Appendix B1

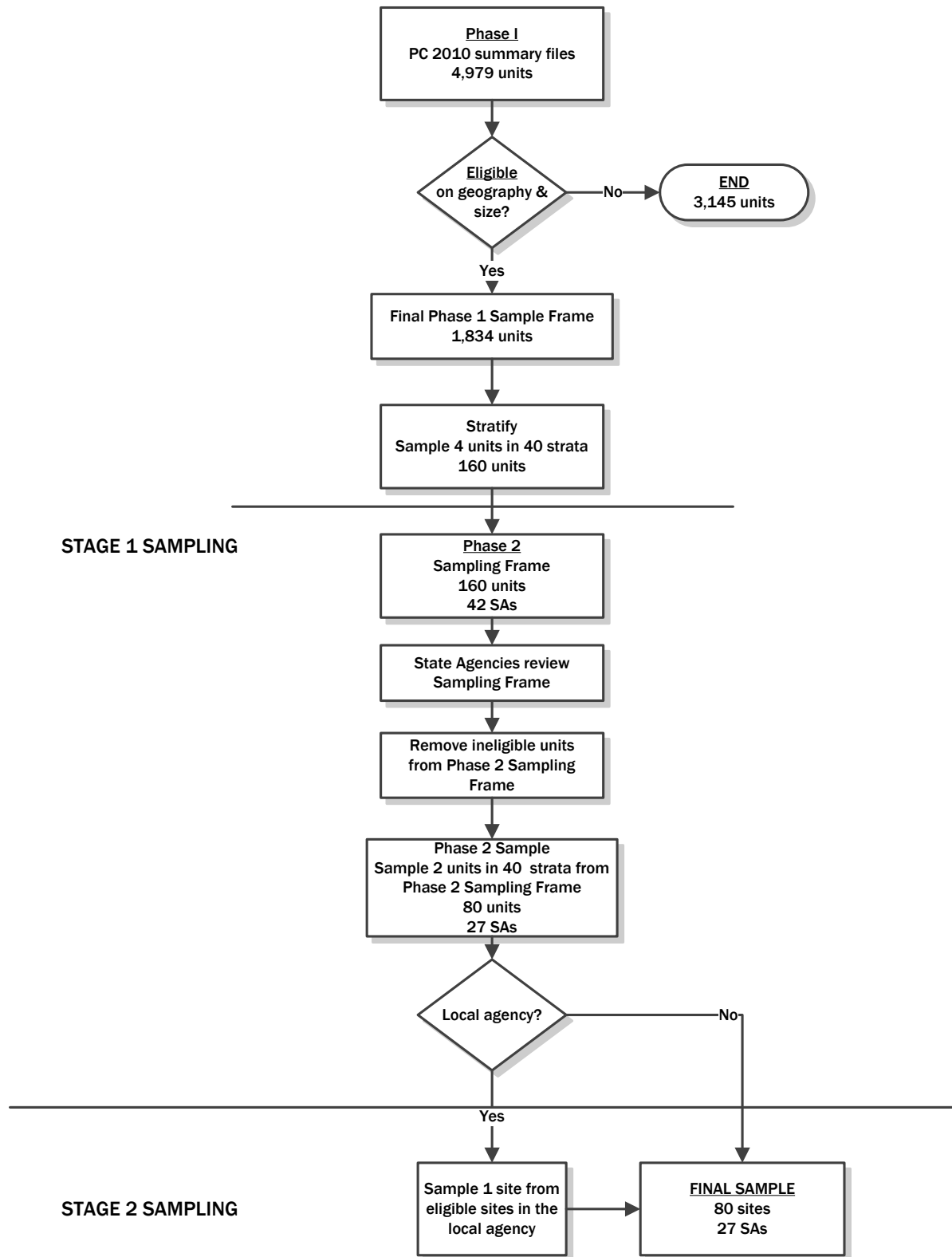# Details of Sampling and Weighting Procedures

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 SAs had flexibility for PC2010 for reporting service location identifiers (IDs), the IDs provided in the records by the SAs varied; some SAss provided the site ID in addition to a local agency code, whereas other SAss 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 SAss 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 SAsto 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

Phase I
PC 2010 summary files
4,979 units

↓

Eligible
on geography &
size? —No→ **END**
3,145 units

Yes
↓

Final Phase 1 Sample Frame
1,834 units

↓

Stratify
Sample 4 units in 40 strata
160 units

STAGE 1 SAMPLING

Phase 2
Sampling Frame
160 units
42 SAs

↓

State Agencies review
Sampling Frame

↓

Remove ineligible units
from Phase 2 Sampling
Frame

↓

Phase 2 Sample
Sample 2 units in 40 strata from
Phase 2 Sampling Frame
80 units
27 SAs

↓

Local agency? —No→

Yes
↓

STAGE 2 SAMPLING

Sample 1 site from
eligible sites in the
local agency → **FINAL SAMPLE**
80 sites
27 SAs

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 PC2010 dataset. PC2010 data were provided through a total of 90 individual SAS data files—one for each SA. 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., 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, and 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

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[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.

