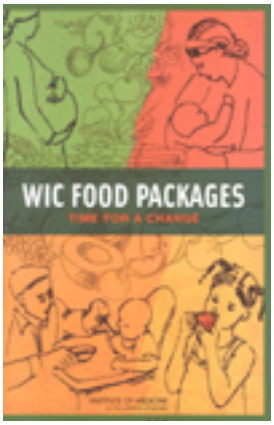

WIC Food Packages: Time for a Change

Committee to Review the WIC Food Packages
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WIC Food Packages

Time for a Change

Committee to Review the WIC Food Packages
Food and Nutrition Board

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Willing is not enough; we must do."
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Reviewers

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their review of this report:

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Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations nor did they see the final draft of the report before its release. The review of this report was overseen by Elaine L. Larson, School of Nursing, Columbia University, New York, coordinator, appointed by the Institute of Medicine; and Johanna T. Dwyer, Tufts–New England Medical Center, Boston, MA, and Office of Dietary Supplements at the National Institutes of Health, Bethesda, MD, monitor, appointed by the National Research Council. The coordinator and monitor were responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the institution.

PREFACE

The Special Supplemental Nutrition Program for Women, Infants, and Children (often called the WIC program) has promoted the health of low-income families for over 30 years by providing nutrition education, supplemental food, and other valuable services. The program reaches millions of families every year, and is one of the largest nutrition programs in the United States. Periodic evaluations of the WIC program have found that it is an extremely successful program and an important investment in our nation's health.

The WIC program serves a low-income population with escalating challenges to maintenance of a healthy lifestyle:

- Increased availability of low-cost, energy-dense foods;
- Decreased time available to prepare foods in the home and increased use of pre-prepared foods that are often of poor nutritional quality;
- Decreased physical activity due to more sedentary lifestyles;
- Increased prevalence of overweight and obesity resulting from energy imbalance; and
- Increased prevalence of chronic diseases such as diabetes, hypertension, cardiovascular disease, and cancer.

Thus, in today's environment, low-income families face a dual challenge: to maintain a secure, nutritionally adequate food supply, and simultaneously to avoid over-consumption, especially of energy-dense foods. While reduction of food insufficiency remains an important priority for food assistance programs such as the WIC program, there is also an

increased realization of the need to reduce the risk of chronic disease. This revision of the WIC food packages comes at a time when improving health requires meeting these two, sometimes conflicting, goals: improving dietary quality and food security while also promoting a healthy body weight that will reduce the risk of chronic diseases.

There have been many changes in both the WIC clientele and the environment in which they live since the inception of the WIC program. Furthermore, scientific knowledge of the importance of nutrition in health promotion has expanded greatly. The task for the Committee to Review the WIC Food Packages of the Institute of Medicine (IOM) was to evaluate one component of the WIC program, the food packages that are supplied to participants, and determine if revisions were needed. The committee extensively reviewed the scientific literature, heard from many speakers about the current food packages, and read hundreds of written comments from stakeholders, all of which provided important information for our deliberations. The committee concluded that it was time for a change in the WIC food packages.

The committee itself represented a diversity of expertise and experience with the nutrition of low-income families. Members included a pediatrician, two former WIC directors, three economists, two former members of the Subcommittee on Uses and Interpretation of the Dietary Reference Intakes, and an expert in health risk assessment, as well as several experts in nutrition for the target populations. The committee met 7 times over 14 months and released a preliminary report on the proposed criteria and priorities, as well as this final report on recommended changes to the WIC food packages. Each member volunteered substantial time from busy professional lives to complete this task in a timely manner. All committee members recognized the importance of the WIC program to the future of our nation and were committed to identifying the best possible WIC food packages within the constraint of cost neutrality. The committee's dedication to this task was truly outstanding, and, in fact, several members stated that this was one of the most important of their professional accomplishments. I extend my deep appreciation to every member. It was an immensely rewarding experience for us all.

The committee would like to thank Chun-Fu Chen of the Iowa State University Graduate Program in Economics whose excellent research and computer skills assisted the committee greatly in the analyses of intake distributions and predicted intakes. Alicia Carriquiry, Professor of Statistics at Iowa State University, assisted the committee with specific aspects of the evaluation of potential benefits and risks; her advice helped the committee formulate the approach used in that evaluation. Nancy Krebs participated in the project as a liaison between the Food and Nutrition Board and the committee; her advice and counsel were greatly appreciated. The IOM staff

played an essential role in making the committee's work possible. Janice Okita, Senior Program Officer with the Food and Nutrition Board, provided leadership and inspiration, and worked tirelessly throughout the process. She was ably assisted by Senior Program Assistant Jon Sanders and Research Associates Tazima Davis and Alice Vorosmarti. Linda Meyers, Director of the Food and Nutrition Board, provided advice and direction at crucial points in our deliberations. The staff ensured that the committee understood and adhered to its tasks, provided background research support, organized the meetings, effectively responded to reviewers, and compiled both of the committee's reports. The committee owes a huge debt of gratitude to them all.

The USDA's Food and Nutrition Service and the state and local WIC agencies have been successfully delivering WIC services to the most vulnerable of our nation's low-income individuals for over 30 years. The committee was repeatedly impressed with the dedication of the WIC staff at all levels, and we hope that the changes in the WIC food packages that are recommended in this report will help them to make this important program even better.

Suzanne P. Murphy, *Chair*
Committee to Review the WIC Food Packages

CONTENTS

Executive Summary

The Special Supplemental Nutrition Program for Women, Infants, and Children (often called the WIC program) is one of the largest food assistance programs in the United States. Started in 1972–1974, the WIC program was designed to meet the special nutritional needs of low-income pregnant, breastfeeding, and postpartum non-breastfeeding women; infants; and children up to five years of age who are at nutritional risk. The WIC program started as a pilot project and has now expanded to serve all 50 states and the District of Columbia as well as Puerto Rico, Guam, American Samoa, the American Virgin Islands, and 34 Indian Tribal Organizations.[1] The WIC program provides participants with supplemental foods, nutrition education, breastfeeding support, and referrals to health and social services. Its goal is to improve birth outcomes, support the growth and development of infants and children, and promote long-term health in all WIC participants.

Supplemental foods are made available monthly in the form of seven different WIC food packages. Most WIC participants access the food packages by redeeming vouchers or food-checks to obtain specific foods at participating retail outlets. In 2000, the WIC program served 54 percent of all U.S. infants (essentially all the income-eligible U.S. infants) and 25 percent of all U.S. children ages 1 year through 4 years,[2] along with many of

[1]The term *WIC state agency* is used to refer to the entities administering the WIC program in all these 89 locations.

[2]Throughout the report, age ranges are inclusive of the upper boundary of the range.

their mothers. In fiscal year 2003, the cost of supplemental food for the WIC program was $3.2 billion.

Many changes have occurred since the WIC program began.

- Advances have occurred in nutrition knowledge and its application.
- The food supply has expanded, and dietary patterns have changed.
- The WIC program has grown dramatically, and it serves a more culturally diverse population.
- Obesity has emerged as a major public health problem.

Despite these many changes, the WIC food packages have remained largely unchanged. Thus, it is time to address revisions in the WIC food packages that would enable the WIC program's potential to be realized more completely.

COMMITTEE'S TASK

The U.S. Department of Agriculture's Food and Nutrition Service charged the Institute of Medicine's Committee to Review the WIC Food Packages with conducting a two-phase evaluation of the WIC food packages. In Phase I, the committee was tasked with reviewing the nutritional needs of population subgroups participating in the WIC program, assessing supplemental nutrition needs of these subgroups, and proposing priority nutrients and general nutrition recommendations. In Phase II, the committee was tasked with using the initial assessment to recommend specific changes to WIC food packages. In doing so, the committee was charged with considering the supplemental nature of the WIC program and making recommendations that are culturally suitable, non-burdensome to administration, efficient for nationwide distribution and vendor checkout, and cost-neutral. In addition, the committee was to consider burdens and incentives for eligible families and the role of the food packages in reinforcing nutrition education, breastfeeding, and prevention of chronic disease.

CRITERIA AND PRIORITIES FOR REVISIONS

During Phase I of the project, the committee developed the criteria shown in Box ES-1 to guide its work. It also used various data sources to identify nutrients and food groups to try to increase or decrease in the food packages (called priority nutrients and priority food groups), with the goal of improving the nutrition of WIC participants. The committee's preliminary report, released in August 2004, included those findings. Subsequently, the committee received numerous public comments about the proposed

BOX ES-1
Criteria for a WIC Food Package

1. The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.
2. The package contributes to an overall dietary pattern that is consistent with the *Dietary Guidelines for Americans* (for individuals 2 years of age and older).[a]
3. The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.
4. Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities.
5. Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.
6. Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

[a]*Dietary Guidelines for Americans* provide science-based advice to promote health and to reduce risk for major chronic diseases through diet and physical activity. By law the *Dietary Guidelines* form the basis of federal food, nutrition education, and information programs, including the WIC program.

criteria, priority nutrients and priority foods, and the methods used; it also reviewed the August 2004 report of the Dietary Guidelines Advisory Committee. Then the committee conducted additional analyses and slightly revised the priority nutrients and priority food groups for the WIC population. The priorities relate to Criteria 1 through 3 in Box ES-1. Among others, iron, vitamin E, potassium, and fiber were identified as nutrients to increase; fruits and vegetables were food groups to increase in at least some of the packages. The work providing the basis for nutrient and food priorities is summarized in Chapter 2—*Nutrient and Food Priorities*.

PROPOSED WIC FOOD PACKAGES

This section briefly describes the proposed WIC food packages, summarizes how the proposed food packages differ from the current food packages, and provides an overview of the rationale for the changes. For a complete description of the proposed food packages, see Chapter 4. Side-by-side comparisons of the current and revised food packages are presented in Appendix A.

The committee's complete set of recommendations for the packages evolved from an iterative process that considered the six criteria, public comments, and cost and nutrient analyses (see Figure ES-1). Although the proposed changes are expected to have beneficial effects, the committee recognizes that some of them could cause unintended undesirable consequences. For this reason, the committee urges pilot testing and randomized, controlled trials of the changes before they are implemented nationwide (see Chapter 7—Recommendations for Implementation and Evaluation of the Revised WIC Food Packages).

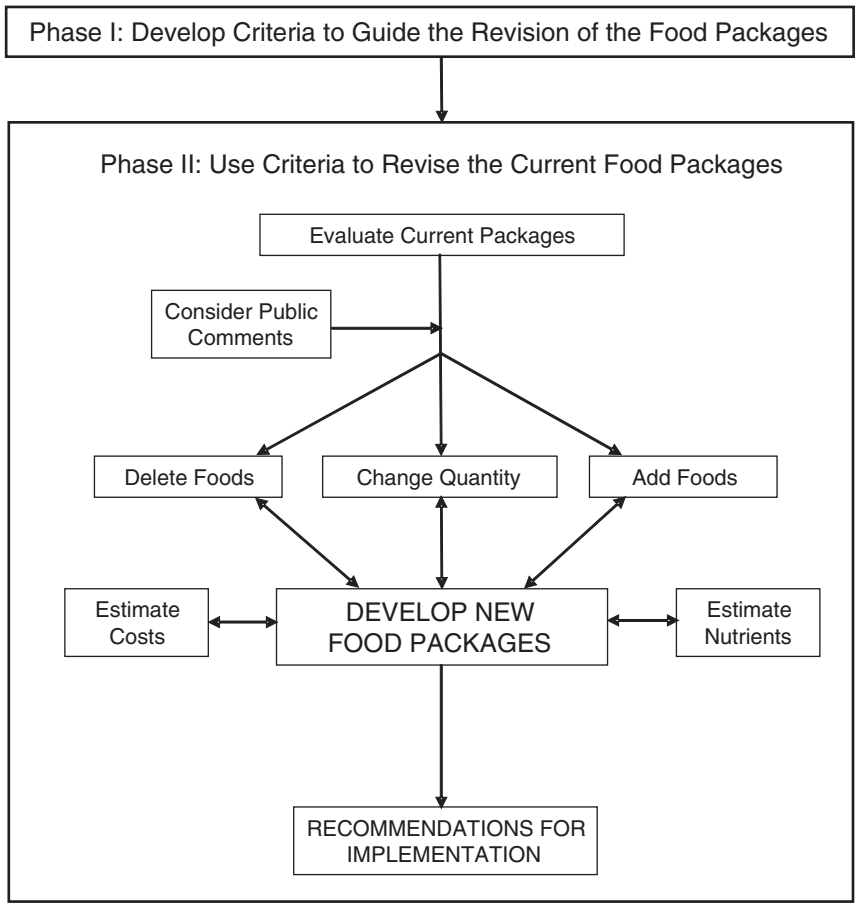

FIGURE ES-1 Process for revising the WIC food packages.

Food Packages I and II for Infants

Change in Age Specifications and Breastfeeding Categories

The committee made several important changes to the age specifications and breastfeeding categories for infants. Each merits priority for pilot testing and randomized, controlled trials.

The committee recommends that Food Package I serve infants from birth through age 5 months and that Food Package II serve infants ages 6 months through 11 months. Currently, the shift from Food Package I to II occurs at age 4 months. The proposed Food Package I would provide only iron-fortified infant formula for partially breast-fed and fully formula-fed infants until an infant is 6 months old. This change is consistent with recent position statements from the American Academy of Pediatrics emphasizing that the introduction of complementary feedings before 6 months of age only substitutes foods that lack the protective components of human milk and that exclusive breastfeeding should be used as the reference or normative model for feeding infants.

To support the successful establishment of breastfeeding, the committee recommends offering only two feeding options initially—full breastfeeding or full formula feeding. That is, formula would not be provided routinely during the first month after birth for any infants whose mothers intend to breastfeed. In a few circumstances, a small amount of powdered formula may be provided during the first month after birth if needed as the mother/infant pair establish a pattern of breastfeeding. As currently is the case, the breastfeeding mother could ask to have the infant assigned to full formula feeding at any time.

Beginning the second month after birth, a third infant feeding option is available—partial breastfeeding. The committee proposes the following definition of a partially breast-fed infant for the purpose of assigning WIC food packages: *the infant is breast-fed but also receives formula from the WIC program in an amount not to exceed approximately half the amount of formula allowed for a fully formula-fed infant*. In contrast, the current approach provides the same amount of formula to partially breast-fed and fully formula-fed infants and could allow a mother who breastfeeds an average of once daily to qualify as a breastfeeding woman. Under the new proposal, breastfeeding mothers who request more than the amount of formula allowed for partially breast-fed infants could receive up to the maximum amount of formula for the fully formula-fed infant, but the mother no longer would be eligible for Food Package V for a partially breastfeeding mother. Because Package V is more desirable than the package for non-breastfeeding mothers, this change might encourage a higher

level of breastfeeding among mothers who both breastfeed and formula-feed their infants.

Food Package I

Food Package I provides iron-fortified formula only. The monthly amount of formula depends on the feeding method, form of formula provided (concentrated liquid, powdered, or ready-to-use), and the age of the infant, as follows.

- *Fully formula-fed infants* receive the equivalent of about 806 fluid ounces of formula (or 403 fluid ounces of concentrated formula) per month through 3 months of age; thus, Food Package I is unchanged for fully formula-fed infants from birth through 3 months of age. Fully formula-fed infants 4 months through 5 months of age receive the equivalent of about 884 fluid ounces of formula (or 442 fluid ounces concentrated) per month. Juice and infant cereal are no longer provided for infants ages 4 months through 5 months, to be consistent with current dietary guidance for complementary feeding of infants. Compared with the current package, the amount of formula is increased slightly for infants ages 4 months through 5 months to compensate in part for the decrease in nutrients and calories that results from the omission of juice and infant cereal.
- *Partially breast-fed infants* ages 1 month through 3 months receive an amount of powdered formula per month that reconstitutes to 384 to 435 fluid ounces of formula (depending on the container size and reconstitution rate). Partially breast-fed infants 4 months through 5 months of age receive the equivalent of about 442 fluid ounces of formula (in any form) per month. Because formula is supplemental to breast milk for partially breast-fed infants, the maximum allowance of formula is approximately 50 percent of the maximum allowance for fully formula-fed infants. This policy should encourage mothers using the combination feeding method (feeding both breast milk and formula) to aim for a greater contribution of breast milk to the infant's intake.[3] To promote food safety and minimize waste, powdered formula is recommended until partially breast-fed infants reach 4 months of age.

By definition, fully breast-fed infants do not receive formula from the WIC program. Instead, they receive the benefit of breast milk, which pro-

[3]The food package for fully formula-fed infants is available if more formula is needed but any mother who requests that package will receive Food Package VI (available up to 6 months after giving birth) rather than Food Package V (available up to 12 months after giving birth), a more generous package offered to partially breastfeeding women.

TABLE ES-1 Maximum Monthly Allowances for Proposed Food Package II for Infants Ages 6 Months to 1 Year, by Feeding Category

	Fully Breast-Fed Infants	Partially Breast-Fed Infants	Fully Formula-Fed Infants
Specialty Food			
Infant Formula	—	156 fluid ounces of iron-fortified liquid formula concentrate [about 10 fluid ounces per day of formula as consumed]	312 fluid ounces of iron-fortified liquid formula concentrate [about 20 fluid ounces per day of formula as consumed]
Food Group			
Fruits and Vegetables	256 ounces of baby food fruits and vegetables [about 8 ounces per day]	128 ounces of baby food fruits and vegetables [about 4 ounces per day]	128 ounces of baby food fruits and vegetables [about 4 ounces per day]
Grains	24 ounces of iron-fortified infant cereal	24 ounces of iron-fortified infant cereal	24 ounces of iron-fortified infant cereal
Meat	77.5 ounces of baby food meat [about 2.5 ounces per day]	—	—

vides the nutrients they need and a wide array of protective and health-promoting components in a safe form.

Food Package II

Food Package II is available for infants from 6 months through 11 months of age. This package differs substantially by infant-feeding category, as shown in Table ES-1. The proposed food package introduces the following changes:

- Formula—decreased for fully formula-fed infants (from 403 to 312 fluid ounces of liquid formula concentrate per month) and partially breast-fed infants (from 403 to 156 fluid ounces of formula concentrate);
- Baby foods—added to the food package to encourage healthy dietary patterns; and

- Juice—omitted to help make possible the addition of baby food fruits and vegetables.

The amount of infant cereal in the package is unchanged. The decrease in the maximum allowance of formula for fully formula-fed infants is consistent with meeting nutritional requirements. The decrease for partially breast-fed infants is to encourage a greater contribution of breast milk to the infant's diet. Decreasing the maximum amount of formula and omitting juice make possible other enhancements. For example, the addition of baby food fruits and vegetables in the second 6 months of infancy introduces infants to a variety of nutritious foods at an age when almost all infants are developmentally ready for semisolid foods. The baby food meat for breast-fed infants provides needed iron and zinc in forms with high bioavailability, and the larger quantities of baby food for fully breast-fed infants may encourage some mothers to continue full breastfeeding.

Food Package III for Those with Special Dietary Needs

Currently, Food Package III provides only special formulas, juice, and cereal. The committee recommends the following:

- Continue to provide participants with the special formulas that are prescribed because of specific medical or developmental conditions;
- In addition, provide the foods that they would receive from the package to which they would be assigned if they did not have special dietary needs, to the extent that is appropriate (for example, foods from Food Package IV for children ages 1 year through 4 years); and
- Include infants with special dietary needs among the populations served by this package.

The committee supports the least restriction of WIC foods consistent with the participant's special health needs. The addition of infants with special dietary needs is recommended to increase efficiency in keeping track of foods and food costs for all individuals with special dietary needs.

Food Package IV for Children

A side-by-side comparison of the current and revised food packages for children appears in Table ES-2. Food Package IV serves more than 50 percent of all WIC participants. The proposed food package introduces the following changes:

- Juice—limited to an amount that is consistent with the recommendation by the American Academy of Pediatrics;

TABLE ES-2 Comparison of the Current and Proposed Food Package for Children, Maximum Monthly Allowances

Food Group	Current Food Package IV	Revised Food Package IV
Fruits and Vegetables	288 fluid ounces of vitamin C-rich juice [about 10 fluid ounces per day]	128 fluid ounces of vitamin C-rich juice [about 4 fluid ounces per day]
	—	$8 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	24 quarts of milk [about 3 cups per day] with some allowed substitutions	16 quarts of milk [about 2 cups per day] with more allowed substitutions • 1-year-old: whole milk (3.5–4% milk fat) • 2- through 4-year-old: 2% milk fat or less
Grains	36 ounces of iron-fortified cereal (not limited to whole grains)	36 ounces of iron-fortified whole grain cereal
	—	2 pounds of whole grain bread or other whole grain options
Meat and Alternatives	2–2.5 dozen eggs	1 dozen eggs
	1 pound of dried beans or peas *or* 18 ounces of peanut butter	1 pound of dried beans or peas or the equivalent canned *or* 18 ounces of peanut butter

[a]Alternatively, a processed fruit and vegetable option is available.

NOTE: For side-by-side comparisons of the current and revised versions of all the food packages, see Appendix A.

- Fruits and vegetables—added, with fresh and processed options;
- Milk and milk alternatives

– limited to approximately the amount recommended in the *Dietary Guidelines* or other dietary guidance;

– as recommended by the American Academy of Pediatrics, whole milk for 1-year-old children and fat-reduced milk (2 percent milk fat or less) for older children;

– yogurt allowed as a new option to substitute for part of the milk;

- Eggs—reduced in quantity to make other package enhancements possible;

TABLE ES-3 Proposed Food Packages for Women, Maximum Monthly Allowances

Food Group	Package V: Pregnant Women (throughout pregnancy), Partially Breastfeeding Women (from 1 month after delivery up to 1 year after delivery)	Package VI: Fully Formula-Feeding Women (from delivery up to 6 months after delivery)	Package VII: Fully Breastfeeding Women (from delivery up to 1 year after delivery)
Fruits and Vegetables	144 fluid ounces of vitamin C-rich juice [4.8 fluid ounces per day]	96 fluid ounces of vitamin C-rich juice [3.2 fluid ounces per day]	144 fluid ounces of vitamin C-rich juice [4.8 fluid ounces per day]
	$10 cash-value voucher for fresh fruits and vegetables[a]	$10 cash-value voucher for fresh fruits and vegetables[a]	$10 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	22 quarts of milk, 2% milk fat or less, with some allowed substitutions [2.9 cups per day]	16 quarts of milk, 2% milk fat or less, with some allowed substitutions [2.1 cups per day]	24 quarts of milk, 2% milk fat or less, with some allowed substitutions [3.2 cups per day]
	—	—	1 pound of cheese (in addition to substitutions allowed for milk)
Grains	36 ounces of iron-fortified whole grain cereal	36 ounces of iron-fortified whole grain cereal	36 ounces of iron-fortified whole grain cereal
	1 pound of whole grain bread or other whole grain options	—	1 pound of whole grain bread or other whole grain options
Meat and Alternatives	1 dozen eggs	1 dozen eggs	2 dozen eggs
	—	—	30 ounces canned fish (light tuna or salmon)
	1 pound of dried beans or peas or the equivalent canned *and* 18 ounces of peanut butter	1 pound of dried beans or peas or the equivalent canned *or* 18 ounces of peanut butter	1 pound of dried beans or peas or the equivalent canned *and* 18 ounces of peanut butter

[a]Alternatively, a processed fruit and vegetable option is available.

- Dry beans or peas—canned forms allowed to increase participant options; and
- Whole grains—only whole grain cereals allowed; additional whole grains options were included.

Food Packages V, VI, and VII for Women

As can be seen in Table ES-3, the packages for the three categories for women all provide juice, breakfast cereal, milk, eggs, dried beans or peas (or peanut butter), and fruits and vegetables. Food Packages V and VII provide whole grain bread as well, but the package for non-breastfeeding postpartum women does not. As currently is the case, the package for fully breastfeeding women provides the largest number of different kinds of food and the largest amount of food (for up to 12 months after delivery); the package for fully formula-feeding women provides the least (for up to 6 months after delivery).

Most of the changes in the packages for women were of the same type and made for similar reasons as those for children. Juice was decreased in the packages by approximately 50 percent, and a $10 cash-value voucher for fresh fruits and vegetables was added. Milk also was decreased in all packages, but the packages continue to supply approximately the amounts recommended by the *Dietary Guidelines*, and more options for substitutions are allowed. Dried beans or peanut butter were added to Food Package VI for non-breastfeeding postpartum women to improve their intake of several nutrients, but whole grain bread was not added to this package. The nutritional needs of pregnant and breastfeeding women ordinarily are higher than those for the non-breastfeeding postpartum women who receive Food Package VI.

One goal of the changes in the infants' and women's packages was to reduce the disparity in the market value of the three options (full breastfeeding, partial breastfeeding, and full formula feeding) for mother/infant pairs. The market value of the breastfeeding packages has been increased substantially (see Chapter 5—*Evaluation of Cost*—Table 5-5). Further narrowing of the gap in market values would be desirable but did not appear to be feasible while maintaining cost neutrality and meeting the other criteria for the revision of the food packages.

PROPOSED FOOD PACKAGES ARE IN LINE WITH THE COMMITTEE'S CRITERIA

Proposed Food Packages Support Improved Nutrient Intakes

The committee redesigned the food packages to increase or decrease their content of priority nutrients with the goals of improving overall nutri-

ent consumption and reducing the prevalence of inadequate or excessive nutrient intakes among WIC participants.

Compared with the current food packages for children and women, the committee estimates that the revised packages provide greater amounts of nearly all of the nutrients of concern with regard to inadequate intake. The exceptions were potassium for children, calcium and vitamin D for pregnant and partially breastfeeding women, and vitamin C for pregnant and breastfeeding women. However, the amounts of calcium and vitamin C in most food packages are still close to or exceed required amounts. Furthermore, some allowed food choices could increase nutrient intakes above the committee's estimates.

The revised food packages for women and children provide less saturated fat, cholesterol, total fat, and sodium than the current food packages. For formula-fed infants and children, the amount of preformed vitamin A provided, which was undesirably high, has been reduced in most of the packages. Although zinc also was identified as a nutrient of concern for excessive intake in the diets of formula-fed infants and children, the committee did not find acceptable ways to address this concern. Knowing that the difference between the amount of zinc recommended and the amount consumed is small, the committee chose to promote adequate zinc intake for the entire group of WIC infants. The risk from possible inadequate zinc intake was judged to be greater than that from zinc intakes that might slightly exceed the Tolerable Upper Intake Level.

Proposed Food Packages Are More Consistent with Dietary Guidance

Dietary Guidance for Infants and Young Children

All the proposed food packages for infants and children younger than 2 years are responsive to widely accepted dietary recommendations from professional groups. The recommendations address obesity concerns mainly by improving the overall nutrient density of the packages while keeping the caloric content the same or slightly lower.

Dietary Guidelines for Americans

All the proposed food packages for individuals age 2 years and older share new features that contribute to a diet consistent with *Dietary Guidelines for Americans* by:

- Including foods from each basic food group and allowing some variety and choice within food groups;

- Providing fruits and vegetables, with both fresh and processed options that have minimal restrictions on variety and choice;
- Promoting the consumption of whole fruits and vegetables as the major forms in this food group;
- Including only whole grain products in the breads and cereal food group;
- Reducing saturated fat, cholesterol, total fat, and, in some cases, calories;
- Specifying no added sugars or limitations on the amounts of caloric sweeteners allowed (to promote higher nutrient density and limit calories);
- Including options that contain no added salt or are reduced in sodium (to limit salt, that is, sodium); and
- Addressing container size as related to food safety concerns.

Overall, the emphasis on fruits and vegetables, whole grains, and fat-reduced milk and milk products are major steps in improving consistency of the WIC food packages with the *Dietary Guidelines for Americans*.

The addition of *fresh* fruits and vegetables merits special attention. To improve the consumption of these foods and the appeal of this option, especially for people of different cultural backgrounds, the committee recommends minimal restrictions on participant choice. To make the fresh produce option workable for retail vendors, the committee recommends that it be implemented through cash-value vouchers in small denominations. Because a fresh produce option might not be practical in some situations, the committee also recommends a processed option and a combined fresh and processed option for fruits and vegetables.[4] Processed options would be obtained using the standard food instrument.

Proposed Food Packages Have Features with Wide Appeal to Diverse Populations

Among the features that may improve the incentive value of the WIC food packages and encourage participants to consume the foods provided are:

- a wider variety of foods; and
- more participant choices.

[4]The committee's primary recommendation includes fresh fruits and vegetable rather than processed forms because of the wider variety available in most locations and the lower sodium content of likely choices.

The addition of fruits and vegetables greatly expands the variety of foods offered in most of the packages, and the addition of whole wheat bread or other whole-grain options expands the variety offered in three of the packages. Proposed participant choices include options for (1) fresh, processed, or combined fresh and processed fruits and vegetables; (2) canned or dried legumes (e.g., dry beans and peas); and (3) canned fish choices (for fully breastfeeding women only). The committee encourages WIC state agencies to allow yogurt as a partial substitute for milk for children and women, calcium-set tofu as a partial milk substitute for women, and calcium- and vitamin D-rich soy beverage ("soy milk") as a milk alternative for women who choose this alternative.

Proposed Food Packages Address Concerns of WIC Program Staff and Vendors

The committee carefully considered impacts that proposed changes might have on program staff and vendors and addressed concerns expressed by representatives of both of these stakeholder groups as follows:

- Because more foods are allowed, WIC state agencies are expected to have less need to obtain approval at the federal level for changes to address local needs. In addition, local agencies can be more flexible in prescribing culturally appropriate packages.
- By being more consistent with the *Dietary Guidelines* and with current dietary recommendations for infants and young children, the packages hold more potential for effective nutrition education.
- The feasibility of using cash-value vouchers for fresh produce is based on input from vendors.

Through public comments, WIC program staff emphasized that they could and would develop workable approaches to implement improvements in the WIC food packages.

PROPOSED FOOD PACKAGES ARE COST-NEUTRAL

The committee considered cost containment throughout the process of revising the food packages. The goal was to achieve cost neutrality for the food package portion of the WIC program on a national level. Cost neutrality in this context implies that the estimated average cost of providing the set of revised food packages would not exceed the estimated average cost of providing the set of current food packages under the assumption of no changes in participation rates. The two sets of packages were evaluated assuming maximum monthly allowances were prescribed and obtained by

all participants. The cost of some packages increased, and the cost of others decreased. This shift in relative values was intentional and was designed to promote healthy dietary behaviors. For example, to promote and support breastfeeding, the committee increased the attractiveness of the combined food packages for fully breastfeeding mother/infant pairs. The costs of medical foods for participants with special dietary needs (e.g., Food Package III) were not included in the cost analysis because these costs were assumed to be unchanged.

The committee used the same methods to estimate the average cost per participant for the current and revised sets of packages. In addition, the committee calculated a range for the average cost per participant of the revised packages using several assumptions about allowed food substitutions. The average 2002 cost per participant for the current set of packages is estimated at about $35 per month ($34.76), while the average 2002 cost for the set of revised packages is estimated to range between $34 and $35 per month ($34.03–$34.95). Thus, cost neutrality was achieved. Compared to the cost of current food packages, the cost of the revised food packages would change less in response to changes in the costs of dairy products and infant formula due to the greater variety of foods in the revised packages.

RECOMMENDATIONS FOR IMPLEMENTATION

The proposed revisions to the WIC food packages are by far the most substantial changes in the WIC food packages since the program's inception in 1974. Additionally, the committee's process for revising the WIC food packages is the first national application of the Institute of Medicine's framework for dietary planning for groups and the first effort undertaken to incorporate the *Dietary Guidelines for Americans 2005* into a national food program. The committee's recommendations for revising the WIC food packages resulted from a thorough and careful deliberation of how best to meet the criteria set out for the food packages while maintaining cost neutrality.

Nonetheless, the committee also recognized that it is impossible to predict *a priori* the effects of the revised WIC food packages on either food consumption or nutrient intakes. The WIC program can control only what is offered to participants, not what participants actually consume. With the revisions, food choices might change in unintended detrimental ways, rather than in intended ways. Moreover, the revised food packages could increase or decrease the incentive for different groups to participate in the WIC program, and they could increase or decrease breastfeeding rates. Implementation procedures and the type of nutrition education provided are likely to influence the effectiveness of the revised food packages. In light of these considerations, the committee made recommendations relating to pilot

studies, flexibility, workable procedures, breastfeeding promotion and support, nutrition education, and product availability.

- *Studies Prior to Implementation of the Revised Packages*—The committee urges that pilot tests and randomized, controlled trials be conducted prior to the full-scale implementation of the revised food packages. High-priority topics include the effects of recommendations regarding infant-feeding options during the first month after birth, the age for transferring to Food Package II, and changes in the contents of Food Package II.
- *Flexibility and Variety*—The committee urges the Food and Nutrition Service to retain, and possibly expand, the flexibility proposed for the revised food packages, so as to allow state and local agencies to adapt the packages to the needs of their WIC populations. It further recommends that WIC state agencies aim for the maximum variety and participant choice in food selections consistent with foods available in their area and with cost containment.
- *Workable Procedures*—The committee recommends that WIC state agencies use input from Competent Professional Authorities,[5] vendors, and participants to inform the design of new food vouchers; implement cash-value vouchers issued in small denominations for fresh produce; and work with vendors to ease the transition to cash-value vouchers for fresh produce.
- *Breastfeeding Promotion and Support*—In tandem with the proposed package changes for breastfeeding mother/infant pairs, the committee strongly recommends intensive support for breastfeeding mothers, particularly in the first few weeks after delivery, and further support to extend the duration of breastfeeding for at least one year postpartum. In view of a recent recommendation by the American Academy of Pediatrics that a daily vitamin D supplement be given to many breast-fed infants, it would be useful for the WIC program to work with mothers and health care providers to facilitate providing the recommended supplement for these breast-fed infants.
- *Nutrition Education*—The committee recommends adapting nutrition education to address changes in the food packages related to food choices, shopping, handling foods in the home, incentives for breastfeeding, and feeding infants and young children. To realize fully the potential of these revised food packages to improve the nutritional status of the WIC population, a revised system for providing nutrition education may be

[5]Competent Professional Authorities (CPAs) are professionals and paraprofessionals who tailor the food packages and educate and counsel WIC participants.

needed that includes greater frequency and intensity of nutrition education efforts.

- *Product Availability*—The committee encourages food manufacturers to consider changes in some of their products to address the nutritional needs of WIC participants—for example, more choices with reduced salt (that is, sodium) content and economical packaging that is re-sealable.

IT IS TIME FOR A CHANGE

The proposed changes to the WIC food packages hold potential for improving the nutrition and health of the nation's low-income pregnant women, new mothers, infants, and young children. The new packages are well-aligned with current nutrient and food intake recommendations, and they allow considerable flexibility in food selection. Thus, the committee anticipates that the revised food packages will provide greater incentives for families to participate in the WIC program and to consume the foods prescribed. The new packages are cost-neutral and thus should not result in higher average food costs per WIC participant. Although the burden to vendors and to WIC agencies may increase in the short term, it is anticipated that improvements in procedures will ease such burden in the long term. The changes to the food packages reinforce the *Dietary Guidelines for Americans* and should result in improved diets for WIC participants. In turn, the revised WIC food packages are expected to improve the WIC program's positive contribution to the nation's health.

