 48-month interview;
- A set of participants for whom birth length and weight measurements were available;
- A set of participants for whom 6-month length and weight measurements were available;
- A set of participants for whom 12-month length and weight measurements were available;
- A set of participants for whom 24-month length and weight measurements were available;
- A set of participants for whom 36-month length and weight measurements were available;
- A set of participants for whom 48-month length and weight measurements were available;
- A set of participants who responded to either the 1-month or the 3-month interview; also responded to the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the

18-month interview, the 24-month interview, the 30-month interview, and the 36-month interview; and also provided 36-month length and weight measurements; and

- A set of participants who responded to either the 1-month or the 3-month interview; also responded to the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, the 13-month interview, the 15-month interview, the 18-month interview, the 24-month interview, the 30-month interview, the 36-month interview, the 42-month interview, and the 48-month interview; and also provided 48-month length and weight measurements.

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

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

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

As discussed in Section B1.3, two samples were selected at each site: a core longitudinal and supplemental sample. For some interviews, both the core and supplemental sample (combined) are interviewed, while for other interviews, only the core sample is interviewed. The participant weights for these interviews include factors to account for the subsampling of participants for the core sample and for the subsampling of participants in the supplemental sample, to produce core-only sample weights and combined sample weights. The weights for a particular interview are based on the sample to which the interview was administered.

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

B1.7.2 Adjusting for Nonresponse

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

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

- **Adjusting for log nonresponse and nonresponse to the screener:** Service site.
- **Adjusting for nonresponse to the enrollment instrument or failure to consent to the study:** Mother's age; timing of WIC enrollment (1st trimester, 2nd trimester, 3rd trimester, postnatal); mother's weight category (overweight, obese, other); mother's Hispanic origin; mother's race; poverty status; and language.
- **Adjusting for prenatal interview nonresponse:** Timing of WIC enrollment, mother's age, language, and race.
- **Adjusting for 1-month interview nonresponse:**
 - **Core-only sample:** Timing of WIC enrollment, food security, mother's Hispanic origin, mother's weight category, mother's race, age, language, and poverty status.
 - **Combined sample (core and supplemental):** Timing of WIC enrollment, mother's race, mother's weight category, mother's Hispanic origin, age, food security, language, and poverty status.

- **Adjusting for 3-month interview nonresponse (Core-only sample):** Mother's weight category, food security, language, poverty status, race, timing of WIC enrollment, and mother's age.
- **Adjusting for nonresponse to both the 1- and 3-month interviews:**
 - **Core-only sample:** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
 - **Combined sample (core and supplemental):** Food security, mother's weight category, mother's age, language, mother's race, timing of WIC enrollment, and poverty status.
- **Adjusting for 5-month interview nonresponse (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for 7-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race.
- **Adjusting for 9-month interview nonresponse (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for 11-month interview nonresponse (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for 13-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, mother's race, and WIC enrollment status at 7 months.
- **Adjusting for nonresponse to any interview from the prenatal interview through the 13-month interview (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for nonresponse to the 1-month interview and the 3-month interview, or to any interview from the 5-month interview through the 13-month interview (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race.
- **Adjusting for nonresponse to the 1-month interview and the 3-month interview, or to any interview from the 5-month interview through the 24-month interview**

(Core-only sample): Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race.

- **Adjusting for 15-month interview nonresponse (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 13 months, and mother's race.
- **Adjusting for 18-month interview nonresponse (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, WIC enrollment status at 15 months, and mother's race.
- **Adjusting for 24-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, WIC enrollment status at 13 months, and mother's race.
- **Adjusting for nonresponse to the 1-month interview and the 3-month interview, or to any interview from the 5-month interview through the 36-month interview (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for 30-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race.
- **Adjusting for 36-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race.
- **Adjusting for nonresponse to the 1-month interview and the 3-month interview, or to any interview from the 5-month interview through the 48-month interview (Core-only sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for 42-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, mother's Hispanic origin, and mother's race.
- **Adjusting for 48-month interview nonresponse (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, poverty status, language, mother's Hispanic origin, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to the birth length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, WIC enrollment status at 1 month, and mother's race.

- **Adjusting for nonresponse (i.e., lack of availability) to the 6-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 3 months, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to the 12-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, WIC enrollment status at 7 months, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to the 24-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, WIC enrollment status at 13 months, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to the 36-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to the 48-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to any of the 6-month, 12-month, 24-month, and/or 36-month length and weight measurements (Combined sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, language, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to any of the interviews (1- or 3-month through 36-month) and/or 36-month length and weight measurements (Core sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.
- **Adjusting for nonresponse (i.e., lack of availability) to any of the interviews (1- or 3-month through 48-month) and/or 48-month length and weight measurements (Core sample):** Food security, mother's weight category, mother's age, timing of WIC enrollment, mother's Hispanic origin, poverty status, language, and mother's race.

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

the weights from the previous adjustment (i.e., the weights from the previous adjustment were divided by the weighted response rate in the weighting class) to obtain the corresponding nonresponse-adjusted weights.

B1.7.3 Replicate Weights

In addition to the full sample weights described above, a series of replicate weights were created and attached to each data record for variance estimation. Replication methods provide a relatively simple and robust approach to estimating sampling variances for complex survey data (Rust & Rao, 1996). The basic replication approach is to repeatedly select portions of the sample (“replicates”) and then to apply the weighting process developed for the full sample to each replicate separately. The estimate of interest is calculated for each replicate. The variability among these estimates is then used to estimate the variance of the full sample statistics. The replicate weights were used to calculate standard errors of the survey-based estimates and to conduct significance tests and other analyses.

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

B1.7.4 Determining Which Survey Weight to Use for a Particular Analysis

As discussed in section B1.7.1, several different sets of weights have been computed for different analysis purposes. In planning for an analysis, a critical early step is to identify the weight that is appropriate for that analysis. To do this, the analyst should determine how the set of cases being used in the analysis is defined. It is important to note that the choice of survey weight is not a function specifically of the variables being used, but rather of the set of cases being used in the analysis. For example, if the analysis involves estimating the proportion of infants with medical

conditions affecting feeding by 5 months of age, by whether or not they were exclusively breastfed through 5 months, including other covariates from the baseline (1- or 3-month) interview, then the set of cases included in the analysis are those who completed the 5-month interview; thus, the appropriate weight is the 5-month interview (cross-sectional) weight. To consider another example, if the analysis involves examining how the introduction of sugar-sweetened beverages by 13 months of age is related to prenatal nutrition education provided by the WIC program and duration of breastfeeding (as measured by whether the infant was still being breastfed at each of 5-, 7-, 9-, 11-, and 13-months), the set of cases included in the analysis are those who completed the prenatal interview, a baseline (1- or 3-month) interview, and each of the 5-, 7-, 9-, 11-, and 13-month interviews; thus, the appropriate weight for that analysis would be the (longitudinal) weight computed for the set of participants who responded to the prenatal interview, the 1-month interview, the 3-month interview, the 5-month interview, the 7-month interview, the 9-month interview, the 11-month interview, and the 13-month interview.