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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 ineligibles from unit selection process

```
        ┌─────────────────────────────┐
        │      4,979 units            │
        │ MOS:  PC 2010 Summary files │
        └─────────────────────────────┘
                     │
                     ▼
              ◇ Acceptable ◇                    ┌──────────────────────────┐
              ◇ geographic ◇ ──No──►            │        17 units          │
              ◇ location?  ◇                     │    American Samoa        │
                     │                           │        Guam              │
                    Yes                          │    Virgin Islands        │
                     │                           │  North Mariana Islands   │
                     ▼                           └──────────────────────────┘
        ┌─────────────────────────────┐
        │      4,962 units            │
        │   MOS: 224,840.8            │
        └─────────────────────────────┘
                     │
                     ▼
              ◇ Met enrollment ◇                 ┌──────────────────────────┐
              ◇   criteria?    ◇ ──No──►         │      3,128 units         │
                     │                           │   MOS:  28,795.4         │
                    Yes                          └──────────────────────────┘
                     │
                     ▼
        ┌─────────────────────────────┐
        │      1,834 units            │
        │   MOS: 196,045.4            │
        │ Final Phase 1 Sampling      │
        │         Frame               │
        └─────────────────────────────┘
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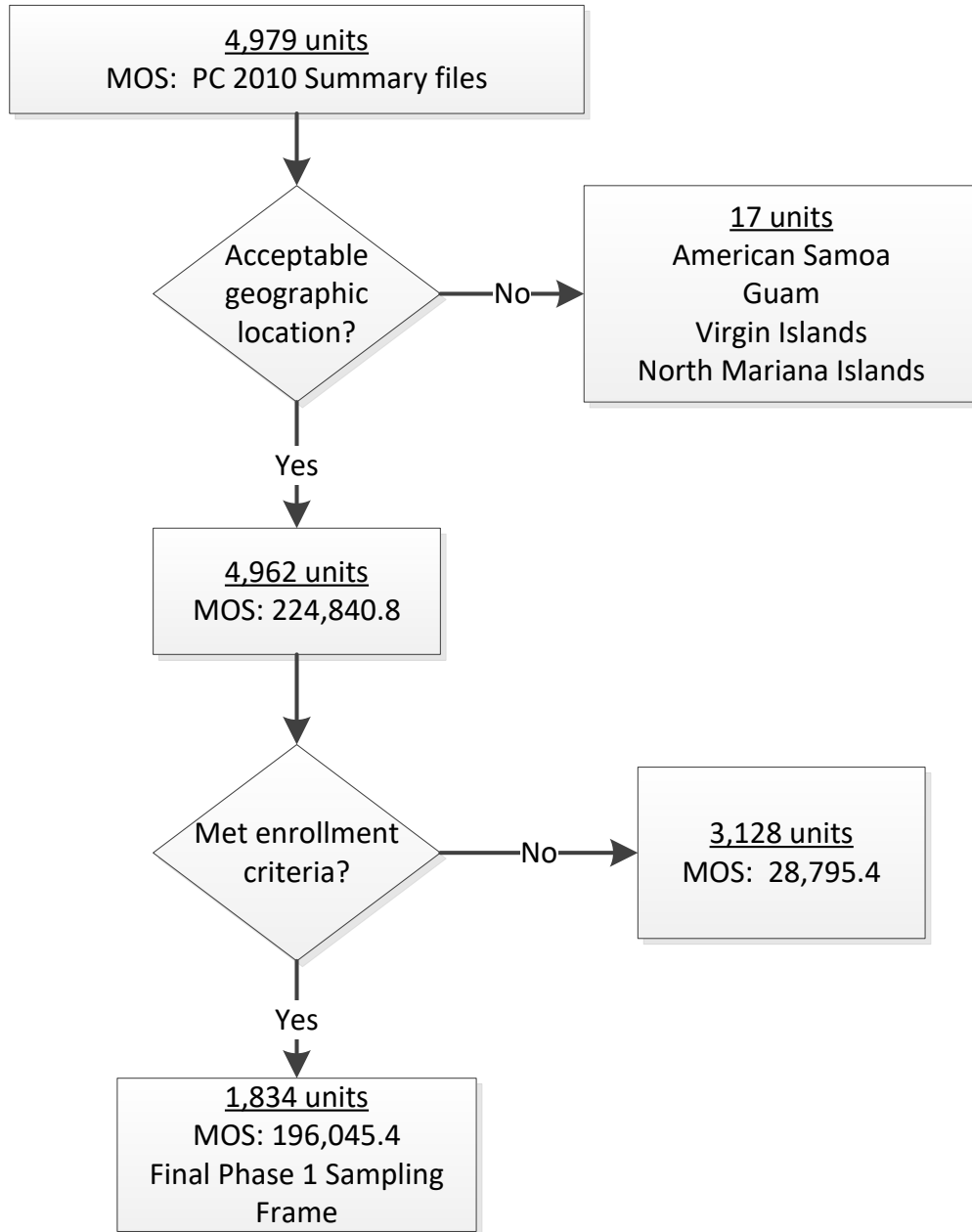
B1.3.3   Stratification and Selection of the Phase 1 Sample

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.

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[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.

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, 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 SAplan, (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 probability proportional to size (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 units sampled eligible for phase 2			Phase 2 units sampled		
					Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites	Total	Agencies	Sites
101	Does the state operate a breastfeeding peer counseling program? YES	0 – 10.5691	0 – 36.7147	4,997.2	65	1	64	4	0	4	4	0	4	2	0	2
102		0 – 10.5691	36.7147 – 45.9689	4,952.0	62	0	62	4	0	4	3	0	3	2	0	2
103		10.5691 – 14.4928	0 – 35.5971	4,994.0	61	4	57	4	0	4	4	0	4	2	0	2
104	Does the State require that general nutrition education be provided by a professional staff member, e.g., dietitian, nurse? NO	10.5691 – 14.4928	35.5971 – 44.0943	5,000.0	49	3	46	4	0	4	3	0	3	2	0	2
105		14.4928 – 20.3863	0 – 33.5319	4,973.4	66	4	62	4	0	4	4	0	4	2	0	2
106		14.4928 – 20.3863	33.5319 – 44.3548	4,980.8	63	9	54	4	1	3	2	0	2	2	0	2
107		20.3863 – 63.5838	0 – 30.7242	5,019.4	59	28	31	4	3	1	4	3	1	2	1	1
108	Is infant formula issued in the 1st month to partially breastfed infants? NO	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

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	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
200	Does the state operate a breastfeeding peer counseling program? YES Does the State require that general nutrition education be provided by a professional staff member, e.g., dietitian, nurse? NO Is infant formula issued in the 1st month to partially breastfed infants? YES	0 – 100	0 – 100	6,340.4	1	1	0	1	1	0	1	1	0	1	1	0
201		0 – 14.2857	0 – 28.7699	4,874.6	64	14	50	4	1	3	4	1	3	2	0	2
202		0 – 14.2857	28.7699 – 30.9995	4,905.0	47	11	36	4	2	2	3	1	2	2	1	1
203		0 – 14.2857	30.9995 – 33.0338	4,839.8	47	10	37	4	1	3	3	1	2	2	0	2
204		0 – 14.2857	33.0338 – 34.1299	4,913.8	45	14	31	4	3	1	4	3	1	2	1	1
205		0 – 14.2857	34.1299 – 35.0733	4,893.4	48	12	36	4	1	3	4	1	3	2	1	1
206		0 – 14.2857	35.0733 – 35.8987	4,853.8	45	17	28	4	2	2	3	2	1	2	1	1
207		0 – 14.2857	35.8987 – 36.6585	4,881.4	45	18	27	4	3	1	4	3	1	2	2	0
208		0 – 14.2857	36.6585 – 37.5487	4,868.6	40	18	22	4	4	0	4	4	0	2	2	0
209		0 – 14.2857	37.5487 – 39.0369	4,961.8	39	18	21	4	1	3	4	1	3	2	0	2
210		0 – 14.2857	39.0369 – 40.9907	4,768.6	38	17	21	4	3	1	4	3	1	2	2	0
211		0 – 14.2857	40.9907 – 44.6064	4,982.6	53	21	32	4	3	1	4	3	1	2	1	1
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
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

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	Units on frame Total	Units on frame Agencies	Units on frame Sites	Phase 1 units sampled Total	Phase 1 units sampled Agencies	Phase 1 units sampled Sites	Phase units sampled eligible for phase 2 Total	Phase units sampled eligible for phase 2 Agencies	Phase units sampled eligible for phase 2 Sites	Phase 2 units sampled Total	Phase 2 units sampled Agencies	Phase 2 units sampled Sites
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 Is infant formula issued in the 1st month to partially breastfed infants? N/A	7.6336 – 33.3992	34.2542 – 50.2087	4,154.4	47	6	41	4	1	3	4	1	3	2	1	1
Total				196,045.4	1,834	554	1,280	157	78	79	139	70	69	79	42	37

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 SAss 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. Group B's SAs 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 provided by the SAs 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 the month. 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 prespecified recruitment window. Mothers were eligible to participate even if they had enrolled in WIC for a previous pregnancy or previous child. The recruitment window was a consecutive string of days in which all new WIC enrollees in that site were designated to be screened for eligibility and recruited into the WIC Infant and Toddler Feeding Practices Study (WIC ITFPS-2). The length of the recruitment window for each site was

predetermined based on the estimated amount of time that would have been needed in July 2012[4] 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, the study team increased the recruitment window for each site by 3 percent to serve as a buffer based on new enrollment data that suggested the WIC enrollment was declining. However, even with the 3 percent buffer, after 4 weeks into recruitment with 40 sites in the field (August 1, 2013), the study team projected reaching only about 84 percent of the estimated number of eligible WIC women relative to the expected numbers that were estimated in July 2012. As a result, all recruitment windows were extended by an additional 10 percent (with the exception of 5 sites where the full 10 percent extension could not be achieved while still ending recruitment on November 18).

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

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, prepregnancy BMI, household composition, and income, and new enrollees not required to achieve the subgroup targets were subsampled from the supplemental sample. This approach was designed to drop approximately: 68 percent of White mothers; 81 percent of Hispanic mothers; 71 percent of mothers in their first trimester; 68 percent of mothers in their second or third trimester; 18 percent of mothers enrolling postnatally; 58 percent of obese mothers; 29 percent of overweight mothers; 71 percent of mother with low or normal prepregnancy BMI; 54 percent of mothers with income at or below 75 percent of poverty; 64 percent of mothers with income between 76-130 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, the study team altered the study participant sampling process to eliminate the subsampling of participants in the supplemental

sample. Additionally, the proportion of sampled cases designated for the core (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, and 24-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 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; and

■ A set of participants for whom 24-month length and weight measurements were available.

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 non-respondents), and non-respondents' 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 non-respondents. 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 (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.

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 ± 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.

B1.8　Imputation

Imputation was used to adjust for item nonresponse (i.e., missing data for particular items among those who respond to a given wave). All the key socio-demographic variables (see Table 1-7 in Chapter 1, Section 1.8) are imputed for the total sample. 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.

B1.9   References