1

Introduction and Background

The Special Supplemental Nutrition Program for Women, Infants, and Children (frequently referred to as the WIC program) is one of the largest food assistance programs in the United States. In terms of dollars or in terms of number or participants, the WIC program is exceeded only by the food stamp and school nutrition programs (FY2003 data; FNS, 2004a, 2004b, 2004f). Created as a pilot program in 1972 and permanently established in 1974, the WIC program has provided nutritious food, valuable nutrition education, breastfeeding support, and important health and social service referrals to millions of families over the past 30 years. Approximately one-half of all infants in the United States (54.2 percent in 2000) and one-fourth of children ages 1 through 4 years[1] (25.4 percent in 2000), along with many of their mothers, receive supplemental nutrition through the WIC program (Bartlett et al., 2002; U.S. Census Bureau, 2001).[2] The WIC program is an investment in the nutrition of the people of the

[1]Throughout the report, age ranges are inclusive of the upper boundary of the range.

[2]Using data for the year 2000 for the U.S. population (U.S. Census Bureau, 2001) and for participation in the WIC program (Bartlett et al., 2002), 2,062,759 infants participated in the WIC program out of 3,802,648 infants in the United States; from these data an estimate of 54.2 percent of infants in the United States participate in the WIC program. Using data from the same sources for children ages 1 through 4 years, 3,897,425 children participated in the WIC program out of 15,370,150 children in the United States in this age range; from these data an estimate of 25.4 percent of children ages 1 through 4 years in the United States participate in the WIC program. In the year 2000, the number of adolescent and adult women who participated in the WIC program was 898,210.

United States during the earliest stages of life and thus has the potential to promote both the short- and long-term health of the nation.

In 1974, Congress authorized $100 million for the WIC program for fiscal year 1975 (U.S. Congress, Pub. L. No. 93-326, 1974); by the end of June 1975, more than 200,000 women, infants, and children were participating in the program. From the start, the WIC program has worked to improve the nutrition of eligible low-income pregnant, postpartum, and breastfeeding women;[3] infants;[4] and children.[5] The WIC program does this by providing four main benefits: (1) supplemental food; (2) nutrition education; (3) breastfeeding support; and (4) referrals to health and social services. About three-fourths of funds for the WIC program are used to provide the food packages.

Unlike other federal food assistance programs, WIC is a highly targeted nutrition program. It aims "to provide supplemental nutritious food as an adjunct to good health care during such critical times of growth and development . . . to prevent the occurrence of health problems" (U.S. Congress, Pub. L. No. 94-105, 1975) and "improve the health status of these persons" (U.S. Congress, Pub. L. No. 95-627, 1978). In fiscal year 2003, the WIC program served an average of 7.6 million women, infants, and children per month at a total yearly cost of $4.5 billion (FNS, 2004f). The cost for the supplemental food that year was $3.2 billion (FNS, 2004f). However, WIC is not an entitlement program; the numbers of eligible women, infants, and children who can be served by the WIC program may be limited by the amount of funds appropriated to the program. To meet the WIC program's goals of disease prevention and health promotion most effectively, the supplemental foods provided in the food packages must help address current nutritional concerns for participant groups while controlling costs. Thus, the food packages should be designed to improve participants' food and nutrient intake to promote improved health.

Throughout the 30 years of the WIC program, many changes have occurred in the demographics and health risks of the population served, in

[3]Pregnant women must be recertified after delivery. For the purposes of describing WIC participants, the term *postpartum* refers to women who have recently delivered a baby and are not breastfeeding. Currently in the WIC program, a woman is considered to be breastfeeding if she is providing breast milk on the average of at least once a day. If a woman is WIC-eligible after delivery, she will be recertified (a) for 6 months if not breastfeeding or (b) for 12 months if breastfeeding. Women who stop breastfeeding between 6 and 12 months following delivery become categorically ineligible and are removed from the WIC program.

[4]For the purposes of describing WIC participants, the term *infants* is used exclusively for individuals from birth to the first birthday.

[5]For the purposes of describing WIC participants, the term *children* is used for individuals from the first birthday to the fifth birthday (ages 1 year through 4 years). Five-year-olds are not eligible to participate in the WIC program.

the food supply and dietary patterns, and in dietary guidance. Many groups and individuals have called for changes in the supplemental foods provided by the WIC program. Researchers have documented reasons for change; however, the only notable change made in the supplemental foods provided occurred in 1992, when the set of foods provided for breastfeeding women was somewhat expanded.

THE COMMITTEE'S TASK

In response to many concerns about the WIC food packages, the Food and Nutrition Service of the U.S. Department of Agriculture (USDA) asked the Institute of Medicine (IOM) to conduct a review of the WIC food packages. The Food and Nutrition Board undertook the project in September 2003, and the committee to Review the WIC food packages was appointed to conduct the study. The committee's task follows.

> The committee's focus is the population served by the Special Supplemental Nutrition Program for Women, Infants, and Children (the WIC program). Specific tasks for the committee during Phase I were to review nutritional needs, using scientific data summarized in Dietary Reference Intake reports (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a); assess supplemental nutrition needs by comparing nutritional needs to recent dietary intake data for pertinent populations; and propose priority nutrients and general nutrition recommendations for the WIC food packages. The publication, *Proposed Criteria for Selecting the WIC Food Packages: A Preliminary Report of the Committee to Review the WIC Food Packages* (released in August 2004), presented the committee's findings for Phase I of the project (IOM, 2004b). The Phase II task is to recommend specific changes to the WIC food packages. Recommendations are to be cost-neutral, efficient for nationwide distribution and vendor checkout, non-burdensome to administration, and culturally suitable. The committee will also consider the supplemental nature of the WIC program, burdens and incentives for eligible families, and the role of WIC food packages in reinforcing nutrition education, breastfeeding, and chronic disease prevention.

Responding to the request from the Food and Nutrition Service, this report presents evidence of the need for change and analyses of the types and amounts of current and proposed foods in the WIC food packages. Based on these analyses, the report provides detailed recommendations for the supplemental foods to be offered for each category of WIC participants. This chapter incorporates data from the Phase I report to provide an overview of the WIC supplemental nutrition program, a review of reasons why a systematic evaluation and revision of the supplemental food benefit is timely, a summary of the criteria the committee proposed for designing new WIC food packages, and the basis for the criteria.

THE SPECIAL SUPPLEMENTAL NUTRITION PROGRAM FOR WOMEN, INFANTS, AND CHILDREN

The WIC program is a federal grant program to 50 states, the District of Columbia, Puerto Rico, Guam, American Samoa, the American Virgin Islands, and 34 Indian Tribal Organizations (Kresge, 2003). For convenience, the terms *state agency* or *WIC state agency* are used to refer to the entities administering the WIC program in these 89 locations. Working within federal regulations, the WIC state agencies oversee the targeted food assistance, nutrition education, breastfeeding support, and health and social service referral program for eligible women, infants, and children. Eligibility for the WIC program requires meeting all three of the following requirements:

- *Categorical Eligibility*—being a member of one of these groups: pregnant woman; breastfeeding woman up to 1 year postpartum; woman less than 6 months postpartum; infant age 0 through 11 months; or young child from age 1 through 4 years;
- *Income Eligibility*—living in a family with any of the following characteristics—income at or below 185 percent of federal poverty guidelines or enrolled in Temporary Assistance for Needy Families, Food Stamp, or Medicaid programs (or other assistance program designated by the state of residence); and
- *Nutritional Risk*—having at least one of an approved list of nutritional risk factors for a poor health outcome. Examples of nutritional risk include specific criteria for anemia, obesity, and underweight.

Those enrolled and participating in the WIC program (or their caregivers) receive the following: (1) supplemental food; (2) nutrition education; (3) breastfeeding support; and (4) referrals to health and social services, as applicable. Ideally, the supplemental food and nutrition education components complement each other. By law (U.S. Congress, Pub. L. No. 101-445, 1990), the *Dietary Guidelines for Americans* form the basis of federal food, nutrition education, and information programs. This means that both the food and nutrition education provided by the WIC program should be consistent with the *Dietary Guidelines* (see section on *Nutrient Recommendations and Dietary Guidance Have Changed* and Chapter 2—*Nutrient and Food Priorities*—for more information).

Supplemental Foods and Target Nutrients

The definition of WIC supplemental foods found in the statutes has evolved (see Appendix F—*Supplementary Information*—Box F-1 for de-

tailed information). The most recent definition, "those foods containing nutrients determined by nutritional research to be lacking in the diets of pregnant, breastfeeding, and postpartum women, infants, and children, and those foods that promote the health of the population served by the program authorized by this section, as indicated by relevant nutrition science, public health concerns, and cultural eating patterns . . .", provides considerable latitude for USDA to name the foods to be included. Congress no longer names target nutrients, as it did in the original WIC statute (U.S. Congress, Pub. L. No. 92-433, 1972), an amendment to the National School Lunch Act. Instead, the current law calls for the use of nutrition research to identify key nutrients and evidence concerning the nutrient content of foods, public health problems, and eating patterns to identify appropriate foods.

The term *target nutrients* has remained in use despite its being dropped from the statutes in 1978. A WIC Food Package Advisory Panel, convened in 1978, recommended retaining calcium, iron, vitamin A, vitamin C, and high-quality protein as the target nutrients. Investigators at Pennsylvania State University (Guthrie et al., 1991) submitted to USDA technical papers that addressed current and new target nutrients. In 1992, the National Advisory Council on Maternal, Infant, and Fetal Nutrition used those papers and other materials to develop recommendations to Congress and the President (NACMIFN, 1991). Their report recommended that folate, vitamin B_6, and zinc be added as target nutrients, but this recommendation did not result in changes in the statutes or regulations. In 2003, the USDA published a request for public comments regarding revisions to the WIC food packages (FNS, 2003a). Under a contract from the USDA, the IOM formed the Committee to Review the WIC Food Packages. As stated under *The Committee's Task* above, the Food and Nutrition Service asked the IOM committee to identify priority nutrients based on current scientific evidence. In accordance with current scientific evidence and dietary guidance, the committee identified both *priority nutrients* and *priority food groups* for the WIC food packages with regard to both *inadequate intakes* and *excessive intakes*.

The WIC Food Packages

When the WIC program first began serving mothers, infants, and children, USDA devised market baskets of food that could be made available to recipients in amounts not to exceed defined maximum quantities. Later these "market baskets" came to be called WIC food packages. Table 1-1 identifies the maximum contents of the current WIC food packages. The number of food packages (seven) exceeds the number of participant categories (five) to take into account the changing needs of infants (Food Packages

TABLE 1-1 Current WIC Food Packages, Maximum Monthly Allowances

Foods/Package Number	Formula-Fed Infants, 0–3.9 mo I	Formula-Fed Infants, 4–11.9 mo II	Children and Women with Special Dietary Needs III
Infant formula (concentrated liquid)[c]	403 fl oz	403 fl oz	403 fl oz[d]
Juice (reconstituted frozen)[e]		96 fl oz[f]	144 fl oz
Infant cereal		24 oz	
Cereal (hot or cold)			36 oz
Milk[g]			24 qt
Cheese[g]			
Eggs[h]			
Dried beans or peas *and/or* Peanut butter			
Tuna (canned)			
Carrots (fresh)[i]			

[a]In addition to pregnant women, breastfeeding women whose infants receive formula from the WIC program may receive Food Package V.

[b]Food Package VII is available to breastfeeding women who do not receive infant formula from the WIC program.

[c]Powdered or ready-to-feed formula may be substituted at the following rates: 8 lb powdered per 403 fl oz concentrated liquid; or 26 fl oz ready-to-feed per 13 fl oz concentrated liquid.

[d]May be special formulas or medical formulas, not just infant formula; additional amounts of formula may be approved for nutritional need, up to 52 fl oz concentrated liquid, 1 lb powdered, or 104 fl oz ready-to-feed.

[e]Single strength adult juice may be substituted at a rate of 92 fl oz per 96 fl oz reconstituted frozen.

Children, 1–4.9 y	Pregnant or Partially Breastfeeding Women (up to 1 y postpartum)[a]	Non-Breastfeeding Postpartum Women (up to 6 mo postpartum)	Breastfeeding Women Enhanced Package (up to 1 y postpartum)[b]
IV	V	VI	VII
288 fl oz	288 fl oz	192 fl oz	336 fl oz
36 oz	36 oz	36 oz	36 oz
28 qt	24 qt	28 qt	
			1 lb
2–2.5 doz	2–2.5 doz	2–2.5 doz	2–2.5 doz
1 lb *or* 18 oz	1 lb *or* 18 oz		1 lb *and* 18 oz
			26 oz
			2 lb

[f]Infant juice may be substituted for adult juice at the rate of 63 fl oz per 92 fl oz single strength adult juice.

[g]A choice of various forms of milks and cheeses may be available. Cheese may be substituted for fluid whole milk at the rate of 1 lb cheese per 3 qt milk, with a 4-lb maximum. Additional cheese may be issued in cases of lactose intolerance.

[h]Dried egg mix may be substituted at the rate of 1.5 lb per 2 doz fresh eggs; or 2 lb per 2.5 doz fresh eggs.

[i]Frozen carrots may be substituted at the rate of 1 lb frozen per 1 lb fresh; or canned carrots at the rate of 16–20 oz canned per 1 lb fresh.

DATA SOURCE: Adapted from http://www.fns.usda.gov/wic/benefitsandservices/foodpkgtable.htm (FNS, 2004e).

I and II in Table 1-1) and the *special dietary needs*[6] of a small group of children and women (Food Package III).

The Food and Nutrition Service has set nutritional standards for some of the food items allowed in the WIC food packages. By regulation, for example, juice products must be 100 percent fruit or vegetable juice and must contain a minimum amount of vitamin C per unit volume; breakfast cereals must provide a minimum amount of iron but not more than a specified amount of sugar per unit weight.

While meeting federal specifications, each WIC state agency determines which forms or brands of foods are allowable. Tailoring of food packages at the local level with regard to the specific nutritional needs of an individual may involve decreasing the amount of a food item below the maximum allowance at the federal level. WIC state agencies also have some flexibility, on a case by case basis, to substitute more culturally appropriate foods if they are nutritionally equivalent and cost-neutral. Such substitutions must be approved at the federal level. Only 3 of 10 petitions for substitutions based on cultural preferences have been allowed since 1990 (personal communication, Tracy Von Ins, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, FNS, USDA, 2004).

Each WIC state agency develops a food list. In doing so, the state agency determines whether it will use the minimum federal nutritional standards for specific foods or set higher nutritional standards, the types of foods that will be allowed (e.g., fresh, frozen, or canned carrots for breastfeeding women), and the brands that will be allowed, when applicable. WIC state agencies have the option of approving products such as calcium-fortified juice for inclusion on their lists of WIC-approved juices. The Food and Nutrition Service encourages state agencies to develop policies and procedures for local agencies to follow when prescribing such foods (FNS, 2004d). To help control costs, WIC state agencies negotiate with infant formula companies and select a sole provider. In exchange for allowing the single brand of formula, the formula company provides the state agency with a substantial rebate for formula provided to WIC participants.

At the local level, a Competent Professional Authority[7] (CPA) assesses each participant's nutritional needs and food preferences and prescribes a

[6]The term *special dietary needs* is used to refer to medical or developmental conditions that require medical foods that meet specific nutritional requirements. Foods provided for children with special dietary needs include formulas that are thickened or formulated for children 1 year of age or older, and foods provided for women with special dietary needs include medical foods. Infants also may have special dietary needs that include formulas that are hypoallergenic, thickened, used to treat diarrhea, formulated for premature infants, or formulated for diseases or metabolic disorders [e.g., phenylketonuria (PKU)].

[7]The term *Competent Professional Authorities* is used to refer to professionals and paraprofessionals who tailor the food packages and educate and counsel WIC participants.

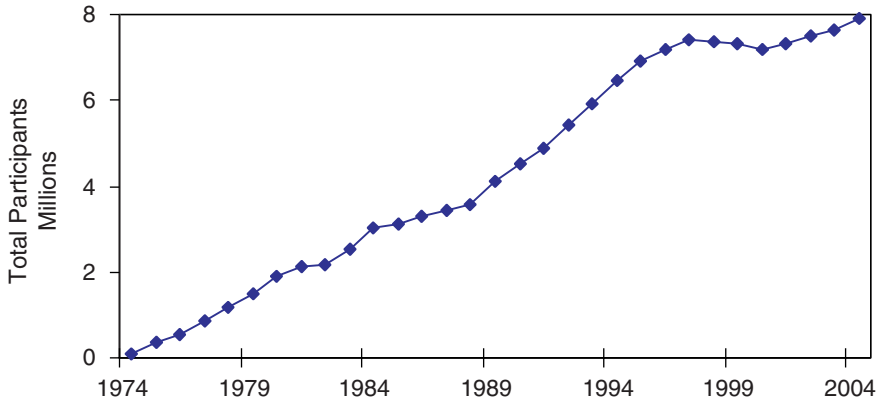

FIGURE 1-1 Annual number of participants in the WIC Program constructed from monthly averages of participants, fiscal years 1974–2004.
DATA SOURCE: USDA website (FNS, 2004f, 2004g). Data from FY 2003 (12 months) are the latest complete data set. Data for FY 2004 (preliminary data) are incomplete.

tailored food package—one that fits the participant's needs and circumstances to the extent that the amounts and WIC-approved foods allow. Most local WIC clinics do not actually distribute the food packages. Instead, a WIC staff member provides the participant or his or her caregiver with a food instrument (usually either an itemized voucher or check) that can be exchanged for specific foods in participating grocery outlets.[8] Examples of choices include the kind of fruit juice and the fat content of the milk. The food instrument lists the quantities of specific food items, sometimes including brand names, that may be obtained.

WHY CONSIDER CHANGES IN THE WIC FOOD PACKAGES?

Marked Demographic Changes Have Occurred in the WIC Population

Over the past several decades, the total number of persons served by the WIC program has increased greatly (see Figure 1-1), and the demo-

[8]A few states currently have different distribution systems. In Vermont, the prescribed items are delivered to the participants' homes. In Mississippi, participants obtain their food items through designated distribution centers rather than through retail outlets. In Alaska, some participants receive boxes of food items flown to remote areas.

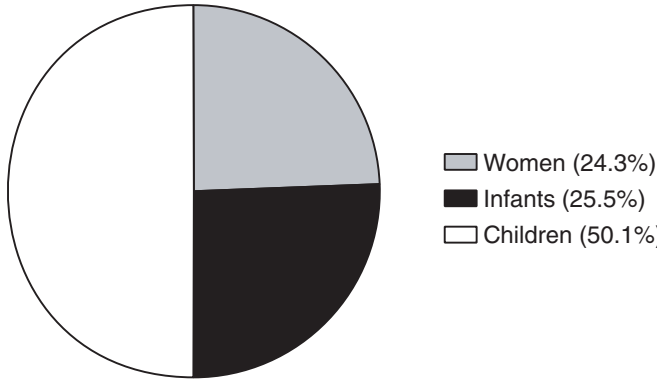

FIGURE 1-2 The WIC population by participant category, 2003.
DATA SOURCE: USDA website (FNS, 2004f). Data from FY 2003 are the latest complete data set.

graphics of the WIC population have changed greatly as well. In fiscal year 1974, the year when WIC became a permanent program, WIC served an average of 88,000 women, infants, and children per month. In sharp contrast, during 2003, the WIC program served an average of 7.6 million women, infants, and children per month at a cost of $4.5 billion for the fiscal year (FNS, 2004f). The distribution of the WIC caseload is approximately 50 percent children, 25 percent infants, and 25 percent women (Figure 1-2, data for 2002) (Cole et al., 2001; FNS, 2004f).[9]

The ethnic composition of the WIC population has shifted substantially. Hispanics constituted 38 percent of the WIC caseload in 2002, up from 21 percent in 1988. Asians and Pacific Islanders have become a substantial part of the WIC population in several states over the same period. Figure 1-3 illustrates the ethnic and racial diversity of the WIC population in 2002. The diversity of the WIC population actually is greater than Figure 1-3 suggests, since each of these major racial/ethnic groups is composed of numerous subgroups. For example, people with a cultural heritage from anywhere in Mexico, Central America, South America, the Caribbean, or Spain may self-identify as being of Hispanic origin. Ethnic composition varies among geographic areas, even within states, with some local WIC clinics serving much more ethnically diverse populations than others.

[9]Between 1988 and 2003, the composition of the WIC caseload was approximately 50 percent children (ranging from a low of 46.3 percent in 1990 to a high of 51.4 percent in 1996), 25 to 30 percent infants (ranging from a low of 25.5 percent in 1998 to a high of 31.2 percent in 1988), and 20 to 25 percent women (ranging from a low of 21.3 percent in 1988 to a high of 24.4 percent in 2001) (Cole et al., 2001; FNS, 2004f).

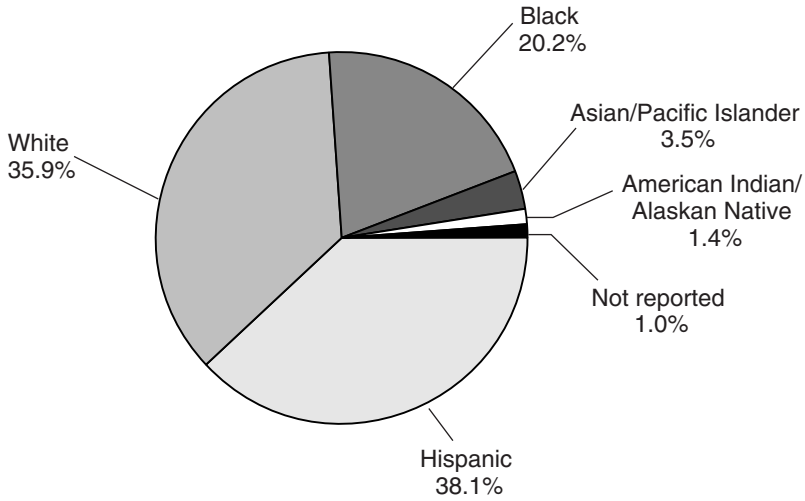

FIGURE 1-3 Ethnic composition of the WIC population, 2002 (percentage).
DATA SOURCE: *WIC Participant and Program Characteristics 2002* (Bartlett et al., 2003).

A growing proportion of women who participate in the WIC program are in the work force. In a study reported in 1988, 14.5 percent of pregnant women enrolled in the WIC program were employed (Rush et al., 1988a). In 1998, about 25 percent of the women who were certified for the WIC program or who certified a child were employed (Cole et al., 2001). This is consistent with data from the Bureau of Labor Statistics showing that work activity has increased recently in low-income households with children (Federal Interagency Forum on Child and Family Statistics, 2001), although other factors may have affected these statistics for the WIC program. Among children who lived with both parents in families with income below the poverty level, the proportion with at least one parent employed full-time increased from 44 percent in 1990 to 52 percent in 1999 (GAO, 2001). Over the same period, the proportion of poor children living in families with a single mother employed full-time doubled, from 9 to 18 percent.

The Food Supply and Dietary Patterns Have Changed

Increased Variety in the Food Supply

The number of food products in U.S. retail food outlets has increased approximately 60 percent since 1990. Between 1997 and 2003, an average

of 10,539 new food products were introduced into the market each year (Food Institute, 2002, 2003, 2004a). Many of these were existing products that were repackaged or relabeled, or they were simple line extensions. Recent new food products include consistent-weight packages of fresh fruits and vegetables that were formerly purchased as bulk, random-weight items. Each product is called a stock-keeping unit (SKU) by food manufacturers and vendors. The average number of SKUs in a typical supermarket has increased from 20,000 items in 1990 to over 32,000 items in 2002 (Food Institute, 2002).

A wider variety of fresh produce is now available year-round at reasonable prices and in many more locations. Variety in the forms of food products also has increased. For example, more foods are fortified with particular nutrients. Examples include oatmeal fortified with iron and orange juice fortified with calcium and vitamin D. More brands of products are available. Supermarkets are differentiating themselves from competition and building store loyalty through expansion of their own "store brands." In a typical supermarket, the percentage of SKUs that are store-brand products rose from 18.6 percent in 1995 to 20.7 percent in 2004 (Food Institute, 2004a). The baby food category experienced the greatest increase in private-label brands in 2003 (Food Institute, 2004b). Most store-brand products are priced between 15 and 50 percent lower than national-brand products of similar quality (Food Institute, 2002).

Changes in Food Consumption

The percentage of personal disposable income spent for food from retail stores has fallen over the last several decades. The average American household spent 7.8 percent of disposable income on food eaten at home in 2001(BLS, 2003), compared to over 10 percent in 1970 (ERS, 2004a). Despite this trend, households in the lowest income quintile, which would include most WIC participant households, spend 25 percent of their disposable income for food at home (Blisard, 2001). Table 1-2 shows trends and changes in women's consumption of selected types of food between 1977 and 1995. The trends in mean dietary intakes for women 20 years of age and older reveal substantial increases in beverages (a 114 percent increase for carbonated beverages), grain products (a 44 percent increase), and sugars and sweets (a 22 percent increase) (Enns et al., 1997). Mean intake of eggs decreased by 33 percent (Enns et al., 1997). Similar trend data were available for children ages 6 through 11 years (Enns et al., 2002), but no trend data of this type were available for children in the age range eligible for the WIC program.

TABLE 1-2 Trends and Changes in the Consumption from Selected Types of Food: Mean Intakes for Women 20 Years and Older

	Mean Intake (grams per day)			
Type of Food	1977–1978 (n = 10,035)	1989–1991 (n = 6,229)	1994–1995 (n = 3,284)	Percent Change, 1977–1978 to 1994–1995
Grain products	177	234	255	+44
Vegetables	205	187	189	–8
Fruits	142	150	156	+10
Milk and milk products	203	206	202	–0.5
Meat, poultry, and fish	184	167	168	–9
Eggs	24	16	16	–33
Legumes	18	17	19	+6
Fats and oils	13	16	16	+23
Sugars and sweets	17	17	19	+12
Beverages (nonalcoholic)	698	753	854	+22
Fruit drinks and ades	29	46	58	+100
Carbonated soft drinks	137	238	293	+114

NOTES: n = sample size. The term *ades* indicates sweetened drinks made from water and fruit juice.

DATA SOURCE: Enns et al. (1997), using data from the National Food Consumption Survey 1977–1978 and the Continuing Survey of Food Intake by Individuals, CSFII 1989–1991 and CSFII 1994–1995.

The Health Risks of the WIC-Eligible Population Have Changed

Since the inception of the WIC program, fundamental changes have occurred in the major health and nutrition risks faced by the WIC-eligible population. The prevalences of underweight (Sherry et al., 2004) and of iron-deficiency anemia (Sherry et al., 1997, 2001) have decreased. Diets have improved in many respects, and nutrients for which intakes often appeared to be low in the 1970s (calcium and vitamins A and C) are less problematic, particularly for children. Access to health care for WIC participants has improved (Fox et al., 2003); at present more than 80 percent of WIC participants report some kind of health care insurance, primarily Medicaid or employer-sponsored insurance (Cole et al., 2001). Furthermore, evidence indicates that the Medicaid-enrolled children who participate in the WIC program have greater use of all health services, including preventive services and effective care of common illnesses, than the

Medicaid-enrolled children who are not WIC participants (Buescher et al., 2003). Despite these improvements, the prevalences of overweight and obesity in adults, adolescents, and children have increased dramatically—regardless of WIC participation.

Overweight and Obesity in Adolescent and Adult Women[10,11]

From 1976 to 1994, among women of childbearing ages (20 through 39 years) the prevalence of being overweight increased (Kuczmarski et al., 1994) and the prevalence of obesity doubled (Flegal et al., 1998). Data from the National Health and Nutrition Examination Survey (NHANES) 1999–2000 indicate that 28 percent of nonpregnant women aged 20 through 39 years are obese (Flegal et al., 2002). More recent data from NHANES 2001–2002 indicate that the prevalence of obesity among these women remains high at 29 percent (Hedley et al., 2004). Excess body fat and physical inactivity are associated with the development of hypertension, type 2 diabetes, coronary heart disease, dyslipidemia (e.g., abnormally high blood cholesterol), osteoarthritis, respiratory ailments, sleep problems, certain cancers (e.g., breast cancer), and all-cause mortality (Mokdad et al., 2004).

While there is no firm evidence that the WIC participant population is any more prone to being overweight than non-WIC populations (CDC, 1996a, 1996b), neither are they protected. Overweight and obesity are prevalent among minority groups, except for Asian Americans. The latter group is the fastest-growing ethnic minority in the country and still predominantly consists of first-generation immigrants. There is some evidence that overweight and obesity can be expected to become significant problems in these groups as well. Data from the most recent NHANES multistage probability sampling (1999–2002) estimate the overall prevalences of being overweight and obese at 70 and 47 percent for non-Hispanic black women, 62 and 31 percent for Mexican American women, and 50 and 25 percent for non-Hispanic white women, respectively (Hedley et al.,

[10]Obesity is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass. Adults (age 20 years and above) are considered overweight if their individual BMI exceeds 25 and are considered obese if their BMI exceeds 30 (CDC, 2004d; Hedley et al., 2004). BMI is body mass index [weight (kg)/ height $(m)^2$].

[11]Children and adolescents are considered overweight if their individual BMI is equal to or exceeds the 95th percentile of the gender-specific CDC BMI-for-age growth charts (CDC, 2004d, 2004g; Hedley et al., 2004). Children and adolescents are considered at risk for overweight if their individual BMI is above the 85th percentile but less than the 95th percentile of the gender-specific CDC BMI-for-age growth charts (CDC, 2004d, 2004g; Hedley et al., 2004). The term *obesity* is generally not used to refer to children.

2004). Of particular concern is the prevalence of Class 3 obesity (body mass index [BMI] equal to or greater than 40), which affects 15 percent of non-Hispanic black women ages 20 years and over, a prevalence nearly double that (7.9 percent) reported in the 1988–1994 NHANES (Flegal, et al, 2002). Moreover, women of low socioeconomic status disproportionately bear the burden of obesity and overweight regardless of race or ethnicity. Among individuals with less than a high school education, the prevalence is roughly twice that of college graduates (Mokdad et al., 1999).

Overweight in Children[11]

The prevalence of being overweight for children in the United States also has steadily risen over the last several decades (Jolliffe, 2004). Data from NHANES 1999–2000 indicate that the prevalence of being overweight was 15 percent in children ages 6 through 11 years as compared to 4 percent in 1965 (Ogden et al., 2002). In a 1999–2000 survey, 10 percent of children ages 2 through 5 years of age were overweight (Ogden et al., 2002). A 1998 survey of children participating in the WIC program found that 13 percent of these children were overweight (Cole, 2001). Being overweight in childhood and adolescence increases risk for overweight in adulthood (Serdula et al., 1993). Childhood overweight has been linked to adverse health outcomes including elevated blood pressure, hyperinsulinemia, glucose intolerance, type 2 diabetes, dyslipidemia, and other early risks for chronic disease, as well as to psychosocial problems including depression, social isolation, and low self-esteem (Dietz, 1998; Must and Strauss, 1999).

Nutrient Recommendations and Dietary Guidance Have Changed

New Nutrient Recommendations

Over the past decade, knowledge of nutrient requirements has increased substantially, resulting in a set of new dietary reference values called the Dietary Reference Intakes (DRIs) (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). The DRIs replace the 1989 Recommended Dietary Allowances (RDAs) (NRC, 1989b) as nutrient reference values for the U.S. population. Based on the DRIs, many of the recommendations for nutrient intakes for individuals (that is, the RDAs) have changed substantially since the WIC food packages were originally formulated. Although basic concepts of nutrition have not changed, there has been a substantial increase in knowledge of specific concepts such as bioavailability, nutrient-nutrient interactions, and the distribution of dietary intake of nutrients across subgroups of the population. In addition to recommended intakes, the DRIs

include appropriate standards to use in determining whether diets are nutritionally adequate without being excessive. The DRIs encompass more aspects of nutrition than did the earlier RDAs, as follows:

- DRIs consider reduction in the risk of chronic disease, as well as the absence of signs of deficiency.
- For most nutrients, DRIs include both RDA and Estimated Average Requirement (EAR) values.
- For some nutrients, insufficient data were available to set EAR and RDA values. For these nutrients, Adequate Intake (AI) values were estimated.
- DRIs include Tolerable Upper Intake Levels (ULs), which are used in the evaluation of the risk of adverse effects from excess consumption.
- DRIs specify appropriate ranges of macronutrient densities, which are called Acceptable Macronutrient Distribution Ranges (AMDRs).
- When adequate data are available, DRIs provide reference values for food components other than nutrients.

New Dietary Guidance

At the time the WIC program was established, there was no systematic process for the development and revision of science-based dietary guidance for the U.S. population. However, guidance on food intakes is available now. Nutrition education tools such as the *Four Food Groups* focused on eating enough of various types of foods to ensure nutrient adequacy. The original selection of foods for the WIC food packages was based on food consumption data that indicated that calcium, iron, vitamin A, and vitamin C were the nutrients most likely to be low in the diets of low-income women and young children. Understanding of the necessity for adequate high-quality protein in periods of rapid growth and development provided the basis for inclusion of protein as a target nutrient. The specific foods selected for the food packages are good sources of the nutrients listed above, as well as widely available, generally acceptable, and reasonable in cost.

As deficiency diseases became less common, scientific research into the relationships between various dietary components and chronic diseases expanded. In 1977, the U.S. Senate Select Committee on Nutrition and Human Needs published *Dietary Goals for the United States* (U.S. Senate, 1977). This was the first government publication that set forth dietary guidance that included a focus on the total diet and recommendations both for minimizing risk of chronic disease and for ensuring nutritional adequacy. Much controversy surrounded these goals because of the lack of agreement among scientists on many of the issues and because of the pro-

cess used to set the goals (McMurry, 2003). A period of intense activity on the association between dietary components and chronic disease culminated in the *1979 Surgeon General's Report on Health Promotion and Disease Prevention* (DHEW/PHS, 1979). Then, in 1980, USDA and the Department of Health and Human Services (DHHS) jointly issued the first edition of the *Dietary Guidelines for Americans* (USDA/DHHS, 1980). The purpose was to provide the public with authoritative, consistent guidelines on diet and health. According to law (U.S. Congress, Pub. L. No. 101-445, 1990), the *Dietary Guidelines* form the basis of federal food, nutrition education, and information programs, including the WIC program.

Since 1980, the *Dietary Guidelines*, expressly intended for the general public ages two years and older, have been revised every five years. The *Dietary Guidelines for Americans* (DHHS/USDA, 2005) was released January 12, 2005. Those new guidelines are addressed in this report.