B1.8 Imputation

Imputation was used to adjust for item nonresponse (i.e., missing data for particular items among those who respond to a given interview). All the key socio-demographic variables are imputed for the total sample (see Section 1.7). Table B1-2 presents the frequency of key socio-demographic characteristics using the 42-month cross-sectional weight, the 48-month cross-sectional weight, and the 1- or 3-month through 48-month weight, which is referred to as the longitudinal weight in this report. As with weighting, a carefully designed imputation procedure aims to reduce bias due to nonresponse (in this case, item nonresponse). The hot deck imputation method was used to generate the imputations (Kalton & Kasprzyk, 1982). With this approach, imputation cells are formed by cross-classifying variables that are associated with the variable being imputed and, where possible, also associated with the probability of response to the variable being imputed.

Table B1-2. Frequency of key socio-demographic characteristics using alternative weights

Key socio-demographic characteristic	Socio-demographic subgroups	42-month cross-sectional weight % (SE)	48-month cross-sectional weight % (SE)	Longitudinal weight (1 or 3 through 48 months) % (SE)
Caregiver race	African American	22.0 (2.9)	21.8 (2.9)	22.7 (3.0)
	White	58.3 (3.5)	58.7 (3.4)	59.1 (3.7)
	Other	19.7 (2.8)	19.4 (2.8)	18.2 (2.5)
Caregiver ethnicity	Hispanic or Latino	46.1 (4.6)	46.9 (4.8)	43.9 (5.1)
	Not Hispanic or Latino	53.9 (4.6)	53.1 (4.8)	56.1 (5.1)
Age of mother (at child's birth)	16-19 years	11.3 (1.2)	11.7 (1.2)	9.5 (1.2)
	20-25 years	40.6 (1.5)	40.2 (1.5)	40.8 (1.5)
	26 years or older	48.1 (1.4)	48.0 (1.5)	49.8 (1.6)
Marital Status at 36 months	Married	38.5 (1.9)	38.8 (2.0)	41.7 (2.6)
	Not married (including divorced and widowed)	61.5 (1.9)	61.2 (2.0)	58.3 (2.6)
Food Security at 36 months	High or marginal food security	74.0 (1.2)	73.8 (1.3)	74.0 (1.8)
	Low food security	16.1 (0.9)	16.4 (0.9)	16.0 (1.3)
	Very low food security	9.8 (0.8)	9.8 (0.8)	9.9 (1.1)
Participation in non-WIC benefit programs at 36 months	Does not participate in any other programs	19.4 (1.2)	20.1 (1.3)	19.0 (1.5)
	Participates in SNAP or SNAP and other programs	48.4 (1.6)	48.1 (1.7)	47.8 (2.3)
	Participates in other programs excluding SNAP	32.2 (1.4)	31.8 (1.4)	33.2 (1.7)
Parity	First born	42.5 (1.7)	42.5 (1.7)	40.9 (1.7)
	Second born	26.5 (1.1)	26.8 (1.2)	29.1 (1.7)
	Third or subsequent born	30.1 (1.5)	30.6 (1.5)	30.0 (2.0)
Weight status of mother at 30 months	Normal or underweight	34.4 (1.2)	34.6 (1.2)	32.9 (2.0)
	Overweight	29.5 (1.1)	29.4 (1.2)	30.1 (1.8)
	Obese	36.1 (1.1)	36.0 (1.1)	36.9 (1.4)
Poverty level at 36 months	75% of poverty guideline or below	43.4 (1.7)	43.9 (1.8)	44.1 (2.6)
	Above 75% but not more than 130% of poverty guideline	33.0 (1.3)	31.9 (1.4)	33.3 (2.1)
	Above 130% of poverty guideline	23.6 (1.2)	24.2 (1.3)	22.6 (1.6)
Timing of WIC enrollment	First trimester	31.2 (2.1)	30.8 (2.2)	31.5 (2.2)
	Second trimester	40.0 (1.8)	40.4 (1.8)	39.7 (1.6)
	Third trimester	15.4 (0.9)	15.6 (1.1)	15.7 (1.2)
	Postnatal	13.3 (1.5)	13.1 (1.5)	13.1 (1.4)
WIC participation status at 36 months	Child currently receiving WIC	58.8 (2.0)	58.8 (2.1)	62.6 (2.6)
	Child not currently receiving WIC	41.2 (2.0)	41.2 (2.1)	37.4 (2.6)

B1.9 Attrition

Table B1-3 Attrition of enrolled participants up to the 48-month interview

Attrition of enrolled participants (n = 4,367)	13-month Interview %	24-month Interview %	36-month Interview %	48-month Interview %
Total	17.6	21.6	26.1	28.9
Eligible ^a	12.9	16.8	21.2	23.8
Ineligible ^b	4.7	4.8	4.9	5.1

^a Participants eligible to continue in the study. Includes non-participation reasons such as non-locatable, refusal, and not completing a baseline interview.

^b Participants not eligible to continue in the study. Includes non-participation reasons such as pregnancy loss, child decease, and moving out of the country.

B1.10 References

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Appendix B2

B2a: Additional Analysis Details From Chapter 2

B2b: Additional Analysis Details From Chapter 3

B2c: Additional Analysis Details From Chapter 4

B2d: Additional Analysis Details From Chapter 5

B2e: Additional Analysis Details From Chapter 6

B2f: Additional Analysis Details From Chapter 7

Appendix B2a
Additional Analysis Details From Chapter 2

Appendix B2a

Additional Analysis Details From Chapter 2

Table B2a-1 presents the percentage of caregivers in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2) who work by their school status at 30 and 42 months.