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Appendix B2

Development of WIC Program Composite Variables

Appendix B2
Development of WIC Program Composite Variables

B2.1   WIC Program Composite Variables

We use composite measures to capture the variation among WIC sites. Four strategies were used to collect information about site characteristics and practices:

- Key informant interviews conducted with state agency officials (State Interview);

- Key informant interviews conducted with local agency and/or site staff (Local Interview);

- WIC site profile developed from onsite observation and discussion of staffing, facilities and resources (Site Profile); and

- Survey of WIC site staff (Staff Survey).

Each of the data sources provided multiple variables for consideration in developing composite variables for the following five programmatic topic areas: Breastfeeding Education and Support, Breastfeeding Peer Counseling, Breast Pumps, Education, and Food Packages. The composites contain site-level variations in WIC program characteristics and features of service delivery.

Methodology

The variables identified for each topic area were included in principal component analyses (PCA) to identify latent themes, or main factors, present at the WIC site level. PCA is a variable reduction technique that is useful to employ when data on a large number of variables has been obtained and the variables are believed to be correlated. Under these conditions, PCA can help to reduce the variables into a smaller number of principal components that will account for most of the variance. These may then be used as predictor or criterion variables in subsequent analyses.

Within each composite, there were often multiple themes present as identified through PCA and expert review. Determination of relevant themes and potential applicability led to more than one factor being retained for some topic areas. Once the number of factors, and correspondingly the number of variables generated to represent a composite topic area, were identified for retention and

use for each domain, PCA post-estimation techniques were used to create one or more composite variables.

To address the issue of missing data, a second set of variables was created using only the specific variables identified as substantially contributing to the composite theme. Within a given factor loading, only those with a 40 percent or greater variable contribution were retained for the second set of alternative composite measures[5]. These variables were calculated as the average of the retained variables standardized values. This step resulted in variables that included more WIC sites.

Description of the Composite Variables

Breastfeeding Education and Support

Principal component analysis was conducted with eight variables identified as potentially contributing to a composite for the Breastfeeding Education and Support topic area. Results of the PCA showed two primary factors that closely corresponded to the subtopics identified for this composite: Factor 1: Pre- and post-natal breastfeeding support contacts and Factor 2: Staff available to support breastfeeding. The two factors account for 40.7 percent of the variance in sites that had complete information on all of the variables included in the analysis (n=76). Data sources for the two factors are listed below.

Source	Questions
Factor 1: Pre- and Post-natal Breastfeeding Support Contacts	
Local Interview	How many contacts do the staff below have with pregnant women and when do these occur: Q40.e. breastfeeding peer counselors (BFPC)? Q41.c. lactation consultants/professionals (LC)? Please describe the types of breastfeeding support: Q40.d. peer counselors provide to WIC mothers? Q41.b. your lactation consultants/professionals provide to WIC mothers?
Staff Survey	Asked of breastfeeding peer counselors: Q43.a. How many times, on average, do you speak with a mother who is breastfeeding for the first time (in person or on the phone) during the first 10 days after birth?
Factor 2: Staff Available to Support Breastfeeding	
Local Interview	Q41. Do you have certified lactation consultants/professionals at your site?
Site Profile	Section E: Staffing. Identify the duties of each job classification/role of WIC staff (e.g., eligibility, certification assessment, nutrition education, breastfeeding education and support, food issuance/administrative)

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[5] Two variables did not meet the common 0.4 threshold but were retained based on expert opinion. Their values were 0.37 and 0.33.

Breastfeeding Peer Counseling

Principal component analysis was conducted with 13 variables identified for the Breastfeeding Peer Counseling (BFPC) composite. Only 64 of the 80 sites reported they had BFPC programs, and of these, 58 had complete data and were included in the analysis. PCA identified a common underlying theme related to Staff Confidence and Professional Support. This final single factor accounted for 14 percent of the variance between the 58 sites for which data were available. The data sources for the Breastfeeding Peer Counseling composite are listed below.

Source	Questions
Factor 1: Staff Confidence and Professional Support	
Local Interview	Q40.g. Describe the supervision and training for breastfeeding peer counselors?
Staff Survey	Q5. What is your highest level of education?
Staff Survey	Asked of breastfeeding peer counselors: How confident are you when talking with: Q23a. WIC participants who do not want to breastfeed? Q23b. WIC participants about problems establishing a sufficient milk supply? Q23c. WIC participants who lack support from family or friends to breastfeed? Q23d. WIC participants about strategies for returning to work? Q23e. WIC participants whose doctor's suggested adding formula?

Breast Pumps

For the Breast Pumps composite, principal component analysis was conducted with 17 variables identified as potentially impacting breast pump allocation to WIC mothers. The results of the PCA identified three factors with the following underlying themes: Factor 1: Open allocation of breast pumps, Factor 2: Targeted allocation of breast pumps, and Factor 3: Breast pump accessibility. In all, the three factors account for 35.8 percent of the variance across the 80 sites. The three factors drew from variables across the subtopic areas that were previously identified and the items represented are shown below by factor.

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Source	Questions
Factor 1: Open Allocation of Breast Pumps	
Staff Survey	Q32 Which type of participants do you think should receive a breast pump from WIC?
Local Interview	Q44. Tell me about the education provided to the WIC mothers on the use of the breast pumps. What information is provided and who does it?
Factor 2: Targeted Allocation of Breast Pumps	
Staff Survey	Q32. Which type of participants do you think should receive a breast pump from WIC? Q31. Having breast pumps available for WIC participants improves the likelihood that they will breastfeed longer.
State Interview	Q17.a What is the State's policy or criteria for providing breast pumps to participants?
Factor 3: Breast Pump Accessibility	
Site Profile	Section F, Q2.a. Breastfeeding supplies onsite: PUMPS
State Interview	Q17.a. What is the State's policy/ criteria for providing breast pumps to participants?
Local Interview	Q43. How do WIC mothers who need breast pumps get access to them?

Education

For the Education composite, principal component analysis was conducted using 18 variables. After careful consideration of seven variables related to staff knowledge of WIC recommendations for early infant and toddler feeding practices, the study team excluded these from the principal component analysis because there was little variation across sites for these variables. The analyses identified common, underlying themes for two factors: Factor 1: Staff confidence and education methods and Factor 2: Staff training and number of education contacts. These two factors account for 26.8 percent of the variance across sites for which data were available (n=79).

Source	Questions
Factor 1: Staff Confidence and Education Methods	
Staff Survey	Q24. How comfortable are you talking about weight issues with parents/caregivers of overweight WIC toddlers? Q25. How confident are you that you can help WIC infants/toddlers maintain a healthy bodyweight? How confident are you when talking with WIC participants: Q23.a. who do not want to breastfeed? Q23.b. about problems establishing a sufficient milk supply? Q23.c. who lack support from family or friends to breastfeed? Q23.d. about strategies for returning to work? Q23.e. whose doctor's suggested adding formula? Q19.a. about inappropriate formula dilution? Q19.b. about early introduction of solids? Q19.c. about propping the bottle? Q19.d. about food or infant cereal in the bottle? Q19 e. about beverages other than formula or breastmilk in the bottle?