Many Stakeholders Are Calling for Change

In September 2003, USDA solicited public comments "to determine if the WIC food packages should be revised to better improve the nutritional intake, health and development of participants; and, if so, what specific changes should be made to the food packages" (FNS, 2003a). In response to this advanced notice of proposed rulemaking, the department received 195 letters. Respondents represented the general public, state and local WIC agencies, the National WIC Association, state WIC associations, industry, independent health professionals, vendors, WIC participants, and others. Comments received from the National WIC Association included two published position papers (NAWD, 2000; NWA, 2003) and provided recommendations based on that organization's analysis of the evidence. In addition, the members of this committee received over 70 written and 30 oral public comments.

As anticipated, the comments represent a wide range of perspectives. In some cases, a substantial number of persons from a small geographic area submitted nearly identical comments. A majority of those who commented expressed general support for foods currently offered, but also proposed at least one change. Nearly three-fourths of those responding to USDA stated that fruits and vegetables should be added to the packages. Other comments addressed topics including priority nutrients, design and structure of the food package, amount of juice, amount of milk, choices of milk products, alternative sources of calcium, cereal and grain choices, forms of legumes (i.e., dried or canned dry beans or peas), peanut butter, eggs, tuna, alternative sources of protein, infant formula, medical foods regulations, cost, incentives to breastfeed, flexibility at the state agency level, and more variety and choice at the participant level (FNS, *Advanced Notice of*

Proposed Rulemaking [ANPRM], Revisions to the WIC Food Packages: Content Summary Analysis, March 2004). Comments submitted directly to this IOM committee addressed similar themes. Examples of the public comments are presented in Chapter 3—*Process Used for Revising the WIC Food Packages*.

CRITERIA FOR THE REDESIGN OF THE WIC FOOD PACKAGES

The WIC program is conceptualized as a supplemental nutrition program designed to improve health outcomes. The committee sees the role of the WIC food packages as improving the diet in ways that could have both short- and long-term health benefits. These include improving reproductive outcomes, supporting the growth and development of infants and children, and promoting long-term health in all WIC participants.

The definition of "supplemental" food is central to decision-making about the composition of the WIC food packages. The maximum allowances for formula in the current food package for the youngest formula-fed infants approach, and in some cases exceed, their total nutrient and food energy needs (Kramer-LeBlanc et al., 1999). For older WIC participants, the current WIC food packages are intended to increase dietary quality by improving intakes of the target nutrients, as well as meeting some of the food energy needs. For example, the current WIC food package for postpartum non-breastfeeding women supplies about one-third of food energy needs (Kramer-LeBlanc et al., 1999). Thus, the current WIC food packages are "supplemental" to different degrees for different WIC subgroups.

The WIC food packages not only supplement the diets of individuals, but augment the household's economic resources. Although family expenditures are influenced by many factors (Rush et al., 1988b), there is some evidence that the nutritious foods in the WIC food packages replace other foods in the diet, resulting in greater nutrient density of the diet consumed (Wilde et al., 2000; Ikeda et al., 2002; Chandran, 2003). By supplying some foods, the WIC program frees up household funds, which then may be used to purchase other foods or necessities that benefit women and children (Basiotis et al., 1998).

The committee received positive feedback on proposed criteria published in its preliminary report, *Proposed Criteria for Selecting the WIC Food Packages* (IOM, 2004b). The criteria were slightly refined for greater clarity and are presented in Box 1-1. This final report addresses how the committee applied these criteria in developing its set of recommendations for changing the WIC food packages. The remainder of this section presents the rationale for each criterion, drawing on the preliminary report (IOM, 2004b). The criteria are also addressed briefly at the end of Chapter 3—

BOX 1-1
Criteria for a WIC Food Package, if Consumed as Specified

1. The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.
2. The package contributes to an overall dietary pattern that is consistent with the *Dietary Guidelines for Americans* for individuals 2 years of age and older.
3. The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.
4. Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities.
5. Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.
6. Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

Process Used for Revising the WIC Food Packages—and in Chapter 6—*How the Revised Food Packages Meet the Criteria Specified*.

Criterion One: Addressing the Dual Problems of Undernutrition and Overnutrition

1. The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.

Designing supplemental food packages that optimize the potential benefit for long-term health poses mixed challenges. Problems of undernutrition still occur, but they must be addressed in the context of the current high prevalences of overweight and obesity. Some individuals remain at risk of inadequate intake of energy as well as of essential nutrients. Diets that provide excess food energy often provide inadequate amounts of essential micronutrients and other beneficial components of food. Depending on the amounts taken, the consumption of certain fortified foods could result in excessive intake of some micronutrients—possibly accompanied by inadequate intake of other nutrients. Thus, for example, the committee considered the potential impact of the amount and bioavailability of nutrients in fortified foods in the WIC food packages with regard to improving nutrient

intakes. Chapter 2—*Nutrient and Food Priorities*—addresses the committee's analyses and findings regarding the prevalence of inadequate and excessive nutrient intakes. It also addresses nutrition-related health risks and outcomes of WIC-eligible populations.

Criterion Two: Consistency with the Dietary Guidelines for Americans

2. The package contributes to an overall dietary pattern that is consistent with the *Dietary Guidelines for Americans* for individuals 2 years of age and older.

As stated previously, by law, both the supplemental food and the nutrition education provided by the WIC program need to be consistent with the *Dietary Guidelines for Americans*. To be as current as possible, the committee used the *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2005 to the Secretary of Health and Human Services and the Secretary of Agriculture* (DHHS/USDA, 2004) as the basis for determining ways to meet this criterion. See Chapter 2—*Nutrient and Food Priorities*—for more information.

Criterion Three: Consistency with Recommendations for Infants and Children Younger Than Age 2 Years

3. The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.

Breastfeeding merits attention because breastfeeding rates by WIC mothers are far below the objectives set in *Healthy People 2010* (DHHS, 2000a, 2000b; Ryan et al., 2002). The short duration of breastfeeding WIC infants is of special concern. The committee considered American Academy of Pediatrics recommendations for limiting juice intake and waiting to introduce complementary foods until the infant is developmentally ready. The committee also considered ways to avoid contributing to excessive intake of food energy. See Chapter 3—*Process Used for Revising the WIC Food Packages*—for more information.

Criterion Four: Suitability and Safety for Persons with Limited Transportation Options, Storage, and Cooking Facilities

4. Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities.

In the 1998 WIC participant survey, 15 percent of WIC participants reported that limited transportation to grocery stores was a problem (Cole et al., 2001). Participants without automobiles may be able to take home only what they can carry, losing some value of their WIC food package. If it takes a long time to transport food to the home, perishable items, such as milk, may spoil, especially in hot weather. Spoilage may also occur if participants lack sanitary storage space or refrigeration or if perishable foods are supplied in packages that are larger than can be used in a reasonable or safe time. Where families share kitchen facilities and keep their foods locked in a private space, safely storing relatively large quantities of food may not be feasible. If foods (e.g., dried beans) need extensive cooking or preparation, lack of kitchen facilities, cooking knowledge, or time could also be a barrier to consuming those foods.

The packaging of food products has implications for food safety. For example, if a household uses only a part of the perishable food in a package on one occasion, safe storage is essential to minimize the risk of foodborne illness. Re-sealable packages or single-serving size packages may be needed to lessen the chance of food contamination, spoilage, or foodborne illness in some situations.

The ability to follow recommended cooking instructions, when applicable, also is important to keep foods safe. Proper cooking inactivates heat-labile, foodborne pathogens and toxins that occur naturally in raw foods. For example, eggs need to be cooked thoroughly to avoid foodborne illnesses.

Foods are not suitable for WIC food packages if two conditions apply: (1) they are particularly susceptible to contamination by organisms that cause foodborne illness; and (2) they result in serious adverse effects that are specific to a population that benefits from the WIC program. As an example, listeriosis is a foodborne illness considered potentially dangerous during pregnancy because it is associated with increased risk of spontaneous abortion, preterm birth, and fetal death. A surviving baby may succumb to respiratory distress and circulatory failure. New scientific knowledge about listeriosis as a hazard (CFSAN, 2003a) has generated changes in recommendations about the use of certain foods during pregnancy (CDC, 1998). Common foods that carry *Listeria monocytogenes* are ready-to-eat luncheon meats, hotdogs, and soft cheeses. Proper handling and cooking of food may help to lower the hazard of listeriosis. However, in some cases, especially where cooking is unlikely or inappropriate, certain foods are to be avoided during pregnancy (FSIS, 2001; Kaiser and Allen, 2002; CFSAN, 2003a).

Criterion Five: Acceptability, Availability, and Incentive Value

5. Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.

Food Acceptability

WIC-authorized foods need to fit the lifestyle of both employed and non-employed pregnant women and mothers of small children. As noted above in the section *Why Consider Changes in the WIC Food Packages?*, employment has increased in low-income households with children (GAO, 2001). Among women participating in the WIC program, the highest rate of employment is among pregnant women (32 percent) (Cole et al., 2001). Time constraints may push individuals, especially working parents, to use convenient, ready-to-heat, and ready-to-eat foods. In evaluating food items in the WIC food packages, the committee recognized that WIC participants are no more likely to desire or be able to spend considerable time in food preparation than the rest of the population. Suitable items for WIC food packages should not pose a heavy burden of food preparation for employed parents.

Foods Commonly Consumed

Changes in dietary patterns at population levels occur slowly and with concerted efforts at education and motivation (Bhargava and Hays, 2004; Burke et al., 2004; Cullen et al., 2004; MacLellan et al., 2004; Steptoe et al., 2004). To increase the likelihood that dietary changes will occur as a result of changes in the WIC food packages, the committee considered information about foods that are commonly consumed. Various sources indicate foods in each food group that are commonly consumed in the United States (Krebs-Smith et al., 1997; Smiciklas-Wright et al., 2002, 2003; Cotton et al., 2004). One source provides recent consumption data with breakdowns by variables such as age, gender, and quantities consumed per eating occasion (Smiciklas-Wright et al., 2002, 2003). The committee also used data concerning purchases of various foods, varieties of specific foods, brand names, and package sizes (ACNielsen, 2001).

From the public comments the committee received, it is apparent that some WIC participants feel the choice of foods in the current WIC food packages is very limited. Thus, the committee also took the position that participant acceptance of the food packages (and, as a result, improved eating patterns) might be increased if a wider variety of foods and choices were made available, especially for persons with different cultural backgrounds.

Participant Diversity

The WIC food packages must be suitable for participants in all 50 states, the District of Columbia, Puerto Rico, Guam, American Samoa, the American Virgin Islands, and 34 Indian Tribal Organizations (Kresge, 2003; FNS, 2004f). In addition, the WIC food packages need to be suitable to a growing number of migrant farm workers, particularly in California, Florida, and Texas (Kresge, 2003).

The need to consider diverse preferences due to cultural heritage applies across all regions and to food preferences of large and small cultural groups. Here, the term *culture* refers to groups of people who have shared beliefs, values, and behaviors and therefore may have needs differing from those of the general population (NWA, 2003). Culture may be defined by national, regional, and ethnic origins; religious affiliations; lifestyle (e.g., vegetarian); generation; or overlapping residence and socioeconomic variables.

Providing culturally acceptable foods does not necessarily mean that foods consumed most frequently by a cultural group should be offered in the WIC food packages. Some of those foods may be very low in the target nutrients or contain too much fat, sugar, cholesterol, or sodium. Also, WIC participants may have access to sufficient amounts of certain staple or core cultural foods (e.g., white rice, white potatoes), regardless of the contents of the WIC food packages (Kaiser et al., 2003). If the WIC food packages were designed to complement these core foods, they might serve as incentives for various cultural groups to participate in the WIC program.

The term *culturally acceptable* implies that the foods are easily accepted within the cultural norms of the participants. Studies have found that WIC participants from specific cultural groups have attitudes that value other foods above some of the foods provided in the current WIC food packages. For example, a study of women of Chinese descent living in California found that pregnant WIC participants value other sources of calcium (i.e., dark green vegetables and calcium-set tofu) more highly than the cheese provided in current WIC food packages (Horswill and Yap, 1999). To design culturally acceptable WIC food packages may require that the WIC program accommodate more substitutions than are allowed currently (Fishman et al., 1988; Story and Harris, 1989; Horswill and Yap, 1999; Pobocik et al., 2003). This is the position of the National WIC Association (formerly the National Association of WIC Directors) (NAWD, 2000; NWA, 2003).

Among immigrant subgroups, acculturation to the mainstream American culture results in dietary change (Lee et al., 1999; Neuhouser et al., 2004; Romero-Gwynn, et al., 1993) and sometimes results in excessive body weight gain (Goel et al., 2004). Dietary change often means that nutritious traditional foods are consumed less often, but some changes can

be positive. For example, a study among Korean Americans found that acculturation is correlated with increased consumption of oranges, tomatoes, fat-reduced milk, and bread (Lee et al., 1999). Ideally, the WIC food packages will promote positive dietary changes while supporting the beneficial components of traditional diets.

Some WIC participants have special conditions, such as milk allergies and lactose intolerance. Other WIC participants have diverse preferences, for example, choosing to avoid milk and other animal products for personal reasons unrelated to ethnicity or cultural heritage. Increasing flexibility at the state agency level in allowable substitutions to account for the needs and preferences of participants (or potential participants) may be a way to accommodate the culturally diverse preferences of the WIC participant population as a whole. Increasing variety and choices of options at the participant level may also be viewed as accommodating the culturally diversity of WIC participants.

Food Availability

Local food availability can influence dietary quality. As an example, most vendors in low-income neighborhoods are small, independent grocery outlets and convenience-type establishments that stock fewer selections and less fresh produce than do the larger, chain retail food stores that are predominantly in suburban and more affluent communities (Fisher and Strogatz, 1999; Morland et al., 2002a, 2002b, 2003; Cummins, 2003; Sloane et al., 2003). The presence of supermarkets in a community has been associated with increased intakes of fruits and vegetables by the local residents (Morland et al., 2002a). However, the greater the distance individuals live from a large chain grocery store, the poorer is their dietary quality (Laraia et al., 2004).

Vendors authorized to accept WIC vouchers are required to carry a sufficient stock of WIC-authorized foods (including specific brands and sizes) to ensure that participants can obtain their food prescription in one visit. The Food and Nutrition Service conducts studies of WIC food vendor management practices (Singh et al., 2003). Such studies found that 2.3 percent of larger vendors (i.e., outlets having 6 or more cashier registers) failed to carry sufficient stocks of WIC food items in 1998 (Singh et al., 2003). At the same time, 6.9 percent of small vendors (i.e., outlets having 1 to 5 cashier registers) did not have sufficient stocks of WIC food items (Singh et al., 2003). Although the percentage of vendors meeting inventory requirements for WIC-authorized foods for women and children substantially increased from 1991 to 1998, the percentage of vendors carrying sufficient stocks of infant package items decreased from 92.1 to 90.7 percent over the same period (Singh et al., 2003). In both the 1991 and 1998 studies, smaller

vendors were more likely than larger vendors to have insufficient stocks of WIC-authorized foods. In a study of barriers to the use of WIC services in the state of New York, 16 percent of 3,144 WIC participants noted that they sometimes or frequently find WIC-authorized food out of stock (Woelfel et al., 2004).

Incentive Value

The intent is to design WIC food packages that will serve as incentives for participation in the WIC program and promote healthy behaviors by participants. The packages should be viewed as valuable enough to promote and maintain enrollment in the WIC program and thus enable the participants to receive the dietary, educational, and health referral benefits that the WIC program provides. The food packages also should reinforce the WIC educational messages and promote long-term dietary quality.

A major objective for the nation is to promote the initiation of breastfeeding and support sustained breastfeeding through at least the infant's first year (OWH, 2000). The current food packages provide an extra incentive to the fully breastfeeding mother solely by including more food and additional choices in Food Package VII. The committee considered ways that both the infants' and mothers' packages could be redesigned to provide greater incentive to breastfeed.

Criterion Six: Consideration of Administrative Impacts

6. Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

Vendors

Increased vendor costs are potential consequences of increased flexibility, offering a wider variety of foods, allowing more options for participants, and other changes in the WIC food packages. Straightforward administrative procedures and efficient vendor checkout or food distribution would enhance the ease of program administration (Kirlin et al., 2003). The store that sells food to WIC participants must (1) have the designated types and package sizes of food available; (2) train checkout clerks to recognize the WIC-approved foods; (3) treat the WIC customers with respect; (4) organize an appropriate number of checkout stands to accept WIC customers; (5) train personnel to handle the redemption of WIC food instruments; and (6) carry the already sold inventory on their accounts until state payments are received. Implementation of specific changes in the WIC food packages has the potential to impact vendors to varying degrees in each of these areas.

Some changes in the WIC food packages would increase vendor costs. Requirements to procure a new business license to sell perishable (non-packaged) food could subject vendors to an increased frequency of inspection by state health departments (DHHS/PHS/FDA, 2001). In small stores or stores that serve WIC customers exclusively, arranging to have small loads of perishable products delivered on a regular basis has the potential to increase costs. The frequency of delivery could affect the quality of fresh fruits and vegetables. With the need for refrigeration and rapid turnover of perishables, the cost of distribution and inventory increases. In addition, special handling to ensure the safety of perishable products is needed. On the other hand, including more fruits and vegetables in the WIC food packages could mean that vendors are likely to sell more produce, a relatively high margin department in most stores.

The on-going initiative that will install electronic benefit transfer (EBT) systems in more locales may ease the transitions necessary in making changes to the WIC food packages. At present, however, such electronic systems and the efficiencies they achieve are not found in many vendor locations.

WIC Agencies

Changing the items in the WIC food packages or allowing greater flexibility in substitutions could pose administrative challenges at the state agency level. States and tribal organizations need to determine what products will be on their approved foods lists. Then they need to train vendors and monitor their compliance in allowing only WIC-approved foods. They also need to ensure appropriate training of personnel at local agencies.

Greater variety and choice by participants could pose a challenge at the local agency level. Local agencies must instruct participants, often with limited literacy skills, how to choose the allowed foods at the market. Increased complexity of the WIC food packages (i.e., number of items or options) could increase counseling time, waiting time, and staffing requirements at the local agencies. In a study of New York State WIC agencies, the most commonly cited barrier for participants was waiting too long at the local WIC clinic to receive services (Woelfel et al., 2004).

Currently, many state and local WIC agencies provide services to a large number of participants without the assistance of efficient electronic information technology. In 2001, over 50 percent of WIC state agencies had management information systems that were not capable of efficiently performing essential program tasks, such as tailoring food packages, assessing applicants' income, or printing food vouchers (GAO, 2001). Thus, at present, efficient information technology systems cannot be counted on in every location to ease the transitions necessary in making changes to the

WIC food packages. In the future, changes may be more easily implemented through efficient information technology systems in more locales.

SUMMARY

The WIC program provides an average of 7.6 million women, infants, and young children each year with supplemental food. Changes in the food packages are warranted because of changes in demographics of the WIC population, in the food supply, in dietary patterns, in health risks, and in dietary guidance and recommendations. Together, these changes have created the current scenario in which the WIC food packages are inconsistent with dietary guidance and are in need of change to improve their acceptance by participants. Many stakeholders have called for changes in the WIC food packages based on changes in one or more of the areas listed above. The committee used the six criteria that appear in this chapter in making recommendations for changes to the WIC food packages. The remainder of this report addresses the processes used to develop recommendations for changes to the WIC food packages and the recommendations themselves.

- Chapter 2—*Nutrient and Food Priorities for the WIC Food Packages*—identifies the priorities the committee set for revising the WIC food packages and discusses how those priorities were determined.
- Chapter 3—*Process Used for Revising the WIC Food Packages*—discusses the process the committee used in redesigning the food packages.
- Chapter 4—*Revised Food Packages*—presents the committee's specific recommendations for revising the WIC food packages.
- Chapter 5—*Evaluation of Cost*—estimates the costs of the food packages and variations of the packages, and compares estimated average per participant cost per month of the current and revised packages.
- Chapter 6—*How the Revised Food Packages Meet the Criteria Specified*—relates the committee's recommended package changes back to the criteria.
- Chapter 7—*Recommendations for Implementation and Evaluation of the Revised WIC Food Packages*—presents the committee's recommendations for effectively incorporating the revised food packages into the WIC program.

Overall, this report presents findings and other information intended to guide the Food and Nutrition Service of USDA to improve the supplemental food portion of the WIC program, improve the nutritional status of WIC participants, and, indirectly, to facilitate making the nutrition education component of the WIC program more consistent with the *Dietary Guidelines for Americans*.

2

Nutrient and Food Priorities for the WIC Food Packages

The first step in revising the WIC food packages is identification of the nutrients and food groups of highest priority, either because of potential inadequacies or excesses. The committee considered the following types of evidence to identify priority nutrients and foods: (1) results from an analysis of the estimated nutrient adequacy of the diets of categorical WIC subgroups (i.e., women, infants, and children); (2) published evidence of nutrient inadequacy or excess, based on physiological or biochemical data; and (3) published data from analyses of foods consumed relative to new recommendations contained in the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005) and relative to dietary guidance for children under 2 years of age. This chapter summarizes nutrient and food priorities that the committee took into account when redesigning the WIC food packages with the goal of improving the nutrition of WIC participants.

NUTRIENT PRIORITIES

Assessing nutrient adequacy involves determining the extent to which the diets of WIC-income-eligible subgroups meet nutrient requirements without being excessive. This task involves using the new dietary reference values called the Dietary Reference Intakes (DRIs) (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a) and the methods recently published by the Institute of Medicine (IOM, 2000a) to assess the nutrient adequacy of the reported diets of WIC subgroups. To date, no published studies have reported such analyses. Therefore, the committee conducted analyses applying the DRIs and the recommended methods to assess the nutrient ad-

equacy of the diets of WIC subgroups—WIC infants under 1 year of age, WIC children 1 through 4 years of age, and pregnant, lactating, and non-breastfeeding postpartum women.[1] To guide the committee in recommending specific changes in the food packages, the committee conducted analyses to determine nutrients of concern: (1) nutrients of concern regarding inadequate intakes as defined by intakes below the Estimated Average Requirement (EAR); and (2) nutrients of concern regarding excessive intakes as defined by intakes above the Tolerable Upper Intake Level (UL). This chapter summarizes the analysis results. Details on the methods and results of the analysis of nutrient adequacy are provided in Appendix C—*Nutrient Intake of WIC Subgroups*.

Estimated Adequacy of Micronutrient Usual Intakes

Overall, fully formula-fed WIC infants had adequate intakes of micronutrients and macronutrients. For three nutrients—iron, zinc, and protein—precise estimates of inadequacy can be calculated. These results show a low prevalence of inadequacy for formula-fed WIC infants 6 through 11 months but a higher prevalence of inadequacy for iron and zinc for breast-fed infants (Table 2-1). The results for breast-fed infants (WIC and non-WIC breast-fed infants combined because of small sample sizes) indicate 40 percent of breast-fed infants 6 through 11 months had inadequate iron intakes and 60 percent had inadequate zinc intakes (Table 2-1).

WIC children have adequate intakes of all micronutrients except vitamin E, while the diets of pregnant, lactating, and non-breastfeeding postpartum women have high levels of inadequacy for a number of nutrients (Table 2-2). The micronutrients with the highest prevalence of inadequacy were magnesium and vitamin E. For vitamin E, the estimated prevalence of inadequacy exceeded 90 percent for pregnant and lactating women and was almost 100 percent for non-breastfeeding postpartum women. More than 40 percent of pregnant and lactating women had inadequate folate intakes. About one-third of pregnant and lactating women had inadequate intakes of vitamins A, C, and B_6. An even higher percentage of non-breastfeeding postpartum women had inadequate intakes of vitamins A and C (more than 40 percent). The prevalence of inadequate intake of vitamin B_6 was twice as high for pregnant and lactating women as for non-breastfeeding postpartum women.

[1]Due to sample size limitations in the data set from the Continuing Survey of Food Intakes by Individuals (CSFII), the analyses of nutrient adequacy used *all* pregnant and lactating women (14 through 44 years of age) and *all* non-breastfeeding women (14 through 44 years of age) up to one year postpartum. In contrast, the analyses for infants and children used only infants and children receiving WIC benefits. For details on sample size, see Appendix C—*Nutrient Intake of WIC Subgroups*.

TABLE 2-1 Estimated Prevalence of Inadequacy of Selected Micronutrients and Protein Using Usual Intakes, Infants

Nutrient	Estimated Prevalence of Inadequacy (percentage)	
	WIC Infants, Non-Breastfed, 6–11.9 mo (n = 275)	Breast-Fed Infants, 6–11.9 mo[a] (n = 143)
Iron	1.7	39.5
Zinc	0.3	60.3
Protein	0.6	—

[a]Because of the lack of data on the quantity of breast milk consumed by breast-fed infants 6–11.9 mo of age, protein adequacy could not be assessed. Iron and zinc adequacy could be assessed, since breast milk consumed by these older breast-fed infants has little iron and zinc content.

NOTES: n = sample size. Details of these analyses are provided in Tables C-2C and C-3C in Appendix C—*Nutrient Intake of WIC Subgroups*. Further analyses of non-breastfed infants ages 0–3.9 mo and 4–5.9 mo are provided in Tables C-2A and C-3A (0–3.9 mo) and Tables C-2B and C-3B (4–5.9 mo).

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations). Intake distributions were calculated using C-SIDE (ISU, 1997). Estimated Average Requirements used in the analysis were from the Dietary Reference Intake reports (IOM, 2001, 2002/2005).

Zinc, thiamin, and niacin appear to be inadequate in the diets of a substantial proportion of pregnant and lactating women. Almost one-quarter had inadequate zinc intakes, 17 percent had inadequate thiamin intakes, and 8 percent had inadequate niacin intakes (based on intakes of preformed niacin). Interestingly, the prevalence of inadequate intake for non-breastfeeding postpartum women was only 12 percent for folate, 3 percent for thiamin and niacin, and virtually zero for zinc.

For iron, 7.5 percent of pregnant and lactating women and 9.5 percent of non-breastfeeding postpartum women had inadequate usual intakes. The estimated prevalence of inadequate intake of selenium, phosphorus, and the remaining B vitamins (riboflavin and vitamin B_{12}) was low (less than 7 percent) for pregnant, lactating, and non-breastfeeding postpartum women.

Calcium, Potassium, and Fiber Usual Intakes

Calcium intakes appear to be adequate for formula-fed WIC infants and WIC children but low for pregnant, lactating, and non-breastfeeding

TABLE 2-2 Estimated Prevalence of Inadequacy of Selected Micronutrients and Protein Using Usual Intakes, Children and Women

	Estimated Prevalence of Inadequacy (percentage)			
Nutrient	WIC Children, 1–1.9 y (n = 287)	WIC Children, 2–4.9 y (n = 872)	Pregnant Women and Lactating Women, 14–44 y (n = 123)	Non-Breastfeeding Postpartum Women, 14–44 y (n = 105)
Iron	1.6	0.4	7.5	9.5
Zinc	0.2	0.1	24.1	<0.1
Selenium	0.3	<0.1	1.4	<0.1
Magnesium	0.1	0.5	49.4	87.5
Phosphorus	0.6	0.2	0.4	0.7
Vitamin A	0.5	0.4	31.2	44.1
Vitamin E[a]	55.3	47.0	94.4	99.8
Vitamin C	<0.1	<0.1	32.7	42.2
Thiamin	0.1	<0.1	17.2	3.2
Riboflavin	<0.1	<0.1	3.8	1.2
Niacin[a]	2.5	0.1	8.1	3.3
Vitamin B_6	<0.1	<0.1	34.0	17.1
Vitamin B_{12}	0.1	<0.1	1.5	6.6
Folate[a]	1.2	<0.1	41.5	12.0
Protein	<0.1	<0.1	17.1	4.2

[a]For discussion of important issues regarding differences between the Dietary Reference Intakes (DRIs) and dietary intake data in the units used for vitamin E, niacin and folate, please see the section *Data Set—Nutrients Examined* in Appendix C—*Nutrient Intake of WIC Subgroups*.

NOTES: n = sample size. Details of these analyses are provided in Tables C-2D through C-2G and Tables C-3D through C-3G (protein), in Appendix C—*Nutrient Intake of WIC Subgroups*.

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations). All young children were non-breastfed. Intake distributions were calculated using C-SIDE (ISU, 1997). Estimated Average Requirements used in the analysis were from the DRI reports (IOM, 1997, 1998, 2000b, 2001, 2002/2005).

postpartum women (Table 2-3). For WIC infants and children, mean calcium intakes exceeded the Adequate Intake (AI), while for women, mean calcium intakes were low, far below the AI in most cases. Although mean intakes below the AI do not necessarily imply nutrient inadequacy, when mean intakes are far below the AI, concerns about nutrient adequacy may arise. (See Appendix C—*Nutrient Intake of WIC Subgroups*—for details of the methodology.)

TABLE 2-3 Adequate Intakes and Mean Reported Usual Intakes of Calcium, Potassium, and Fiber

		Dietary Component		
Participant Category	n	Calcium (mg/d)	Potassium (mg/d)	Fiber (g/d)
WIC Infants,[a] 0–3.9 mo	152			
AI*		210*	400*	ND
Mean usual intake		562	736	—
WIC Infants,[a] 4–5.9 mo	104			
AI*		210*	400*	ND
Mean usual intake		675	974	—
WIC Infants,[a] 6–11.9 mo	275			
AI*		270*	700*	ND
Mean usual intake		722	1,349	—
WIC Children,[a] 1–1.9 y	287			
AI*		500*	3,000*	19*
Mean usual intake		937	2,029	8
WIC Children, 2–4.9 y	872			
AI*		500* / 800*[b]	3,000* / 3,800*[b]	19* / 25*[b]
Mean usual intake		833	2,211	11
Women, pregnant or lactating, 14–44 y	123			
AI*		1,300* / 1,000*[c]	4,700* / 5,100*[d]	28* / 29*[d]
Mean usual intake		956	2,909	18
Women, non-breastfeeding postpartum, 14–44 y	105			
AI*		1,300* / 1,000*[c]	4,700*	26* / 25*[c]
Mean usual intake		668	2,086	12

[a]Breast-fed infants and children were excluded from the analyses.
[b]The AIs refer to children 1–3 y of age and children 4 y of age, respectively.
[c]The AIs refer to women 14–18 y of age and 19–44 y of age, respectively.
[d]The AIs refer to pregnant women and lactating women, respectively.

NOTES: AI = Adequate Intake, used when an Estimated Average Requirement could not be determined, indicated by a asterisk (*); n = sample size; ND = not determined. Details of these analyses are provided in Tables C-2A through C-2G (calcium and potassium) and Tables C-3A through C-3G (fiber) in Appendix C—*Nutrient Intake of WIC Subgroups*.

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations). All infants and young children were non-breastfed. AIs are from the Dietary Reference Intake reports (IOM, 1997, 2002/2005, 2005a). Intake distributions were calculated using C-SIDE (ISU, 1997).

Intakes of potassium and fiber were low for all subgroups one year of age or older. As with calcium, mean intakes were substantially less than the AI, raising concerns about inadequate intake levels.

Usual Food Energy Intakes

Both the mean and median reported usual intakes of food energy of WIC infants and children exceeded the comparable percentiles of the energy requirement distributions (Table 2-4). For WIC infants 0 through 3 months (excluding breast-fed infants), mean food energy intake (673 kilocalories per day) exceeded mean Estimated Energy Requirement (EER) (555 kilocalories per day) by 118 kilocalories per day, or by about 20 percent. For older WIC infants (ages 6 through 11 months), mean energy intake was greater than the mean EER by 238 kilocalories per day or 30 percent. For WIC children, mean energy intakes exceeded mean EERs by 346 kilocalories per day for children one year of age and by 303 kilocalories per day for children 2 through 4 years of age. The large magnitude of these differ-

TABLE 2-4 Reported Usual Food Energy Intakes and Estimated Energy Requirements

		Usual Energy Intakes (kcal/d)		Estimated Energy Requirement (kcal/d)	
Participant Category	n	Median	Mean	Median EER	Mean EER
WIC Infants, 0–3.9 mo	152	635	673	559	555
WIC Infants, 4–5.9 mo	104	786	802	614	623
WIC Infants, 6–11.9 mo	275	970	992	740	754
WIC Children, 1–1.9 y	287	1,262	1,288	935	942
WIC Children, 2–4.9 y	872	1,553	1,585	1,285[a]	1,282[a]
Women, pregnant or lactating, 14–44 y	123	2,088	2,115	2,451[a]	2,465[a]
Women, non-breastfeeding postpartum, 14–44 y	105	1,754	1,774	2,148[a]	2,163[a]

[a]EER calculations assumed low active Physical Activity Level (IOM, 2002/2005). For additional detail, see Appendix C—*Nutrient Intake of WIC Subgroups*.

NOTES: EER = Estimated Energy Requirement; kcal = kilocalories; n = sample size. Details of these analyses are provided in Tables C-3A through C-3G in Appendix C—*Nutrient Intake of WIC Subgroups*.

DATA SOURCES: Intake data were obtained from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000). All infants and young children were non-breastfed. EERs were calculated according to the Dietary Reference Intake report (IOM, 2002/2005). Intake distributions were calculated using C-SIDE (ISU, 1997).

ences would imply larger body weight gains than have been observed among infants and children, suggesting *overreporting* of food intakes for infants and children (see section on *Discussion of Results*).

In contrast, reported intakes of food energy were less than the EER for pregnant, lactating, and non-breastfeeding postpartum women (Table 2-4). Mean reported food energy intake was 350 kilocalories per day less than the mean EER for pregnant and lactating women and 389 kilocalories per day less than the mean EER for non-breastfeeding postpartum women suggesting *underreporting* of food intakes for these subgroups (see section on *Discussion of Results*).

Usual Intakes of Macronutrients and Added Sugars

Many WIC children have reported usual fat intakes outside the Acceptable Macronutrient Distribution Range (AMDR) (Table 2-5). Interestingly, more WIC children were below the lower bound of the AMDR for total fat than were above the upper bound (21 percent below and 5 percent above for WIC children 1 year of age; 18 percent below and 10 percent above for WIC children 2 through 4 years of age). This suggests that excessive intake of total fat is not a concern in children. Saturated fat, however, is a nutrient of concern with regard to excessive intake; 91 percent of WIC children ages 2 through 4 years had saturated fat intakes above the recommended range of less than 10 percent of total food energy (Table 2-5). The estimate of the percentage of WIC children with intakes of added sugars exceeding 25 percent of food energy (the upper bound set in the DRI reports [IOM, 2002/2005]) was about 3 percent (Table 2-5). However, it is difficult to plan diets that provide recommended amounts of nutrients when added sugars provide such a high percentage of total calories (DHHS/USDA, 2004). (See also discussion of added sugars in the section on *Food Priorities*).