Table B2a-1. Percentage of WIC ITFPS-2 caregivers working by school status at 30 and 42 months

Interview month	Full-time only, no school % (SE)	Full-time and school % (SE)	Part-time only, no school % (SE)	Part-time and school % (SE)	Total	Unweighted n	Weighted n
Month 30	26.2 (1.2)	4.9 (0.6)	14.3 (1.0)	3.8 (0.4)	49.2 (1.7)	2,621	441,560
Month 42	28.5 (1.2)	4.4 (0.4)	17.1 (1.1)	3.2 (0.4)	53.3 (1.7)	2,624	439,406

Table B2a-2 presents the percentage of WIC ITFPS-2 caregivers attending school by work status at 30 and 42 months.

Table B2a-2. Percentage of WIC ITFPS-2 caregivers who attend school by work status at 30 and 42 months

Interview month	School only, not working % (SE)	School and working part-time % (SE)	School and working full-time % (SE)	Total	Unweighted n	Weighted n
Month 30	6.1 (0.8)	3.8 (0.4)	4.9 (0.6)	14.8 (0.4)	2,621	441,560
Month 42	4.9 (0.5)	3.2 (0.4)	4.4 (0.4)	12.6 (0.9)	2,624	439,406

Table B2a-3 presents the percentage of WIC ITFPS-2 study children in regular child care at 30 and 42 months.

Table B2a-3. Percentage of WIC ITFPS-2 study children in regular child care at 30 and 42 months

Interview month	Currently using regular child care % (SE)	Ever used regular child care % (SE)	Unweighted n	Weighted n
Month 30	50.3 (1.8)	65.3 (1.6)	2,625	442,408
Month 42	53.2 (1.7)	71.1 (1.3)	2,636	441,987

Table B2a-4 presents the percentage of WIC ITFPS-2 children and/or mothers reporting participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) at 42 and 48 months.

Table B2a-4. Percentage of WIC ITFPS-2 children and/or mothers receiving WIC at 42 and 48 months

Interview month	Receiving WIC % (SE)	Not receiving WIC % (SE)	Unweighted n	Weighted n
Month 42	56.8 (2.4)	43.2 (2.4)	2,635	441,693
Month 48	52.5 (2.4)	47.5 (2.4)	2,569	441,056

Table B2a-5 presents the percentage of WIC ITFPS-2 families reporting participation in the Supplemental Nutrition Assistance Program (SNAP) or receiving Temporary Assistance for Needy Families (TANF) at 42 and 48 months.

Table B2a-5. Percentage of WIC ITFPS-2 families reporting receipt of SNAP or TANF at 42 and 48 months

Interview month	Receiving SNAP % (SE)	Receiving TANF % (SE)	Unweighted n	Weighted n
Month 42	48.9 (1.9)	7.0 (1.1)	2,625	440,162
Month 48	46.3 (1.7)	6.3 (1.0)	2,559	439,680

Table B2a-6 presents the percentage of WIC ITFPS-2 caregivers by level of agreement with select statements about fruits and vegetables in their communities at 42 months.

Table B2a-6. Percentage of WIC ITFPS-2 caregivers by level of agreement with select statements about fruits and vegetables in their communities at 42 months

Statement about fruits and vegetables in the community	Agree or strongly agree % (SE)	Neither agree nor disagree % (SE)	Disagree or strongly disagree % (SE)	Unweighted n	Weighted n
Easy to buy	88.0 (1.0)	6.0 (0.6)	6.0 (0.6)	2,624	439,366
Plentiful	87.6 (0.6)	6.1 (0.4)	6.3 (0.4)	2,624	439,366
Of high quality	75.4 (1.1)	14.4 (0.8)	10.2 (0.8)	2,624	439,366

Table B2a-7 presents the percentage of WIC ITFPS-2 caregivers by level of agreement with select barriers to consumption of fresh fruits and vegetables at 42 months.

Table B2a-7. Percentage of WIC ITFPS-2 caregivers by level of agreement with select barriers to consumption of fruits and vegetables at 42 months

Statement about barriers to consumption fruits and vegetables	Agree or strongly agree % (SE)	Neither agree nor disagree % (SE)	Disagree or strongly disagree % (SE)	Unweighted n	Weighted n
Cost too much	27.2 (0.9)	19.3 (1.4)	53.6 (1.5)	2,634	441,601
Take too much time to prepare	4.6 (0.5)	6.0 (0.7)	89.5 (0.9)	2,634	441,601
Do not like	4.7 (0.5)	4.5 (0.6)	90.8 (0.9)	2,634	441,601

Table B2a-8 presents the percentage of study children with a medical home at 42 months and the percentage that had a well visit around age 3 years.

Table B2a-8. Percentage of WIC ITFPS-2 study children with a medical home and the percentage who had a well visit at age 3 years

Yes or No at 42-month interview	Have medical home % (SE)	Had a well visit around age 3 % (SE)
Yes	95.2 (0.4)	91.9 (0.5)
No	4.8 (0.4)	8.1 (0.5)
Unweighted n	2,630	2,627
Weighted n	440,822	440,298

Appendix B2b
Additional Analysis Details From Chapter 3

Appendix B2b

Additional Analysis Details From Chapter 3

Table B2b-1 presents the percentage of children in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2) eating meals and snacks on a given day at 36 and 48 months.

Table B2b-1. Percentage of WIC ITFPS-2 children eating meals and snacks on a given day at 36 and 48 months

Interview month	Breakfast % (SE)	Lunch % (SE)	Dinner % (SE)	Snack % (SE)	Unweighted n	Weighted n
Month 36	98.3 (0.3)	94.0 (0.5)	96.2 (0.6)	83.4 (2.0)	2,585	438,283
Month 48	98.2 (0.3)	94.4 (0.6)	96.1 (0.6)	85.9 (1.8)	2,562	439,736

Table B2b-2 presents the percentage of WIC ITFPS-2 children consuming select foods or beverages at 36 and 42 months.

Table B2b-2. The percentage of WIC ITFPS-2 children consuming select foods or beverages at 36 and 42 months.