Local Interview	What methods does your staff use to cover these topics: Q16. late prenatal through 6 weeks? Q24. 4 to 8 months? Q32. 11 through 24 months?
Factor 2: Staff Training and Number of Education Contacts	
Local Interview	Q4. Do new employees have to complete a competency-based training program before they can work independently?
	Q8. Are there any training sessions related to nutrition or breastfeeding that your agency or site provides to your staff beyond those provided by the state?
Staff Survey	Q9 I receive adequate training from the WIC program to help participants with infant and toddler feeding issues.
Local Interview	How many nutrition and breastfeeding education contacts do you plan for the mother and baby, and when do these occur: Q14. for the late prenatal period – the last trimester through 6 weeks postpartum? Q22. for the period between 4 and 8 months? Q30. for the period between 11 through 24 months?

Food Package

Twenty variables were included in the analysis for the Food Package topic area. Sixteen of these were incorporated into three intensity scale variables. After review, one scale variable was omitted from the factor analysis because it did not load on any factor with other variable. The remaining two intensity scale variables plus four other variables not incorporated into the intensity scale variables (total of six variables) were used for the analysis. The analyses identified a single factor that accounts for 28 percent of the variance across sites with complete data (n=79) and which is comprised of the six variables examined. The single Food Package Policies and Practices composite variable appears to encompass policy and practices related to both infant and other food packages.

Source	Questions
**Food Package Policies and Practices**	
State Interview	Q19. Please describe your State's policy for providing formula in the first month (30 days of life) for breastfed infants? Q20. What accommodation has your State made in food selections for cultural or religious dietary practices?
Local Interview	Q42.a. What are your policies and practices when a fully breastfeeding woman says she wants to start some formula for her infant?
Staff Survey	Q13. How do you determine the amount of formula to provide for a partially breastfeeding infant? Q14. I am able to make changes or substitutions to WIC participants' food packages to meet their individual nutritional needs and preferences. Q11. Please tell us how much of an influence you think the WIC foods have on the following participant behaviors: (List of behaviors follows.)

Appendix B3

B3a: Additional Analysis Details from Chapter 2

B3b: Additional Analysis Details from Chapter 4

B3c: Additional Analysis Details from Chapter 6

Appendix B3a

Additional Analysis Details from Chapter 2

Appendix B3a
Additional Analysis Details from Chapter 2

Table B3a-1 contains details on the percentage of WIC ITFPS-2 caregivers working and going to school by work status at each interview month.

Table B3a-1. The percentage of WIC ITFPS-2 caregivers working and going to school by work status

Interview Month	Full-time, only	Full-time and school	Part-time only	Part-time and school	Total	Unweighted n	Weighted n
Month 3	14.4%	1.5%	12.5%	1.8%	30.2%	2,785	441,648
Month 7	17.9%	2.1%	16.2%	3.3%	39.5%	3,122	441,766
Month 13	20.3%	2.8%	17.0%	4.0%	44.0%	2,800	441,567
Month 18	21.5%	2.3%	16.1%	3.8%	43.7%	1,987	441,072
Month 24	23.4%	4.0%	16.7%	4.0%	48.1%	2,456	441,723

Table B3a-2 contains details on the percentage of WIC ITFPS-2 caregivers working and going to school by work status at each interview month.

Table B3a-2. The percentage of WIC ITFPS-2 caregivers who attend school by work status

Interview Month	School only	Also working part-time	Also working full-time	Total	Unweighted n	Weighted n
Month 3	7.6%	1.8%	1.5%	11.0%	2,785	441,648
Month 7	8.5%	3.3%	2.1%	13.9%	3,122	441,766
Month 13	8.9%	4.0%	2.8%	15.6%	2,800	441,567
Month 18	7.6%	3.8%	2.3%	13.7%	1,987	441,072
Month 24	7.5%	4.0%	4.0%	15.5%	2,456	441,723

Table B3a-3 contains details on Breastfeeding rates by employment status groups at each interview month.

Table B3a-3. Breastfeeding rates by employment status groups by interview month

Interview Month	Full-time	Part-time	Not employed	Unweighted n	Weighted n
Month 3	34.1%	41.3%	43.6%	2,785	441,648
Month 7	19.6%	25.9%	28.4%	3,122	441,766
Month 13	9.8%	14.8%	19.2%	2,802	441,792

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Table B3a-4 contains details on number of breastfeeding accommodations available.

Table B3a-4. Percentage of employed, breastfeeding caregivers reporting accommodations for pumping breastmilk by number of accommodations

Number of workplace accommodations for pumping milk	Percentage of employed, breastfeeding caregivers
No accommodations	15.2%
One accommodation	10.8%
Two accommodations	16.6%
Three accommodations	57.4%
Unweighted n	307
Weighted n	49,372

Table B3a-5 contains details on breastfeeding accommodations.

Table B3a-5. Percentage of employed, breastfeeding caregivers reporting accommodations for pumping breastmilk by type of accommodation

Workplace accommodations for pumping milk	Percentage of employed, breastfeeding caregivers
At least one accommodation	84.8%
Unweighted n	307
Weighted n	49,372
Reasonable breaks to pump	75.6%
Reasonable place to store pumped milk	69.2%
Provide a place other than a bathroom for pumping	70.4%
Unweighted n*	308
Weighted n	49,552

* Is the number of responses to the last question in the series. n may differ slightly across items due to item non-response.

Table B3a-6 contains data on breastfeeding duration by select work characteristics.

Table B3a-6.   Median breastfeeding duration by select characteristics

Characteristic	Median days	Standard error	Unweighted n	Weighted n
Employment status				
Not employed	91.15	11.368	1253	204,305
Employed part time	79.11	8.129	465	80,778
Employed full time	59.56	3.174	569	83,469
Number of workplace accommodations for pumping milk				
Three	189.32	34.499	155	25,421
Two	165.51	67.02	44	6,954
One	143.6	50.242	28	4,789
None	140.21	29.433	53	7,571

Table B3a-7 contains details on child care use.

Table B3a-7.   The percentage of study children in regular child care, currently and ever

Interview month	Currently using child care	Ever used child care	Unweighted n	Weighted n
Month 3	22.3%	23.3%	2,785	441,569
Month 7	33.5%	39.0%	3,132	442,591
Month 13	38.9%	49.7%	2,807	442,547
Month 24	43.7%	60.0%	2,461	442,405

Table B3a-8 contains data on breastfeeding rates for children in regular child care.

Table B3a-8.   Breastfeeding rates by child care status

Interview month	Currently in regular child care	Not currently in regular child care	Unweighted n	Weighted n
Month 3	37.2%	43.0%	2,783	441,336
Month 7	22.6%	27.8%	3,127	441,967
Month 13	12.3%	18.4%	2,806	442,531

Table B3a-9 contains data on methods of breastmilk receipt for children in child care.

Table B3a-9. Among breastfed infants in regular child care, the percentage distribution of infants by method of breastmilk receipt

Method of receipt	Month 3	Month 7
Pumped milk	60.4%	51.9%
Mother goes to site to feed	11.2%	12.5%
Both pumped milk and mother goes to site to feed	8.4%	10.9%
Neither	20.0%	24.7%
Unweighted n	228	236
Weighted n	36,597	33,490

Table B3a-10 contains data on breastfeeding rates for children in regular child care.

Table B3a-10. Median and mean breastfeeding duration by use of regular child care by age 13 months

Use of regular child care	Median duration (in days)	Standard error of the median	Mean duration (in days)	Unweighted n	Weighted n
Never used regular child care by 13-month Interview	90.58	14.47	162	776	184,963
Ever used regular child care by 13-month Interview	69.37	7.86	138	765	185,412

There are no additional analysis details from Chapter 3. See Appendix C2 for more analyses.

Appendix B3b

Additional Analysis Details from Chapter 4

Appendix B3b
Additional Analysis Details from Chapter 4

Table B3b-1 contains details on the average percentage of infants consuming fruit and fruit products on a given day at each interview month.

Table B3b-1.   Percentage of study children consuming different types of fruit products on a given day by interview month (Month 3 - 24)

| Food group/food | Percentage of children consuming fruit products | | | | | | | | |
	Month 3 % (SE)	Month 5 % (SE)	Month 7 % (SE)	Month 9 % (SE)	Month 11 % (SE)	Month 13 % (SE)	Month 15 % (SE)	Month 18 % (SE)	Month 24 % (SE)
Any fruit	2.0 (0.3)	16.2 (1.1)	57.7 (1.3)	71.3 (1.0)	70.1 (1.2)	70.9 (1.5)	66.8 (1.4)	69.2 (1.4)	69.9 (1.4)
Baby food fruit	1.9 (0.3)	14.8 (1.0)	54.9 (1.4)	65.4 (1.0)	53.6 (1.2)	26.5 (1.1)	11.2 (1.0)	5.3 (0.6)	1.2 (0.2)
Non-baby food fruit	0.2 (0.1)	2.4 (0.3)	10.8 (1.0)	19.2 (1.7)	32.5 (1.8)	56.3 (1.8)	61.5 (1.5)	66.5 (1.5)	69.5 (1.4)