Approximately 7 percent of pregnant and lactating women and 20 percent of non-breastfeeding postpartum women had intakes of added sugars greater than 25 percent of total food energy intake (Table 2-5). A substantial proportion of pregnant and lactating women had usual fat intakes outside the AMDR. Only a small proportion had usual fat intakes less than the lower bound of the AMDR (20 to 25 percent of food energy intakes), but almost a quarter had usual fat intakes exceeding the upper bound of the AMDR (35 percent of energy intakes) (Table 2-5). Saturated fat is a nutrient of concern with regard to excessive intake; 81 percent of pregnant and lactating women and 96 percent of non-breastfeeding postpartum women (Krauss et al., 1996) did not meet dietary guidance to limit saturated fat intake to less than 10 percent of total food energy intakes (AHA, 2004; DHHS/USDA, 2005).

TABLE 2-5 Percentage with Reported Usual Intakes of Macronutrients and Added Sugars Outside Dietary Guidance

	Participant Category			
Nutrient	WIC Children, 1–1.9 y (n = 287)	WIC Children, 2–4.9 y (n = 872)	Pregnant Women and Lactating Women, 14–44 y (n = 123)	Non-Breastfeeding Postpartum Women, 14–44 y (n = 105)
Protein				
%<AMDR	<0.1	0.5	<0.1	0.3
%>AMDR	1.5	1.0	<0.1	<0.1
Carbohydrate, total				
%<AMDR	7.5	2.0	1.5	4.8
%>AMDR	2.8	1.1	0.2	0.1
Added Sugars				
%>25% of food energy	na	2.9	7.3	20.4
Fat, total				
%<AMDR	20.8	18.1	0.2	<0.1
%>AMDR	5.5	10.4	24.5	4.9
Fat, saturated[a]				
%>10% of food energy	na	91.0	80.9	96.2

[a]The dietary guidance in this table for saturated fat is a part of the *Dietary Guidelines for Americans* (DHHS/USDA, 2005). The dietary guidance from the Dietary Reference Intake (DRI) reports for saturated fat is to consume amounts as low as possible while consuming a nutritionally adequate diet (IOM, 2002/2005).

NOTES: AMDR = Acceptable Macronutrient Distribution Range; n = sample size; na = not applicable; %<AMDR, percentage with usual intake less than AMDR; %>AMDR, percentage with usual intake greater than AMDR. For details of these analyses, see Table C-4 in Appendix C—*Nutrient Intake of WIC Subgroups*.

DATA SOURCES: Intake data were obtained from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000). All young children were non-breastfed. Usual intake distributions were calculated using C-SIDE (ISU, 1997). AMDRs and dietary guidance for added sugars were obtained from the DRI report (IOM, 2002/2005). Dietary guidance for saturated fat was obtained from the *Dietary Guidelines* (DHHS/USDA, 2005) (see note *a*).

Excessive Intake Levels

In general, the risk of excessive nutrient intakes was low, less than 1 percent for most WIC subgroups (Tables 2-5 and 2-6). Some notable exceptions were:

- Intakes of sodium appeared excessive. More than 90 percent of WIC children 2 through 4 years and of pregnant, lactating, and non-

TABLE 2-6 Percentage with Reported Usual Intakes Above the Tolerable Upper Intake Level and Dietary Guidance

	WIC Infants, Formula-Fed		
	0–3.9 mo (n = 152)	4–5.9 mo (n = 104)	6–11.9 mo (n = 275)
Calcium (mg/d)			
UL	ND	ND	ND
%>UL	—	—	—
Iron (mg/d)			
UL	40	40	40
%>UL	0.2	0.3	0.3
Zinc (mg/d)			
UL	4	4	5
%>UL	86.0	96.8	87.6
Selenium (mcg/d)			
UL	45	45	60
%>UL	0.3	<0.1	5.1
Phosphorus (mg/d)			
UL	ND	ND	ND
%>UL	—	—	—
Sodium (mg/d)			
UL	ND	ND	ND
%>UL	—	—	—
Vitamin A (mcg/d)			
UL	600	600	600
%>UL	38.3	56.3	42.7
Vitamin C (mg/d)			
UL	ND	ND	ND
%>UL	—	—	—
Vitamin B_6 (mg/d)			
UL	ND	ND	ND
%>UL	—	—	—
Cholesterol (mg/d)			
Guidance	na	na	na
%>Guidance	—	—	—

[a]UL for children 2–3.9 y / children 4–4.9 y.
[b]UL for women 14–18 y / women 19–44 y.
[c]UL for pregnant women 14–44 y / lactating women 14–44 y.

NOTES: n = sample size; na = not applicable; ND = not determined, UL not determined due to lack of data of adverse effects; UL = Tolerable Upper Intake Level; %>Guidance = percentage with usual intake greater than the applicable dietary guidance (e.g., cholesterol intake should not exceed 300 mg/d); %>UL = percentage with usual intake greater than UL. Details of these analyses are provided in Tables C-2A through C-2G (micronutrients and sodium) and Tables C-3A through C-3G (cholesterol) in Appendix C—*Nutrient Intake of WIC Subgroups*.

WIC Children		Women, 14–44 y	
1–1.9 y (n = 287)	2–4.9 y (n = 872)	Pregnant or Lactating (n = 123)	Non-Breastfeeding Postpartum (n = 105)
2,500	2,500	2,500	2,500
0.1	<0.1	<0.1	<0.1
40	40	45	45
<0.1	<0.1	0.1	<0.1
7	7 / 12[a]	34 / 40[b]	34 / 40[b]
55.7	58.1	<0.1	<0.1
90	90 / 150[a]	400	400
4.0	9.1	<0.1	<0.1
3,000	3,000	3,500 / 4,000[c]	4,000
<0.1	<0.1	<0.1	<0.1
1,500	1,500 / 1,900[a]	2,300	2,300
63.5	92.8	97.2	90.7
600	600 / 900[a]	2,800 / 3,000[b]	2,800 / 3,000[b]
25.0	16.1	<0.1	<0.1
400	400 / 650[a]	1,800 / 2,000[b]	1,800 / 2,000[b]
<0.1	<0.1	<0.1	<0.1
30	30 / 40[a]	80 / 100[b]	80 / 100[b]
<0.1	<0.1	<0.1	<0.1
na	<300	<300	<300
—	12.2	32.2	8.1

DATA SOURCES: Intake data were obtained from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations) or sodium intake from table salt. All infants and young children were non-breastfed. The ULs were obtained from IOM (1997, 1998, 2000b, 2001, 2002/2005, 2005a). Intake distributions were calculated using C-SIDE (ISU, 1997). Dietary guidance for cholesterol is from the American Heart Association (AHA, 2004) and the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005).

breastfeeding postpartum women had usual sodium intakes above the UL. More than 60 percent of WIC children age one year had usual sodium intakes above the UL. It is noteworthy that the data set used for these analyses did not include dietary sodium added in the form of table salt.

- High proportions of formula-fed WIC infants and WIC children ages 1 through 4 years had estimated usual intakes of zinc and preformed vitamin A that exceeded the UL. Almost 90 percent of formula-fed WIC infants and more than half of WIC children had usual zinc intakes above the UL. About 38 percent of formula-fed WIC infants 0 through 3 months and even higher percentages of formula-fed older WIC infants had usual preformed vitamin A intakes above the UL. High percentages of WIC children also had usual intakes of preformed vitamin A above the UL. The values for preformed vitamin A in Table 2-6 are likely *underestimates* since the data set for these analyses did not include intake from dietary supplements.
- Sizeable proportions of subgroups have saturated fat intakes above the dietary guidance to consume less than 10 percent of total food energy as saturated fat: 91 percent of WIC children ages 2 through 4 years; 81 percent of pregnant and lactating women; and 96 percent of non-breastfeeding postpartum women. About one-third of pregnant and lactating women had usual cholesterol intakes that exceeded the recommended limit of 300 milligrams per day.

Discussion of Results

The results above provide a comprehensive analysis of the nutrient adequacy of the diets of WIC subgroups, focusing on the prevalence of inadequate nutrient intake, risk of excessive intake, and dietary imbalances in macronutrient intake. The results indicate inadequate intakes of a number of micronutrients, particularly vitamin E and magnesium; reported food energy intakes that differ from EERs; excessive intake of saturated fat (expressed as a percentage of total food energy intake); low intakes of calcium, potassium, and fiber; excessive intakes of sodium; and, for some groups, potentially excessive intakes of zinc and preformed vitamin A. The diets of WIC infants and children were more nutritionally adequate than those of adolescent and adult women (pregnant, lactating, and non-breastfeeding postpartum).

Data Limitations

In interpreting these results, several analytic issues should be noted. First, the dietary data used in the analysis (1994–1996 and 1998 Continu-

ing Survey of Food Intakes by Individuals [CSFII]) do not include nutrients from dietary supplements and thus may *overestimate* the true prevalence of inadequacy and *underestimate* the prevalence of excessive intake levels. Second, the differences between mean EER and mean food energy intakes for the women suggest that some women were *underreporting* intakes. If food energy intakes were less than actual energy expenditures for specific subgroups, then individuals could not maintain their body weight, and these subgroups would then experience weight loss. Given the increase in the prevalence of overweight and obesity, however, underreporting of food intakes is the likely explanation for the difference between mean EER and mean food energy intakes.

Given the likely underreporting of food energy intakes by adolescents and adults in general (Mertz et al., 1991; Johansson et al., 1998; Schoeller, 2002), an important question is the extent to which the prevalence of inadequacy for micronutrients was *overestimated* in these analyses for adolescent and adult women in the WIC population. The answer depends on the extent of underreporting and the correlation between food energy intake and micronutrient intakes. Nonetheless, given the very high prevalence of inadequacy for some micronutrients—vitamin E and magnesium in particular—and the low intakes of calcium, it is unlikely that underreporting of food intakes could explain fully the apparent inadequacies in the intakes of these nutrients.

For WIC children, mean food energy intakes were considerably larger than the mean EER for low-income children 1 through 4 years of age. Although the increasing prevalence of overweight and obesity among children is consistent with an excess of food energy intakes over requirements, the magnitude of the difference between mean intake and mean EER suggests that parents or caregivers overreported food intakes of children. To the extent that caregivers overreport the food intakes of children (Devaney et al., 2004), the rates of inadequate nutrient intakes in this report are *underestimates*.

Estimates of Requirements

Although the committee used the DRIs as nutrient standards when redesigning the WIC packages, it was recognized that it would not be possible for a supplemental food package to raise intakes of all priority nutrients to a level that would reduce the prevalence of inadequacy to a very low percentage. This was particularly true for nutrients, such as vitamin E, for which the prevalence of inadequacy was identified as being very high.

Vitamin E—Estimates of dietary intakes of vitamin E were inadequate for large proportions of the population in the data sample, with the prevalence of inadequacy ranging from about 50 percent among children to more than 90 percent among women. Other recent studies also reported inadequate dietary intakes of vitamin E in young children (Devaney et al., 2004), school age children (Suitor and Gleason, 2002), adolescents (Suitor and Gleason, 2002), and adults (Maras et al., 2004). Vitamin E intakes were inadequate even when dietary supplements were included in the analysis (Devaney et al., 2004). Although clinical vitamin E deficiency is rare, low dietary intake of vitamin E may increase the long-term risk of cardiovascular disease (Knekt et al., 1994; Kushi et al., 1996; Iannuzzi et al., 2002; Ford et al., 2003). The committee is aware that the current vitamin E requirements are considered high by some. Nonetheless, the Dietary Guidelines Advisory Committee accepted the DRIs for vitamin E (DHHS/USDA, 2004); the *Dietary Guidelines* state that vitamin E may be a nutrient of concern because of low intake (DHHS/USDA, 2005); and federal nutrition assistance programs such as WIC are required to follow the *Dietary Guidelines* recommendations (U.S. Congress, Pub. L. No. 101-445, 1990). Therefore, vitamin E was considered a priority nutrient for WIC women and children.

Other nutrients also have requirement estimates that are difficult to achieve on a population level (for example, magnesium requirements for adults, the AIs for fiber for children, and AIs for potassium for children and women). If functional consequences of the reported low intakes of such nutrients are not observed, further evaluation of these requirement estimates may be appropriate.

Estimates of Upper Levels

The committee recognized that it would not be feasible to revise the food packages in ways that would substantially reduce the prevalence of excessive intakes for all nutrients with a UL. The zinc and vitamin A ULs for infants and children are particularly problematic because high proportions of the population exceed these ULs. If adverse effects of these reported high intakes are not observed, further evaluation of these ULs may be appropriate in future revisions of the DRIs.

Zinc—Substantial proportions of non-breastfed WIC infants and of WIC children had estimated usual intakes above the UL for zinc, indicating a possible risk of adverse effects. Zinc intakes above the UL have been observed in other analyses (Arsenault and Brown, 2003). The method used to set the ULs for zinc resulted in relatively narrow margins between the UL and the Recommended Dietary Allowance (RDA) or AI; the ULs are 1.7–2.0 times the AI or RDA for infants and 2.3–2.4 times the RDAs for

children (IOM, 2001).[2] There has been no evidence of adverse effects from ingestion of zinc as naturally occurring in food (IOM, 2001; Brown et al., 2004a). However, zinc is added to infant formula and some infant cereal and is also used as a fortificant in some foods that are commonly consumed by children (e.g., breakfast cereal). Further study is needed of the contribution of the zinc in such food products to the possible overconsumption of zinc.

Vitamin A—Additionally, substantial proportions of non-breastfed WIC infants and of WIC children had estimated usual intakes above the UL for preformed vitamin A, indicating a possible risk of adverse effects. The method used to set the ULs for retinol resulted in relatively narrow margins between the UL and the RDA or AI for vitamin A; the ULs are 1.2–1.5 times the AIs for infants and 2.0–2.3 times the RDAs for children (IOM, 2001).[3] Although certain animal-derived food sources of preformed vitamin A can contribute to hypervitaminosis A, toxicity is rare without a supplemental source of retinol (IOM, 2001). Preformed vitamin A is used in infant formula and is also used as a fortificant in some foods that are commonly consumed by children (e.g., fortified milk products and breakfast cereals). Further study is needed of the contribution of the preformed vitamin A in such food products to possible overconsumption of vitamin A.

Priority Nutrients

While the discussion and caveats above suggest caution in interpreting the results presented in this report, concerns persist about dietary inadequacies and excesses. Based on the detailed analyses results, the following nutrients are considered high priority.

- *WIC Infants Under 1 Year of Age, Non-Breastfed*—No nutrients were identified with a high risk of inadequacy. Priority nutrients related to risk of excessive intakes in non-breastfed infants are zinc, preformed vitamin A, and food energy.

[2]For infants, the AI is 2 mg zinc per day for ages 0 through 5 months, and the RDA is 3 mg zinc per day for ages 6 through 11 months; the ULs are 4 and 5 mg zinc per day for ages 0 through 5 months and 6 through 11 months, respectively (IOM, 2001). For children, the RDAs are 3 and 5 mg zinc per day for ages 1 through 3 years and 4 years, respectively; the ULs are 7 and 12 mg zinc per day for ages 1 through 3 years and 4 years, respectively (IOM, 2001).

[3]For infants, the AIs are equivalent to 400 and 500 mcg retinol per day for ages 0 through 5 months and 6 through 11 months, respectively; the UL is 600 mcg retinol per day for all infants (IOM, 2001). For children, the RDAs are equivalent to 300 and 400 mcg retinol per day for ages 1 through 3 years and 4 years, respectively; the ULs are 600 and 900 mcg retinol per day for ages 1 through 3 years and 4 years, respectively (IOM, 2001).

- *Breast-Fed Infants 6 Through 11 Months*—Priority nutrients identified as lacking in the diets of the breast-fed infants six months and older are iron and zinc.
- *WIC Children 1 Through 4 Years of Age*—Priority nutrients identified as lacking in the diets of young children are vitamin E, fiber, and potassium. Nutrients that may be excessive in the diets of young children are zinc, preformed vitamin A, sodium, food energy, and saturated fat.
- *Pregnant, Lactating, and Non-Breastfeeding Postpartum Women*—*Priority* nutrients identified as lacking are calcium, magnesium, vitamin E, potassium, and fiber. Nutrients with more moderate, but still high, levels of inadequacy are vitamins A, C, and B_6, and folate. Nutrients with lower levels of inadequacy are iron, zinc, thiamin, niacin, and protein. Sodium intakes and saturated fat intakes (the latter expressed as a percentage of food energy intakes) are excessive in the diets of pregnant, lactating, and non-breastfeeding postpartum women.

NUTRITION-RELATED HEALTH PRIORITIES

In addition to analyses of nutrient adequacy, a comprehensive examination of nutrition priorities needs to consider nutrition-related health risks. For this analysis of nutrition-related health risks, the committee reviewed epidemiological evidence on body weight status, micronutrients of special concern during reproduction and early childhood, food allergies, and selected environmental risks to the health of women, infants, and children.

Overweight and Obesity

Data from the National Health and Nutrition Examination Survey (NHANES) and Pediatric Nutrition Surveillance System document a substantial increase in the prevalence of overweight and obesity among children and among women of reproductive age (Kuczmarski et al., 1994; Ogden et al., 2002; Flegal et al., 2002). Among nonpregnant women 20 to 39 years of age, 28 percent are obese (Flegal et al., 2002), and overweight and obesity are more common among most minority and low-income groups (Hedley et al., 2004). Among children 6 to 11 years of age, the prevalence of overweight increased from 4 percent in 1965 to 15 percent in 1999–2000 (Ogden et al., 2002). Among children 2 through 5 years in 1999–2000, 10 percent were overweight (Ogden et al., 2002).

The increasing prevalence of overweight and obesity suggests the need to monitor energy intakes and energy expenditure (Koplan and Dietz, 1999; IOM, 2002/2005).

Iron-Deficiency Anemia

Recent data from NHANES suggest that, despite declines in the prevalence of iron deficiency, this deficiency remains a nutrition-related health risk for both children and women of reproductive age. Additionally, reduction of iron deficiency is a goal of *Healthy People 2010* (DHHS, 2000a). Although the prevalence of inadequacy of iron intake by WIC subgroups was lower than that for most nutrients examined (see previous section), a large body of literature suggests that WIC foods contribute to the adequacy of iron intake among low-income women, infants, and children (Yip et al., 1987; Rush et al., 1988c, 1988d; Batten et al., 1990; Rose et al., 1998; Pehrsson et al., 2001; Sherry et al., 2001; Siega-Riz et al., 2004). Because of considerable evidence of the role of the WIC program in reducing iron-deficiency anemia, as well as the important role that iron status plays in child growth and cognitive development, iron remains a priority nutrient, both in terms of the need to increase intakes in some subgroups (e.g., older infants fully breast-fed) and in terms of the importance of maintaining adequate intakes in other subgroups (e.g., infants fed iron-fortified formula).

Folate and Birth Defects

Well-designed studies have documented the relationship between low maternal folate stores and birth defects such as the neural tube defects of spina bifida and anencephaly (Daly et al., 1995). Randomized, controlled clinical trials have shown a protective effect of folic acid in the periconceptional stage (MRC Vitamin Study Research Group, 1991; Czeizel and Dudas, 1992; Czeizel et al., 1994). In response to this information, enriched grain products are required to be fortified with folic acid. Despite the fortification of grain products and a resulting decline in the prevalence of neural tube defects over the last decade (Honein et al., 2001; Mathews et al., 2002; Williams et al., 2002; CDC, 2004f), disparities in folate intake persist (CDC, 2004f), and many women are unaware of the connection between folate intake and birth outcomes (March of Dimes Birth Defects Foundation, 2004). Only 40 percent of women of childbearing age report taking a multivitamin containing folic acid on a regular basis (CDC, 2004h; March of Dimes Birth Defects Foundation, 2004). Despite numerous public health messages targeted to women of reproductive age, a low percentage of women in this age group use a multivitamin supplement or other measures that may contribute to optimal folate status (March of Dimes Birth Defects Foundation, 2003, 2004).

Other Nutrition-Related Health Risks

The committee identified several other nutrition-related health risks and outcomes in its review of epidemiological evidence.

- *Vitamin D and Bone Health*—Recent evidence suggests that vitamin D deficiency may be re-emerging as a health concern, especially for population subgroups in regions with seasonal variation in exposure to sunlight (Kreiter et al., 2000). Despite some controversy about the actual prevalence and public health significance of vitamin D deficiency,[4] a calcium- and vitamin D-rich diet is important during periods of peak bone mass accretion (Raisz, 1999; Curran and Barness, 2000; Branca and Vatueña, 2001; New, 2001; Calvo and Whiting, 2003). The *Dietary Guidelines* note the importance of dietary sources of vitamin D for the elderly, persons with dark skin, and those with insufficient exposure to ultraviolet B radiation (DHHS/USDA, 2005). Recommendations from the American Academy of Pediatrics note the importance of vitamin D supplementation of breast-fed infants (AAP, 2005).
- *Zinc and Breast-Fed Infants 6 Through 11 Months*—Chemical analyses of breast milk at various stages of lactation indicate that at 6 through 11 months postpartum, the zinc (and iron) content of breast milk alone is not sufficient for older infants (Krebs, 2000; Dewey, 2001; Krebs and Westcott, 2002). Thus, the content and bioavailability of zinc (and iron) in complementary foods become very important for fully breast-fed infants.
- *Calcium Intake and Lead Exposure*—Studies of calcium intakes and exposure to lead suggest that adequate calcium intake has an added benefit of decreasing blood lead levels in pregnant women and lactating women (Hertz-Picciotto et al., 2000; Hernandez-Avila et al., 2003).
- *Dioxins*—Dioxins are low-level environmental contaminants, but their presence in animal feed, food and water resources for animals in the wild (e.g., fish), and the human food supply is widespread. Because dioxins have a variety of potential toxic effects, including developmental effects on

[4]There is recent evidence that vitamin D intakes are inadequate for adolescent and adult women of reproductive age (Moore et al., 2004). However, vitamin D intakes appeared adequate for children ages 1 to 8 years (Moore et al., 2004), indicating that vitamin D intakes are likely to be adequate among children in these age groups on a population basis. Nevertheless, vitamin D deficiency has been reported in population subgroups or the whole population in regions with seasonal variation in exposure to sunlight (Daaboul et al., 1997; Lawson and Thomas, 1999; Lawson et al., 1999; Kreiter et al., 2000; Dawodu et al., 2003). Thus, whether inadequate intakes of vitamin D are a public health concern remains controversial.

the fetus and infant, it is prudent to minimize their exposure whenever possible (ATSDR, 1998). Almost all current human exposure occurs through food, and the large majority of that through consumption of fat from animal sources (IOM, 2003b). A reduction in the consumption of fat from animal sources will reduce exposure to these toxicants.

- *Methylmercury*—Consumption of fish or shellfish is an important part of the diet of women and young children (NRC, 1989b). However, almost all fish and shellfish contain some methylmercury, an environmental contaminant that is hazardous to the fetus and to the nervous system of young children at excessive exposures (ATSDR, 1999; CFSAN, 2001; EPA/FDA, 2004; CDC, 2004a). Certain types of fish and shellfish contain high levels of methylmercury. The FDA and EPA advise "women who may become pregnant, pregnant women, nursing mothers, and young children to avoid some types of fish and eat fish and shellfish that are lower in mercury" (EPA/FDA, 2004).

Summary of Nutrition-Related Health Priorities

The review of nutrition-related health risks indicates several nutrient and food priorities for all WIC subgroups—obesity, poor iron status, and contamination of food with dioxin and methylmercury. Low folate intake is a concern for all women during their reproductive years because of its importance in preventing neural tube defects. Insufficient calcium intake for pregnant and breastfeeding women may be associated with potential lead toxicity for the fetus and infant. Low intake of vitamin D is a potential concern for women of reproductive age. Inadequate zinc intake is a concern for breast-fed infants 6 through 11 months of age. These nutrition-related health risks are summarized in Table 2-7.

FOOD GROUP PRIORITIES

To determine whether specific foods or types of food should receive priority in the redesign of WIC food packages, the committee reviewed information about dietary guidance, amounts of foods consumed by groups that potentially are eligible for the WIC program, and the amounts of foods in current WIC food packages. The assessment gave heavy weight to the federal requirement that the WIC program promote the *Dietary Guidelines for Americans* in carrying out its program (Pub. L. No. 101-445, U.S. Congress, 1990). To do this, the committee used the newly released the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005) as the source of dietary guidance for children ages two years and older and widely accepted dietary guidance from professional groups for children under 2 years of age. This section summarizes the results of the committee's assessment.

TABLE 2-7 Summary of Nutrition-Related Health Risks

Nutrient or Food Component	Health Concern	WIC Subgroup
Vitamin D	Low intake of vitamin D; poor bone health	All women Fully breast-fed infants
Folate	Low intake of folate; birth defects persist	All women
Calcium	Low intake of calcium; lead exposure persists	Pregnant women and lactating women
Iron	Iron-deficiency anemia persists	Women, infants, and children
Zinc	Low amount of zinc in breast milk after 6 mo postpartum	Fully breast-fed infants, 6–11.9 mo
Food energy	Comorbidities of obesity	Women, infants, and children
Dioxins	Developmental effects	Women, infants, and children
Methylmercury	Adverse effects on nervous system	Women, infants, and children

Low-Income Children Ages 2 Through 4 Years and Women

Using data from Pyramid Serving Data, (FSRG, 1999), Table 2-8 shows mean numbers of servings of foods from five basic food groups and for selected food subgroups. It also gives the mean number of teaspoons of added sugars consumed. To allow comparison of the means with the newly released dietary guidance, Table 2-8 also shows the daily amount specified in the revised USDA food pattern for 1,000 to 1,600 kilocalories (which covers the energy range for most young children) and the daily amount for the 2,000 kilocalories food pattern (which would meet the needs of many of the women served by the WIC program). The income level used—under 131 percent of the federal poverty level—is the level publicly available that is most representative of the WIC population (FSRG, 1999). Results are very similar to those for individuals of all incomes (FSRG, 1999)

Children Ages 2 Through 4 Years

The biggest shortfalls in reported intake were for food subgroups rather than major food groups, especially for whole grains and dark green leafy vegetables. Mean intakes of dark green leafy vegetables, deep yellow vegetables, and legumes were very low compared with the revised USDA pattern. These subgroups are rich in a number of the nutrients of concern identified above. Similarly, whole grains are a better source of fiber and

certain other nutrients than are refined grains, but mean intake of whole grains was less than one serving in a day.

The *Dietary Guidelines* (DHHS/USDA, 2005) set no specific limits on added sugars but urge that intake be limited as needed to allow for the intake of essential nutrients without exceeding energy needs. The revised USDA food patterns specify teaspoons of sugar only as an example. Added sugars may improve the palatability of some food, and, in some cases, added sugars may lead to increased intake of foods (e.g., milk, breakfast cereal) that are excellent nutrient sources (Frary et al., 2004). However, the mean amount of added sugars consumed (about 1/3 cup) provides no essential nutrients while providing about 240 kilocalories. Based on this information, the committee determined that added sugars should be limited, but, as shown in Table 4-3 (Chapter 4—*Revised Food Packages*), it allows selected foods to contain small specified amounts of added sugars.

Women in the Childbearing Years

Among women, mean intake of whole grains was much lower than the three one ounce-equivalents recommended by the *Dietary Guidelines* (DHHS/USDA, 2005) (see Table 2-8). Intakes of dark green leafy vegetables, deep yellow vegetables, and cooked dry beans and peas were much lower than the amounts specified in the revised USDA pattern. Reported intakes from the dairy group also were much lower than the newly recommended three servings per day.

Mean intake of added sugars by the teens (20 teaspoons) was somewhat greater than that by the women (17 teaspoons). Added sugars would provide about 320 and 270 kilocalories per day, respectively—more than is easily compatible with meeting recommended nutrient intakes without exceeding energy needs.

Summary for Children Ages 2 Through 4 Years and Women in the Childbearing Years

Examining the data in the light of the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005), the following concerns have been identified.

- *Children*—Intakes tend to be low in whole grains and in dark green leafy vegetables, deep yellow vegetables, and cooked dry beans and peas rather than vegetables in general.
- *Women*—Intakes tend to be low in whole grains, dark green leafy vegetables, deep yellow vegetables, cooked dry beans and peas, fruits, and milk and milk products.
- *Overall*—Intakes of whole grains, vegetable subgroups excluding

TABLE 2-8 Mean Numbers of Servings from Five Basic Food Groups with Selected Subgroups and Mean Teaspoons of Added Sugars Consumed by Selected Age Groups, Income Under 131 Percent of Federal Poverty Level

Food Group and Food Subgroups	Amount in Revised USDA 1,000–1,600 Kcal Pattern (daily or weekly)	Mean Number of Servings[a] Consumed Daily by Children	
		Males, 2–5 y	Females, 2–5 y
Grains, total	3–6 oz equiv/d[b]	6.3	6.0
Whole grain	3 oz equiv/d[c]	0.8	0.8
Vegetables, total	2–4/d	2.3	2.3
Dark green leafy	2–4/wk	†	0.1
Deep yellow	1–3/wk	0.1	0.1
Dry beans/peas, cooked	1–5/wk	0.2	0.2
White potatoes	3–5/wk	1.0	1.0
Other starchy vegetables	3–5/wk	0.2	0.2
Tomatoes	8–11/wk	0.4	0.3
Other vegetables	8–11/wk	0.4	0.4
Fruits, total	2–3/d	1.9	1.8
Citrus, melons, berries	—	0.7	0.8
Dairy, total[d]	2/d	1.8	1.8
Milk	—	1.5	1.5
Yogurt	—	†	†
Cheese	—	0.3	0.3
Meat and Alternatives[e]	2–5 oz equiv/d[f]	3.2 ‡	3.0 ‡
Meat	—	1.1	1.1
Poultry	—	0.8	0.7
Fish	—	0.1	0.2
Organ meat	—	†*	†*
Frankfurter/lunch meat	—	0.7	0.6
Eggs	—	0.4	0.3
Soybean products	—	†*	†*
Nuts and seeds	—	0.1	0.1
Added Sugars	4–5 tsp/d[g]	13.9	14.0

[a]Servings from each food group: fruits and vegetables, 1/2 cup or equivalent; grains, 1 oz dry or 1/2 cup cooked; dairy, 1 cup milk or equivalent; meat and meat alternatives, equivalent to 1 oz of lean meat.

[b]For the grain food group a 1 oz equiv is equal to: 1 slice of bread; 1 cup dry cereal; or 1/2 cup cooked rice, pasta, or cereal (USDA/DHHS, 1992).

[c]Three whole grain one ounce-equivalents per day is the minimum amount specified by the Dietary Guidelines Advisory Committee regardless of the total number of servings of grain (DHHS/USDA, 2004). The *Dietary Guidelines for Americans 2005* specifies a minimum of 3 whole grain one ounce-equivalents per day (DHHS/USDA, 2005); a general recommendation is also provided that at least half the total grain servings should be whole grain (DHHS/USDA, 2005). The revised USDA food patterns specify that half the total number of servings of grain be whole grain.

[d]Intakes include small amounts of miscellaneous dairy products, such as whey and nonfat sour cream, that are not included in the subgroups milk, yogurt, and cheese.

[e]Intakes exclude dry beans and peas (i.e., legumes) because they were tabulated as vegetables. Dry beans and peas may be counted either as vegetables or in the meat group, but not both.

Amount in Revised USDA 2,000 Kcal Pattern (daily or weekly)	Mean Number of Servings[a] Consumed Daily by Women	
	12–19 y	20–39 y
6 oz equiv/d[b]	6.3	5.4
3 oz equiv/d[c]	0.9	0.8
5/d	2.8	2.8
6/wk	0.1	0.1
4/wk	0.1	0.1
6/wk	0.2	0.2
6/wk	1.2	0.7
	0.1	0.2
~2/d	0.5	0.4
	0.7	1.0
4/d	1.1	1.2
—	0.6	0.6
3/d	1.4	1.1
—	0.9	0.7
—	†	†
—	0.4	0.4
5.5 oz equiv/d[f]	4.3	4.3
—	1.9	1.7
—	0.9	1.1
—	0.2	0.4
—	†*	†*
—	0.8	0.6
—	0.4	0.4
—	†*	†*
—	0.1	0.1
10–12 tsp/d[g]	22.6	18.7

[f]For the meat and bean food group a 1 oz equiv is equal to: 1 oz of cooked lean meats, poultry, or fish; 1 egg; 1/4 cup cooked dry beans; or 1 tablespoon of peanut butter (DHHS/USDA, 2004, 2005).

[g]Example of how remaining (discretionary) calories might be distributed if a person consumes recommended amounts of foods in their fat-reduced, no added sugars forms.

NOTES: † = value less than 0.05 but greater than 0; ‡ = recommended minimum number of servings is different for specific subgroups; * = statistical reliability is reduced due to small cell size; kcal = kilocalories; oz equiv = ounce equivalents; tsp = teaspoon. ~ indicates approximate amount.

DATA SOURCES: Intake date were obtained from 1994–1996 Continuing Survey of Food Intakes by Individuals (CSFII) and are 2-day average intakes based on daily intakes (FSRG, 1999). Available sample size information may be found in the "Appendix A table" of this online report (FSRG, 1999). Daily amounts in revised USDA patterns were obtained from "Appendix A-2" of the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005, pg. 53).

potatoes and other starchy vegetables, fruits, milk and milk products, and meat are all lower than recommended on average. Data are not available on the extent to which fruit juice intake exceeds recommendations.

Low-Income Children Younger Than 2 Years of Age

To identify food-related priorities for infants and children younger than 2 years of age, the committee obtained descriptive information about their food intakes and examined the data in relation to objectives in *Healthy People 2010* (DHHS, 2000a, 2000b) and to widely accepted dietary guidance from the American Academy of Pediatrics, the American Dietetic Association, and other selected sources (see Table 2-9).

In 2002, reported breastfeeding rates for WIC participants were about 60 percent in the first week postpartum and 22 to 26 percent at six months (Abbott Laboratories, 2003; Li et al., 2005). These rates are substantially lower than the *Healthy People 2010* (DHHS, 2000b) objectives of 75 percent in the early postpartum period and 50 percent at six months.[5] Furthermore, rates for WIC participants are about 20 percentage points lower than the rates for non-WIC infants (Abbott Laboratories, 2003; Li et al., 2005).

Much of the dietary guidance related to feeding infants and young children addresses when to introduce foods of different types and feeding a varied, healthful diet to toddlers (see Table 2-9). A study of WIC participants (Bayder et al., 1997) and the Feeding Infants and Toddler Study found that many infants are introduced to foods earlier than recommended. For example, almost 30 percent of infants were fed complementary foods before age four months (Briefel et al., 2004a), and almost 25 percent of infants ages 9 through 11 months were fed cow's milk (Bayder et al., 1997; Briefel et al., 2004a). Fruit juice intake exceeded recommendations for about 60 percent of the children (Skinner et al., 2004), and non-juice fruit and vegetable consumption was low, with approximately 30 percent of infants and toddlers consuming no fruits or vegetables (Fox et al., 2004). The most common vegetable consumed by toddlers 15 months and older was fried potatoes (Fox et al., 2004). Most caregivers in the Feeding Infants and Toddlers Study reported offering a new food to infants or toddlers no more than 3 to 5 times before deciding that their infant or toddler disliked it (Carruth et al., 2004), whereas research suggests 8 to 15 exposures may be necessary for acceptance (Sullivan and Birch, 1994; Birch and Fisher, 1995).