Food or beverage	36-month interview % (SE)	48-month interview % (SE)
Any fruit or 100% fruit juice	90.6 (0.6)	88.4 (0.8)
Any fruit excluding 100% fruit juice	71.9 (1.1)	71.6 (1.7)
100% fruit juice	69.3 (1.2)	65.2 (1.6)
Any vegetable	62.5 (1.6)	63.6 (1.4)
Cooked vegetables	55.4 (1.7)	56.8 (1.5)
Raw vegetables	16.4 (1.1)	16.7 (1.0)
Cow's milk	83.7 (1.0)	81.0 (1.3)
Soy or rice milk	2.1 (0.4)	1.4 (0.4)
Cheese	38.0 (1.4)	38.5 (1.6)
Yogurt	19.2 (1.0)	18.0 (1.2)
Breakfast cereals	59.0 (1.2)	57.7 (1.5)
Bread and rolls	27.8 (1.2)	29.2 (1.4)
Crackers, pretzels, rice cakes	29.9 (1.3)	29.5 (1.1)
Rice and pasta	25.8 (2.3)	26.6 (2.3)
Grains in mixed dishes	70.2 (1.7)	72.7 (1.8)
Desserts and candy	55.2 (1.2)	57.4 (1.3)
Other sweets	26.3 (1.2)	28.2 (1.3)
Sugar-sweetened beverages	28.8 (1.4)	33.2 (1.4)
Salty snacks	29.6 (1.7)	28.4 (1.5)
Unweighted n	2,586	2,562
Weighted n	438,319	439,736

Appendix B2c
Additional Analysis Details From Chapter 4

Appendix B2c

Additional Analysis Details From Chapter 4

Table B2c-1 presents the median percentage of total energy consumed at eating occasions by children in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2).

Table B2c-1. Median of percent of total energy consumed by WIC ITFPS-2 children at eating occasions, 36 and 48 months

Interview month	Median Percent at Eating Occasion			
	Breakfast	Lunch	Dinner	Snack
Month 36	24.7	28.8	26.6	23.8
Unweighted n	2,541	2,430	2,487	2,207
Weighted n	430,845	412,106	421,741	365,418
Month 48	24.3	28.6	27.4	23.6
Unweighted n	2,502	2,408	2,466	2,213
Weighted n	431,756	414,992	422,683	377,734

Table B2c-2 presents parameter estimates, standard errors, and p-values from the linear regression used to explore the independent effects of socio-demographic characteristics, aspects of the child's lifestyle, early feeding practices, and participation in Federal feeding programs on total energy intake at 48 months.

Table B2c-2. Model results from regression of total energy intake at 48 months on covariates including early feeding practices

Independent variable	Estimate	Standard Error	t Value	Pr > t
Intercept	1,897.09	65.62	28.91	<.0001
Child gender: Female compared to male	-109.99	24.44	-4.50	<.0001
Caregiver race: African American compared to White	-12.44	20.84	-0.60	0.5541
Caregiver race: All Other compared to White	39.47	37.59	1.05	0.3000
Caregiver ethnicity: Hispanic or Latino compared to Not Hispanic or Latino	-128.06	23.87	-5.37	<.0001
Mom's weight status at 30 months: Obese compared to normal or underweight	-30.64	21.63	-1.42	0.1643
Mom's weight status at 30 months: Overweight compared to normal or underweight	47.60	28.55	1.67	0.1033
Marital status at 36 months: Not married compared to married	100.10	20.92	4.79	<.0001
Age of caregiver at child's birth	-10.28	1.83	-5.63	<.0001
Child's BMI percentile at 48 months	-0.42	0.33	-1.30	0.2012
Outdoor Time in a typical week: 14 hours or less compared to more than 14 hours	-46.26	20.87	-2.22	0.0324
Sleep duration at night: Sleeps for less than 10 hours usually compared to sleeps for at least 10 hours usually	32.68	20.16	1.62	0.1128
Breastfeeding duration	-0.10	0.08	-1.31	0.1977
Sugar sweetened beverage introduced in child's first year compared to not introduced in first two years	93.64	31.28	2.99	0.0047
Sugar sweetened beverage introduced in child's second year compared to not introduced in first two years	40.89	35.84	1.14	0.2607
Solid foods introduced after 4 months compared to introduced prior to 4 months	-20.12	24.83	-0.81	0.4224
Sweets introduced in child's first year compared to not introduced in child's first two years	4.80	44.28	0.11	0.9142
Sweets were introduced in child's second year compared to not introduced in child's first two years	-8.80	42.09	-0.21	0.8354
Receive SNAP only, not WIC at 48 months compared to receive neither	59.18	35.23	1.68	0.1008
Receive WIC and SNAP at 48 months compared to receive neither	-43.39	28.56	-1.52	0.1366
Receive WIC only, not on SNAP at 48 months	-67.54	31.08	-2.17	0.0358

Appendix B2d
Additional Analysis Details From Chapter 5

Appendix B2d

Additional Analysis Details From Chapter 5

Table B2d-1 presents the percentage of caregivers in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2) by their level of agreement with select statements about feeding practices.

Table B2d-1. Percentage of WIC ITFPS-2 caregivers by their level of agreement with select statements about feeding practices at 42 months

Statement about feeding practices	Agree or strongly agree % (SE)	Neither agree nor disagree % (SE)	Disagree or strongly disagree % (SE)	Median	Unweighted n	Weighted n
Parent decides how much child should eat	59.8 (1.5)	15.7 (0.9)	24.4 (1.4)	1.8 (0.0)	2,631	440,750
Best way to get child to behave is to offer favorite foods as a reward	34.7 (1.6)	26.5 (1.4)	38.8 (1.7)	2.6 (0.1)	2,631	440,750
Important to finish food on plate	45.7 (1.2)	29.0 (1.1)	25.3 (0.8)	2.1 (0.0)	2,631	440,750

Table B2d-2 presents the percentage of WIC ITFPS-2 caregivers by how often they think children should be allowed to eat different types of less healthy foods.

Table B2d-2. Percentage of WIC ITFPS-2 caregivers by how often they think children should be allowed to eat different types of less healthy foods

Frequency	Fast food % (SE)	Sugary foods % (SE)	Snack foods % (SE)	Sugary drinks % (SE)
Whenever they want	0.5 (0.2)	0.4 (0.2)	2.3 (0.4)	0.7 (0.2)
Occasionally	87.8 (0.8)	93.1 (0.6)	92.6 (0.8)	76.4 (1.4)
Never	11.7 (0.8)	6.5 (0.6)	5.0 (0.7)	22.9 (1.4)
Unweighted n	2,633	2,633	2,633	2,633
Weighted n	441,311	441,311	441,311	441,311

Table B2d-3 presents model results from the univariate regression of 2015 Healthy Eating Index Scores (HEI-2015) on carefully controlling what the child eats on. The reference group is those who never employ this practice.