100% fruit juice	2.6 (0.2)	7.4 (0.7)	23.7 (1.0)	36.1 (1.7)	46.6 (1.4)	60.2 (1.2)	65.5 (1.2)	67.4 (1.0)	69.6 (1.2)
Unweighted n	2,773	2,596	3,081	2,412	2,285	2,763	2,048	1,973	2,438
Weighted n	439,616	438,284	435,294	435,705	435,281	434,035	437,375	437,505	439,020

Note: Any fruit includes baby food fruit or non-baby food fruit, but not 100 fruit juice.

Data source: AMPM 24 Hour Recall for Food Intake, Month 3 - 24. Cross-sectional weights for 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18-, and 24-month Interviews are used for this table.

Table B3b-2 contains details on the average percentage of infants consuming vegetables on a given day at each interview month.

Table B3b-2.   Percentage of study children consuming different types of vegetables on a given day by interview month (Month 3 - 24)

| Food group/food | Percentage of children consuming vegetables | | | | | | | | |
	Month 3 % (SE)	Month 5 % (SE)	Month 7 % (SE)	Month 9 % (SE)	Month 11 % (SE)	Month 13 % (SE)	Month 15 % (SE)	Month 18 % (SE)	Month 24 % (SE)
Any vegetable	0.7 (0.2)	14.6 (0.9)	59.4 (1.4)	64.6 (1.6)	65.5 (1.2)	62.6 (1.4)	60.3 (1.8)	60.3 (1.4)	62.2 (1.4)
Baby food vegetables	0.5 (0.2)	12.8 (0.9)	52.2 (1.3)	53.1 (1.7)	42.0 (1.0)	16.9 (0.8)	6.6 (0.7)	4.2 (0.6)	1.1 (0.3)
Cooked vegetables	0.7 (0.2)	14.3 (0.9)	59.0 (1.4)	63.9 (1.7)	63.9 (1.1)	59.8 (1.5)	57.4 (2.0)	55.8 (1.6)	56.5 (1.4)
Raw vegetables	0.0 (0.0)	0.2 (0.1)	0.8 (0.2)	1.8 (0.3)	3.7 (0.4)	6.4 (0.7)	7.5 (0.7)	10.2 (0.8)	13.8 (0.9)
Unweighted n	2,773	2,596	3,081	2,412	2,285	2,763	2,048	1,973	2,438
Weighted n	439,616	438,284	435,294	435,705	435,281	434,035	437,375	437,505	439,020

Data source: AMPM 24 Hour Recall for Food Intake, Month 3 - 24. Cross-sectional weights for 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18-, and 24-month Interviews are used for this table.

Table B3b-3 contains details on the average percentage of infants consuming cow's milk and milk alternatives on a given day at each interview month.

Table B3b-3.   Percentage of study children consuming cow's milk and milk alternatives on a given day (Months 3-24)

Food group/food	Percentage of children consuming cow's milk and milk alternatives								
	Month 3 % (SE)	Month 5 % (SE)	Month 7 % (SE)	Month 9 % (SE)	Month 11 % (SE)	Month 13 % (SE)	Month 15 % (SE)	Month 18 % (SE)	Month 24 % (SE)
Any type of milk[b]	100 (0.0)	100 (0.0)	99.8 (0.1)	99.6 (0.1)	99.6 (0.1)	98.7 (0.2)	96.3 (0.5)	92.9 (1.0)	90.6 (0.8)
Milk and milk products[c]	0 ( )	0.1 (0.1)	0.6 (0.1)	2.3 (0.3)	9.2 (1.0)	78.3 (0.8)	87.6 (0.8)	87.3 (1.0)	88.1 (0.9)
Cow Milk	0 ( )	0.1 (0.1)	0.5 (0.1)	1.8 (0.3)	8.7 (1.0)	75.3 (1.0)	83.9 (1.0)	83.8 (1.1)	84.7 (1.0)
Soy or rice milk	0 ( )	0 ( )	0.1 (0.0)	0.2 (0.1)	0.2 (0.1)	1.8 (0.3)	2.3 (0.4)	2.1 (0.5)	1.8 (0.3)
Other milk	0 ( )	0.0 (0.0)	0.1 (0.1)	0.3 (0.1)	0.3 (0.1)	1.6 (0.3)	2.0 (0.4)	2.1 (0.4)	2.1 (0.4)
Unweighted n[a]	2,773	2,596	3,081	2,412	2,285	2,763	2,048	1,973	2,438
Weighted n	439,616	438,284	435,294	435,705	435,281	434,035	437,375	437,505	439,020

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

[b]   Including formula.

[c]   Not Including formula.

Data source: AMPM 24 Hour Recall for Food Intake, Months 3-24. Cross-sectional weights for 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18- and 24-month Interviews are used for this table.

Table B3b-4 contains details on the average percentage of infants consuming desserts and candy, sugar sweetened beverages, and salty snacks on a given day at each interview month.

Table B3b-4. Percentage of study children consuming desserts and candy, sugar sweetened beverages, and salty snacks on a given day by interview month (Month 3 - 24)

Food group/food	Percentage of children consuming desserts and candy, sugar sweetened beverages, and salty snacks								
	Month 3 % (SE)	Month 5 % (SE)	Month 7 % (SE)	Month 9 % (SE)	Month 11 % (SE)	Month 13 % (SE)	Month 15 % (SE)	Month 18 % (SE)	Month 24 % (SE)
Desserts and candy	0.3 (0.1)	1.8 (0.3)	10.9 (0.8)	21.5 (1.1)	29.8 (1.0)	40.8 (1.4)	41.9 (1.7)	45.8 (1.5)	51.6 (1.2)
Sweetened beverages	1.1 (0.3)	1.0 (0.3)	2.0 (0.3)	3.4 (0.4)	6.5 (0.7)	11.4 (0.9)	15.9 (1.1)	18.5 (1.4)	23.4 (1.2)
Salty snacks	0 ( )	0.2 (0.1)	0.7 (0.2)	2.8 (0.6)	5.0 (0.8)	9.5 (0.7)	13.2 (1.0)	17.5 (1.7)	24.3 (1.2)
Unweighted n	2,773	2,596	3,081	2,412	2,285	2,763	2,048	1,973	2,438
Weighted n	439,616	438,284	435,294	435,705	435,281	434,035	437,375	437,505	439,020

Data source: AMPM 24 Hour Recall for Food Intake, Month 3 - 24. Cross-sectional weights for 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18-, and 24-month Interviews are used for this table.

Table B3b-5 contains details on the percentage of study children eating breakfast, lunch, dinner, and snack on a given day by interview month.

Table B3b-5. Percentage of study children eating breakfast, lunch, dinner, and snacks by interview month (Month 3 - 24)

Eating occasion	Percentage of children								
	Month 3 (%)	Month 5 (%)	Month 7 (%)	Month 9 (%)	Month 11 (%)	Month 13 (%)	Month 15 (%)	Month 18 (%)	Month 24 (%)
Breakfast	53.50	60.90	80.40	85.50	88.50	92.60	94.60	94.90	97.60
Lunch	47.60	54.20	73.20	79.30	82.90	86.60	89.40	91.40	93.60
Dinner	47.20	55.20	73.50	77.90	83.60	87.90	89.60	91.30	94.60
Snack	27.50	33.80	51.50	61.60	66.70	74.40	74.70	77.10	80.00
Unweighted n	2,773	2,596	3,081	2,412	2,285	2,763	2,048	1,973	2,434
Weighted n	439,616	438,284	435,294	435,705	435,281	434,035	437,375	437,505	438,206

Data source: AMPM 24 Hour Recall for Food Intake, Month 3 - 18. Cross-sectional weights for 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18-, and 24-month Interviews are used for this table.

There are no additional analysis details from Chapter 5. See Appendix C4 for more analyses.

Appendix B3c

Additional Analysis Details from Chapter 6

Table B3c-1 contains data on weight for length of study children.

Table B3c-1. The percentage distribution of study children in weight-for-length categories by age group

Weight-for-length range	Early infancy (1 to <7 months)	Late infancy (7-15 months)	Toddlerhood (20-28 months)
Low (below 2nd percentile)	0.9%	0.6%	0.8%
Healthy (between 2nd and 98th percentiles)	82.7%	80.2%	76.3%
High (above 98th percentile)	16.4%	19.2%	22.9%
Unweighted n	2,014	2,442	1,731
Weighted n	349,824	420,357	442,713

Table B3c-2 to B3c-4 contain data on children by weight-for-length percentile by select socio-demographics.

Table B3c-2. Percentage of children in each weight-for-length percentile range by household food security

		Household food security (measured using 6-item module)		
Weight-for-length percentile range	Study children % (SE)	High or marginal food security % (SE)	Low food security % (SE)	Very low food security % (SE)
Early Infancy (1-7 Months)[d]				
Low weight-for-length (below 2nd percentile)	0.9 (0.2)	0.3 (0.1)	2.2 (0.7)	0.6 (0.4)
Healthy weight-for-length (between 2nd and 98th percentiles)	82.7 (1.5)	82.8 (1.7)	80.4 (2.8)	86.9 (2.2)
High weight-for-length (above 98th percentile)	16.4 (1.5)	16.9 (1.7)	17.4 (2.7)	12.5 (2.2)
Unweighted n[a]	2,014	1,066	610	338
Weighted n	349,824	185,822	107,586	56,416
Late Infancy (7-15 Months)				
Low weight-for-length (below 2nd percentile)	0.6 (0.2)	0.4 (0.2)	0.4 (0.2)	1.3 (0.7)
Healthy weight-for-length (between 2nd and 98th percentiles)	80.2 (1.1)	80.5 (1.5)	79.2 (2.4)	81.1 (2.3)
High weight-for-length (above 98th percentile)	19.2 (1.1)	19.1 (1.5)	20.4 (2.5)	17.7 (2.2)
Unweighted n[b]	2,442	1,270	767	405
Weighted n	420,357	218,968	130,940	70,449
Toddlerhood (20-28 Months)				
Low weight-for-length (below 2nd percentile)	0.8 (0.3)	0.8 (0.3)	0.2 (0.2)	1.8 (1.0)
Healthy weight-for-length (between 2nd and 98th percentiles)	76.3 (1.1)	78.8 (1.8)	69.7 (3.5)	75.3 (2.6)
High weight-for-length (above 98th percentile)	22.9 (1.0)	20.4 (1.7)	30.0 (3.5)	22.9 (2.6)
Unweighted n[c]	1,731	1,135	373	223
Weighted n	442,713	286,253	100,999	55,462

[a] n is the number of children with valid weight and length data at 6 months.

[b] n is the number of children with valid weight and length data at 12 months.

[c] n is the number of children with valid weight and length data at 24 months.

[d] Chi-square statistic testing of household food security differences is significant at $p \leq 0.05$.

Data source: WIC Administrative Data

Table Bc3-3.   Percentage of children in each weight-for-length percentile range by participation in non-WIC benefit program(s)

Weight-for-length percentile range	Study children % (SE)	Participation in non-WIC benefit program(s)		
		Does not participate in any other program % (SE)	Participates in other program(s) and is on SNAP % (SE)	Participates in other program(s) and is not on SNAP % (SE)
Early Infancy (1-7 Months)				
Low weight-for-length (below 2nd percentile)	0.9 (0.2)	1.2 (0.7)	0.9 (0.3)	0.9 (0.4)
Healthy weight-for-length (between 2nd and 98th percentiles)	82.7 (1.5)	77.8 (2.8)	84.3 (1.8)	83.0 (2.0)