[5] *Healthy People 2010* includes the breastfeeding objective of 25 percent of mothers breastfeeding at 12 months postpartum (DHHS, 2000b).

TABLE 2-9 Dietary Guidance for Infants and Children Under the Age of Two Years

Breastfeeding	*Source*
Breastfeeding is the preferred method of infant feeding because of the nutritional value and health benefits of human milk.	AAP, 2004, 2005
Encourage breastfeeding with exclusion of other foods until infants are around 6 months of age.[a]	AAP, 2005; WHO, 2002
Continue breastfeeding for first year after birth.	AAP, 2004, 2005
Continue breastfeeding into second year after birth if mutually desired by the mother and child.	AAP, 1997, 2001b, 2004, 2005; Kleinman, 2000
Formula Feeding	*Source*
For infants who are not currently breastfeeding, use infant formula throughout the first year after birth.	Kleinman, 2000; AAP, 2004, 2005
Infant formula used during the first year after birth should be iron-fortified.	AAP, 1999, 2001b, 2004, 2005
Infants with specific medical conditions may require medical formula and this should be readily available through projects such as the WIC program.	AAP, 2001b
Feeding Other Foods to Infants and Young Children	*Source*
Introduce semisolid complementary foods gradually beginning around 6 months of age.[a]	Kleinman, 2000; WHO, 2001a, 2002; AAP, 2005
Introduce single-ingredient complementary foods, one at a time for a several day trial.	AAP, 2004
Introduce a variety of semisolid complementary foods throughout ages 6–12 mo.	WHO, 2001a
Encourage consumption of iron-rich complementary foods during ages 6–12 mo.	AAP, 2001a, 2004, 2005
Avoid introducing fruit juice before 6 mo of age.	Kleinman, 2000; AAP, 2001a, 2004
Limit intake of fruit juice to 4–6 fl oz/d for children ages 1–6 y.	Kleinman, 2000; AAP, 2001a, 2004, 2005
Encourage children to eat whole fruits to meet their recommended daily fruit intake.	AAP, 2001a, 2004

continues

TABLE 2-9 Continued

Delay the introduction of cow's milk until the second year after birth.	AAP, 1992a, 2004, 2005
Cow's milk fed during the second year after birth (that is, ages 1–1.9 y) should be whole milk.	AAP, 1992b, 1998
Developing Healthy Eating Patterns	*Source*
Provide children with repeated exposure to new foods to optimize acceptance and encourage development of eating habits that promote selection of a varied diet.	ADA, 1999c, 2004
Prepare complementary foods without added sugars or salt (i.e., sodium).	AAP, 2004
Promote healthy eating early in life.	ADA, 1999c, 2004
Promoting Food Safety	*Source*
Avoid feeding hard, small, particulate foods up to age 2–3 y to reduce risk of choking.	Kleinman, 2000; AAP, 2004

[a]There is acknowledged disagreement among experts on the subject of timing of introduction of complementary foods (AAP, 2004, 2005). Many organizations that support maternal and child health currently recommend exclusive breastfeeding (i.e., feeding of no food or beverages other than breast milk with the exception of medications and vitamin or mineral supplements) for the first **six** months after birth (AAP, 1997; UNICEF, 1999; ACOG, 2000; AAFP, 2005; WHO, 2001b). The rationale for the recommendation to encourage breastfeeding with exclusion of other foods until infants are around six months of age is summarized in the following quotes from the most recent policy statement from the American Academy of Pediatrics (AAP, 2005).

- "Exclusive breastfeeding is sufficient to support optimal growth and development for approximately the first 6 months after birth and provides continuing protection against diarrhea and respiratory tract infection." "There is a difference of opinion among AAP experts on this matter. The Section on Breastfeeding acknowledges that the Committee on Nutrition supports introduction of complementary foods between 4 and 6 months of age when safe and nutritious complementary foods are available."
- Regarding exclusive breastfeeding of infants—"Complementary foods rich in iron should be introduced gradually beginning around 6 months of age."
- Regarding exclusive breastfeeding of infants—"Introduction of complementary feedings before 6 months of age generally does not increase total caloric intake or rate of growth and only substitutes foods that lack the protective components of human milk."

DATA SOURCES: Dietary guidance is from: the American Academy of Pediatrics (AAP, 1992a, 1992b, 1997, 1998, 1999, 2001a, 2001b, 2004, 2005; Kleinman, 2000); the American Dietetic Association (ADA, 1999c, 2004); and the World Health Organization (WHO, 2001a, 2002).

Summary for Infants and Children Younger Than 2 Years of Age

Examining the data in the light of *Healthy People 2010* (DHHS, 2000a, 2000b) and dietary guidance from professional groups (see Table 2-9), the committee identified the following concerns:

- Breastfeeding rates are below the nationwide objectives. This affects the health both of mothers and infants.
- For many infants, complementary foods and beverages (juice and cow's milk) are introduced earlier than recommended.
- For many infants and toddlers, fruit juice intake substantially exceeds recommendations.
- Most older infants and young toddlers have limited exposure to different fruits and vegetables.

SUMMARY

Based on the information presented above and documented in greater detail in Appendix C—*Nutrient Intake of WIC Subgroups*, the committee developed the following list of nutrient and food priorities (Table 2-10). Additional key points about food choices are the following:

- The dietary practices of most concern for the infants and toddlers younger than 2 years of age include the short duration of breastfeeding, excessive consumption of fruit juice, early introduction of solid food and cow's milk, low consumption of fruits (other than juice) and vegetables, and infrequent exposure to new foods.
- Examination of foods in the current WIC packages shows that there is room for improvement to become more consistent with current dietary guidance.

TABLE 2-10 Nutrient and Food Group Priorities for Revision of the WIC Food Packages

Participant Category	Nutrients of Concern with Regard to Inadequate Intake
Infants, younger than 1 y, non-breastfed	No need identified to increase particular nutrients; maintain iron intakes and continue to provide a balanced set of essential nutrients[a]
Infants, 6–11.9 mo, breast-fed	Increase intakes of: Iron and Zinc
Children, 12–23.9 mo	Increase intakes of: Iron, Potassium, Vitamin E, and Fiber
Children, 2–4.9 y	Increase intakes of: Iron, Potassium, Vitamin E, and Fiber
Adolescent and adult women of reproductive age	*Give highest priority to increasing intakes of:* Calcium, Iron, Magnesium, Potassium, Vitamin E, and Fiber *Also try to increase intakes of:* Vitamin A, Vitamin C, Vitamin D, Vitamin B_6, and Folate

[a]Iron intakes are apparently adequate for non-breastfed infants, probably due in part to provision of iron-fortified formula in the current WIC food packages. The committee recommends that the WIC program continue to provide iron-fortified formula to prevent iron-deficiency anemia.

[b]The Tolerable Upper Intake Level applies only to preformed vitamin A (i.e., retinol) ingested from the combined sources of animal-derived foods, fortified foods, and dietary supplements (IOM, 2001).

Priority Food Groups	Nutrients of Concern with Regard to Excessive Intake	Nutrients and Ingredients to Limit in the Diet
na	Decrease intakes of: Zinc, Vitamin A, preformed,[b] and Food energy	
na		
Increase intakes of a *variety of nonstarchy vegetables*.	Decrease intakes of: Zinc, Vitamin A, preformed,[b] and Food energy	
Increase intakes of *whole grains*, and a *variety of nonstarchy vegetables*.	Decrease intakes of: Zinc, Sodium, Vitamin A, preformed,[b] and Food energy	Limit intakes of: Saturated fat, Cholesterol, and Added sugars
Increase intakes of *whole grains*, a *variety of nonstarchy vegetables*, *fruit*, and *fat-reduced milk products*.	Decrease intakes of: Sodium, Food energy, and Total fat	Limit intakes of: Saturated fat, Cholesterol, *Trans* fatty acids,[c] and Added sugars

[c]*Trans* fatty acids have not specifically been identified as a hazard for infants and children, and thus are shown in the table as nutrients to limit only in the diets of adolescents and adults (IOM, 2002/2005). However, the dietary guidance to limit *trans* fatty acids from processed foods in the diet is presumed to apply to all individuals regardless of age.

NOTE: na = not applicable.

3

Process Used for Revising the WIC Food Packages

This chapter describes the approach the committee used in revising the WIC food packages. The approach involved evaluating the current food packages in relation to the criteria identified in the first phase of this study (Box 1-1—*Criteria for a WIC Food Package* in Chapter 1—*Introduction and Background*). Criteria 1, 2 and 3 include consideration of the priority nutrients and priority food groups that also were identified in Phase I of the study. The process then proceeded to considering public comments; deciding on the configuration of the packages (possible modifications to the types of packages); identifying food items that could be deleted or reduced in quantity to make room for the inclusion of others without increasing cost; identifying candidate foods and quantities to be added to the revised packages; and engaging in iterative analyses to evaluate potential packages with regard to cost and impact on nutrient content. This chapter addresses the need for flexibility, highlights issues relating to priority nutrients and priority food groups, and discusses each step in the decision making process.

Figure 3-1 illustrates the process the committee used in developing its recommendations.

THE NEED FOR FLEXIBILITY

The six criteria that the committee used are broad and interrelated goals that would be impossible to meet with a rigid prescription for the WIC food packages; thus, greater flexibility became a hallmark of the committee's recommendations. For example, Criterion 5 suggests that the

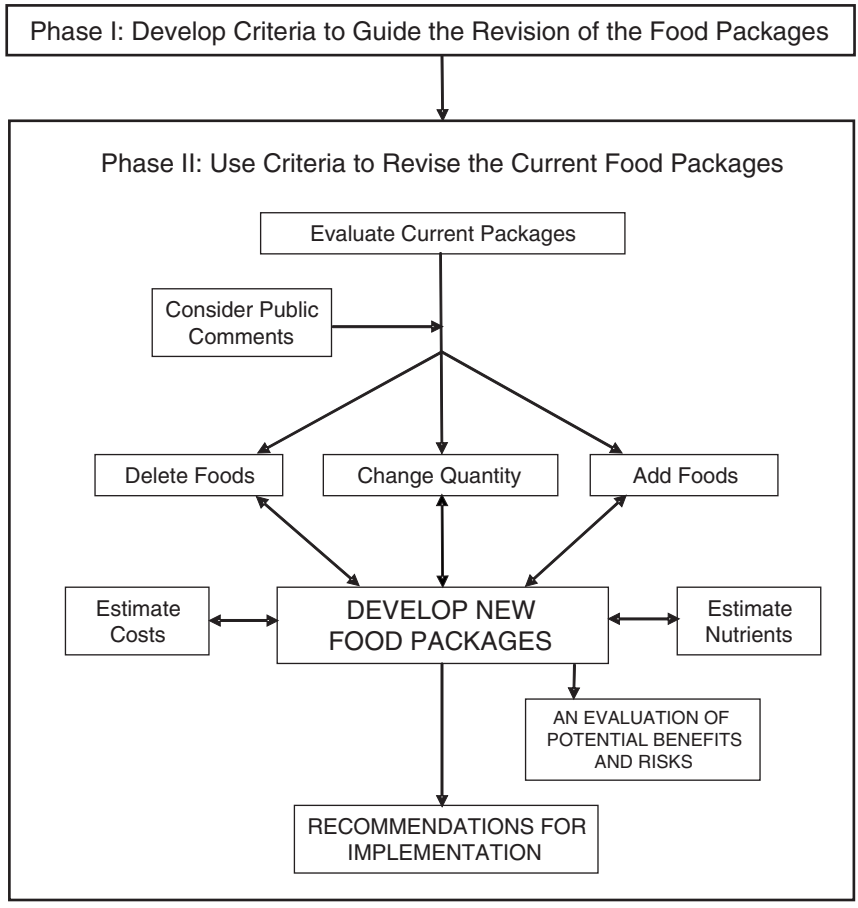

FIGURE 3-1 Schematic representation of process used for revising the WIC food packages.

packages need to take into account cultural food preferences, but preferences vary among states and regions of the United States. Likewise, foods that achieve the nutrient and food guidance goals presented in the first two criteria may not be commonly consumed or readily acceptable in a particular location, as specified by Criterion 5. Foods that might be considered the most desirable (Criterion 5) may require refrigeration or cooking facilities that are not readily available to some low-income families (Criterion 4). To address all the criteria simultaneously, the committee used an approach that would allow more flexibility at the WIC state agency level and more variety and choice at the participant level.

The process of revising the food packages also called for the committee to be flexible in its approach to the overall set of packages. When considering how to promote breastfeeding (Criterion 3), for example, the committee did not focus on the new mothers only. Instead, the committee considered the relative value of the food packages for breastfeeding mother/infant pairs compared to the value of the food package for non-breastfeeding mother/infant pairs.

PRIORITY FOOD GROUPS AND NUTRIENTS

Foods and nutrients of highest priority, either because of inadequate or excessive intake levels, were identified in Phase I of the study. As discussed in Chapter 2—*Nutrient and Food Priorities*—the committee used three types of evidence in identifying priority foods and nutrients: (1) food choices and dietary patterns of WIC-eligible subgroups relative to the report of the Dietary Guidelines Advisory Committee (DHHS/USDA, 2004) and other dietary guidance; (2) results from an analysis of the nutrient adequacy of the WIC categorical subgroups; and (3) published information on nutrition-related health outcomes.

The results of the committee's analyses of nutrient intakes based on data from the Continuing Survey of Food Intakes by Individuals (CSFII) 1994–1998 were presented in a preliminary report (IOM, 2004b). After the preliminary report was published, the committee undertook additional nutrient analyses to analyze selected nutrients more thoroughly. The set of analyses of nutrient intakes used to support the nutrient priorities are in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

Table 2-10 of Chapter 2—*Nutrient and Food Priorities*—summarizes the nutrient and food group priorities for revising the WIC food packages. The following is a brief summary of the priorities for change highlighted in Table 2-10.

Food group priorities—Increase the consumption of fruits and vegetables, whole grains, and fat-reduced milk (for children 2 years and older and women); limit intakes of foods with added sugars, saturated fat, cholesterol, and *trans* fatty acids[1]; promote breastfeeding of infants; introduce complementary foods at about six months of age; limit juice intake to recommended amounts; and delay introduction of cow's milk until 1 year of age.

Nutrient priorities because of inadequate intakes—No priority to increase nutrient intakes of formula-fed infants under 1 year of age; increase in-

[1]The term *trans fatty acids* refers to unsaturated fatty acids that contain at least one double bond in the *trans* configuration (that is, with carbon atoms on opposite sides of the longitudinal axis of the double bond).

take of iron and zinc for breast-fed infants 6 through 11 months; increase intake of iron, potassium, vitamin E, and fiber for children 1 through 4 years; increase intake of calcium, iron, magnesium, potassium, vitamin A, vitamin D, vitamin E, vitamin C, vitamin B_6, folate, and fiber for adolescent and adult women of reproductive age.

Nutrient priorities because of excessive intakes—Decrease intake of zinc and preformed vitamin A for formula-fed infants under 1 year of age and children ages 1 through 4 years; decrease intake of food energy and sodium for children beginning at age 2 years and for women; and decrease intake of total fat for women. Limit saturated fat, cholesterol, *trans* fat, and added sugars for children beginning at age 2 years and for women.

COMPARING CURRENT FOOD PACKAGES WITH DIETARY GUIDANCE

The committee examined how the current WIC food packages compare with dietary guidance provided by the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005) for those 2 years and older and by widely accepted dietary guidance from professional groups for infants and children younger than 2 years. Table 3-1 summarizes the most recent dietary guidance that is related to foods in current WIC food packages. For example, one can see that the inclusion of dried beans and peas in the current food packages is consistent with dietary guidance to consume dried peas and beans. In other cases (e.g., lack of specification of the type of milk, lack of promotion of whole grains), the correspondence with dietary guidance is weaker.

In several cases, the maximum number of servings provided by the current WIC food packages exceeds the number of servings recommended. For example, several packages provide more than the recommended amount of milk or milk products, and packages for infants and young children exceed recommendations for juice. Currently, the WIC food packages contribute no vegetables except (1) the option of dried peas and beans rather than peanut butter and (2) carrots for breastfeeding women. The packages provide no whole fruits for any participants. Whole grain cereals are among the choices available to participants, but participants may select refined grains if they prefer.

CONSIDERING PUBLIC COMMENTS

The committee considered all of the many public comments it received directly and those that had been submitted to USDA (as shown schematically in Figure 3-1). (See also section in Chapter 1—*Introduction and Background—Many Stakeholders Are Calling for Change*.) Public comments

TABLE 3-1 Dietary Guidance Related to Foods in Current WIC Food Packages.

Foods in Current WIC Food Packages	Dietary Guidance for Feeding Infants and Toddlers	Guidance from *Dietary Guidelines for Americans 2005*[a]
Iron-fortified infant formula	**Breastfeeding recommended for at least 1 y** (DHHS, 2000b; AAP, 1997, 2004, 2005; Kleinman, 2000); if formula-fed, iron-fortified formula recommended (Kleinman, 2000; AAP, 2004, 2005)	NR
Vitamin C-rich juice (about 3 fl oz/d for infants, >9 fl oz/d for children, 6–11 fl oz/d for women)	**Limit intake of fruit juice to 4–6 fl oz/d for children ages 1–6 y** (Kleinman, 2000; AAP, 2001a, 2004, 2005)	**Consume whole fruit** (fresh, frozen, canned, dried) **rather than fruit juice for a majority of the suggested total daily amount** to promote adequate fiber intake.
Iron-fortified infant cereal	Introduce iron-rich complementary foods beginning around age 6 mo (AAP, 2001a, 2004, 2005)	NR
High-iron, low-sugar cereal,[b] may be hot or cold, refined or whole grain	NR	**Increase intake of whole grains** to at least three servings daily
Milk, may be whole milk or fat-reduced types[b]	No cow's milk before age 1 y (AAP, 1992a, 2004, 2005) Whole milk for toddlers age 1 y (AAP, 1992b, 1998)	Consume 3 c per day of **low-fat or fat-free milk or equivalent milk products** (2 c for young children)

continues

TABLE 3-1 Continued

Cheese, fat content not specified[b]	NR	When selecting milk or milk products, **make choices that are fat-reduced.**
Eggs[b]	NR	Limit cholesterol intake to less than 300 mg/d
Dry beans or peas[b] *and/or*	NR	About 3 c of cooked legumes per week for women, smaller amounts for children
Peanut butter[b,c]	Avoid eating peanut butter from a spoon for safety reasons until age 3 y (AAP, 2004)	Counted as part of the meat group
Tuna (canned)—breastfeeding women only	na	Counted as part of the meat group. Evidence suggests about two servings of fish per week may reduce the risk of mortality from coronary heart disease. Avoid white tuna (albacore) because of mercury content.
Carrots—breastfeeding women only	na	**Increase intake of fruits and vegetables.**

[a]For persons ages 2 years and older (DHHS/USDA, 2004, 2005)

[b]Beginning at age 1 year

[c]Peanut butter is a source of vitamin E, identified as a nutrient of concern with regard to inadequate intake (Table 2-10, Chapter 2—*Nutrient and Food Priorities*).

NOTES: na = not applicable; NR = no recommendation. **Bold** font highlights topics needing more attention when revising the food packages.

DATA SOURCES: Dietary guidance for feeding infants and toddlers is from several sources: American Academy of Pediatrics (AAP, 1992a, 1992b, 1997, 1998, 2001a, 2001b, 2004, 2005; Kleinman, 2000); *Healthy People 2010* (DHHS, 2000b); 2005 Dietary Guidelines for Americans Advisory Committee Report (DHHS/USDA, 2004); and *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005).

were received by the committee during three public sessions held during the course of the study; and many other public comments were submitted in letters or via e-mail. Among the public comments were two carefully researched position papers by the National WIC Association (NAWD, 2000; NWA, 2003) and presentations and written comments by food industry representatives and vendors, representatives of public interest groups, former WIC participants, WIC staff from a number of state agencies, academicians, and others. Examples of the points of view that were most prevalent among the public comments are listed here, by type of food package.

Women's food packages

- Offer fruit and vegetables to partially or fully replace juice.
- Offer alternative milk products (e.g., yogurt).
- Offer alternatives to milk and milk products (e.g., soy beverage ["soy milk"], tofu).
- Offer alternatives to eggs, peanut butter, and dried beans (e.g., canned chicken, canned beans).
- Decrease the amount of juice, cheese, eggs, and milk.
- Reduce or eliminate canned tuna because of concerns about methylmercury (e.g., offer canned salmon, chicken, or sardines as options).
- Allow partial replacement of cereals by other whole grains.
- Re-examine the policy of allowing partially breastfeeding woman to receive Food Package V while at the same time her infant is eligible to receive the maximum allowance of infant formula.

Infants' food packages

- Create policies that allow breastfeeding infants to receive a food package consistent with their nutritional needs.
- Re-examine the policy of providing formula for the infant of a breastfeeding woman, especially in the first few weeks, as this policy may undermine a woman's commitment to breastfeed successfully.
- Minimize the allowance of formula for *partially* breast-fed infants; and provide only powdered formula, which has a longer shelf life than concentrated formula. This would allow the mother to use small quantities as needed.
- Re-examine the policy of allowing a partially breastfeeding woman to receive Food Package V while at the same time her infant is eligible to receive the maximum allowance of infant formula.
- Reduce the amount of infant formula provided or eliminate formula except under exceptional medical or social situations.
- Do not provide juice before 6 months of age.

Food package for children ages 1 through 4 years

- Offer fruits and vegetables to replace juice either partially or fully.
- Offer alternative milk products (e.g., yogurt).
- Offer alternatives for children who are allergic to milk, eggs, and peanut butter.
- Decrease the amounts of juice, cheese, eggs, and milk.

Food packages for those with special dietary needs

- Eliminate Food Package III. Instead, have the other food packages cover those with special dietary needs, allowing substitutions to be prescribed as needed.
- Include infants with special dietary needs in Food Package III. (Currently Food Package III is provided only for women and children, not infants.)
- Expand Food Package III to include other WIC-approved foods beyond formula, juice, and cereal.

IDENTIFYING FOODS THAT COULD BE DELETED OR REDUCED IN QUANTITY

Because cost neutrality was required, new foods could be added to the food packages only if some of the current foods were deleted or reduced in amount. Thus, early in the process, the committee considered ways to pare down the current food packages (as shown schematically in Figure 3-1). Decisions regarding food reductions and deletions and their rationale are summarized in Table 3-2.

IDENTIFYING CANDIDATE FOODS FOR ADDITION TO THE PACKAGES

The committee considered foods that would be appropriate additions to the current food packages (as shown schematically in Figure 3-1). The following decisions guided the selection of specific foods:

- **Food packages as supplementary foods—**The foods provided in the packages are intended to supplement the usual diets of WIC participants. Thus, food groups and nutrients that are lacking in the diet are to be emphasized, rather than staple foods that are already adequate in the diet. Only the package for formula-fed infants from birth through 5 months of age would provide a complete diet for some infants, if the maximum allowance is prescribed.

TABLE 3-2 Foods in the Current WIC Food Packages to Be Deleted or Reduced in the Revised Food Packages[a]

Food	Change	Rationale
Infant formula	Reduce maximum amounts for partially breast-fed infants	The maximum amount provides approximately half the amount provided to fully formula-fed infants to encourage the mother to breastfeed enough to provide at least half of the infant's nutritional needs and to make possible other improvements in the WIC food packages.
Infant formula	Reduce maximum amounts for fully formula-fed infants ages 6–11.9 mo of age	Since the food package for infants of this age provides greater amounts of nutrients through complementary foods, less formula is needed.
Juice	Delete juice for infants 4–11.9 mo of age; reduce amount of juice for children 1–4.9 y of age.	Meet AAP recommendations: delay introduction of juice for infants until after 6 mo of age; and allow no more than 4–6 fl oz/d for infants above the age of 6 mo (AAP, 2001a, 2005). For infants age 6–11.9 mo, fruit juice has no nutritional benefit over whole fruit (AAP, 2001a, 2004).
Milk	Decrease maximum amounts allowed for children and adults	Amounts provided need not exceed amounts recommended by *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005).
Cheese	Reduce maximum amount allowed in women's and children's packages.	Meets recommendation from the *Dietary Guidelines* (DHHS/USDA, 2005) and recommendation from the IOM to reduce saturated fat and cholesterol intake (IOM, 2002/2005)
Eggs	Reduce maximum amount allowed	Protein is no longer a priority nutrient. Reduction in amount provided is consistent with *Dietary Guidelines* (DHHS/USDA, 2005) and with recommendation from the IOM to reduce cholesterol intake (IOM, 2002/2005).

[a]Although all foods in this table contribute to a healthy diet, it was essential to decrease the quantity of some foods to be able to make improvements in the WIC food packages that meet the committee's six criteria while maintaining cost neutrality.

NOTES: AAP = American Academy of Pediatrics; IOM = Institute of Medicine.

- **Types of food packages—**Keep the same seven packages but alter age ranges in some cases.
- **Basic foods—**Propose a basic set of foods for each food package. Identify other foods as allowable substitutions.
- **Fruits and vegetables—**Add fruits and vegetables to the food packages for older infants, children, and adults, and allow a variety of choices.

- **Whole grains**—Replace refined grains with whole grains. Offer other whole grains in addition to fortified breakfast cereals.
- **Milk and milk products**—Allow more options for milk (e.g., vegetarian options). Limit the fat content of milk and milk products to a maximum of 2 percent milk fat for children ages 2 years and older, and for adolescent and adult women.
- **Supporting and promoting breastfeeding**—Make the food packages for breastfeeding women more attractive than for non-breastfeeding postpartum women who are obtaining infant formula from the WIC program. Improve the food package for fully breast-fed infants ages 6 through 11 months.

Candidate foods to add to the revised food packages were identified using several sources. Foods that are commonly consumed and are good sources of nutrients were identified from published information for adults (Krebs-Smith et al., 1997; Smiciklas-Wright et al., 2002; Cotton et al., 2004; NDL, 2004) and children (Briefel et al., 2004a, 2004b). Nutrient profiles for these foods were determined using food composition data from the Nutrient Data System (NDS-R, version 5.0/35) of the University of Minnesota (Schakel et al., 1988, 1997; Schakel, 2001) and the USDA Standard Reference Database (NDL, 2004). In addition to published sources of candidate foods, public comments also guided identification of foods to consider adding to the food packages.

In order to model the potential effects of revised food packages on nutrient intakes and on cost when the committee proposed a choice among allowed foods, it was necessary to select specific items. In this case, the committee selected, for analyses, specific commonly consumed foods (see above for sources) or weighted averages of similar foods based on consumption/market share data. The specific composites that were used for the analyses are listed in Appendix E—*Cost Calculations*. This approach provides a basis for a good approximation of the amounts of nutrients provided by the revised packages and of the costs of the packages. However, the limitations of this approach must be borne in mind, since it necessarily involves assumptions about participant choice and state-agency level decisions that may, in fact, vary rather widely.

EVALUATING POSSIBLE FOOD PACKAGES

An iterative process was followed to design revised food packages that meet the criteria identified in Box 1-1—*Criteria for a WIC Food Package* (Chapter 1—*Introduction and Background*). The committee applied the following general steps to develop each food package. The iterative nature of the process is illustrated by the two-way arrows in Figure 3-1.

- Propose a set of foods that addresses the priorities and is consistent with the basic decisions listed above.
- Examine nutrient values for foods per unit weight.
- Determine a specific food combination for the food package.
- Calculate the nutrient and food group contributions for each specified food combination.
- Estimate an approximate cost.
- Make adjustments to the types or amounts of foods to come closer to target recommendations without exceeding cost constraints.
- Weigh each possible food package against the six criteria.
- Discuss the relative benefits of the food package as a whole with the entire committee.
- Repeat the above steps as necessary.

Following is a brief discussion of the process that was used to evaluate each candidate food package relative to the six criteria presented in Box 1-1—*Criteria for a WIC Food Package* (Chapter 1—*Introduction and Background*).

1. The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.

Changes in nutrient content were evaluated for each iteration of the revised food packages. Attempts were made to design food packages that would result in increased intakes of nutrients with a high prevalence of inadequacy and decreased intakes of nutrients with a risk of excessive intakes. In some cases, trying to improve nutrient intake involved including foods of different types that might be more acceptable to participants rather than larger quantities of the foods in the current packages. Ensuring that the WIC food packages did not contribute to excessive energy intake was a particularly important consideration.

2. The package contributes to an overall dietary pattern that is consistent with the *Dietary Guidelines for Americans*, for individuals 2 years of age and older.

Foods that improved consistency with the food patterns recommended by the *Dietary Guidelines for Americans* were considered important for the revised food packages. Fruit, nonstarchy vegetables, whole grains, and fat-reduced milk products were particularly desirable. Other aspects of the *Dietary Guidelines* that were considered included limiting dietary sources of saturated fat, cholesterol, *trans* fatty acids,[2] and added sugars; and promoting food safety.

3. The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.

The food packages for infants and women were specifically evaluated for their potential impact on both the initiation and duration of breastfeeding. Support for lactating mothers was considered particularly important, so as to encourage breastfeeding over time. Food packages for older infants were redesigned to encourage full breastfeeding and meet current recommendations not to introduce complementary foods before 6 months of age. Food packages for older infants and children younger than age 2 years were redesigned to encourage the development of healthy eating patterns (e.g., juice was eliminated or reduced according to current recommendations).

4. Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities.

Forms of foods that are appropriate for persons with limited transportation, storage, and cooking facilities were included in food specifications for the packages. This includes foods that do not require refrigeration and foods that require a minimum amount of cooking. Availability of foods in neighborhood stores, as well as in large supermarkets, was considered important.

5. Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.

Candidate foods were initially identified by examining which foods were good sources of the priority nutrients (NDL, 2004; DHHS/USDA, 2004). Since foods are good sources of a nutrient only if they are consumed, both acceptability and frequency of consumption were considered from the beginning of the selection process. Foods commonly consumed were identified (Krebs-Smith et al., 1997; Smiciklas-Wright et al., 2002; Cotton et al., 2004). Cultural food preferences, based on both published references (Kittler and Sucher, 2004; ADA, 1994, 1995, 1998a, 1998b, 1998c, 1998d, 1999a, 1999b, 2000) and public comments, were given high priority, par-

[2]Reliable data were not available to assess intakes of *trans* fatty acids; however, the amount of *trans* fatty acids in the current and proposed food packages were estimated and are included in Tables B-2E in Appendix B—*Nutrient Profiles*. The current and revised WIC food packages contain insignificant amounts of industrial *trans* fats—the source of *trans* fat deemed to be of concern by the Dietary Guidelines Advisory Committee (DHHS/USDA, 2004).

ticularly in identifying substitutions to be allowed. Throughout the process of selecting the food packages, the value of the packages to participants (in terms of both dollar value and desirability) was considered. Increased flexibility at the level of the state agency and increased choice by participants were considered desirable attributes of the revised food packages.

6. Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

The committee heard from numerous vendors and WIC agencies during the process of revising the food packages. Changes were evaluated to ensure that they did not impose an undue burden at either the vendor or the agency level.

EVALUATING THE COST OF THE REVISED PACKAGES

In addition to considering the criteria listed above, the committee considered the constraint of cost neutrality in recommending changes to the WIC food packages. At each iteration of food choices, the relative costs of the proposed foods were considered. Some foods that would not fit or were found not to fit in a cost-neutral set of food packages were considered as possible alternatives that could be allowed by individual WIC state agencies, perhaps on a limited basis.

As shown in Chapter 5—*Evaluation of Cost*—for each revised food package, the committee estimated the average cost per participant per month based on the quantities of component foods in each package, the weighted average price of those foods, and the number of participants in the relevant participant category. The average price of component foods were calculated using data from various sources, as appropriate and available to the committee, as described in that chapter.

SUMMARY

Redesigning the WIC food packages was an iterative effort involving identification of foods to omit from the packages or to provide in reduced amounts, the selection of candidate foods to add to each package, and the evaluation of the resulting revised packages using the previously established criteria. Many iterations were undertaken in the revision of the food packages. The results of these evaluations are the revised food packages described in the next chapter (Chapter 4—*Revised Food Packages*).

4
Revised Food Packages

The committee recommends changes to each of the current WIC food packages, based on the criteria developed earlier (IOM, 2004b). That is, the proposed changes respond to current dietary guidance for nutrient intakes and dietary patterns, the major diet-related health problems and risks faced by this population, and the characteristics and diversity of the WIC-eligible population. The proposed changes also attempt to avoid undue burden to WIC agencies and retail vendors. The first part of this chapter presents specific proposals for all of the WIC food packages, briefly compares the revised packages to the current ones, and lists specifications for foods in the revised packages. The second part of the chapter provides the basis for changes in the packages or policies related to the food packages. The committee recommends pilot testing and randomized, controlled trials before full-scale implementation of the proposed changes to the food packages. See Chapter 7—*Recommendations for Evaluation and Implementation*—for details.

DESCRIPTION OF THE REVISED FOOD PACKAGES

In addressing proposed changes to the WIC food packages, the committee retained the basic numbering system used for the current food packages. Subparts were added to identify new subcategories based on infant age and breast-fed versus formula-fed status. The numbering systems for infant packages are is shown in Table 4-1 and the numbering systems for children and women are shown in Table 4-2. Table 4-3 presents proposed specifications for allowable foods.

TABLE 4-1 Revised WIC Food Packages, Maximum Monthly Allowances for Infants [examples of amounts as commonly obtained shown in brackets]

	Fully Formula-Fed (FF)	
Foods/Package Number	**I-FF** I-FF-A: 0–3.9 mo I-FF-B: 4–5.9 mo	**II-FF** 6–11.9 mo
Infant formula[c] [example of commonly available form; *reconstituted volume*]	I-FF-A: 403 fl oz liquid concentrate [31 13-fl oz cans; *806 fl oz*][d] I-FF-B: 442 fl oz liquid concentrate [34 13-fl oz cans; *884 fl oz*][d]	312 fl oz liquid concentrate [24 13-fl oz cans; *624 fl oz*][d]
Infant cereal		24 oz [3 8-oz boxes]
Baby food fruits and vegetables (e.g., strained)		128 oz [32 4-oz jars]
Baby food meat (e.g., pureed)		

[a]To promote the establishment of breastfeeding, the committee recommends that formula not be routinely provided in the first month to breast-fed infants; thus, no mother/infant pairs are classified as partially breastfeeding for the first month postpartum. See discussion in section *Promoting and Supporting Breastfeeding* and recommendations for studies in Chapter 7—*Recommendations for Implementation and Evaluation*.