Table B2d-3. Model results from regressing HEI-2015 on carefully controlling what the child eats^a

Parameter	Estimate	Standard Error	t Value	Pr ≥ t
Intercept	57.25	0.66	86.19	<.0001
Carefully control how much the child eats: About half of the time/Occasionally compared to Never	1.31	0.70	1.86	0.0701
Carefully control how much the child eats: Always/Usually compared to Never	2.02	0.63	3.21	0.0026

^a Results are weighted. Weighted n=414,307; unweighted n=2,425. R-square=0.008.

Table B2d-4 presents model results from the univariate regression of HEI-2015 on using mealtimes to teach about healthy eating. The reference group is those who never employ this practice.

Table B2d-4. Model results from regressing HEI-2015 on using mealtimes to teach about healthy eating^a

Parameter	Estimate	Standard Error	t Value	Pr ≥ t
Intercept	56.38	1.17	48.39	<.0001
Use mealtimes to teach about healthy eating: About half of the time/Occasionally compared to Never	1.33	1.20	1.11	0.2757
Use mealtimes to teach about healthy eating: Always/Usually compared to Never	2.96	1.22	2.42	0.0200

^a Results are weighted. Weighted n=415,368; unweighted n=2,430. R-square=0.010.

Table B2d-5 presents model results from the univariate regression of HEI-2015 on asking the child to help prepare food. The reference group is those who never employ this practice.

Table B2d-5. Model results from regressing HEI-2015 on asking the child to help prepare food^a

Parameter	Estimate	Standard Error	t Value	Pr ≥ t
Intercept	60.05	0.81	74.04	<.0001
Ask child to help prepare food: About half of the time/Occasionally compared to Never	-1.53	0.62	-2.46	0.0183
Ask child to help prepare food: Always/Usually compared to Never	-1.87	0.78	-2.41	0.0204

^a Results are weighted. Weighted n=415,268; unweighted n=2,429. R-square=0.007.

Table B2d-6 presents the percentage distribution of the number of times study mothers introduce a new food before deciding that the child does not like it.

Table B2d-6. Percentage distribution of the number of times study mothers introduce a new food before deciding the child does not like it at 42 months

Number of times new food introduced before deciding child does not like it	Study mothers % (SE)
Once	5.0 (0.5)
Twice	22.2 (1.1)
3-5 times	52.5 (1.4)
6-10 times	8.1 (0.6)
More than 10 times	10.6 (0.8)
Child likes everything	1.5 (0.3)
Unweighted n	2,631
Weighted n	441,263

Table B2d-7 presents the percentage of study mothers who consider their children to be picky eaters by how picky the child is.

Table B2d-7. Percentage of study mothers who consider their children picky eaters by how picky the child is at 42 months

Type of picky eater	Study mothers % (SE)
A very picky eater	18.0 (1.1)
A somewhat picky eater	46.0 (1.1)
Not a picky eater	36.0 (1.3)
Unweighted n	2,632
Weighted n	441,552

Table B2d-8 presents the percentage of study mothers by the frequency of the family eating together during the past week.

Table B2d-8. Percentage of study mothers by the frequency of the family eating together during the past week

Frequency of family eating together during past week	Study mothers % (SE)
7 or more times a week	36.9 (1.3)
5-6 times a week	29.9 (1.1)
3-4 times a week	23.0 (1.1)
1-2 times a week	8.4 (1.0)
Never	1.8 (0.3)

Table B2d-8. Percentage of study mothers by the frequency of the family eating together during the past week - (continued)

Frequency of family eating together during past week	Study mothers % (SE)
Unweighted n	2,634
Weighted n	441,512

Table B2d-9 presents the percentage distribution of study mothers by how frequently the television is on when the child is eating.

Table B2d-9. Percentage distribution of study mothers by how frequently the television is on when the child is eating

Frequency of television on when child is eating	Study mothers % (SE)
Most of the time	18.5 (0.8)
Sometimes	33.6 (1.1)
Rarely	28.0 (1.2)
Never	19.9 (1.0)
Unweighted n	2,635
Weighted n	441,693

Table B2d-10 presents model results from the univariate regression of HEI-2015 on the number of times the family eats together each week. The reference group is zero to four times.

Table B2d-10. Model results from regressing HEI-2015 on frequency of family meals^a

Parameter	Estimate	Standard Error	t Value	Pr ≥ t
Intercept	57.72	0.50	116.37	<.0001
Family Eats Together: 5 or more times during the week compared to 0 to 4 times during the week	1.51	0.41	3.66	0.0007

^a Results are weighted. Weighted n=415,020; unweighted n=2,428. R-square=0.007.

Table B2d-11 presents model results from the univariate regression of HEI-2015 on the frequency of television viewing during meals. The reference group is never.

Table B2d-11. Model results from regressing HEI-2015 on the frequency of television viewing during meals^a

Parameter	Estimate	Standard Error	t Value	Pr ≥ t
Intercept	60.29	0.52	115.98	<.0001
TV on While Eating: Most of the time compared to Never	-3.38	0.69	-4.90	<.0001
TV on While Eating: Rarely compared to Never	-1.00	0.66	-1.53	0.1350
TV on While Eating: Sometimes compared to Never	-1.95	0.51	-3.79	0.0005

^a Results are weighted. Weighted n=415,186; unweighted n=2,429. R-square=0.017.

Appendix B2e
Additional Analysis Details From Chapter 6

Appendix B2e

Additional Analysis Details From Chapter 6

Table B2e-1 presents the percentage of children in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2) by parental report of typical outdoor playtime on weekdays and weekend days and median hours of outdoor play time.

Table B2e-1. Percentage of study children by parental report of typical outdoor playtime on weekdays and weekend days at 42 months

Length of outdoor play time	Study children % (SE)
On a typical weekday	
2 hours or less	64.7 (1.5)
Does not play outside	2.7 (0.5)
Up to an hour	30.4 (1.3)
More than an hour and up to 2 hours	31.6 (1.0)
More than 2 hours	35.3 (1.5)
Unweighted n	2,621
Weighted n	439,901
On a typical weekend day	
2 hours or less	41.1 (1.4)
Does not play outside	3.2 (0.6)
Up to an hour	14.8 (0.9)
More than an hour and up to 2 hours	23.1 (1.0)
More than 2 hours	58.9 (1.4)
Unweighted n	2,616
Weighted n	439,618
Day of the week	Median hours
Typical weekday	1.9
Typical weekend day	2.9

Table B2e-2 presents the percentage distribution of study children by Personal Social Development Scale scores.