High weight-for-length (above 98th percentile)	16.4 (1.5)	21.0 (2.9)	14.9 (1.8)	16.1 (2.1)
Unweighted n[a]	2,014	321	969	724
Weighted n	349,824	60,017	163,034	126,773
Late Infancy (7-15 Months)[d]				
Low weight-for-length (below 2nd percentile)	0.6 (0.2)	0.4 (0.3)	0.9 (0.3)	0.3 (0.1)
Healthy weight-for-length (between 2nd and 98th percentiles)	80.2 (1.1)	75.5 (3.0)	78.9 (1.5)	84.2 (1.7)
High weight-for-length (above 98th percentile)	19.2 (1.1)	24.1 (3.0)	20.3 (1.4)	15.5 (1.7)
Unweighted n[b]	2,442	390	1,173	879
Weighted n	420,357	74,149	196,440	149,768
Toddlerhood (20-28 Months)				
Low weight-for-length (below 2nd percentile)	0.8 (0.3)	0.7 (0.5)	1.1 (0.5)	0.5 (0.3)
Healthy weight-for-length (between 2nd and 98th percentiles)	76.3 (1.1)	81.6 (3.4)	76.3 (1.8)	74.4 (1.9)
High weight-for-length (above 98th percentile)	22.9 (1.0)	17.7 (3.2)	22.6 (1.8)	25.1 (1.9)
Unweighted n[c]	1,731	239	775	717
Weighted n	442,713	66,543	194,424	181,745

[a] n is the number of children with valid weight and length data at 6 months.

[b] n is the number of children with valid weight and length data at 12 months.

[c] n is the number of children with valid weight and length data at 24 months.

[d] Chi-square statistic testing of participation in non-WIC benefit program(s) differences is significant at $p \leq 0.05$.

Data source: WIC Administrative Data

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Table B3c-4.   Percentage of children in each weight-for-length percentile range by ethnicity

Weight-for-length percentile range	Study children % (SE)	Ethnicity	
		Hispanic % (SE)	Non-Hispanic % (SE)
Early Infancy (1-7 Months)			
Low weight-for-length (below 2nd percentile)	0.9 (0.2)	0.6 (0.3)	1.2 (0.4)
Healthy weight-for-length (between 2nd and 98th percentiles)	82.7 (1.5)	81.3 (2.6)	84.0 (1.2)
High weight-for-length (above 98th percentile)	16.4 (1.5)	18.1 (2.6)	14.8 (1.2)
Unweighted n[a]	2,014	856	1,158
Weighted n	349,824	168,281	181,543
Late Infancy (7-15 Months)			
Low weight-for-length (below 2nd percentile)	0.6 (0.2)	0.5 (0.2)	0.7 (0.3)
Healthy weight-for-length (between 2nd and 98th percentiles)	80.2 (1.1)	80.0 (1.8)	80.4 (1.2)
High weight-for-length (above 98th percentile)	19.2 (1.1)	19.6 (1.8)	19.0 (1.3)
Unweighted n[b]	2,442	1,085	1,357
Weighted n	420,357	198,154	222,203
Toddlerhood (20-28 Months)[d]			
Low weight-for-length (below 2nd percentile)	0.8 (0.3)	0.8 (0.4)	0.8 (0.3)
Healthy weight-for-length (between 2nd and 98th percentiles)	76.3 (1.1)	72.9 (2.0)	79.2 (1.4)
High weight-for-length (above 98th percentile)	22.9 (1.0)	26.3 (2.0)	20.0 (1.4)
Unweighted n[c]	1,731	804	927
Weighted n	442,713	204,628	238,084

[a] n is the number of children with valid weight and length data at 6 months.

[b] n is the number of children with valid weight and length data at 12 months.

[c] n is the number of children with valid weight and length data at 24 months.

[d] Chi-square statistic testing of ethnicity differences is significant at $p \leq 0.05$.

Data source: WIC Administrative Data

Table B3c-5 contains data on weight-for-length categories by time until introduction of select foods.

Table B3c-5.   Percentage of children in weight-for-length percentile ranges by time until introduction of select foods

Time until introduction of select foods	Study children % (SE)	Weight-for-length percentile ranges		
		Low weight-for-length (below 2nd percentile) % (SE)	Healthy weight-for-length (between 2nd and 98th percentiles) % (SE)	High weight-for-length (above 98th percentile) % (SE)
Not yet introduced in early infancy (1-7 Months)				
Fruit juice	58.3 (1.5)	59.1 (13.6)	58.0 (1.5)	59.8 (5.1)
Unweighted n[a]	1,158	10	954	194
Weighted n	203,839	1,918	167,709	34,212
Cow's milk	96.7 (0.5)	98.8 (1.3)	96.6 (0.5)	96.8 (0.8)
Unweighted n[a]	1,942	19	1,624	299
Weighted n	338,115	3,206	279,485	55,425
Sweet drinks	89.0 (1.1)	96.2 (3.1)	88.8 (1.1)	89.3 (2.1)
Unweighted n[a]	1,787	17	1,497	273
Weighted n	311,292	3,120	257,034	51,138
Infant cereal	18.7 (1.4)	11.8 (8.6)	19.2 (1.6)	17.0 (2.7)
Unweighted n[a]	374	4	312	58
Weighted n	65,558	382	55,447	9,729
Fruits	24.1 (1.5)	15.5 (12.0)	24.6 (1.5)	21.9 (3.1)
Unweighted n[a]	475	2	400	73
Weighted n	84,312	502	71,254	12,556
Vegetables	21.6 (1.1)	9.1 (6.2)	22.6 (1.2)	17.6 (2.4)
Unweighted n[a]	433	3	365	65
Weighted n	75,696	294	65,297	10,105
Meats	68.2 (1.3)	49.9 (14.7)	68.6 (1.3)	67.2 (4.0)
Unweighted n[a]	1,360	11	1,139	210
Weighted n	238,565	1,619	198,487	38,460
Salty snacks	82.0 (0.9)	74.5 (14.6)	82.1 (0.9)	82.0 (3.3)
Unweighted n[a]	1,638	15	1,375	248
Weighted n	286,741	2,415	237,401	46,925

Table B3c-5.   Percentage of children in weight-for-length percentile ranges by time until introduction of select foods (continued)

Time until introduction of select foods	Study children % (SE)	Weight-for-length percentile ranges		
		Low weight-for-length (below 2nd percentile) % (SE)	Healthy weight-for-length (between 2nd and 98th percentiles) % (SE)	High weight-for-length (above 98th percentile) % (SE)
Not yet introduced in early infancy (1-7 Months)				
Dairy foods	86.4 (0.9)	77.3 (13.6)	86.3 (1.0)	87.7 (2.1)
Unweighted n[a]	1,739	16	1,448	275
Weighted n	302,289	2,506	249,565	50,218
High protein foods	79.8 (1.6)	87.0 (5.2)	79.8 (1.6)	79.8 (3.0)
Unweighted n[a]	1,608	16	1,346	246
Weighted n	279,262	2,820	230,750	45,692
Sweet foods	91.9 (0.9)	93.7 (6.1)	92.1 (0.8)	90.9 (3.3)
Unweighted n[a]	1,847	18	1,536	293
Weighted n	321,457	3,039	266,377	52,041
Not yet introduced in late infancy (7-15 Months)				
Fruit juice	13.1 (0.9)	8.4 (8.6)	13.4 (1.0)	12.0 (2.4)
Unweighted n[b]	302	1	251	50
Weighted n	55,038	203	45,141	9,693
Cow's milk	15.7 (0.9)	12.2 (9.4)	15.9 (1.0)	14.7 (2.0)
Unweighted n[b]	372	2	306	64
Weighted n	65,833	295	53,682	11,857
Sweet drinks	39.7 (2.0)	10.5 (9.2)	40.8 (2.3)	35.8 (3.0)
Unweighted n[b]	925	2	764	159
Weighted n	166,698	254	137,452	28,992
Infant cereal	11.2 (0.9)	8.4 (8.6)	11.8 (1.0)	8.6 (2.2)
Unweighted n[b]	268	1	227	40
Weighted n	47,022	203	39,871	6,948
Fruits	8.6 (0.7)	8.4 (8.6)	8.9 (0.8)	7.5 (2.1)
Unweighted n[b]	202	1	168	33
Weighted n	36,215	203	29,922	6,090
Vegetables	9.1 (0.7)	8.4 (8.6)	9.4 (0.8)	7.9 (2.1)
Unweighted n[b]	213	1	177	35
Weighted n	38,088	203	31,535	6,350

Table B3c-5.   Percentage of children in weight-for-length percentile ranges by time until introduction of select foods (continued)

Time until introduction of select foods	Study children % (SE)	Weight-for-length percentile ranges		
		Low weight-for-length (below 2nd percentile) % (SE)	Healthy weight-for-length (between 2nd and 98th percentiles) % (SE)	High weight-for-length (above 98th percentile) % (SE)
Not yet introduced in late infancy (7-15 Months)				
Meats	12.9 (0.9)	10.5 (9.2)	13.1 (1.0)	11.8 (2.2)
Unweighted n[b]	306	2	252	52
Weighted n	54,076	254	44,292	9,530
Salty snacks	20.6 (1.4)	8.4 (8.6)	20.6 (1.4)	20.6 (2.8)
Unweighted n[b]	479	1	389	89
Weighted n	86,421	203	69,550	16,668
Dairy foods	18.8 (1.0)	8.4 (8.6)	18.9 (1.0)	18.4 (2.0)
Unweighted n[b]	460	1	377	82
Weighted n	78,944	203	63,868	14,873
High protein foods	13.2 (0.9)	8.4 (8.6)	13.4 (0.9)	12.3 (2.2)
Unweighted n[b]	321	1	265	55
Weighted n	55,358	203	45,208	9,946
Sweet foods	26.5 (1.6)	10.5 (9.2)	27.1 (1.8)	24.3 (2.4)
Unweighted n[b]	646	2	528	116
Weighted n	111,370	254	91,447	19,669
Not yet introduced in toddler (20-28 Months)				
Fruit juice	9.0 (0.7)	3.9 (4.0)	8.8 (0.8)	9.9 (1.9)
Unweighted n[c]	156	1	120	35
Weighted n	40,004	137	29,832	10,034
Cow's milk	12.0 (0.8)	3.9 (4.0)	12.0 (1.1)	12.5 (2.1)
Unweighted n[c]	208	1	161	46
Weighted n	53,271	137	40,518	12,616
Sweet drinks	29.6 (2.0)	27.5 (13.5)	29.3 (2.2)	30.8 (3.2)
Unweighted n[c]	502	5	377	120
Weighted n	131,208	979	99,020	31,209
Infant cereal	9.5 (0.9)	3.9 (4.0)	9.5 (1.0)	9.6 (2.2)
Unweighted n[c]	166	1	130	35
Weighted n	41,937	137	32,066	9,733

Table B3c-5.   Percentage of children in weight-for-length percentile ranges by time until introduction of select foods (continued)

Time until introduction of select foods	Study children % (SE)	Weight-for-length percentile ranges		
		Low weight-for-length (below 2nd percentile) % (SE)	Healthy weight-for-length (between 2nd and 98th percentiles) % (SE)	High weight-for-length (above 98th percentile) % (SE)
Not yet introduced in toddler (20-28 Months)				
Fruits	7.1 (0.7)	3.9 (4.0)	6.7 (0.7)	8.6 (1.9)
Unweighted n[c]	120	1	91	28
Weighted n	31,509	137	22,646	8,726
Vegetables	7.0 (0.7)	3.9 (4.0)	6.7 (0.8)	8.2 (1.9)
Unweighted n[c]	124	1	94	29
Weighted n	31,046	137	22,574	8,334
Meats	9.3 (0.7)	10.5 (10.9)	9.1 (0.9)	10.1 (2.0)
Unweighted n[c]	167	2	131	34
Weighted n	41,352	373	30,749	10,229
Salty snacks	15.4 (1.3)	17.2 (12.9)	15.5 (1.5)	15.0 (2.3)
Unweighted n[c]	259	3	200	56
Weighted n	68,233	611	52,411	15,210
Dairy foods	15.2 (1.1)	11.9 (10.9)	14.7 (1.1)	17.2 (2.7)
Unweighted n[c]	262	3	201	58
Weighted n	67,317	425	49,513	17,379
High protein foods	11.0 (0.8)	3.9 (4.0)	10.3 (0.9)	13.7 (2.0)