[b]The committee recommends that infants with special dietary needs receive Food Package III. This means the package would provide the medical foods required by WIC participants of any age if they have special dietary needs. Persons receiving Food Package III also would receive the foods allowed for other participants in the same life stage if those foods were medically and developmentally appropriate for them.

[c]In most cases, the maximum monthly allowance of infant formula is stated as fl oz of liquid concentrate. Powdered or ready-to-feed formula may be provided as alternative forms at rates that provide the approximate number of fl oz of formula (see note *d* for additional detail).

[d]The maximum allowance for infant formula is converted to a practical option using current can sizes commonly obtained, as shown in brackets. For further practical options, see Table B-6—*Substitution Rates for Various Volumes of Formula Concentrate* (Appendix B). Because of differences in container sizes and yields, the maximum amount of formula provided depends on whether the mother obtains powdered, liquid concentrate, or ready-to-feed

Partially Breast-Fed (BF/FF)		Fully Breast-Fed (BF)		Special Dietary Needs
I-BF/FF I-BF/FF-A: 1–3.9 mo[a] I-BF/FF-B: 4–5.9 mo	**II-BF/FF** 6–11.9 mo	**I-BF** 0–5.9 mo	**II-BF** 6–11.9 mo	**I and II or III**[b]
I-BF/FF-A: 51–60 oz powder [4 12.9-oz cans powder; *384 fl oz*][e]	156 fl oz liquid concentrate [12 13-fl oz cans; *312 fl oz*][d]			Same reconstituted volume as others[f]
I-BF/FF-B: 221 fl oz liquid concentrate [17 13-fl oz cans; *442 fl oz*][d]				
	24 oz [3 8-oz boxes]		24 oz [3 8-oz boxes]	Same as others[f]
	128 oz [32 4-oz jars]		256 oz [64 4-oz jars]	Same as others[f]
			77.5 oz [31 2.5-oz jars]	Same as others[f]

formula. When determining the maximum number of cans of each type of formula, the committee recommends rounding to whole cans to approximate the target amount (the maximum monthly allowance shown here in Table 4-1). The results of this method may differ from the rounding currently in use; some rounding methods (e.g., rounding up to whole cans) could result in providing excess formula in some cases. Note that the substitution rate of 8 lb of powdered formula for 403 fl oz of formula concentrate no longer applies; that substitution rate could result in providing excess formula in some cases.

[e]In this case, the maximum monthly allowance is specified in the powdered form—the form that is recommended for partially breast-fed infants, ages 1–3.9 mo. A range is shown to note the amounts that could be provided at current container sizes for powdered formula. For further detail, see Table B-6—*Substitution Rates for Various Volumes of Formula Concentrate* (Appendix B).

[f]The maximum allowance for an infant with special dietary needs is the same as for other infants in the same participant category, if the food is appropriate for the medical, nutritional, and developmental condition of that infant.

NOTES (abbreviations in order of appearance in table): FF = fully formula-fed; BF/FF = partially breast-fed (i.e., the infant is breast-fed but also receives some formula through the WIC program); BF = fully breast-fed (i.e., the infant is breast-fed and receives no formula through the WIC program).

TABLE 4-2 Revised WIC Food Packages, Maximum Monthly Allowances for Children and Women

	Children	
Foods[a]/ Package Number	**IV-A:** 1–1.9 y	**IV-B:** 2–4.9 y
Formula (liquid concentrate)[d]		
Juice	128 fl oz	128 fl oz
Milk,[f] whole	16 qt[g,h]	
Milk,[f] up to 2% milk fat		16 qt[h]
Breakfast cereal (hot or cold)	36 oz	36 oz
Cheese	—	—
Eggs	1 doz	1 doz
Fruits and vegetables (fresh)[l,m]	$8.00 in cash-value vouchers[n] (ca. 9.76 lb)	$8.00 in cash-value vouchers[n] (ca. 9.76 lb)
Whole wheat bread[o]	2 lb	2 lb
Fish (canned)	—	—
Beans (mature legumes), dry[p] *and/or* Peanut butter	1 lb dried *or* 18 oz	1 lb dried *or* 18 oz

[a]See Table 4-3 (*Proposed Specifications for Foods*) and Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*—for allowed types and forms of foods.

[b]Food Package V is available to two groups: pregnant women and breastfeeding women whose infants participate in the WIC program and receive formula in amounts that do not exceed the maximum allowances for Food Packages I-BF/FF-A, I-BF/FF-B, or II-BF/FF, as appropriate for the age of the infant.

[c]Food Package VII is available to breastfeeding women whose infants do not receive formula from the WIC program and to all breastfeeding women during the first month postpartum. See discussion in section on *Promoting and Supporting Breastfeeding* and recommendations for studies in Chapter 7—*Recommendations for Implementation and Evaluation*. Food Package VII is also recommended for women pregnant with two or more fetuses.

[d]The type of formula depends on the special health need.

[e]Some individuals with special dietary needs require complete nutritional liquids or semisolids with nutrient and caloric content that differ from the formulas designed for infants. Many of these products are sold as powders and the proper reconstitution rates vary. Thus, the calculations used for infant formulas (which are relatively consistent at 1 kcal per cc) may not apply to the formulas for children and women with special dietary needs.

[f]Lactose-reduced milk is allowed. See Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

Women			Children and Women
V: Pregnant or Partially Breastfeeding (up to 1 y postpartum)[b]	**VI:** Non-breastfeeding Postpartum (up to 6 mo postpartum)	**VII:** Fully Breastfeeding, Enhanced Package (up to 1 y postpartum)[c]	**III:** Special Dietary Needs
			455 fl oz,[e] if appropriate
144 fl oz	96 fl oz	144 fl oz	Same as others[i]
			Same as others[i]
22 qt[j,k]	16 qt[j,k]	24 qt[j,k]	Same as others[i]
36 oz	36 oz	36 oz	Same as others[i]
—	—	1 lb	Same as others[i]
1 doz	1 doz	2 doz	Same as others[i]
$10.00 in cash-value vouchers[n] (ca. 12.2 lb)	$10.00 in cash-value vouchers[n] (ca. 12.2 lb)	$10.00 in cash-value vouchers[n] (ca. 12.2 lb)	Same as others[i]
1 lb	—	1 lb	Same as others[i]
—	—	30 oz	Same as others[i]
1 lb dried *and* 18 oz	1 lb dried *or* 18 oz	1 lb dried *and* 18 oz	Same as others[i] Same as others[i] Same as others[i]

[g]Whole milk (3.5–4% milk fat) is the only type of milk allowed for 1-y-old children. Exceptions can be made in special circumstances when prescribed in writing by a Recognized Medical Authority (a licensed physician, physician assistant, nurse practitioner, or other health professional specified by the WIC state agency to have this authority).

[h]For children, cheese or yogurt may be substituted for milk at the rate of 1 lb of cheese per 3 qt of milk (to a maximum of 1 lb of cheese) or 1 qt of yogurt per 1 qt of milk. A maximum of **4** qt of milk can be substituted for in this manner.

[i]If appropriate for the medical, nutritional, and developmental condition of a participant assigned to Food Package III, the maximum allowance for each food is the same as for the food package to which the participant would be assigned if he or she had no special health need.

[j]Cheese, yogurt, or calcium-set tofu (tofu prepared with calcium salts) may be substituted for milk at the rate of 1 lb of cheese per 3 qt of milk (to a maximum of 1 lb of cheese), 1 qt of yogurt per 1 qt of milk, or 1 lb of tofu per 1 qt of milk. A maximum of **4** qt of milk can be substituted for in this manner in Food Packages V and VI. A maximum of **6** qt of milk can be substituted for in this manner in Food Package VII for fully breastfeeding women.

continues

TABLE 4-2 Continued

[k]For women, soy beverage ("soy milk") may be substituted for milk at the rate of 1 qt of calcium- and vitamin D-rich soy beverage for 1 qt of milk up to the total allowance of milk prescribed.

[l]Processed fruits and vegetables may be substituted for fresh fruits and vegetables using the substitution rates shown in note *n*. Dried fruits may be included with processed fruits only for adolescent and adult women.

[m]In the canned options for children, 222 oz of canned fruits and vegetables (e.g., 7 15-oz cans of fruit plus 7 14.5-oz cans of vegetables) would substitute for the $8.00 cash-value vouchers. In the canned options for adolescent and adult women, 280 oz of canned fruits and vegetables (e.g., 9 15-oz cans of fruit plus 9 14.5-cans of vegetables) would substitute for the $10.00 cash-value vouchers.

[n]The value of the cash voucher is intended to deliver approximately the weight of fresh produce specified and may need to be adjusted upward to account for local prices in some states agencies.

[o]Other whole grain foods could substitute for whole wheat bread on an equal weight basis. Examples and specifications are listed in Table 4-3 (*Proposed Specifications for Foods*) and Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

[p]Legumes include dry beans, peas, and lentils. Canned legumes may be substituted for dried legumes at the rate of 64 oz of canned beans for 1 lb dried beans. See Table 4-3 (*Proposed Specifications for Foods*) and Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*—for additional information.

NOTE: ca. = the calculated amount.

In the sections that follow, the packages for women are presented immediately after the packages for infants because they are so closely related.

WIC Food Packages for Infants

Overview of Current Food Packages for Infants

Currently, there are two WIC food packages for infants: Food Package I (for infants ages 0–3 mo) provides infant formula only; and Food Package II (for infants 4–11 mo) provides formula, cereal, and juice. When fully breast-fed infants reach the age of 4 months, they receive Food Package II with cereal and juice only. Infants who are partially breast-fed receive either Food Package I or II, depending on their age. Although partially breast-fed infants are eligible to receive the entire allowance of formula, the Competent

Professional Authority[1] (CPA) in the WIC local agency may tailor packages to provide smaller amounts if appropriate.[2]

Revised Food Packages for Infants

Food Package I—The committee recommends that Food Package I serve infants from birth through 5 months of age, as shown in Table 4-1, rather than covering the current period of birth through 3 months of age. For formula-fed infants, formula must be iron fortified as specified in the current packages. Because of differences in container sizes and yields, the maximum amount of formula provided depends on whether the mother obtains powdered, concentrated, or ready-to-feed formula. When determining the maximum number of cans of each type of formula, the committee recommends rounding to whole cans to approximate the target amount (the maximum monthly allowance shown in Table 4-1); the committee's recommendations are presented in Table B-6—*Substitution Rates for Various Volumes of Formula Concentrate*—in Appendix B. In some cases the results of this method may be different from the rounding currently in use (e.g., rounding up to whole cans). Otherwise, Food Package I for fully formula-fed infants ages zero through three months is unchanged.

For the first month after birth, the committee further recommends only two feeding options initially—full breastfeeding or full formula feeding. Refer to the later section *Promoting and Supporting Breastfeeding* for a full explanation of the committee's recommendations concerning infant food package choices during the first month after birth.

For ages 1 month through 3 months, the proposed food package for partially breast-fed infants (Food Package I-BF/FF-A in Table 4-1) provides powdered formula as the standard. The maximum allowance is approximately half of the allowance of formula that is provided to fully formula-fed infants (Food Package I-FF-A); in this case it is slightly less than half due to rounding to whole cans in the example used in the Table 4-1. (For further information, see Table B-6 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.) The committee recommends powdered formula for partially breast-fed infants because the amount prepared can be tailored closely to the amount needed. This may help reduce waste, food safety concerns, and/or overfeeding of formula to breast-fed infants. If

[1]The term *Competent Professional Authorities* is used to refer to professionals and paraprofessionals who tailor the food packages and educate and counsel WIC participants.

[2]The committee had no data on which to base assumptions regarding the amount of formula currently prescribed for partially breast-fed infants. Thus, in the nutrient and cost analyses, the committee used the assumption that partially breast-fed infants received the maximum monthly allowance for formula in the current food packages.

the partially breastfeeding mother requests and obtains more than the maximum amount of formula for her partially breast-fed infant, the infant will be considered fully formula-fed and assigned the package for fully formula-fed infants (Food Package I-FF-A in Table 4-1).

At 4 months of age, the amount of formula provided for fully formula-fed infants, increases slightly—corresponding closely to the average nutritional needs of infants of this age (see Food Package I-FF-B in Table 4-1). This additional formula is a partial replacement for the juice and cereal that the current Food Package II provides to infants of this age. The maximum amount of formula provided for partially breast-fed infants also increases (see Food Package I-BF/FF-B in Table 4-1). At this age, any of the three types of formula would be acceptable. Due to rounding to whole cans of powdered formula, the amount of formula may not increase at four months of age, depending on the can sizes of formula provided (see Table B-6 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*). The maximum allowance for the partially breast-fed infant is calculated as half of the allowance for fully formula-fed infants of the same age; however, rounding to whole cans of powdered formula may result in a slightly lower amount (that is, a reduction of less than two ounces per day) (see Table B-6 in Appendix B).

Food Package II—At 6 months of age, infants are assigned to Food Package II. This food package provides semisolid foods for all infants (see Food Packages II-BF, II-BF/FF, and II-FF in Table 4-1) and formula to those who are not fully breast-fed.[3] Commercial baby food fruits and vegetables in the revised package replace juice in the current package. To support the continuation of full breastfeeding past 6 months, Food Package II-BF provides more commercial baby food fruits and vegetables than do the other two versions of Food Package II. Because fully breast-fed infants age six months and older need more iron and zinc than breast milk provides (Krebs, 2000; Dewey, 2001; Krebs and Westcott, 2002), Food Package II-BF provides commercial baby food meats. (Infant formulas provide these two minerals in amounts that meet or exceed the needs of most infants [see Table C-2C and IOM, 2004b].) The maximum amount of formula provided for fully formula-fed infants (see Food Package II-FF in Table 4-1) or partially breast-fed infants (see Food Package II-BF/FF in Table 4-1) has been reduced. For formula-fed infants, the combination of foods in the revised Food Package II provides slightly fewer calories than in the current

[3]Although semisolid foods are not included in the food packages until 6 months of age, this does not prevent the parents or caregivers from introducing semisolid foods to infants before 6 months of age.

package, provides nutrients in amounts close to the recommended levels,[4] and introduces more variety into the infant's diet. For fully breast-fed infants, the revised Food Package II provides more calories than before and introduces more variety into the infant's diet. As is the case for Food Package I, if the partially breastfeeding mother requests and receives more than the maximum amount of formula specified for partially breast-fed infants, the infant will be considered fully formula fed and assigned the package for fully formula-fed infants.

WIC Food Packages for Women

Overview of Current Food Packages for Women

Four packages are currently provided to women as shown in Table 1-1 in Chapter 1—*Introduction and Background*. Food Package V is designed for pregnant women and partially breastfeeding women (i.e., mothers who combine breastfeeding with formula feeding); Food Package V is available throughout pregnancy and can be available to partially breastfeeding women for up to 12 months postpartum. Food Package VI is for non-breastfeeding postpartum women and is available for 6 months postpartum. Food Package VII, the enhanced breastfeeding package, is for nursing mothers whose infants receive no formula from the WIC program (i.e., fully breastfeeding women); Food Package VII can be available to fully breastfeeding women for up to 12 months postpartum.

Food Packages V and VII provide milk, cheese (as a substitute for part of the milk), vitamin C-rich juice, iron-rich breakfast cereal, eggs, and dry beans (plus peanut butter in Food Package VII, with peanut butter as an alternative to dry beans in Food Package V). Food Package VI for non-breastfeeding postpartum women provides most of these foods (except peanut butter and dry beans); however, some maximum allowances are smaller. Food Package VII—the enhanced breastfeeding package for fully breastfeeding women—also provides canned tuna, carrots, cheese (in addition to cheese substituted for milk), and additional juice. Pregnant and breastfeeding women may receive Food Package III if they have special medical problems that preclude prescription of the regular packages.

[4]For details on specific nutrients, compare nutrients provided in Tables B-2 and B-3 (Appendix B—*Nutrient Profiles of Current and Revised Food Packages*) to recommended levels of nutrients in Table F-1 (Appendix F—*Supplementary Information*).

Revised Food Packages for Women

The committee recommends continuing to provide Food Packages V, VI, and VII to the same groups of women for virtually the same periods of time. However, the committee recommends changing the definitions of breast-fed infants, which would change the classifications of nursing mothers as well.[5] Under the proposed system, all women who choose to breastfeed would be encouraged to breastfeed fully in the first month after delivery and therefore would receive the enhanced fully breastfeeding package (Food Package VII) in that first month. A fully breastfeeding woman would receive no formula for her infant from the WIC program, with a few exceptions during the first month postpartum. Generally starting at one month, a partially breastfeeding woman could receive up to half the maximum allowance for a fully formula-fed infant of the same age. If she requests and receives more than this maximum amount of formula, she would no longer be classified as breastfeeding for the purposes of assigning her food package. If the request were made before the end of the sixth postpartum month, she would be reclassified as a postpartum non-breastfeeding woman and switched to Package VI. If the request were made after the sixth postpartum month, the woman no longer would be certified for the WIC program.

Food Package VII, for fully breastfeeding women, provides the greatest variety and quantity of food; Food Package VI, for mothers of fully formula-fed infants, provides the least (Table 4-2). Compared with the current food packages (Table 1-1 in Chapter 1—*Introduction and Background*), all three revised food packages for women provide smaller amounts of milk products, eggs, and juice; the same amount of iron-fortified cereal (now whole grain only); and fruits and vegetables as an addition. Whole grain bread or other whole grains have been added to Food Packages V and VII. The fat content of the milk cannot exceed 2 percent. The revised food packages for women allow several alternatives to cow's milk for meeting calcium needs. Calcium- and vitamin D-rich soy beverage ("soy milk") is allowed as an alternative to milk. Cheese, fat-reduced yogurt, and calcium-set tofu (tofu prepared with calcium salts) are allowed as partial substitutions for milk (up to 4 qt of milk in Food Packages V and VI; up to 6 qt of milk in Food Package VII). The current specifications for tuna are not changed. Light tuna, which the Food and Drug Administration and the

[5]Currently in the WIC program a woman is classified as breastfeeding if she is providing breast milk on the average of at least once a day. The committee considers this an inappropriate definition of breastfeeding for the purpose of assigning food packages. Thus, the committee proposes classifying a woman as breastfeeding for the purpose of assigning food packages if she requests no more than the maximum amount of formula allowed for partially breast-fed infants (see Table 4-1).

Environmental Protection Agency determined is sufficiently low in mercury to be safe for breastfeeding women (CFSAN, 2001; EPA/FDA, 2004) is allowed; but white tuna (albacore), which is higher in mercury content, is not. Other low-mercury fish options are included in Table 4-3 for participants preferring to avoid tuna (see Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*—for details).

Based on estimates of increased nutrient and energy needs of women pregnant with more than one fetus,[6] the committee recommends that Food Package VII rather than Food Package V be used for such women. Further, the committee recommends that women who are fully breastfeeding twins be prescribed 1.5 times the maximum amounts of Food Package VII to cover their higher needs for energy and nutrients.[7] In addition, the committee recommends that women partially breastfeeding twins or higher multiples be assigned to Food Package VII since their milk production would be comparable or perhaps higher than that of mothers breastfeeding one infant.

Recommendations for women with special dietary needs (currently covered by Food Package III) are discussed in a later section (*Food Package III for Children and Women with Special Dietary Needs*).

WIC Food Packages for Children

Overview of the Current Food Package for Children

Currently there is one package for children: Food Package IV for children ages 1 through 4 years. Food Package IV contains milk and cheese,

[6]*Pregnancy*—Nutritional needs of a pregnant women are increased when she is carrying more than one fetus (Luke, 2004). Using a method similar to that used by the Institute of Medicine (IOM, 2002/2005), Brown and Carlson (2000) estimate that, compared with the energy needs of women with singleton pregnancies, women bearing twins need an additional 150 kilocalories per day to support the recommended weight gain. The recommended intakes of most nutrients increase only a small amount (from no increase to about a 10 percent increase) for a singleton pregnancy (IOM, 2005b). The exceptions are iron, zinc, and iodine—for which recommended intakes are 1.4 to 1.5 times higher for pregnant than for nonpregnant women of the same age.

[7]*Lactation*—Based on the composition and expected volume of breast milk produced by a woman breastfeeding twins, she would need about 500 additional kilocalories and higher intake of many vitamins and minerals—a major exception being iron. Considering the nutrient content of proposed Food Package VII for breastfeeding women and the amounts of nutrients needed for milk production, prescribing 1.5 times the maximum amount of Food Package VII would help the woman breastfeeding twins meet her energy and nutrient needs. Moreover, it would help improve comparability of the value of packages for mother/infant combinations, especially considering that each twin is eligible to receive formula if that feeding method is chosen.

vitamin C-rich juice, iron-rich breakfast cereal, eggs, and peanut butter or dry beans—all of which also are in the current food packages for women.

Revised Food Package for Children

The committee recommends continuing to provide Food Package IV to children, making a distinction in the fat content of milk provided at different ages. In particular, whole milk is specified for children age one year (12–23 mo of age), and milk with a fat content not to exceed 2 percent is specified for the older children (2 y of age and above). Compared with the current package, the revised food package includes smaller amounts of milk and juice but adds fruits, vegetables, and whole grains. Cheese and fat-reduced yogurt are allowed as partial substitutes for milk (these dairy products may substitute for up to 4 qt of milk using the substitution rates in Table 4-2). Soy products (i.e., tofu, soy beverage ["soy milk"]) are not allowed as substitutions for milk in the children's package except when prescribed in writing by a Recognized Medical Authority[8] (RMA). Nutrition education may be needed to help parents or guardians guard against nutritional risk if they offer their child substitutes for milk.

These changes make the entire package more consistent with the *Dietary Guidelines for Americans* and provide a more balanced nutrient intake.

Food Package III for Children and Women with Special Dietary Needs

Overview of Current Food Package III

Currently, Food Package III is unique in that it provides special formula to children and women with special dietary needs. It also provides juice and breakfast cereal. (This package does not serve infants because the current Food Packages I and II provide for infants who have special dietary needs).

Revised Food Package III

The committee recommends that the unique aspect of Food Package III—the provision of special formula—be retained. However, the committee recommends changing the other foods contained in the package. In particular, the package should be restrictive only to the extent dictated by the participant's health condition. A child should be allowed foods from

[8]The term *Recognized Medical Authority* is used to refer to a licensed physician, physician assistant, nurse practitioner, or other health professional specified by the WIC state agency to have the stated authority.

Food Package IV to the extent that those foods are compatible with the child's special health needs. The same holds true for a woman and the package for which she ordinarily would be eligible. Thus, any foods contained in the food package that ordinarily would apply to that individual's life stage are to be provided if suitable considering the participant's special dietary needs. For example, even if a child with special dietary needs continues to receive infant formula from WIC beyond the first birthday; he or she would also receive any of the foods in the children's food package (Food Package IV) in amounts appropriate for the child's condition.

The committee also recommends that infants with special dietary needs be assigned to Food Package III, with maximum amounts of formula based on maximums for healthy infants of the same age and feeding method (i.e., fully formula-fed, partially breast-fed). The rationale for including infants in Food Package III is to consolidate all individuals with special dietary needs into one package to facilitate efficient management and tracking of the benefits and costs of providing supplemental foods to these participants.

Food Package III for Infants[9]—The revised food package would include special formula that is documented to be medically necessary for an infant or infant formula in developmentally advanced forms (e.g., thickened). For infants 6 through 11 months of age with special dietary needs, if any foods included in Food Package II are appropriate for the infant, these foods would be provided as part of the food package.

Food Package III for Children—The revised package would include infant formula or special formula that is documented to be medically necessary for the child or formula in developmentally advanced forms (e.g., noninfant formula). If any foods included in the children's package (Food Package IV) are appropriate for a child with special dietary needs, these foods would be provided as part of the food package.

Food Package III for Women—The revised package would include medical foods that are documented to be medically necessary for the woman. The committee is not recommending changes in the amounts of these medical foods provided in the current package. However, in cases in which any of the foods allowed in the food package for her life stage (Food Packages V, VI, or VII, as applicable) are appropriate for a woman with

[9]The committee is using the functional definition of an infant with special dietary needs from the federal regulation for exempt infant formula (U.S. Congress, 2004b; 21 CFR § 107, subpart C). This would be an infant who has an inborn error of metabolism, low birth weight, or who otherwise has a medical problem or dietary issue.

special dietary needs, these foods would be provided as part of her food package.

DISCUSSION OF MAJOR CHANGES

The changes proposed to the WIC food packages respond to the criteria presented in Box 1-1—*Criteria for a WIC Food Package*—in Chapter 1—*Introduction and Background*—and discussed in Chapter 3—*Process Used for Revising the WIC Food Packages*. The proposed changes will serve to make the WIC food packages more consistent with national and professional dietary guidance that promotes healthful diets. The first three topics covered relate specifically to contents of the food packages. The next three topics relate to ways in which the committee addressed major diet- and health-related issues. The final topic relates to flexibility and choice at the state and participant levels, respectively. The major changes the committee proposes for the revised WIC food packages are:

- Including fruits and vegetables for all participants 6 months of age and older;
- Including more whole grain products;
- Reducing the amounts of saturated fat provided for participants two years of age and older (this also reduces the amounts of cholesterol and total fat provided);
- Promoting and supporting breastfeeding, especially full breastfeeding;

BOX 4-1
Definitions of Food Instruments

- *Standard WIC Food Instrument*—a check, voucher, electronic benefit transfer (EBT) authorization, or other payment method that is issued to the participant to obtain specific foods allowed under the WIC program. For a representation of a standard food instrument, see Figure F-1A in Appendix F—*Supplementary Information*. In this report, the term *food instrument* applies only to the standard WIC food instrument.
- *Cash-Value Voucher*—a check, voucher, or other payment method with a specific cash value (e.g., $1.00, $2.00) that can be used only to obtain fresh fruits and vegetables. See Figure F-1B in Appendix F—*Supplementary Information*—for a representation of a cash-value voucher. In this report, the term *cash-value voucher* is not meant to indicate only a voucher method of payment. For example, an EBT authorization system could be programmed to serve as both the standard food instrument and the cash-value voucher.

- Addressing developmental needs of infants and young children;
- Addressing obesity concerns; and
- Providing more flexibility for WIC states agencies and more variety and choice for WIC participants.

Some of the specific recommendations discussed in this section deal with specification for the foods to be allowed in the revised food packages. These specifications are presented in Table 4-3 (*Proposed Specifications for Foods*) and in Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*—with additional detail.

Including Fruits and Vegetables in the WIC Food Packages

The single most fundamental change in the revised WIC food packages is the inclusion of a variety of fruits and vegetables in all packages for individuals 6 months of age and older. The forms vary from commercial baby food fruits and vegetables to fresh produce for children and women. Regardless of the form, the principle is consistent—to increase fruit and vegetable intakes by WIC participants. To facilitate participant choice in obtaining fresh produce, within WIC budget constraints, this option would involve issuing cash-value food instruments (such as vouchers, food-checks, or coupons). As an alternative, processed fruits and vegetables may be specified by WIC state agencies when fresh produce is limited and to allow the processed option to be chosen by participants who prefer processed forms.[10] Using the specifications in Table 4-3 and other information, state agencies would identify specific processed fruits and vegetables to be included on lists from which participants could choose using the regular WIC food instrument. (See Box 4-1 to distinguish between standard food instruments and cash-value vouchers.) Because of greater participant choice, lower cost in many states, and potentially greater nutrient contribution from the fresh produce option, the committee encourages states to adopt that option to the extent possible.

Rationale for Adding Fruits and Vegetables

The addition of fruits and vegetables to WIC food packages is consistent with a major recommendation of the *Dietary Guidelines for Ameri-*

[10]The committee's primary recommendation for Food Packages IV through VII includes fresh fruits and vegetable rather than processed forms because of the wider variety available in most locations and the lower salt (i.e., sodium) content of likely choices. For details on the sodium content of food packages, see Tables B-2A and B-3A in Appendix B—*Nutrient Profiles of Food Packages*.

cans 2005 (DHHS/USDA, 2005)—namely, to increase daily intake of fruits and vegetables. The basis for that recommendation was the substantial body of literature that supports the association of fruit and vegetable consumption with reduced risk of chronic disease including stroke and perhaps other cardiovascular diseases (e.g., Bazzano et al., 2001, 2002), some cancers (e.g., WCFR/AICR, 1997; IARC, 2003), and type 2 diabetes (e.g., Ford et al., 2003). Evidence also suggests that increased fruit and vegetable consumption may be useful in programs to promote and sustain loss of body weight in overweight individuals (Stamler and Dolecek, 1997; Appel et al., 2003).

In addition, increased consumption of fruits and vegetables helps promote nutritional adequacy and may displace less nutritious items in the diet. Food consumption data show that fruits contribute more vitamin C than any other food group in the American diet, while vegetables contribute the greatest amount of vitamin A and potassium (DHHS/USDA, 2004). Fruits additionally provide more than 10 percent of total intake for 8 nutrients and vegetables for 15 nutrients (DHHS/USDA, 2004). Five of the priority nutrients identified by the committee (potassium, fiber, vitamin A, vitamin C, and folate) are high in commonly consumed fruits and vegetables. Fruits and vegetables are low in saturated fat, total fat, and sodium unless sources of these nutrients are added in processing.

Numerous studies have examined predictors of the acceptance, liking, and consumption of fruits and vegetables by children. The availability of fruits and vegetables in the household and the modeling of fruit and vegetable consumption by parents are the two most powerful predictors identified (Gibson et al., 1998; Kratt et al., 2000; Tibbs et al., 2001; Cullen et al., 2001, 2003; Fisher et al., 2002; Brown and Ogden, 2004; Cooke et al., 2004).

The committee received many public comments from health professionals, consumers, WIC program staff, and others advocating for the inclusion of fruits and vegetables in the WIC food packages. Importantly, two recent pilot studies provided cash-value vouchers for fresh fruits and vegetables to WIC participants (Herman, 2004; Runnings, 2004). In one pilot study, the cash value of the vouchers totaled $40—four times the amount per month being proposed by this Institute of Medicine (IOM) committee. Preliminary results of that study showed a high redemption rate for the cash-value vouchers (Herman, 2004). The experience from both pilot studies, albeit unpublished at the present time, indicated that providing fresh produce to WIC participants using cash-value vouchers (1) increased the intakes of fruits and of vegetables, (2) added variety to the diets of WIC participants, and (3) was highly acceptable to WIC participants of various ethnic/cultural backgrounds (Herman, 2004; Runnings, 2004). Abuse of the cash-value vouchers, if it occurred, was minimal. Thus, the committee

anticipates that the proposed addition of fresh fruits and vegetables will be a welcome addition to the food packages and will serve as an incentive for participation in the WIC program.

Specific Recommendations

Juice, primarily consumed as fruit juice, is part of the current food package for infants 4 months of age and over. In contrast, juice is not provided in the revised food packages for infants at any age and the quantity of juice is reduced in food packages for children and women. Deleting or reducing the quantity of juice in the set of food packages helps allow for the inclusion of whole fruits and vegetables while containing food costs. The reduction in the amount of juice provided for older children to about 4 ounces per day per day is consistent with the AAP recommendation for that age group (AAP, 2004). The AAP also notes that juice does not provide any additional nutritional benefit beyond that of whole fruit. The reduced amount of juice for women is consistent with the recommendation of the *Dietary Guidelines 2005* that whole fruits be used for a majority of the total daily amount of fruit (DHHS/USDA, 2005).

For infants beginning at 6 months of age, the committee recommends the inclusion of commercial baby food fruits and vegetables and fresh bananas. Fresh bananas may be substituted for baby food fruits at the rate of approximately one fresh banana per four ounces of commercial product. To encourage or promote full breastfeeding, the recommended amounts of baby food fruits and vegetables are more generous for fully breast-fed infants than other infants as follows.

- For fully breast-fed infants, approximately eight ounces of commercial baby food fruits and vegetables are provided per day.
- For other infants, approximately four ounces of commercial baby food fruits and vegetables are provided per day.

These changes in Food Package II are based on several considerations. Baby food fruits and vegetables serve to introduce all older infants to new flavors and textures. For the fully breast-fed infants, they provide needed nutrients and also provide a nutritious food to mix with the pureed meat products (to improve their palatability and texture). Commercial baby foods allow targeting the food to the infant, and they are available in developmentally appropriate textures. The small size of the containers is compatible with food safety. That is, the food can be consumed within the safe storage period for refrigerated opened baby foods. The small size of the containers is also compatible with introducing the infant to a variety of foods and flavors over time. Substitution of banana for part of the commercial baby

food would need to be requested at the time of issuing the food package prescription in the WIC clinic. If chosen, banana would be specified on the standard food instrument.

For children and adults, three different types of fruit and vegetable offerings are proposed, as follows:

1. *Fresh Produce Option for Children and Women*—Since few fresh fruits and vegetables are sold in uniform weight units with uniform bar codes, and their prices vary considerably across seasons, regions, and stores, they cannot be prescribed in quantity terms and still control the overall cost of the WIC food package. Thus, to implement the fresh produce option, the committee recommends the issuance of separate (small denomination, such as $2) cash-value vouchers at the level of $10 per month for adolescent or adult women and $8 per month for children. This corresponds to approximately 12 pounds and 10 pounds of fresh produce for women and children, respectively, or 1 to 2 servings per day. The committee recommends that any combination of fresh fruit or fresh vegetable—except white potatoes[11]—be allowed in quantities with a value up to the amount of the cash-value voucher(s).

2. *Processed Fruit and Vegetable Option for Children and Women*—This would be handled with the WIC program's standard food instrument system. There are several possible scenarios: (1) at the store, the client would be able to select preferred types among some alternatives listed on the food instrument or (2) with input from the client, the CPA would specify the types and amounts of processed fruits and vegetables selected from the list of choices allowed by the WIC state agency. (For specifications of allowable products from which the state agency could choose, see Table 4-3 and Table B-1 in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.) Seven 15-ounce cans of fruit and seven 14.5-ounce cans of vegetables would provide approximately the same the number of child-size servings that could be obtained with the proposed $8 fresh produce option for children. Nine 15-ounce cans of fruit and nine 14.5-ounce cans of vegetables would provide approximately the same number of adult-size servings that could be obtained with the proposed $10 fresh produce option for women.

3. *Combined Fresh and Processed Option for Children and Women*—The WIC state agency could choose to allow a combination of fresh pro-

[11]Orange yams and sweet potatoes would be allowed. Some states may choose to **exclude** a very small number of other starchy vegetables if local use is very common. For example, specific state agencies might exclude white yams (*ñame*), a popular root crop among some Hispanic groups; the possible exclusion of *ñame* is likely to be important only in certain regions.

duce and processed fruits and vegetables for those who request it. Doing this would entail a combination of cash-value vouchers and the use of the WIC program's standard food instrument system. For example, the client might request cash-value voucher(s) for $6 worth of fresh produce and processed fruits and vegetables for the remainder.

Effects on Program Staff and Vendors of Adding Fruits and Vegetables

The committee anticipates that a number of adjustments will be necessary on the part of both program staff and vendors in order to implement the committee's recommendations concerning fruits and vegetables.