Table B2e-2. Percentage distribution of study children by Personal Social Development Scale scores

Personal Social Development Scale score range	Study children % (SE)
Refer (≤ 31.12)	6.5 (0.6)
Monitor (31.12-41.25)	14.1 (0.7)
Typical (> 41.25)	79.4 (0.9)
Unweighted n	2,634
Weighted n	441,657

Table B2e-3 presents the percentage distribution of study children at ages 3 years and 4 years by their body mass index (BMI)-for-age weight status categories.

Table B2e-3. Percentage distribution of study children by BMI-for-age weight status categories at ages 3 and 4 years

Weight status categories	Age 3 (32 to 40 months) % (SE)	Age 4 (44 to 52 months) % (SE)
Underweight (less than 5th percentile)	4.1 (0.5)	5.0 (0.8)
Normal/Healthy Weight (5th to less than 85th percentile)	65.2 (1.4)	61.4 (1.2)
Overweight (85th to less than 95th percentile)	13.6 (1.0)	15.2 (0.9)
Obese (95th or higher percentile)	17.0 (1.0)	18.3 (1.0)
Unweighted n	1,886	2,115
Weighted n	442,544	442,085

Appendix B2f
Additional Analysis Details From Chapter 7

Appendix B2f

Additional Analysis Details From Chapter 7

Table B2f-1 presents the percentage distribution of mothers in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Infant and Toddler Feeding Practices Study (ITFPS-2) by length of time they stopped participating in WIC. The findings are among those currently participating in WIC at 42 months who indicated that there was a time during the study when they did not participate in WIC.

Table B2f-1. Among those currently participating in WIC at 42 months who indicated that there was a time during the study when they did not receive WIC, the percentage distribution of study mothers by length of time they stopped participating in WIC

Length of time stopped participating	Study mothers participating in WIC at 42 months who reported a previous break in participation % (SE)
Less than 1 month	15.2 (2.2)
1 to 6 months	53.0 (3.1)
7 to 12 months	14.6 (2.0)
More than 12 months	17.2 (2.5)
Unweighted n	291
Weighted n	49,507

Table B2f-2 presents the percentage of study mothers by reason for return to WIC among those currently participating in WIC at 42 months who indicated that there was a time during the study when they did not participate in WIC.

Table B2f-2. Among those currently participating in WIC at 42 months who indicated that there was a time during the study when they did not participate in WIC, the percentage of study mothers by reasons for return to WIC

Reason for return*	Study mothers participating in WIC at 42 months who reported a previous break in participation % (SE)
Became pregnant again	42.5 (4.1)
Income changed and qualified again	42.0 (3.7)
Missed recertification, but eventually returned to WIC	55.0 (4.3)
Worked out a transportation problem	29.8 (3.5)
Worked out a schedule problem	35.3 (3.0)
Re-enrolled after a move	74.8 (2.7)
Needed WIC food or education again	31.6 (4.1)
Other reasons	3.5 (1.4)

Table B2f-2. Among those currently participating in WIC at 42 months who indicated that there was a time during the study when they did not participate in WIC, the percentage of study mothers by reasons for return to WIC – (continued)

Reason for return*	Study mothers participating in WIC at 42 months who reported a previous break in participation % (SE)
Unweighted n	243
Weighted n	42,263

* Respondents could mark all reasons that apply.

Table B2f-3 presents the percentage of study mothers by reason for staying with WIC among those currently participating in WIC at 42 months.

Table B2f-3. Among those currently participating in WIC at 42 months, the percentage of study mothers by reasons for staying with WIC

Reason to stay	Study mothers participating in WIC at 42 months % (SE)
Food	92.6 (1.0)
Education, information, and advice	94.3 (0.9)
Can talk with other parents about parenting and feeding your child	67.4 (1.9)
WIC staff listen to your thoughts about your child's health and what he/she is eating	90.7 (1.2)
Unweighted n	1,413
Weighted n	250,723

Table B2f-4 presents the percentage distribution of study mothers by their report of the most important benefit WIC provides among those currently participating in WIC at 42 months.

Table B2f-4. Among those currently participating in WIC at 42 months, the percentage distribution of study mothers by most important benefit WIC provides

Most important WIC benefit	Study mothers participating in WIC at 42 months % (SE)
Food	5.8 (0.7)
Education	1.8 (0.3)
Food and education are equally important	92.4 (0.7)
Unweighted n	1,438
Weighted n	254,133

Table B2f-5 presents parameter estimates, standard errors, and p-values from the linear regression used to explore the independent effects of socio-demographic characteristics, aspects of the child's lifestyle, early and contemporary feeding practices, and WIC retention on 2015 Healthy Eating Index (HEI-2015) total scores at 48 months.

Table B2f-5. Model results from regression of 2015 Health Eating Index (HEI-2015) total scores at 48 months on covariates including WIC retention

Independent variable	Estimate	Standard Error	t Value	Pr > t
Intercept	54.47	1.66	32.83	<.0001
Child gender: Female compared to male	1.72	0.62	2.77	0.0084
Caregiver race: African American compared to White	1.25	1.03	1.22	0.2296
Caregiver race: All Other compared to White	0.83	0.85	0.98	0.3331
Caregiver ethnicity: Hispanic or Latino compared to not Hispanic or Latino	6.36	0.82	7.72	<.0001
Caregiver's education level: High School or less compared to more than High School	0.42	0.67	0.62	0.5359
Marital status at 36 months: Not married compared to married	1.01	0.60	-1.68	0.1009
Currently using regular childcare at 42 months compared to not currently using child care at 42 months	0.14	0.57	0.24	0.8112
TV on while eating: Most times or sometimes compared to never or rarely	-0.70	0.70	-1.00	0.3250
Family eats together: 5 or more times during the week compared to less than 5 times	0.55	0.52	1.06	0.2941
Sleep duration at night: Sleeps for less than 10 hours usually compared to sleeps for at least 10 hours usually	-1.05	0.77	-1.37	0.1769
Breastfeeding duration	0.004	0.00	1.99	0.0536
Sweet beverage was introduced in child's first year compared to sweet beverage was not introduced in child's first two years	-1.35	0.81	-1.67	0.1026
Sweet beverage was introduced in child's second year compared to sweet beverage was not introduced in child's first two years	-1.25	0.77	-1.65	0.1061
Solid foods were introduced after 4 months compared to solid foods were introduced prior to 4 months	0.82	0.57	1.44	0.1586
Sweets were introduced in child's first year compared to sweets were not introduced in child's first two years	-1.70	1.10	-1.55	0.1280
Sweets were introduced in child's second year compared to sweets were not introduced in child's first two years	-1.23	1.26	-0.97	0.3360
WIC retention: Intermittent compared to Year 1 only	0.52	1.31	0.40	0.6939
WIC retention: Received WIC consistently 1-48 months compared to Year 1 only	3.17	0.78	4.08	0.0002
WIC retention: Received WIC in Years 1, 2, 3, and 4 only compared to Year 1 only	2.40	1.05	2.29	0.0272
WIC retention: Received WIC in Years 1, 2, and 3 only compared to Year 1 only	1.95	1.11	1.76	0.0865
WIC retention: Received WIC in Year 1 and 2 only compared to Year 1 only	0.77	0.94	0.82	0.4152