Unweighted n[c]	194	1	143	50
Weighted n	48,850	137	34,833	13,880
Sweet foods	19.3 (1.5)	16.6 (10.8)	19.0 (1.6)	20.4 (2.7)
Unweighted n[c]	344	4	261	79
Weighted n	85,298	592	64,065	20,640

[a] n is the number of children who were not introduced to the select food by the age of 7 months.

[b] n is the number of children who were not introduced to the select food by the age of 15 months.

[c] n is the number of toddlers who were not introduced to the select food by the age of 28 months.

Weight-for-Length percentiles are gender specific. Table includes both genders.

Data source: 1-24 Month Interviews, Questions CF33ee-hh; WIC Administrative Data; 6-Month measurement data weights are used for early infancy; 12-Month measurement data weights are used for late infancy; 24-Month measurement data weights are used for toddler.

Table B3c-6 contains details on the logistic regression predicting high weight-for-length status.

Table B3c-6.   Odds ratio estimates for logistic regression predicting the likelihood of high weight-for length status in toddlerhood

Variable	Point estimate	95% confidence interval	
Black or African American vs White	0.670	0.393	1.143
All Other Races vs White	0.796	0.555	1.142
Hispanic or Latino vs Not Hispanic or Latino	1.253	0.730	2.152
Married vs Not married (including divorced and widowed)	0.711	0.477	1.061
Solid foods were introduced prior to 4 months vs Not introduced[a]	2.110	1.364	3.263
Child with rapid weight gain in toddlerhood vs Child did not gain weight rapidly[a]	3.796	2.379	6.056
Child was overfed at 24 Month 24-Hour Recall vs Child was not overfed	0.673	0.400	1.133
Mother was smoking during pregnancy vs Mother not smoking during pregnancy	1.301	0.479	3.533
Child has heath condition at 24 Month Interview vs Child does not has heath condition	0.416	0.151	1.143
Child typically plays outside less than 2 hours daily vs Child typically plays outside at least 2 hours daily[a]	0.586	0.373	0.919
Plays more than 0.3 hours of video games per day vs Plays 0.3 hours or less of video games per day[a]	1.591	1.033	2.450
Low Birth Weight vs Normal Birth Weight	0.492	0.136	1.779
High Birth Weight vs Normal Birth Weight[a]	4.806	1.005	22.971
Breastfeeding duration	0.999	0.998	1.001

[a] This variable is significant at the 95% confidence level

Appendix B4

Dietary Intake Coding Procedures and Estimating Usual Intake

Appendix B4
Dietary Intake Coding Procedures and Estimating Usual Intake

B4.1   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 application[6]. Nutrient values are taken from the U.S. Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies, 5.0 (FNDDS5).[7] 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-, and 60-months. Replicate intakes are collected from a 10 percent subsample of children at 13, 15, 18, 24, 36, 48, and 60 months to estimate "usual" intake.

B.4.1.1   AMPM Interview Data Entry

The AMPM is constructed such that the mother is asked to recall all her child's dietary intake for the previous day in a systematic fashion. She is guided through the day and asked to report all foods, beverages, and dietary supplements for each eating event during the 24-hour period, which are recorded by the interviewer. The interview produces a 24-hour snapshot of all foods, beverages, and dietary supplements consumed by the child, which are then coded and translated into calories, nutrients, and food group values. 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. The interview procedures used in WIC ITFPS-2 were customized to capture breastfeeding and formula feeding details that allowed for more specific data analyses. These additional procedures captured

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[6] 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.

[7] 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.

whether breastmilk was expressed or fed from the breast and the frequency of breast and bottle feedings. Additionally, if caregivers report that they do not know what the child ate while away 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 two working days to obtain the missing information.

B.4.1.2 Post Interview Processing System

Westat processed the recall data through PIPS and then created SurveyNet batches by recall month (3-, 5-, 7-, etc.) of no more than 20 intake days each. The online Coder Tracking System tracked each batch through the various coding and review steps. Dietary coders assigned themselves batches and completed the coding for all intake days within a single assigned batch.

B.4.1.3 Standard SurveyNet Processing

Assigning Food Codes

SurveyNet displays a shorthand version of each 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. During PIPS processing, approximately 70 percent of foods are auto-coded, meaning that a food code and/or a portion quantity is pre-assigned; in those cases, the dietary coder merely reviews the pre-filled fields to ensure that no changes need to be made. Changes to these preassigned data may be required if the interviewer enters a comment or a text response in any field that would cause the coder to change the pre-assigned 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 the food needs to be flagged for nutrient modification after analysis because the nutrient profile of the foods differs too much from existing food codes. Several food items are handled in this way: agave syrup, almond milk, chia seed, edamame, Greek yogurt, hemp seed, and quinoa. Senior coding staff obtain nutrient information for these products from USDA Database for Survey Research and correct 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 amount is not given, how to handle reports of nonstick spray, etc.). A second set of coding guidelines have been developed for coding amounts of dietary supplements, since the default dose for non-children's supplements in the NHANES Dietary Supplement Database is generally appropriate for adults rather than infants and children. Additional guidelines are developed throughout the study, as new issues are resolved. Coding staff document these guidelines in a decision log that is being 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 also provides predetermined food weights for foods in commonly eaten portions (e.g., one-half grapefruit, one medium chicken leg). Food amounts that are entered as a shape; by dimensions (length, width, and height); volume; or weight are automatically converted 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. Should the coding guidelines not apply, coders select the "quantity not specified" portion option available in SurveyNet.[8]

Estimating Breastmilk Intake

In order to allow complete nutrient analysis of infant dietary intake, coding procedures have been developed for determining the quantity of breastmilk consumed by breastfed infants. Guidelines have been established for coding breastmilk when fed from the breast, based on research from the Feeding Infants and Toddlers Study[9] and the Davis Area Research on Lactation in Infant Nutrition and Growth study.[10] These guidelines using the child's age and breastfeeding exclusivity status to estimate intake quantities. For fully breastfed infants (i.e., those who did not report consuming infant formula or any other milks) between birth and 5.9 months, a total breastmilk intake of 780 ml/day is assumed. For fully breastfed infants between 6 and 11.9 months, a total breastmilk intake of 600 ml/day is assumed. For partially breastfed infants between birth and 5.9 months, breastmilk intake is imputed by summing the amounts of infant formula and other milks reported, and subtracting that total amount from 780 ml/day (e.g., if a partially breastfed, 3 month old infant reported consuming 240 ml of infant formula and no other milks, then the infant was coded as also consuming 540 ml of breastmilk). For partially breastfed infants between 6 and 11.9 months, breastmilk intake is imputed by summing the amounts of infant formula and other milks reported and subtracting that total amount from 600 ml/day. For partially breastfed infants whose reported intake is more than 780 ml or 600 ml of formula and/or other milks, a total breastmilk intake of 78 ml or 60 ml per day is assumed, respectively. In the study sample, only 1.2 percent of young infants (birth to 5.9 months) and 0.7 percent of older infants (6 to 11.9 months) were partially breastfed and reported consuming more than 780 ml/day or 600ml/day, respectively, of formula and other milks.

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[8] For participants less than 2 years old, one-half of the "quantity not specified" amount was coded.

[9] Butte, N. F., Fox, M. K., Briefel, R. R., Siega-Riz, A. M., Dwyer, J. T., Deming, D. M., & Reidy, K. C. (2010). Nutrient intakes of US infants, toddlers, and preschoolers meet or exceed dietary reference intakes. *Journal of the American Dietetic Association, 110*(12), S27-S37.