At the WIC state agency level, the decision would be made regarding which of the three fruit and vegetable options would be allowed. State agencies also would need to determine which processed fruit and vegetable choices could be made available while controlling costs. The committee encourages state agencies to allow participants many choices within the processed option as well as the option for cash-value vouchers. This would promote acceptability of the foods by people of many different backgrounds. See the section *Providing More Flexibility for WIC States Agencies and More Variety and Choice for WIC Participants*.

Local WIC program staff, if allowed by the state agency, would issue separate food instruments for fresh and processed items (i.e., cash-value vouchers for fresh produce expressed in maximum dollar amounts; standard itemized food instruments for processed items expressed in maximum quantities). Any allocation of the fruits and vegetables into fresh or processed would have to be decided at the time the WIC food prescription is written. The inclusion of fruits and vegetables in WIC food packages will provide the necessity and the opportunity for participant education regarding choosing and using fruits and vegetables and using the cash-value voucher(s). See Chapter 7—*Recommendations for Implementation and Evaluation*—for further recommendations concerning nutrition education.

It is anticipated that retail food vendors will sell more fresh fruits and vegetables as a result of the inclusion of these products in the children's and women's food packages. Because fresh produce is a relatively high margin department in retail food stores, this is expected to be a welcome change. Fruit and vegetable producers and distributors would benefit from increases in sales. There will, however, be some added vendor costs to implement this change. Examples follow.

- Sales personnel in the produce section may need to spend time assisting shoppers to determine the cost of unpackaged fresh fruit and vegetable selections.
- Checkout areas may be slowed initially if participants overestimate

or underestimate the cost of the fresh fruits and vegetables they select. (See *Fresh Produce* in the *Workable Procedures* section of Chapter 7—*Recommendations for Implementation and Evaluation*—for suggestions on ways to resolve this problem.)

- Retail food stores may have to program the computers that collect scanner data to be able to track the sales of food products to WIC recipients by type of payment (cash-value voucher versus standard itemized food instrument).
- Small stores may need to increase the array of foods in the produce section.
- Retail vendors that serve only WIC customers do not currently carry fresh fruits and vegetables, except possibly for carrots. They will need to change their operations to accommodate the sale of some fresh fruits and vegetables. This may involve new business licenses to meet health and safety regulations.

Except in very small stores, adding processed fruits and vegetables is not expected to pose an additional vendor burden beyond the staff training that will be required to accommodate additional items and choices recommended for the revised packages. Small stores may need to increase the array of foods on the shelves.

In public meetings held by the committee, various vendors commented on implementation issues relating to the sale of fresh (or processed) fruits and vegetables. They specifically asked that fresh produce be prescribed using a method that designates a dollar value (e.g., a cash-value voucher).

Including More Whole-Grain Products

The committee makes recommendations to include more whole grains in WIC food packages for women and children. This action responds to the new dietary guidance (DHHS/USDA, 2004; DHHS/USDA, 2005) to consume at least three servings per day of whole grains to reduce the risk of coronary heart disease and type 2 diabetes, to help with body weight maintenance, and to increase intake of dietary fiber. In particular, the committee recommends that allowed breakfast cereals for children and adults include iron-fortified whole-grain cereals only and that whole-grain bread (with allowable substitution of brown rice, oatmeal, bulgur, whole-grain barley, or soft corn tortillas) be included in the food packages for children and pregnant and breastfeeding women (Food Packages IV, V, and VII). State WIC agencies would use Table 4-3 (*Proposed Specifications for Foods*) and Table B-1 (Appendix B—*Nutrient Profiles of Current and Revised Food Packages*) and other resources to determine which types and brands of whole-grain products would be allowed.

Reducing Saturated Fat and Limiting Cholesterol for Participants 2 Years of Age and Older

The committee took several steps to reduce the amount of saturated fat in the revised food packages for participants 2 years of age and older and to limit the amount of cholesterol in the food packages for women. The changes also reduce the amount of total fat provided by the packages. The intent is to be consistent with the current recommendations from *Dietary Guidelines* for children ages 2 through 4 years and for adult women: limiting saturated fat intake to less than 10 percent of food energy while keeping total fat intake within the range of 20 to 35 percent of food energy for adults, 25 to 35 percent of food energy for children 4 through 18 years, and 30 to 35 percent of food energy for children aged 2 through 3 years; and keeping dietary cholesterol intake below 300 mg per day (DHHS/USDA, 2005). This dietary guidance is based on substantial data showing that intakes of saturated fat greater than 7 to 10 percent of food energy are associated with increased risk for coronary heart disease and that dietary fat intake exceeding 35 percent of food energy may increase risk for overweight and obesity and often is accompanied by excessive saturated fat intake (IOM, 2002/2005; DHHS/USDA, 2004). Current food intake data show that average saturated fat intake is 11 to 13 percent of food energy (Briefel and Johnson 2004; Gleason and Suitor, 2001).

To reduce the saturated fat content of the food packages for children and women, the committee proposed several changes in recommendations for fluid milk. One is a modest reduction in the recommended maximum amounts of milk in packages for children and women. Another change, and perhaps the most fundamental, is that the revised food packages specify reduced-fat, low-fat, or nonfat fluid milk (i.e., maximum of 2 percent milk fat)[12] for children 2 years and older and for adult women. Whole milk (3.5 to 4 percent milk fat) is a major source of saturated fat in the diet, contributing almost one-third of saturated fat intake in the United States (Cotton et al., 2004). Furthermore, a recent IOM report on reducing exposure to dioxins and similar compounds through the food supply specifically recommended the substitution of fat-reduced milk for whole milk in government-sponsored feeding programs for children (including school feeding programs and the WIC program), in order to reduce the exposure to these compounds that occurs through consumption of animal fat (IOM, 2003b).

[12]The committee is using terminology as required on labeling for milk and milk products (FDA, 1998). *Reduced-fat* has up to 2 percent milk fat, *low-fat* has up to 1 percent milk fat, and *nonfat* is skim or fat-free. The term *fat-reduced* is used to refer to all varieties with 2 percent or less milk fat.

The maximum amount of cheese allowed has also been reduced in the revised food packages. At present the packages allow up to four pounds of cheese (current Food Packages IV–VI) and five pounds in the current Food Package VII. The committee proposes a maximum of one pound of cheese in revised Food Packages IV–VI and two pounds in the revised Food Package VII. Reducing the maximum amount of cheese reduces the amount of saturated fat, total fat, and cholesterol.

The revised food packages for children and women provide less cholesterol than the current package because they provide fewer eggs, but the major reason for decreasing the quantity of eggs was to help make it possible for the packages to provide a wider variety of foods. This revision is consistent with current dietary guidance on cholesterol intake from the IOM (i.e., that cholesterol intake be as low as is consistent with a nutritionally adequate diet) (IOM, 2002/2005) and the *Dietary Guidelines for Americans 2005* (i.e., that cholesterol intake be below 300 mg/d) (DHHS/USDA, 2005). The quantity of eggs provided by the revised packages is comparable with the average amount of eggs consumed by children who are participating in the WIC program (Oliveira and Chandran, 2005).

Promoting and Supporting Breastfeeding

The committee placed emphasis on developing food packages that could promote and support breastfeeding. Reasons for this emphasis include the following:

- Breastfeeding provides substantial short- and long-term health benefits for the infant and the mother. Infant feeding recommendations are summarized in Chapter 2—*Nutrient and Food Priorities*—of this report.
- Breastfeeding objectives are part of *Healthy People 2010* (DHHS, 2000b), and WIC participants lag behind the general population in progress toward meeting those objectives (see Chapter 2—*Nutrient and Food Priorities*).
- The Surgeon General issued the *HHS Blueprint for Action on Breastfeeding* in 2000, introducing it with the statement, "Breastfeeding is one of the most important contributors to infant health" (OWH, 2000).
- Breastfeeding rates in the hospital and at 6 months for WIC infants are about 20 percentage points lower than for non-WIC infants (Ryan, 1997; Ryan et al., 2002; Ahluwalia et al., 2003).
- The charge to this IOM committee included consideration of the role of WIC food packages in reinforcing breastfeeding (see Chapter 1—*Introduction and Background*).
- Numerous public comments submitted to the committee expressed the need to encourage breastfeeding.

A study by Chatterji and Brooks-Gunn (2004) on participation in the WIC program and the initiation and duration of breastfeeding, using linked data on mothers and children from the Fragile Families and Child Well-Being Study, concluded that the WIC program faces a difficult challenge in encouraging low-income mothers to breastfeed while also providing formula.

Recognizing the challenge of designing WIC food packages that would support breastfeeding, the committee proposed a three-pronged approach that is more comprehensive than the current approach. (Currently, the regulations simply provide breastfeeding women with food packages for up to 12 months [rather than up to 6 months] and provide an enhanced package for fully breastfeeding women.) In particular, the proposed approach focuses on the market value of the package for the mother/infant pair for the entire first year after birth, addresses differences in supplementary nutrition needs of breast-fed and formula-fed infants, and considers how to minimize early supplementation with formula. Because the proposed changes are substantial and untested, the committee also calls for pilot studies before full-scale implementation.

Market Value of the Packages for the Mother/Infant Pair

Proposed changes to help support breastfeeding address packages for the infant as well as the mother since both the new mother and the infant ordinarily are eligible to receive a WIC food package. From a mother's point of view, the dollar value of the current food packages provided to formula-feeding mother/infant pairs is substantially greater than that of the packages for the fully breastfeeding pairs, especially during the first six months postpartum. Because of differences in the market (pre-rebate) value of food packages, mothers may perceive the current food packages for the partially breastfeeding pair to be the most attractive option and the food packages for fully breastfeeding pairs to be the least attractive.[13] The food package cost evaluation conducted by this committee (see Chapter 5—*Evaluation of Cost*) validates this perception.

Some evidence suggests that attractive packages for fully breastfeeding mother/infant pairs might act as an incentive for breastfeeding. In the WIC Infant Feeding Practices Study of 1997, breastfeeding women were asked if they knew about the special package for breastfeeding women who did not accept formula from the WIC program (Bayder et al., 1997). (See Table 1-1,

[13]The difference is less apparent when examining costs to the WIC program because infant formula rebates reduce the cost borne by the program (Tuttle and Dewey, 1996).

Chapter 1—*Introduction and Background*, for a description of the current enhanced breastfeeding package—the enhancements being the inclusion of both dry beans and peanut butter, cheese [in addition to cheese as a substitute for milk], carrots, canned tuna, and additional juice.) Women who knew about the enhanced package were 27 percent less likely to discontinue breastfeeding than women who were unaware of such a package (Bayder et al., 1997). This gives support for the committee's effort to increase the attractiveness of the contents of the food packages for the fully breastfeeding mother/infant pairs while decreasing the relative pre-rebate values of the food packages for partially breastfeeding pairs and fully formula-feeding pairs. The market value cost comparisons for the proposed packages for mother/infant pairs appear in Chapter 5—*Evaluation of Cost*, Table 5-5.

In comparing the revised food packages for infants at least age 6 months of age, the food package for fully breast-fed infants (Food Package II-BF) provides twice the amount of commercial baby food fruits and vegetables provided by the packages for infants who receive formula (Food Packages II-BF/FF and II-FF). The food package for fully breast-fed infants (Food Package II-BF) also provides commercial baby food meat, a good source of iron and zinc.

Compared with the revised Food Package VI for fully formula-feeding mothers, the revised Food Package VII for fully breastfeeding mothers provides more milk and eggs; it also provides canned fish, whole grains, cheese (in addition to cheese as a substitute for milk), and both dry beans and peanut butter (Table 4-2).

Differences in Nutritional Needs

The differences in the packages for the mother/infant pairs are based on differences in nutritional needs—not just on relative cost. Thus, the package for fully breastfeeding women provides the most food energy and nutrients, and the package for fully formula-feeding women provides the least (see Tables B-2A through B-2E in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*). Similarly, starting at the age of 6 months, the proposed package (Food Package II-BF for fully breast-fed infants) includes commercial baby food meats to add iron and zinc. As listed in Table 2-10 (Chapter 2—*Nutrient and Food Priorities*), intakes of iron and zinc need to be increased for fully breast-fed infants but not for formula-fed infants ages 6 through 11 months.[14]

Chemical analyses of breast milk at various stages of lactation indicate

[14]Data supporting this statement are presented in Table 2-1 (Chapter 2—*Nutrient and Food Priorities*) and in Table C-2C (Appendix C—*Nutrient Intake of WIC Subgroups*).

that iron and zinc contents are low in comparison with the needs of infants ages 6 through 11 months (Krebs, 2000; Dewey, 2001; Krebs and Westcott, 2002). Since the iron and zinc contents of breast milk are not dependent on the mother's mineral status, an older breast-fed infant needs appropriate complementary foods that will supply these minerals (Domellöf et al., 2004). Baby food meats serve this purpose.

Minimizing Early Supplementation

Proposed Policy Change Related to Initial Food Package Options for Mothers/Infant Pairs After Delivery—Because early supplementation with formula may contribute to the short duration of breastfeeding of those who choose to breastfeed, the committee recommends that only two infant feeding options be offered initially after delivery—either full breastfeeding or full formula feeding—and that WIC staff continue or increase their efforts to encourage and support breastfeeding. Women who choose to breastfeed, whether they intend to continue fully breastfeeding or intend to move to partial breastfeeding, would receive the enhanced fully breastfeeding food package (Food Package VII) for the first month after delivery. (If a mother knew she would need to change to partial breastfeeding at month one or later—because of employment, for example—she could arrange for that when initially certified.)

Under this approach, infant formula would not be provided to breastfed infants during the first month after birth, but peer counseling, consultation with a lactation specialist, breast pumps, or other support for breastfeeding would need to be readily available. If a breastfeeding mother contacts the local WIC clinic to request formula during the first month, a desirable approach would be for the clinic to provide additional breastfeeding support and/or counseling with a peer counselor, lactation consultant, or qualified health educator with breastfeeding expertise. If appropriate, the mother may receive up to the maximum amount of formula in Food Package I-BF/FF-A for fully formula-fed infants (with the amount adjusted to the number of days remaining in the first month). The food package assignments could change after the first month. For example, a breastfeeding mother could ask to have her infant assigned to the partially breast-fed category (Food Package I-BF/FF). In this case, the mother would be assigned to Food Package V.

Basis for Policy Change—Evidence for the recommended policy change relates to the physiology of breastfeeding and studies involving the provision of supplemental formula to breastfeeding women. Physiology provides a strong basis for avoiding supplemental formula. The amount of milk a breastfeeding woman produces depends directly on how often and how

long she nurses. If the infant is hungry and needs to nurse often to get enough milk, the mother will begin to produce more milk to meet the demand. Because of this, guidance for new breastfeeding mothers encourages them to nurse often—8 to 12 feedings every 24 hours and for as long a period as the infant remains at the breast (AAP, 2005). Providing supplemental formula to a new breastfeeding mother may interfere with her milk production and success at continued breastfeeding.

In a number of studies among diverse groups, full breastfeeding in the neonatal period (or delayed introduction of formula) has been positively associated with longer duration of breastfeeding (Hill, 1991; Novotny et al., 2000; Whaley et al., 2002; Ekström et al., 2003; Chapman et al., 2004). Some of these studies were conducted in WIC settings (Hill, 1991; Novotny et al., 2000; Whaley et al., 2002). Ekström and colleagues (2003) found that supplementation without a medical reason decreased the prevalence of full breastfeeding and the duration of any breastfeeding. They suggest that lack of self-confidence in breastfeeding ability may be a key factor explaining the negative effects on breastfeeding duration of supplementing with formula for nonmedical reasons.

The committee did not find any interventions that examined the effects of delaying formula in the WIC setting. However, a review of nine randomized, controlled trials (involving a total of 3,730 women) found that providing hospital discharge packs that contained formula reduced the rates of full breastfeeding at all follow-up time points but did not influence early termination of breastfeeding (Donnelly et al., 2000). In retrospective and prospective studies, the receipt of formula in hospital discharge packs is negatively related to breastfeeding duration (Gross et al., 1998).

Recommended Studies

The committee's intent was to recommend food packages and policies that would promote the establishment of successful long-term breastfeeding among women who choose that feeding method. Because effects of these changes in the food packages and initial infant feeding options on initiation and duration of breastfeeding are unknown, the committee strongly recommends comprehensive pilot testing before full-scale implementation of these changes. Elements of such pilot tests are presented in Chapter 7—*Recommendations for Implementation and Evaluation.*

Addressing Developmental Needs of Infants and Young Children

The revised food packages consider specific developmental and physiological needs through the amounts of infant formula provided, the types

and timing of availability of complementary foods, and the requirement for whole milk for 1-year-old children.

Amounts of Infant Formula Provided

Fully Formula-Fed Infants—For fully formula-fed infants birth through 3 months of age (Food Package I-FF-A), the amount of formula provided is not changed from the current Food Package I. The maximum allowance of 403 fluid ounces of formula concentrate (26 fl oz of formula per day)[15] provides approximately 530 kilocalories per day, which is nearly the same as the mean Estimated Energy Requirement (EER) of 555 kilocalories per day for formula-fed WIC infants birth through 3 months of age (see Appendix B—*Nutrient Profiles of Current and Revised Food Packages* for detailed information).

For fully formula-fed infants 4 through 5 months of age (Food Package I-FF-B), the committee recommends increasing the maximum amount of formula to 442 fluid ounces of formula concentrate per month. The slightly increased amount provides an additional 2.5 fluid ounces of formula per day and brings the total food energy to 581 kilocalories per day. This amount of food energy equals 93 percent of the mean EER for infants 4 through 5 months of age (623 kilocalories per day) and 88 percent of the maximum food energy provided by the current Food Package II (for infants 4–11 mo of age).[16] (See Appendix B for detailed information.) Thus, compared with the current Food Package II, the revised Food Package I-FF-B provides slightly less energy to infants 4 through 5 months of age. The seeming contradiction (fewer calories despite more formula) is explained by the exclusion of juice and cereal from the revised food package for infants 4 through 5 months of age. In the current Food Package II, the juice and cereal provide about 134 kilocalories per day (see Appendix B for detailed information). The revised infant food packages provide essential nutrients without providing excess food energy and reinforce the nutrition education message to initiate the routine feeding of complementary foods beginning around six months of age (AAP, 2004, 2005). For fully formula-fed infants ages 6 through 11 months (Food Package II-FF), the proposed amount of

[15]*Factor for days per month*—In keeping with the apparent assumptions used in various FNS documents, the committee used the factor of 31 days per month for calculations involving nutrients provided for infants. For all other participants, the committee used the factor of 30 days per month. For standard use, formula concentrate is diluted with an equal amount of water. Thus, 13 fluid ounces of formula concentrate reconstitutes to 26 fluid ounces of formula. A 13-fluid ounce can of infant formula concentrate is a common unit for purchase.

[16]*Substitution for powdered formula*—See Table B-6 in Appendix B—*Nutrient Profiles*—for the amounts of powdered formula that would be allowed.

formula is reduced to 312 fluid ounces of formula concentrate per month; the rationale is to provide an increasing amount of nutrients through complementary foods while reducing intake of formula.

Partially Breast-Fed Infants—The amounts of formula provided for partially breast-fed infants mirrors the amounts provided for fully formula-fed infants with the following important differences: (1) the partially breast-fed option in not available in the first month postpartum—in order to promote breastfeeding as explained elsewhere; (2) the maximum amount provided approximates half of the amount provided to fully formula-fed infants—to provide about half of the infant's nutritional needs to encourage the mother to breastfeed enough to provide at least half of the infant's nutritional needs; and (3) powdered formula is recommended during ages 1 through 3.9 months—to promote food safety and discourage waste as explained elsewhere.

The revised infant food packages provide essential nutrients, limit food energy, and reinforce the nutrition education message to initiate the routine feeding of complementary foods beginning around 6 months of age (AAP, 2005).

Changes in the Types and Timing of Availability of Complementary Foods

The committee recommends that the WIC program not provide complementary foods until the infant is 6 months of age. This is the age at which most healthy infants are developmentally ready to handle complementary foods (Hammer, 1992; Morris and Klein, 2000; Naylor and Morrow, 2001). Infants ordinarily do not need complementary foods for nutritional reasons at younger ages—either breast milk or iron-fortified infant formula would entirely meet the nutritional needs of most infants (Brown et al., 1998; Dewey, 2001; Domellöf et al., 2001; Griffin and Abrams, 2001; Butte et al., 2002; WHO, 2001a, 2001c, 2002; Habicht, 2004). There are some exceptions in which nutrient supplementation is recommended.[17] The committee's intent is to design food packages that address the nutritional

[17]Infants who will be fully breast-fed should receive vitamin K supplementation within the first six hours after birth (AAP, 2004, 2005). Infants who have inadequate iron stores (e.g., were born preterm, had low birth weight, have hematological disorders) generally require iron supplementation before 6 months of age (AAP, 2004, 2005). Vitamin D supplementation is recommended for fully breast-fed infants (and partially breast-fed infants if receiving less than 17 fluid ounces of iron-fortified formula per day) (AAP, 2004, 2005). Additional supplementation may be required for infants born preterm (see Schanler, 2001) or in underdeveloped countries (Greer, 2001).

needs of most rather than all infants. The committee's recommendation to provide complementary foods beginning at age 6 months is consistent with the most recent dietary guidance on complementary feeding (AAP, 2005; WHO, 2002; Kramer and Kakuma, 2002, 2004) and common guidelines for clinical practice in the field of pediatrics (Hendricks et al., 2001; Morris and Klein, 2000; AAP, 2001c; Rudolph and Rudolph, 2003).[18]

To make possible the gradual introduction of a variety of fruits and vegetables, the committee recommends the deletion of fruit juice and the addition of commercial baby food fruits and vegetables and fresh bananas to Food Package II for infants ages 6 months and older. The allowed foods span the range of textures appropriate for infants at different stages of development. To provide iron and zinc in forms with high bioavailability to meet the needs of fully breast-fed infants, the committee recommends the addition of commercial baby food meats for fully breast-fed infants beginning at age 6 months (Food Package II-BF). The package for fully breast-fed infants also provides additional baby food fruits and vegetables; the rationale is to provide additional nutritional value to improve the parity with other infant packages, to provide sufficient fruits and vegetables to mix with baby food meats to increase the palatability of strained meats for older infants, and to encourage prolonged breastfeeding by adding to the convenience and monetary value of the food packages of the fully breastfeeding mother/infant pair.

The recommendations for the milk fat content are consistent with AAP recommendations of whole milk for children who are one year of age and fat-reduced milk for older children (AAP, 2004). The exclusion of dried fruit from the processed fruit and vegetable options for children (see Table 4-3) is intended to reduce the risk of choking posed by that form of fruit (AAP, 2004).

Addressing Obesity Concerns

Overweight and obesity in children and adults largely outranks undernutrition as a significant public health concern (DHHS/PHS, 1988; NRC, 1989a; IOM, 1991, 2004a; Kessler, 1995; Koplan and Dietz, 1999; Mokdad et al., 1999, 2000, 2004, 2005; DHHS, 2001). Moreover, prevalences of overweight and obesity are especially high in subpopulations that are overrepresented in the WIC population (Flegal et al., 2002, Kumanyika et al., 1999; Paeratakul et al., 2002; Wardle et al., 2002).

[18]Some parents may choose to feed their infants complementary foods before the age of 6 months, but the committee did not find a developmental or nutritional rationale to provide complementary foods in the WIC food package before age 6 months.

Thus, the committee considered ways that redesign of the WIC food packages could help promote healthy body weight for WIC participants. In doing so, the committee kept in mind a number of key points:

- Although many factors contribute to overweight and obesity, the ultimate cause is positive energy balance (Koplan and Dietz, 1999; IOM, 2004a).
- If maintained over time, small changes in energy intake can lead to substantial gain in body weight. For example, it is estimated that most of the U.S. population could maintain a healthy body weight by a change in energy balance of 100 kilocalories per day (Hill et al., 2003)—that is, by decreasing daily intake by 100 kilocalories, increasing daily energy output by 100 kilocalories, or some combination.
- Infancy may be a critical period for preventing the development of overweight during childhood (Whitaker et al., 1997; Ong et al., 2000; Law et al., 2002; Stettler et al., 2002) and its long-term consequences (Whitaker et al., 1997; Law et al., 2002).
- Some evidence suggests that reducing the consumption of sweet drinks, including fruit juice, may be helpful in managing the body weight of preschool children (Welsh et al., 2005).

The committee's recommended changes to the WIC food packages support small reductions in total food energy and improvements in nutrient density. The emphasis is on nutrient-dense foods and beverages and limitations on added sugars for all, and an increase in fiber and decrease in saturated fat content of the packages for children and women. Compared with the current food packages, the revised food packages for infants provide less food energy after the age of four months (except for fully breastfed infants). The food packages for children and women provide somewhat less milk, cheese, eggs, and juice; and, for those age two years and older, milk cannot exceed 2 percent milk fat. The addition of fruits and vegetables and the emphasis on whole grains are consistent with recommendations for food patterns that may contribute to a healthy body weight. Together with nutrition education, the proposed WIC food packages can play an important role in promoting optimal pregnancy weight gain, postpartum weight status, and healthy growth of children.

The revised food packages are designed to encourage breastfeeding and thus may contribute to a reduced risk of overweight in children. In a recent review, Dewey examined 11 studies and found that 8 of the studies demonstrated a moderate but significant protective effect of breastfeeding against overweight in childhood and adolescence (Dewey, 2003). Moreover, a recent prospective study of mother/infant pairs found that the combined effects of short duration of breastfeeding and early introduction

of solid foods are associated with significantly greater infant weight gain, from birth to one year, especially among infants born to overweight mothers (Baker et al., 2004). Based on this evidence, extending the duration of breastfeeding and delaying the introduction of solid foods would appear to be appropriate strategies for early prevention of overweight in young children.

In summary, the subpopulations served by the WIC program are at risk for the development of overweight and obesity. It is important to address issues of a healthy body weight during the life stages of WIC participants. The proposed WIC food packages provide a variety of nutrient-dense foods in moderate amounts and can contribute to developing healthy eating patterns, reinforcing nutrition education, and promoting positive changes in dietary behaviors.

Providing More Flexibility for WIC States Agencies and More Variety and Choice for WIC Participants

The cultural diversity and heterogeneity of the WIC participant population pose special challenges for a supplemental nutrition program. Many public comments called for more options among allowed foods—both to improve incentives for participation in the WIC program and to increase consumption of the foods provided. In proposing revisions, therefore, the committee recommends increases in the types and total number of allowed foods. Table 4-3 lists proposed specifications that give the state agencies more flexibility in determining which food items they will allow. The committee urges WIC state agencies to allow the participants as much variety and choice of foods from Table 4-3 as is feasible considering cost constraints and availability of foods in grocery outlets common to the region. Providing more variety and choice will facilitate the tailoring of food packages to specific situations, especially for different ethnic or cultural groups. Two food categories merit special attention in this regard: fruits and vegetables and milk and milk products. Other areas of increased choice include the form of dry beans and peas (either dry-packaged or canned), more types of fish (see Table 4-3), and whole grain options.

Fruits and Vegetables

The committee recommends a great deal of flexibility for state agencies and the opportunity for variety and choice for participants within the proposed fruit and vegetable category of the food packages. This recommendation is based on three considerations.

- The availability, cost, and quality of different forms of fruits and vegetables vary substantially among states, territories, and tribal agencies.

These characteristics range from (a) markets with a wide variety of fresh produce that is abundant year-round with little seasonal variation to (b) markets with a very limited selection of fresh produce, possibly only seasonally, but with some variety (e.g., the most popular selections) of fruits and vegetables available in canned or frozen forms. WIC state agencies would determine if and when the fresh produce option would be available (e.g., certain months of the year). The committee encourages the WIC state agencies to allow participants to select from a wide variety of processed fruits and vegetables for the processed option.

- The *Dietary Guidelines for Americans 2005* recommends the consumption of a variety of nutrient-dense foods within and among the basic food groups and staying within energy needs (DHHS/USDA, 2005). The recommendation is based on evidence that dietary variety within food groups is related to dietary adequacy for both adults and children (Krebs-Smith et al., 1987; Cox et al., 1997; Foote et al., 2004). Variety and choice at the participant level directly addresses recommendations in the *Dietary Guidelines* (DHHS/USDA, 2005). Although there is some evidence that participation in the WIC program is associated with greater dietary variety than is nonparticipation among low-income children, dietary variety generally is low among children in low-income families (Knol et al., 2004).
- Choice at the participant level also responds to this IOM committee's Criterion 4 (which addresses the suitability of forms of food) and Criterion 6 (which addresses the acceptability of the foods for people of different cultural backgrounds).

The committee recognizes that nutrient content varies widely across individual items within the fruit and vegetable groups. Allowing choice at the participant level makes it impossible to ensure that the selections made will provide a specified amount of nutrients. This is especially applicable to the fresh produce option. However, the limited available evidence from pilot studies shows that, when provided with a fresh fruit and vegetable supplement to the WIC food package, participants chose a wide variety of different items (Herman, 2004; Runnings, 2004). Allowing choice increases the likelihood that a food will be consumed. The committee identified individual participant choice and variety as priorities, especially within this proposed food category. Choice holds potential to provide incentives for participation, improve acceptability of foods offered across a diverse set of cultural backgrounds, and promote long-term healthy eating patterns. The only restriction the committee placed on the choice of fruits and vegetables is not to allow white potatoes (that is, disallow potatoes other than orange yams and sweet potatoes). The committee based this restriction on the amounts suggested in the USDA Food Guide for consumption of starchy vegetables (DHHS/USDA, 2005), food intake data indicating that consumption of

starchy vegetables meets or exceeds these suggested amounts (Krebs-Smith et al., 1997; FSRG, 1999; Smiciklas-Wright et al., 2002; Briefel et al., 2004b), and food intake data showing that white potatoes are the most widely used type of vegetable (Krebs-Smith et al., 1997; FSRG, 1999; Cavadini et al., 2000, Smiciklas-Wright et al., 2002; Briefel et al., 2004b).

Milk Products

Although milk and milk products provide the most concentrated source of calcium in the U.S. diet, a high prevalence of lactose maldigestion and low cultural acceptability have been widely cited as reasons for the low consumption of dairy products among people of color (Pobocik et al., 2003; Auld et al., 2002; Jackson and Savaiano, 2001; Horswill and Yap, 1999; Story and Harris, 1989; Fishman et al., 1988). Studies show that women of color of childbearing age, particularly Asians and African Americans, are especially at risk for low intakes of dietary calcium (Siega-Riz and Popkin, 2001; Klesges et al., 1999; Wu-Tso et al., 1995). Milk and cheese are not a part of traditional food patterns of many cultural groups (NAWD, 2000; NWA, 2003; Kittler and Sucher, 2004). In public comments, yogurt, soy beverage ("soy milk"), and tofu were frequently requested calcium-rich options (NWA, 2003). For a variety of reasons, individuals with lactose maldigestion are able to tolerate yogurt better than milk (Kolars et al., 1984; Savaiano et al., 1984; Smith et al., 1985; Lerebours et al., 1989; Martini et al., 1991; Wynckel et al., 1991; Kotz et al., 1994, Galvão et al., 1995, 1996).

In the U.S. diet, fluid milk is an important source of vitamin D, a fat-soluble vitamin. The U.S. supply of fluid milk is fortified with vitamin D to prevent rickets on a population-wide basis. However, most other milk products are not fortified with vitamin D. If milk is replaced by milk products or other alternatives that are not vitamin D fortified, vitamin D intakes may be inadequate. Thus, replacements for milk are to be approached with caution even if they are rich in calcium.

For the reasons discussed in the two preceding paragraphs, proposed allowed foods include fat-reduced yogurt as a partial substitute for fluid milk for children and women, calcium-set tofu (tofu prepared with calcium salts) as a partial substitute for milk for women, and calcium- and vitamin D-rich soy beverage ("soy milk") as an alternative for all or part of the fluid milk for adult women.[19] These new choices may be viewed by some

[19]Soy products (i.e., tofu, soy beverage ["soy milk"]) are not allowed as substitutions for milk in the children's package except when prescribed in writing by an RMA. Through nutrition education, parents or guardians should learn that children are at nutritional risk when milk is replaced by other foods.

participants as more acceptable sources of calcium (and vitamin D in some cases) for WIC participants with milk allergies and lactose maldigestion and for those who avoid milk for cultural, religious, or other reasons. To maintain the nutritional content and cost neutrality of the food packages, some substitutions for milk (i.e., yogurt, calcium-set tofu) are allowed in limited amounts. These limitations can be waived in cases of lactose intolerance or other medical conditions when prescribed in writing by an RMA.

SUMMARY

The IOM Committee to Review the WIC Food Packages proposed changes in the amounts and kinds of foods in all seven food packages. In doing so, the committee gave special attention to revising the food packages to:

- Include fruits and vegetables for all participants 6 months of age and older;
- Include more whole-grain products;
- Reduce the amount of saturated fat for participants 2 years of age and older;
- Promote and support breastfeeding, especially full breastfeeding;
- Address the developmental needs of infants and young children;
- Address obesity concerns; and
- Provide more flexibility for the WIC states agencies and more variety and choice for the WIC participants.

Additionally, the committee recommends that the revised food packages be provided in full, except to the extent that the packages are tailored to the needs of individual WIC participants.

The proposed changes consider current recommendations for nutrient intakes and dietary patterns, the major diet-related health problems and risks faced by this population, the characteristics of the WIC program, and the diversity of the WIC-eligible population. The proposed changes will serve to make the WIC food packages more consistent with national and professional dietary guidance and more consistent with nutrition education messages that promote healthful diets for the WIC population. The revised WIC food packages have the potential to address current nutrient inadequacies and excesses, to address current discrepancies between dietary intake and dietary guidance described by food groups, and to address current and future diet-related health problems in the nation's population.