Appendix B3

**Dietary Intake Coding Procedures and
Estimating Usual Intake**

Appendix B3

Dietary Intake Coding Procedures and Estimating Usual Intake

B3.1 Dietary Intake Procedures for WIC ITFPS-2

The procedures for child dietary intake include a 24-hour dietary recall using the same system used in the National Health and Nutrition Examination Survey, What We Eat in America (NHANES, WWEIA) interview. This system consists of three components: the Automated Multiple Pass Method (AMPM) 24-hour recall interview system, the Post Interview Processing System (PIPS), and the SurveyNet coding application¹. The system uses the U.S. Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies, 5.0 (FNDDS5) as the source of the nutrient values.² The WIC Infant and Toddler Feeding Practices Study (WIC ITFPS-2) collects the child's dietary intake from the child's caregiver at every interview from 1- to 24-months, and then annually at 36, 48, 60 and 72 months. A 10 percent subsample of children at 13, 15, 18, 24, 36, 48, 60, and 72 months completes a second intake to allow estimation of “usual” intake.

B.3.1.1 AMPM Interview Data Entry

The AMPM interview asks the mother to recall all her child's dietary intake for the previous day in a systematic fashion. The interview guides the mother through the day and asks her to report all foods, beverages, and dietary supplements for each eating event during the 24-hour period; the interviewer records all responses. The interview produces a 24-hour snapshot of all foods, beverages, and dietary supplements consumed by the child. In preparation for the 13-month interview, participants received a package of measuring guides to help them report their child's portion sizes during the interview, and were asked to keep the measuring guides for the duration of the study. Additionally, if caregivers report that they do not know what the child ate while away

¹ Raper, N., Perloff, B., Ingwersen, L., Steinfeldt, L., and Anand, J. (2004). [An overview of USDA's dietary intake data system](#). *Journal of Food Composition and Analysis*, 17(3), 545-555.

² Ahuja, J.K.A., Montville, J.B., Omolewa-Tomobi, G., Heendeniya, K.Y., Martin, C.L., Steinfeldt, L.C., Anand, J., Adler, M.E., LaComb, R.P., and Moshfegh, A.J. (2012). *USDA food and nutrient database for dietary studies, 5.0-documentation and user guide*. Beltsville, MD: U.S. Department of Agriculture, Agricultural Research Service, Food Surveys Research Group.

from the caregiver, the dietary interviewer asked the caregiver to obtain the missing details about those foods from a knowledgeable source; afterward, the data retrieval interviewer contacted the caregiver within 2 working days to obtain the missing information.

B.3.1.2 Post Interview Processing System

Westat processes the recall data through the Post Interview Processing System (PIPS). During PIPS processing, approximately 70 percent of foods are auto-coded, meaning that the system assigns a food code and/or a portion quantity to the interview data. The PIPS also creates SurveyNet batches of no more than 20 intake days each, which the study team separated by recall month (3-, 5-, 7-, etc.). The online Coder Tracking System tracks each batch through the various coding and review steps. Dietary coders assign themselves batches and complete the coding for all intake days within a single assigned batch using SurveyNet.

B.3.1.3 Standard SurveyNet Processing

Assigning Food Codes

SurveyNet displays a shorthand version of each interview question and the selected response for all food description and portion data in a text box at the top of the food-coding screen. Dietary coders review this interview data, select the appropriate food code and enter the quantity reported. In cases where the PIPS automatically assigns the food code or quantity, the dietary coder merely reviews the prefilled fields to ensure that there are no changes needed. Changes to these preassigned data may be required if the interviewer entered a comment or a text response in any field that would cause the coder to change the pre-assigned food code or quantity. For all foods not auto-coded during PIPS, the dietary coders review all question responses to determine the most appropriate food code to apply.

Recipe Modifications

Coding supervisors have the ability to create recipe modifications to more closely match the reported food. Coding supervisors follow the same modification guidelines used in NHANES, which allow modification of a recipe for the type of fat used in cooking; the type of milk used in

preparing selected foods (e.g., beverages, pudding, cooked cereal); the amount of liquid used to prepare condensed soup (when different from instructions); and the type of salad dressing used in salads such as coleslaw or chicken salad.

New Foods

The coders also flag new food items that they cannot link to an acceptable food code in SurveyNet. Coding supervisors do additional research to determine if the food could match an existing food code or if they need to flag the food for nutrient modification after analysis because the nutrient profile of the foods differs too much from existing food codes. The study team handled several food items in this way: agave syrup, almond milk, chia seed, edamame, Greek yogurt, hemp seed, and quinoa. Senior coding staff obtained nutrient information for these products from the USDA National Nutrient Database for Survey Research and corrected the information in the SurveyNet analysis files.

Coding Guidelines

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

Entering Quantities

Once the food code is assigned or reviewed (in the case of auto-coding), coders review the autocoded quantity or enter the amount of food reported. SurveyNet allows entry of portions using the same food models presented in the AMPM, and provides predetermined weights for foods in commonly eaten portions (e.g., one-half grapefruit, one medium chicken leg). SurveyNet

automatically converts food amounts entered as a shape, by dimensions (length, width, and height); volume; or weight in imperial units to a weight in grams. Coders also use SurveyNet to code imprecise measures, such as “handful,” “medium bowl,” or “swallow.” When respondents report “Don’t know” for the quantity consumed, coders are instructed to first consult the coding guidelines, which provide default amounts for items in a sandwich or salad, and other common combinations. If no coding guideline exists, coders select the “quantity not specified” portion option available in SurveyNet.³

Combinations

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

Review

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

Analysis

Coding supervisors use SurveyNet to process the coded intakes and obtain the nutrient analysis. The system automatically generates error reports that document unresolved issues such as missing or invalid food codes, recipe modifications, or portion codes. Supervisors resolve all errors and re-run

³ For participants less than 2 years old, one-half of the “quantity not specified” amount was coded.

the analysis. The system produces two analysis data files: an “ANA” file, which contains one line of data for every food or supplement reported by the respondent on the intake day; and a “TOT” file, which contains one line of data for each respondent for a single intake day. The analysis files include 65 nutrients from the Food and Nutrient Database for Dietary Studies, 5.0 (FNDDS5).