[10] Heinig, M. J., Nommsen, L. A., Peerson, J. M., Lonnerdal, B., & Dewey, K. G. (1993). Intake and growth of breast-fed and formula-fed infants in relation to the timing of introduction of complementary foods: the DARLING study. *Acta Paediatrica*, *82*(s385), 999-1006.

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Combinations

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) are flagged in SurveyNet using combination codes. The combinations are usually identified during data collection by AMPM and a combination type code is prefilled in SurveyNet. If coders need to add additional food codes to represent the reported food, the coder uses the combination type code to link the foods.

Review

After the dietary coders assign food codes, coders and supervisors conduct quality control by verifying, adjudicating, and editing the assigned food codes and portion amounts. Verifying involves a detailed review of coded intakes by a second coder. Any notepad entries made by the second coder highlighting questions or disagreement between coders are adjudicated by a coding supervisor. All adjudicated records are reviewed and edited by the supervisor, and decisions are made on notepad questions and unfound foods. The adjudication process also allows evaluation of the accuracy of each coder's work. Two intakes from every batch are used for calculation of accuracy, so that 10 percent of each coder's work are assessed. Coders are required to maintain 95 percent accuracy.

Analysis

Nutrient analysis is performed using SurveyNet's analysis system. The system automatically generates error reports that document unresolved issues such as missing or invalid food codes, recipe modification, or portion codes. All errors are resolved and the analysis re-run. Two analysis data files are prepared: 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 standard values provided include 65 nutrients from the Food and Nutrient Database for Dietary Studies, 5.0 (FNDDS5). USDA Food Pattern Equivalents food group values are appended to these files.

Quality Control Review

Standard quality control (QC) checks are performed 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. The outliers are reviewed and any deemed to be the result of coding errors are corrected. These outlier checks are explained in more detail below.

Portion Outliers. Portion outlier reports identify errors in the reported amount of foods consumed. In addition, they serve as a check for intakes where an incorrect form of the food is applied[11] when specifying the amount. The USDA SurveyNet software used to code AMPM intakes 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. Records flagged as outliers are examined and any interviewer or coding errors were corrected. 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, a determination of whether or not the intake met minimum criteria is made. 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 is deleted 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 coding guidelines developed for infant breastmilk consumption are applied, so the time and occasion information is not required.

2. **Intake is judged as "unreliable."** Although interviewers do not provide feedback on whether or not a respondent is reliable, guidelines developed in previous studies are implemented.

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[11] For example, the coder entered 1 cup of rice as uncooked by mistake when it was reported as cooked.

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3. **Meals with missing foods.** This flag is implemented 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

After all dietary recall data files are edited and finalized, nutrient values and Food Pattern Equivalent (FPE) values are appended to each record. Nutrient values are taken from the USDA Food and Nutrient Database for Dietary Studies, 5.0 (FNDDS5)[12]. FPE values are taken from the Food Pattern Equivalent Database (FPED) 2011-2012;[13] food codes that do not have a match in the FPED are reviewed and food group values are imputed.

B4.2   Infant Intake Analysis

WIC ITFPS-2 collects usual intake information on infants ages 1 to 11 months with a single intake per individual per month. Although usual intake data are often collected through 24-hour dietary recalls conducted two or more times in a short time window in order to estimate measurement error (variance over repeated interviews), for the infant usual intake data collection it is not considered necessary because diet is less varied in infancy, and it is expected that measurement error would be minimal.

To check whether the WIC ITFPS-2 intake collection for infants yields valid usual intake estimates, results from WIC ITFPS-2 are compared to the results for a similar age range from the NHANES usual intake data collection. The NHANES data have repeated measures of individuals in a narrow time window, so that measurement error can be estimated. The analysis model allows for separate estimates of measurement and person variability. The means, and the between-person variability

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[12] 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.

[13] Bowman, S.A., Clemens, J.C., Friday, J.E., Thoerig, R.C., and Moshfegh, A.J. (2014). *Food patterns equivalents database 2011-12: Methodology and user guide [online].* Beltsville, MD: Food Surveys Research Group, Beltsville Human Nutrition Research Center, U.S. Department of Agriculture, Agricultural Research Service. Available at: http://www.ars.usda.gov/nea/bhnrc/fsrg

indicators, are compared between the NHANES and WIC ITFPS-2 data sources for ages 1 to 5 months and 7 to 11 months.[14]

Focusing on three major nutrients, protein, iron, and zinc, analysis shows that for the 1 to 5 month old group the means are comparable for the three nutrients, whereas the variances are somewhat larger for the WIC ITFPS-2 sample, as expected, ranging from 1.4 to 1.8 times larger for WIC ITFPS-2 than for NHANES. For the 7 to 11 month group the means are still quite similar but the variances for the WIC ITFPS-2 group are larger than the NHANES variances by proportions that are greater than those for the 1 to 5 month group. For protein, iron, and zinc, the WIC ITFPS-2 variances are larger by a factor of 1.4, 3.1, and 1.8 for protein, iron and zinc respectively.

Because these differences are not substantial, the WIC ITFPS-2 1- to 11-month single-observation intake measures are deemed sufficiently valid for reporting usual intake.

B4.3   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).[15] 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. As a result, food and nutrient means and correlations and their associated standard errors are adjusted for measurement error, i.e., estimates of what these values would be without measurement error are calculated. Second, the NCI Method employs algorithms to transform the data so that outcomes are distributed more like a symmetric normal distribution.[16] 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

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[14] The WIC data have only one observation per individual so measurement variance and between-individual variance are the intertwined.

[15] 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):2857-68.

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

underlying the approach.[17] 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 that are 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.

B4.3.1   Results for the Analysis of Dietary Intake Data for Children Ages 13, 15, 18, and 24 Months

The WIC ITFPS-2 AMPM data from ages 13, 15, 18, and 24 months are analyzed using the NCI model for daily consumed nutrients. Note that these data have two observations for about 10 percent of the sample, enabling the estimate of measurement error. Twenty-three nutrients are calculated as a part of usual intake analyses through 24 months, including: calcium (mg), calories (kcal), carbohydrate (g), dietary fiber (g), total fat (g), folate (mcg), iron (mg), magnesium (mg), niacin (mg), phosphorus (mg), potassium (mg), protein (g), riboflavin (mg), sodium (mg), thiamin (mg), vitamin A (mg), vitamin B6 (mcg), vitamin B12 (mcg), vitamin C (mg), vitamin D (D2+D3) (mcg), vitamin E (mg), vitamin K (mg), and zinc (mg). Sampling weights were used in the analysis.

To test the utility of the NCI model approach with WIC ITFPS-2 data, an analysis was executed 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 we can expect more precise estimates of nutrient distributions by employing the NCI model approach to current data. Nutrient data can be found in Chapter 5 of the report, and in Appendix C4.

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