Quality Control Review

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

Portion Outliers. Portion outlier reports identify errors in the reported amount of foods consumed. In addition, they serve as a check for intakes where coders applied an incorrect form of the food when specifying the amount.⁴ The USDA SurveyNet software used to code AMPM intakes also identifies intakes where the portion of the reported food is either below or above established portion size range for that food item; these portion size ranges are specific for the age and gender of the respondent.

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

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

1. **Interview is broken off prior to completing the time and occasion pass.** For intakes other than those collected at the 1-, 3-, and 5-month recall, if the breakoff happens before the time and occasion is recorded for every food in the intake, the intake fails the minimum criteria and coding supervisors delete the intake from the dataset. Without time and occasion information for each food, it is not possible to determine that the reported foods span an entire day’s intake. For intakes collected at 1-, 3-, and 5-months, the coders apply the coding guidelines developed for infant

⁴ For example, the coder entered 1 cup of rice as uncooked by mistake when the respondent reported cooked rice.

breastmilk consumption; the guidelines do not require the time and occasion information.

2. **Intake is judged as “unreliable.”** Although interviewers do not provide feedback on whether or not a respondent is reliable, coding supervisors implement guidelines developed in previous studies.
3. **Meals with missing foods.** Coding supervisors apply this flag when a respondent reports a meal, but cannot recall foods eaten at the meal. For example, the respondent reports the child eating a meal at a friends’ house but cannot recall the foods.

USDA Food Pattern Food Groups

The study team edits and finalizes all dietary recall data files before re-running the SurveyNet analysis to obtain corrected nutrient values. Using the Food Pattern Equivalent Database (FPED) 2010-2011,⁵ the study team appends food pattern equivalent (FPE) values to the dietary data. Coding supervisors identify food codes that do not have a match in the FPED and impute any needed food group values.

FITS Food Groups

In order to allow comparisons of the WIC ITFPS-2 dietary data to the Feeding Infants and Toddler Study (FITS), the study team assigns each FNDDS food code to one of the food groups developed for FITS 2002 and 2008.⁶ The FITS adapted the food groups from the Continuing Survey of Food Intakes by Individuals (CSFII), a nationwide dietary intake study available at the time of the 2002 FITS. The FITS adjusted some of the CSFII food groups to allow slightly different analysis of foods of interest to the diets of infants and toddlers. For example, because diets of young infants are largely milk-based, FITS moved yogurt, milk desserts, and cheese into other groups, leaving milk (breastmilk, formula, cow’s milk and other fluid milks) in a group of its own.

⁵ Bowman, S.A., Clemens, J.C., Thoerig, R.C., Friday, J.E., Shimizu, M., and Moshfegh, A.J. 2013. *Food Patterns Equivalents Database 2009-10: Methodology and User Guide* [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. Available at: <http://www.ars.usda.gov/nea/bhnrc/fsrg>

⁶ Fox, M. K., Pac, S., Devaney, B., and Jankowski, L. (2004). Feeding infants and toddlers study: What foods are infants and toddlers eating? *Journal of the American Dietetic Association*, 104, 22-30.

B3.2 The National Cancer Institute Method for Analyzing Usual Intake Data

The National Cancer Institute (NCI) method for estimating usual intake uses as input repeated administrations of a 24-hour dietary recall over a narrow time window (see Tooze et al., 2006 for an introduction to the model).⁷ This method has several differences from an analysis based on single observations per person. First, the repeated measures over time allow for the estimate of measurement variance (variability within person over time) separately from between-person variance. This results in adjustment of food and nutrient means and correlations and their associated standard errors for measurement error, i.e., the method estimates of what these values would be without measurement error. Second, the NCI method employs algorithms to transform the data to distribute outcomes more like a symmetric normal distribution.⁸ This reduces the bias created by outliers (nutrient data is often highly skewed) and supports the validity of the assumption that errors are normally distributed, which is an assumption of the mixed model underlying the approach.⁹ Third, the NCI method produces model-based estimates of distributions of food and nutrient intakes that have decreased bias and error by using covariates to obtain outcome estimates. Fourth, the NCI method enables the valid estimation of “episodically” consumed food (i.e., foods not consumed on a daily basis), by employing a two-part model where one part of the model estimates the probability that the food will be consumed on a given day and the other part of the model estimates the amount of the food that is consumed if it is consumed at all. Since episodically consumed foods are common in adults, this extends the range of applications for the model. Note that the current application of the NCI method to WIC ITFPS-2 data does not use the episodically consumed feature because episodic foods are assumed to be less common in infants and toddlers, but this feature will be used in the future as needed.

⁷ Tooze, J.A., Kipnis, V., Buckman, D.W., Carroll, R.J., Freedman, L.S., Guenther, P.M., Krebs-Smith, S.M., Subar, A.F., and Dodd, K.W. (2010). A mixed-effects model approach for estimating the distribution of usual intake of nutrients: the NCI method. *Statistics in Medicine*, 29(27), 2857-2868.

⁸ Box, G.E.P., and Cox, D. (1964). An analysis of transformations. *Journal of the Royal Statistical Society, Series B*, 26, 211-252.

⁹ SAS Institute Inc. (2008). *SAS/STAT® 9.2 user's guide*. Cary, NC: SAS Institute Inc., Proc Genmod.

B3.2.1 Results for the Analysis of Dietary Intake Data for Children Ages 13, 15, 18, 24, 36, and 48 Months

The analysis of WIC ITFPS-2 AMPM data from ages 13, 15, 18, 24, 36, and 48 months uses the NCI model for daily-consumed nutrients and FPEs. Note that these data have two observations for about 10 percent of the sample, enabling the estimate of measurement error. All coded nutrients and FPEs are adjusted, except those that had 0 values. All analyses are weighted.

To test the utility of the NCI model approach with WIC ITFPS-2 data, the study team executed an analysis with nutrients for ages 13 through 18 months. In this analysis, the model-based variances, adjusting for measurement error and employing covariates, ranged from 9 to 41 percent of the observed variance. This indicates that employing the NCI model approach to current data will more precisely estimate nutrient and FPE distributions. Chapter 4 of the report provides the dietary intake data.