TABLE 4-3 Proposed Specifications for Foods in the Revised Food Packages[a]

Category/Food	Participant Group	Allowed Foods and Minimum Requirements
Infant Foods		
Infant formula	Infants, 0–11.9 mo	Iron-fortified infant formula. (No change from current specifications.)
Infant cereal	Infants, 6–11.9 mo	Iron-fortified infant cereal, instant. (No change from current specifications.)
Baby food fruits and vegetables	Infants, 6–11.9 mo	Commercial baby food fruits and vegetables without added sugars, starches, or salt (i.e., sodium)—Texture may range from strained through diced. Fresh banana may replace up to 16 oz of baby food fruit at a rate of 1 lb of bananas per 8 oz of baby food fruit.
Baby food meats	Fully breast-fed infants only, age 6–11.9 mo	Single major ingredient, commercial baby food meat; without added sugars, starches, vegetables, or salt (i.e., sodium)—Texture may range from strained through diced.
Fruits and Vegetables		
Juice	Children and women	No change from current specifications.
Fresh fruits and vegetables	Children and women	Any variety of fresh whole or cut fruits, without added sugars Any variety of fresh whole or cut vegetables except white potatoes (orange sweet potatoes and yams are allowed), without added sugars, fats, or oils Variety in choices should be encouraged through nutrition education.
Processed fruits and vegetables	Children and women	Any variety of canned fruits, juice pack or water pack, without added sugars—Any variety of frozen fruits, without added sugars Any variety of canned or frozen vegetables except white potatoes (orange sweet potatoes and yams are allowed), without added sugars, fats, or oils—Soups and condiments such as catsup, pickles, and olives are excluded. Variety in choices should be encouraged through nutrition education.

continues

TABLE 4-3 Continued

Category/Food	Participant Group	Allowed Foods and Minimum Requirements
	Women only	Any variety of dried fruits, without added sugars, fats, oils, or salt (i.e., sodium).
Milk and Alternatives		
Milk, whole	Children (age 1–1.9 y)	Only whole milk is allowed for 1-y-old children.
Milk, fat-reduced	Children (age ≥ 2 y) and women	No more than 2% milk fat allowed.
Cheese	Children and women	No change from current specifications. The committee does not recommend any substitutions for cheese in Food Package VII.
Yogurt, fat-reduced	Children and women	Plain or flavored; ≤ 17 g of total sugars per 100 g yogurt—Yogurt for those age 2 y and older may not contain more than 2% milk fat.
Soy beverage	Women	Soy beverage ("soy milk") must be fortified to contain nutrients in amounts similar to cow's milk.
Tofu	Women	Calcium-set tofu (prepared with only calcium salts [e.g., calcium sulfate]). May not contain added fats, oils, or sodium.
Grains		
Cereal	Children and women	Ready-to-eat cereals and hot cereals (instant, quick- and regular-cooking) must be *whole grain* (e.g., a minimum of 51% of the grain in the product must be whole grains) and conform to other current specifications (e.g., must be iron-fortified, must not exceed added sugars limitations).
Whole-grain bread	Children and women except non-breastfeeding postpartum women	Bread must conform to FDA standard of identity for whole wheat bread (i.e., a minimum of 51% of the grain in the product must be whole grains). *or* Bread must meet labeling requirements for making a health claim as a "whole-grain food with moderate fat content" (i.e., a minimum of 51% of the grain in the product must be whole grains).

continues

TABLE 4-3 Continued

Category/Food	Participant Group	Allowed Foods and Minimum Requirements
Other whole grains		Brown rice, bulgur, oatmeal, barley; without added sugars, fats, oils, or salt (i.e., sodium)—May be instant-, quick-, or regular-cooking. Soft corn or whole wheat tortillas without added fats or oils could be allowed.
Meat and Alternatives		
Eggs	Children and women	No change from current specifications. Hard boiled eggs, where readily available in small quantities, may be provided for participants with limited cooking facilities. The committee does not recommend any substitutions for eggs.
Fish, canned	Woman, fully breastfeeding (VII)	New options include canned salmon and other canned fish that do not pose a mercury hazard as identified by advisories from the FDA or EPA. Pack may include bones and skin as indicated by FDA standard of identity or USDA commercial item description.
Legumes	Children and women	Any variety of mature dry beans, peas, or lentils in dry-packaged (i.e., dried) or canned forms; without added sugars, starches, or fats—Canned legumes may be regular or lower in sodium content. Baked beans may be provided for participants with limited cooking facilities.
Peanut butter	Children and women	No change from current specifications.

[a]See Table B-1 (Appendix-B—*Nutrient Profiles of Current and Revised Food Packages*) for detailed specifications. Any processed foods for children and adults may be regular or reduced in sodium content unless otherwise specified. For the purposes of this specifications table, the term *canned* refers to processed food items in cans or other shelf-stable containers.

NOTES: EPA = U.S. Environmental Protection Agency; FDA = Food and Drug Administration; USDA = U.S. Department of Agriculture.

5
Evaluation of Cost

A major consideration in the redesign of the WIC food packages was the requirement to achieve cost neutrality in proposing recommended changes. According to Public Laws 101-147 and 105-336 (U.S. Congress, 1989, 1998), "States [i.e., WIC state agencies] must undertake cost containment measures, including contracts for the purchase of infant formula and, if possible, other WIC foods."[1] The importance of considering cost also was stated explicitly in the September, 2003 Advance Notice of Proposed Rulemaking (FNS, 2003a, p. 53907). For the purposes of this report, the term *cost neutrality* means that the average cost per participant of the complete set of revised WIC food packages (Food Packages I through VII) proposed in this report does not exceed that cost of the current WIC food packages using identical methods for estimating costs. This chapter explains the methods used to estimate the costs of the current and revised food packages and the results of these estimations on food package costs for the program as a whole. This chapter also presents comparisons of the market value of current and revised food packages for the three types of mother/infant pairs—fully breastfeeding, partially breastfeeding, and fully formula-feeding mother/infant pairs. These comparisons show changes in the potential monetary value of the packages for breastfeeding and non-breastfeeding postpartum women. Lastly, because current trends in the

[1]Quote is from GAO (General Accounting Office). 2001. *Food Assistance: WIC Faces Challenges in Providing Nutrition Services*. Report No. GAO-02-142, p. 32. Washington, DC: U.S. General Accounting Office.

prices of milk and infant formula indicate the potential for large increases in the future costs of the WIC food packages with or without revisions, the chapter addresses the sensitivity of estimates to changes in the prices of these foods.

OVERVIEW

In the process of redesigning the food packages, the committee estimated the cost of a number of possible sets of food packages. At each iteration, possible adjustments were considered in the types and amounts of foods needed to achieve cost neutrality while meeting the criteria shown in Chapter 1—*Introduction and Background* (Box 1-1). In following this approach, the committee initially worked with the basic food packages for women and children—that is, the food packages without substitutions. Depending on the package, these basic food packages include fluid milk, cheese, peanut butter, dried beans, whole wheat bread, eggs, tuna, and fresh fruits and vegetables. Because the committee strived to allow for flexibility in the revised food packages, the costs (and nutrient content) of food packages that incorporated substitutions at specified rates were also estimated (see Appendix E). The final cost estimates for the set of revised food packages include the cost of making selected substitutions at specified rates (see Appendix E)[2] to the basic set of food packages. The specified substitution rates are based on assumptions; differences in assumptions would lead to a range in estimated average participant cost per month. Since most of the substitutions are higher-cost food items, the estimated cost of the set of revised food packages with substitutions is higher than the cost of less flexible food packages.

Within regulatory parameters, WIC state agencies currently can control costs by specifying a food item in lower-cost forms, varieties, brands, or container sizes. In estimating cost, the committee did not consider additional state or local agency discretion. Instead, costs were calculated using various forms, varieties, brands, and container sizes of food items that are representative of current practice or common use (i.e., based on the average share of household market purchases in national survey data) (ACNielsen Homescan; ACNielsen, 2001).

In evaluating the cost neutrality of proposed changes, the committee estimated the food costs to the WIC program based on the estimated costs

[2]Bases of Assumptions Used in Nutrient and Cost Analyses of Food Packages can be found in Tables E-1 (for infants) and E-2 (for children and women) in Appendix E—*Cost Calculations*. Calculated Costs of Representative Amounts of Foods in Revised Packages can be found in Tables E-3A (for infants) and E-3B (for children and women).

of each food package and the number of participants in the relevant participant category for the year 2002.[3] In all cases, it was assumed that the revised food packages or the allowed substitutions had no effect on rates of participation in the WIC program. The cost of each of the current and revised food packages was estimated using the maximum monthly allowance for each food and a nationally representative price for the specified food items. For revised food packages, assumptions were made about the substitution rates for selected higher cost substitutions in the package. This process yields an estimate of the cost of the maximum package per month. Although changes in the prescription rates[4] or redemption rates[5] have the potential to change program costs, data are unavailable on which to adjust for the current or future prescription rates or redemption rates.

METHODS

Data

General Data Considerations

The base year for analysis was 2002, a recent year with a reasonably complete set of program and participant data available. The quantities for food items were based on the maximum allowances specified for the current and revised packages (for current Food Packages I–VII, see Table 1-1 in Chapter 1—*Introduction and Background*; for the revised food packages for infants see Table 4-1 and for children and women see Table 4-2 in Chapter 4—*Revised Food Packages*).

[3]The exception is costs of medical foods for participants with special dietary needs. The committee assumed that there would not be a change in the amount or type of medical foods provided. The cost of these foods is not included in either the current or the revised average cost estimates.

[4]In this report, the term *prescription rate* refers to the percentage of the maximum allowance that is prescribed for WIC participants. For example, although the maximum allowance of milk for a 1-year-old child is currently 24 quarts per month, this maximum allowance is not prescribed for every 1-year-old child. Thus, the actual amount of milk prescribed for a child as a proportion of the maximum allowance for that child contributes to the overall prescription rate for milk in the entire WIC program.

[5]In this report, the term *redemption rate* refers to the percentage of the maximum amount prescribed for WIC participants that is actually obtained. For example, although 24 quarts of milk may be prescribed for a child per month, that amount may not be redeemed for the child. Thus, the actual amount of milk obtained (that is, redeemed) for a child as a proportion of the amount prescribed for that child contributes to the overall redemption rate for milk in the entire WIC program.

Prices

Data for the prices of each of the foods were identified from sources considered nationally representative of the food items likely to be selected and available to the participants. No single best source was available for all of the food prices. The committee used the sources indicated for the following types of foods:

- *Infant Formula*—Retail prices for infant formula were obtained from a report released by the Economic Research Service (ERS) (Oliveira et al., 2001) that calculated the average market price of infant formula using 2000 retail-scanner data (scanner-based retail sales tracking data from Information Resources, Inc. [IRI, Chicago, IL], InfoScan database). The data were designed to be representative of the United States using 64 market areas. The ERS report included price data on all types of infant formula (i.e., standard[6] and specialized).[7] The committee used only data on prices for standard milk-based formulas for this analysis.
- *Fruits and Vegetables*—Estimated prices for fruits and vegetables, including prices by form of the produce (i.e., fresh, canned, frozen, dried), were obtained from Reed et al. (2004) and a recently released data set (ERS, 2004b) on fruit and vegetable purchases and prices. These prices are based on ACNielsen Homescan 1999 price data (ACNielsen, 2001).
- *Eggs*—The source of the egg price was monthly average price data for 2002, Grade A, large eggs from the Consumer Price Index—Average Price Data of the Bureau of Labor Statistics (BLS, 2004a).[8]
- *Other Groceries*—Prices for groceries (including milk and milk products) were calculated based on 2001 ACNielsen Homescan purchase-price data (ACNielsen, 2001). Specifications for each food item reflected the allowed product characteristics for the current food packages obtained from the FNS website (FNS, 2004d, 2004e) or for the revised food packages as described in Table 4-3 (*Proposed Specifications for Foods*, Chapter 4—*Revised Food Packages*). The pricing data used also reflect container sizes allowed, if known for the current packages or if applicable for the

[6]The term *standard infant formula* refers to both milk-based and soy-based infant formulas, excluding specialized infant formula (i.e., formula for infants or children with special dietary needs).

[7]Related items in the infant formula category of the InfoScan database that were not actually infant formula (e.g., Pedialyte and other electrolyte maintenance solutions) were excluded from the data for the ERS analysis.

[8]Egg price data were drawn from BLS (2004a) because of ease in identifying a representative food item in this category and the uniform product specification.

revised packages. The average unit value (expenditure divided by quantity) used purchase data from all sample respondents in the ACNielsen Homescan panel (i.e., regardless of income). This method yields a market purchase-weighted price.

The price data come from different years (1999–2002), depending on the source of data. However, adjustment of the price data to the base year 2002 (BLS, 2004b, Consumer Price Index—Food at Home) showed that, during this period, the adjustment for overall price changes made a small and similar difference in overall costs for both the current and revised set of packages (that is, less than 1 percent difference for either set of packages). Hence, unadjusted price data were used in the analyses presented here.

Infant Formula Rebate Assumption

Under cost control requirements, WIC state agencies must negotiate rebate contracts with infant formula companies. All of the cost estimates make use of the following assumption on the rebate.

Data provided by FNS (public communication during open session, February 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA; FNS, 2004c, 2002 data) indicate that the average monthly pre-rebate cost for Food Package I (for infants ages birth through 3 months) was $94.03, and the average monthly post-rebate food package cost was $30.17. Because the current Food Package I comprises infant formula only, the committee used the ratio of the two costs to estimate the post-rebate cost as 32.1 percent of the pre-rebate cost of formula. Therefore, the committee adjusted the actual cost of the infant formula (obtained as described above) by a factor of 0.321 to obtain the post-rebate cost for the formula included in both the current and revised food packages. By holding the rebate level constant, prices are held constant for the purposes of comparing costs between current and revised food packages.

Numbers of Participants

The numbers of individuals in each participant category were from *WIC Participant and Program Characteristics: PC2002* (Bartlett et al., 2003, tables; Kresge, 2003, executive summary). Further delineation of participant groups by breastfeeding status was based on estimates of breastfeeding practices across the United States and among WIC participants by the Center for Disease Control and Prevention (CDC, 2004b, 2004c, 2004e).

Estimating Food Package Costs

Estimated package costs for the current and revised food packages are based, respectively, on the current or revised amounts of each food item and an estimated cost per unit of the food item.

The contents of the current and revised packages can be described in terms of general food categories (e.g., breakfast cereals) or representative food items (e.g., instant oatmeal). In many cases, the price for a general food category included in the package is the weighted average of several food items, estimated using a series of assumptions. The specific assumptions used in the cost analysis are presented in Tables E-1 and E-2 in Appendix E—*Cost Calculations*. For example, a weighted average for the cost of breakfast cereals using market share data (ACNielsen Homescan; ACNielsen, 2001) was used to determine the proportion of total cereal products purchased as cooked cereal (10 percent) and as ready-to-eat cereal (90 percent). The weighting done to estimate package costs is the same weighting that was done for the nutritional analyses except for some selected food items;[9] details of the weighting are presented in Tables E-1 and E-2. When the package included a cash-value voucher for fresh fruits and vegetables, the value of the voucher was included in the cost of the package. That is, the total package cost for each participant category was calculated as the sum of the costs of component food items plus the cash value of the voucher for fresh produce, as applicable. See Table 5-1 for a comparison of the estimated costs of the current and revised food packages. See Tables E-3A and E-3B in Appendix E—*Cost Calculations* for the cost of representative amounts of component food items used in the revised food packages.

Estimating Program Costs for Food

To estimate program costs for the sets of current and revised food packages, the estimated number of participants receiving each package in 2002 was multiplied by the estimated cost of the respective package. The committee assumed that there would be no change in WIC participation rates and no shifts among applicable participant categories. Although some

[9]Baby food fruits and vegetables are examples of selected food items that were calculated differently for the cost and nutrient analyses. Because there were no cost differences between specific fruits and vegetables in most baby food product lines, differentiation of specific items was not applicable in the cost analysis. The nutrient content varies for the different fruits and vegetables available in commercial baby food product lines, so representative choices were used in a weighted average for the nutrient analysis.

TABLE 5-1 Comparison of Estimated Costs of Current and Revised Food Packages (2002)[a]

Group	Age/Participant Category	Description	Current Package No.
Infants	0–3.9 mo	Fully formula-fed	I
	0–0.9 mo	Partially breast-fed	I
	1–3.9 mo	Partially breast-fed	I
	0–3.9 mo	Fully breast-fed	
	4–5.9 mo	Fully formula-fed	II
		Partially breast-fed	II
		Fully breast-fed	II
	6–11.9 mo	Fully formula-fed	II
		Partially breast-fed	II
		Fully breast-fed	II
Children	1–1.9 y		IV
	2–4.9 y		IV
Women	Pregnant		V
	Partially breastfeeding		V
	Non-breastfeeding postpartum		VI
	Fully breastfeeding		VII

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data (see data sources).

NOTES: BF = fully breast-fed (i.e., the infant receives no formula through the WIC program); BF/FF = partially breast-fed (i.e., the infant is breast-fed but also receives some formula through the WIC program); FF = fully formula-fed.

shifting in WIC participation rates and among participant categories might be expected in response to changes in WIC food packages and policies relating to them, the basic comparison of costs assumed no change in participation rates. The potential effect of participation rate changes on costs was explored through sensitivity analysis (see section on *Cost Neutrality*).

The current and revised sets of food packages do not include estimates of the costs of the package for participants with special dietary needs, that is, for infants receiving special formulas and children and women receiving Food Package III. The committee's assumption is that there would be no differences in the cost of special formulas and medical foods in the sets of current and revised food packages. As an example, the committee used the assumption that the prescription rate for soy infant formula stays constant for the current and revised food packages; therefore, this parameter was not included in the cost analyses.

Current Package Cost (post-rebate, if applicable)	Revised Package No.	Revised Package Cost (post-rebate, if applicable)
$29.75	I-FF-A	$29.75
$29.75	—	—
$29.75	I-BF/FF-A	$11.96
0	—	0
$37.43	I-FF-B	$32.63
$37.43	I-BF/FF-B	$16.32
$ 7.68	I-BF-B	0
$37.43	II-FF	$42.30
$37.43	II-BF/FF	$30.78
$ 7.68	II-BF	$57.10
$39.29	IV-A	$38.98
$39.29	IV-B	$38.49
$41.23	V	$48.45
$41.23	V	$48.45
$34.39	VI	$37.41
$50.61	VII	$57.05

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data) and ACNielsen Homescan (ACNielsen, 2001, price data for 2001obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, 2002 price data).

RESULTS AND DISCUSSION

The estimates of the total program cost for food in 2002 are reported in Tables 5-2 and 5-3 (*Estimated Program Costs for Food per Month Using Current Packages* and *Revised Packages*). In these tables, the average post-rebate costs are the "program participant" weighted average monthly food package costs. The current program cost for food (Table 5-2) is estimated to be an average 2002 cost per participant of $34.76 per month. In comparison, FNS estimated the average monthly post-rebate food package cost for FY02 to be $34.84.[10] The FNS estimate is based on participation,

[10]The FNS estimate of average post-rebate food package cost of $34.84 was provided to the committee by FNS for the average monthly food package cost per person for 2002 (public communication during open session, February 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA) and is also available on the FNS website (2004c, 2002 data).

TABLE 5-2 Estimated Program Costs for Food per Participant per Month Using Current Packages (2002)[a]

Group	Age/Participant Category	Description	Package
Infants	0–3.9 mo	Fully formula-fed	I
		Partially breast-fed[c]	I
		Fully breast-fed[c]	—
	Subtotals[d]		
	4–5.9 mo	Fully formula-fed	II
		Partially breast-fed[e]	II
		Fully breast-fed[e]	II
	Subtotals[d]		
	6–11.9 mo	Fully formula-fed	II
		Partially breast-fed[f]	II
		Fully breast-fed[f]	II
	Subtotals[d]		
	Totals for infant[d]		
Children	1–4.9 y[g]		IV
	Totals for children[d]		
Women	Pregnant[d]		V
	Partially breastfeeding[f]		V
	Non-breastfeeding postpartum[d]		VI
	Fully breastfeeding[b]		VII
	Totals for women[d]		
Total for program			
Average cost per participant (per month)			

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data (see data sources). Data on rates of participation are for 2002 (Bartlett et al., 2003).

[b]Data on the total pre- and post-rebate cost of the infant packages was provided to the committee by FNS (public communication during open session, February 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA). The committee used these data to estimate that the average post-rebate cost of infant formula was 32.1%of the pre-rebate cost using 2002 data. The data for FY2002 can be obtained on the FNS website (FNS, 2004c); data for other years are also available and verify the recent range of post-rebate costs as 29.2 to 32.5% (1999 through 2003) (FNS, 2000, 2001, 2003b, 2005).

[c]Percentage of infants fully breast-fed at 3 mo of age was reported (CDC, 2004c). Percentage of partially breast-fed infants was calculated from these data and data on the percentage of infants who had ever been breast-fed at 3 mo of age (CDC, 2004c).

[d]Number of participants was calculated using data Exhibit 3.1 from USDA's *WIC Participant and Program Characteristics, 2002* (Bartlett et al., 2003), recognizing that some discrepancies exist in these data. An infant is defined as a participant who, at certification, is under 1 y of age and who would be classified as a child at the age of 366 d. However, in 2002, about 2.84% of WIC participants categorized as 1-y-old children are, in fact, 11-mo-old infants who have been recertified as 1-y-old children; additionally, about 0.38% of WIC participants who are classified as infants are participants who are older than 366 d.

Percentage within Age/ Participant Category	Number of Participants	Cost (pre-rebate, if applicable)	Post-Rebate Cost[b]
36	668,309	$ 92.69	$29.75
28	519,796	$ 92.69	$29.75
36	668,309	0	
100	**1,856,414**		
69	38,428	$100.37	$37.43
20	11,138	$100.37	$37.43
11	6,126	$ 7.68	
100	**55,692**		
79	118,955	$100.37	$37.43
16	24,092	$100.37	$37.43
5	7,529		$ 7.68
100	**150,576**		
	2,062,682		
100	4,020,032		$39.29
100	**4,020,032**		
45	878,619		$41.23
11	205,559		$41.23
31	597,451		$34.39
13	252,572		$50.61
100	**1,934,201**		
	8,016,915		
			$34.76

[e]Percentage of infants fully or partially breast-fed at 4–5.9 mo of age was extrapolated from data for infants at 3 and 6 mo of age (CDC, 2004c; Abbott Labs, 2002, 2003 [2001 data]).

[f]Percentages of infants fully or partially breast-fed at 6–11.9 mo of age were calculated as the average of data reported for infants at 6 mo (CDC, 2004c) and 12 mo of age (CDC, 2004c; Briefel et al., 2004a).

[g]Includes 0.8% of children, age 1–4.9 y, who were reported as "age not reported."

[b]Percentage distribution of women as fully breastfeeding (55% of the total) or partially breastfeeding (45%of the total) was calculated according to the distribution of infants identified as fully or partially breast-fed (see notes *e* and *f*).

NOTES: Additional detail is available in Table E-4 in Appendix E—*Cost Calculations*.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001 obtained through ERS, USDA); and Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, 2002 price data). Data on rates of participation are from resources published by USDA (Bartlett et al., 2003, 2002 data; Kresge, 2003, 2002 data). Data on percentages of infants breast-fed were obtained from the *2003 National Immunization Survey* (CDC, 2004b, 2004c) and published resources (Abbott Labs, 2002, 2003; Briefel et al., 2004a).

program total food expenditures, and total rebates from the WIC program administrative databases, adjusted for price changes. The committee's estimates are based on participation, food package quantities, and food prices. The committee's estimates (1) for program participation are described in Tables 5-2 and 5-3, (2) for quantities of food are described in Table 1-1 (Chapter 1—*Introduction and Background*) for the current food packages and in Tables 4-1 and 4-2 (Chapter 4—*Revised Food Packages*) for the revised food packages, and (3) for food prices are described in Tables E-3A and E-3B (Appendix E—*Cost Calculations*). The committee's methods are expected to affect the estimated 2002 cost of the current set of food packages as follows.

- The assumption of a full prescription rate[11] and the selection of some high-priced food items in the packages for children and women (e.g., not restricting selection to store brands), could lead to cost estimates higher than those obtained from administrative data on program total food expenditures.
- The committee's cost estimates do not include any separate costs for participants with special dietary needs (Food Package III). Because the committee assumed these costs would not change, the comparison of the cost of the current and revised food packages are valid. However, the committee's assumption should lead to an estimated cost that is lower than the cost obtained from administrative cost data that include the costs of Food Package III.
- Using nationally representative prices rather than the prices available to WIC participants in local stores or in certain areas served by the WIC program could lead to cost estimates lower than those faced by WIC state agencies (Davis and Leibtag, 2005). For example, some high cost areas such as Alaska, Hawaii, territories, and reservations that are served by the WIC program were not represented in the price data used by the committee.[12]

Nonetheless, the use of the same method for estimating the costs of the current and of the revised packages minimizes the effects of these assump-

[11]The committee did not have access to valid administrative data to estimate the difference between the maximum allowance and the amount of food provided to a WIC participant; that difference is commonly referred to as the prescription rate.

[12]Food prices may be higher in low-income neighborhoods due to number and type of grocery outlets available (Chung and Myers, 1999; Morland et al., 2002b; Leibtag and Kaufman, 2003).

tions used in the cost analyses. This approach produces valid estimates to use in determining whether or not the revised packages are cost-neutral.

Cost Neutrality

For the purposes of evaluating whether the set of revised packages is consistent with controlling food costs, the committee compared the average cost per participant for the current set of packages (as estimated by the committee) to the average cost per participant for the set of revised packages (estimated by the committee in the same manner). The comparison of costs between the two sets of packages is made on the basis of "average post-rebate food package cost." A cost-neutral set of proposed changes would be such that the post-rebate average cost per participant of the set of revised packages is close to that of the current average post-rebate average cost per participant. Thus, the basis of comparison is the committee's estimate of an average 2002 cost per participant for the current food packages of $34.76 per month.

The average 2002 cost of the revised food package is estimated to be $34.57 per participant per month—approximately equal to the current set of packages ($0.19 less than that of the current set of food packages, a difference of less than 1 percent of the average participant cost of the set of current packages). See Tables 5-2 and 5-3. **Therefore the set of revised food packages meets the cost neutrality constraint.** Varying some of the rates of substitution of product forms in ways that test the sensitivity of the estimates to some of the assumptions leads to estimates of the average cost per participant that lie in the range of $34.03 to 34.95 per participant per month. Even though the estimated cost of a revised food package is higher than the cost of the corresponding current food package for some participant groups, costs for other revised packages are lower than those of the corresponding current package. On average, the cost per participant is no higher. Since the methods and sources used for determining costs were the same for the sets of current and revised food packages, the similarity in costs indicates that the proposed changes in components of the packages would have little effect on overall food costs to the WIC program assuming no changes in participation by category or in redemption rates.

Costs of Substitutions

Table 5-4 shows the effects of selected substitutions on costs. For example, one quart of yogurt costs $1.58 more, on average, than does one quart of fat-reduced milk. Buying two quarts (one-half gallon) of calcium- and vitamin D-rich soy beverage ("soy milk") in place of two quarts of low-fat milk would cost an extra $1.88 (2 qt at $0.94 per qt). Use of canned

TABLE 5-3 Estimated Program Costs for Food per Participant per Month Using Revised Packages (2002)[a]

Group	Age/Participant Category	Description	Package
Infants	0–3.9 mo	Fully formula-fed	I
		Partially breast-fed[c,d]	— (0–0.9 mo)
		Partially breast-fed[c,d]	I (1–3.9 mo)
		Fully breast-fed[c]	—
	Subtotals[f]		
	4–5.9 mo	Fully formula-fed	II
		Partially breast-fed[g]	II
		Fully breast-fed[g]	II
	Subtotals[f]		
	6–11.9 mo	Fully formula-fed	II
		Partially breast-fed[h]	II
		Fully breast-fed[h]	II
	Subtotals[f]		
	Totals for infants[f]		
Children	1–1.9 y[i]		IV-A
	2–4.9 y[i]		IV-B
	Totals for children[f]		
Women	Pregnant[f]		V
	Partially breastfeeding[j]		V
	Non-breastfeeding postpartum[f]		VI
	Fully breastfeeding[j]		VII
	Totals for women[f]		
Totals for program			
Average cost per participant (per month)			

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data (see data sources). Data on rates of participation are for 2002 (Bartlett et al., 2003).

[b]Data on the total pre- and post-rebate cost of the infant packages was provided to the committee by FNS (public communication during open session, February 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA). The committee used these data to estimate that the average post-rebate cost of infant formula was 32.1%of the pre-rebate cost using 2002 data. The data for FY2002 can be obtained on the FNS website (FNS, 2004c); data for other years are also available and verify the recent range of post-rebate costs as 29.2 to 32.5% (1999 through 2003) (FNS, 2000, 2001, 2003b, 2005).

[c]Percentage of infants fully breast-fed at 3 mo of age was reported (CDC, 2004c). Percentage of partially breast-fed infants was calculated from these data and data on the percentage of infants who had ever been breast-fed at 3 mo of age (CDC, 2004c).

[d]For the category of partially breast-fed infants 0–3.9 mo, the committee estimated that the number of infants aged 0–0.9 mo was 25% of the category total and the number of infants aged 1–3.9 mo was 75% of the total. In the absence of data on the proportion of infants to anticipate in each of the first 4 mo of life, the committee assumed the distribution would be approximately equal in each month, using the census data for children under the age of 5 y as a model (20.0% ± 0.3%, mean ± SD) (U.S. Census Bureau, 2004).

Percentage within Age/ Participant Category	Number of Participants	Cost (pre-rebate, if applicable)	Cost Post-Rebate[b]
36	668,309	$92.69	$29.75
7	129,949	$ 4.65[e]	$ 1.49
21	389,847	$37.25	$11.96
36	668,309	0	
100	**1,856,414**		
69	38,428	$101.66	$32.63
20	11,138	$50.83	$16.32
11	6,126	0	
100	**55,692**		
79	118,955	$91.02	$42.30
16	24,092	$55.14	$30.78
5	7,529	$57.10	
100	**150,576**		
	2,062,682		
36	1,447,212		$38.98
64	2,572,820		$38.49
100	**4,020,032**		
45	878,619		$48.45
11	205,559		$48.45
31	597,451		$37.41
13	252,572		$57.05
100	**1,934,201**		
	8,016,915		
			$34.57

[e]One alternative is to provide one small can (up to 15 oz) of powdered formula to breastfed infants during the first month if requested by the mother. The committee used the assumption that the number of breastfeeding mothers requesting formula in the first months would approximate 50% of the current number of partially breastfeeding mother/infants pairs. The additional monthly cost per participant who choose this option would be $9.30 in pre-rebate costs and $2.98 in post-rebate costs. Using the estimate of 50% of the current partially breastfeeding participants (0.5 × 129,949 = 64,747) for the first month postpartum, the additional monthly program cost would be an additional 2.4¢ in the average cost per participant.

[f]Number of participants was calculated using data Exhibit 3.1 from USDA's *WIC Participant and Program Characteristics, 2002* (Bartlett et al., 2003), recognizing that some discrepancies exist in these data. An infant is defined as a participant who, at certification, is under 1 year of age and who would be classified as a child at the age of 366 days. However, in 2002, about 2.84% of WIC participants categorized as 1-y-old children are, in fact, 11-mo-old infants who have been recertified as 1-y-old children; additionally, about 0.38% of WIC participants who are classified as infants are participants who are older than 366 d.

continues

TABLE 5-3 Continued

[g]Percentage of infants fully or partially breast-fed at 4–5.9 mo of age was extrapolated from data for infants at 3 and 6 mo of age (CDC, 2004b; Abbott Labs, 2002, 2003 [2001 data]).

[h]Percentages of infants fully or partially breast-fed at 6–11.9 mo of age were calculated as the average of data reported for infants at 6 mo (CDC, 2004c) and 12 mo of age (CDC, 2004c; Briefel et al., 2004a).

[i]The committee calculated the number of participants in each category using data from the USDA sponsored *WIC Participant and Program Characteristics 2002* (Bartlett et al., 2003); data from Exhibit 3.1 (Bartlett et al., 2003) were used to estimate the number of participants ages 1–1.9 y and 2–4.9 y.

[j]Percentage distribution of women as fully breastfeeding (55% of the total) or partially breastfeeding (45% of the total) was calculated according to the distribution of infants identified as fully or partially breast-fed (see notes *g* and *h*).

NOTES: Additional detail is available in Table E-4 in Appendix E—*Cost Calculations*.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001 obtained through ERS, USDA); and Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, 2002 price data). Data on rates of participation are from resources published by USDA (Bartlett et al., 2003, 2002 data; Kresge, 2003, 2002 data). Data on percentages of infants breast-fed were obtained from the *2003 National Immunization Survey* (CDC, 2004b, 2004c) and published resources (Abbott Labs, 2002, 2003; Briefel et al., 2004a).

fruits and vegetables instead of a cash-value voucher for fresh fruits and vegetable would lead to an estimated $1.73 increase in costs per month for an adult and $1.21 increase in costs per month for a child. Buying canned beans (4 16-oz cans) rather than one pound of dried beans would increase the monthly cost by $1.79.

In estimating the average cost per participant of the set of revised food packages (shown in Table 5-3), the committee allowed for the types and rates of substitutions specified in Tables E-1 and E-2 in Appendix E—*Cost Calculations*. For example, costs for the food package for pregnant and partially breastfeeding women assume that 50 percent of participants will obtain the canned form of legumes rather than the dried form; 50 percent of participants will select processed forms of fruits and vegetables rather than the fresh form; 10 percent of women will obtain calcium- and vitamin D-rich soy beverage ("soy milk") as an alternate for milk; and 50 percent of women will choose the maximum amount of allowed substitutions for milk (see Tables E-1 and E-2 for detailed information). Since virtually all of the proposed substitutions increase the cost of the package, the costs shown in Table 5-4, which include all of the allowed substitutions in the revised food packages, are higher than the cost would be if less flexibility were allowed. Nonetheless, even allowing this flexibility, the estimated average monthly

cost of the set of revised packages is approximately equal to that of the set of current food packages; it is lower by less than 1 percent of the average monthly cost of the current package.

Sensitivity analysis that considered the various choices indicated the estimated average 2002 cost would range from $34.03 to $34.95. The lower end of the range uses the cost of only the fresh option for fruits and vegetables and the higher end of the range assumes that 75 percent rather than 50 percent of participants will choose canned rather than dried legumes. The committee encourages the fresh produce option wherever feasible for several reasons: greater participant choice and therefore higher acceptability by participants of widely varied cultural backgrounds, lower estimated costs, and lower sodium content. However, the committee recognizes that the cost of fresh fruits and vegetables is likely to increase over time and, as a result, the amount of fresh produce that could be obtained with the cash-value voucher would decrease. Because this would lead to a reduction in the nutrient content of the package, the value of the cash-value voucher (both monetary and nutritive value) would need to be reviewed every 1 to 3 years. One index to use as the basis of the adjustment is the Bureau of Labor Statistics Consumer Price Index series for fresh fruits and vegetables (BLS, 2005).

COMPARING COST INCENTIVES FOR BREASTFEEDING

Using data from Tables 5-2 and 5-3, Table 5-5 was constructed to compare the market (pre-rebate) value of the maximum allowances for current and revised food packages for the three types of mother/infant pairs—fully breastfeeding, partially breastfeeding, and fully formula-feeding. The data in Table 5-5 consider the full length of time that the mother and infant are eligible for the food packages. Table 5-5 shows that the market value for the revised packages for the fully breastfeeding mother/infant pair is substantially higher than that of the current package. The three revised food packages for mothers/infants pairs are more similar in value than are the current food packages. The market value of the set of revised food packages for the fully formula-feeding mother/infant pair remains higher than that for the fully breastfeeding pair, but the difference is greatly diminished. The market value of the current packages for the fully formula-feeding pair is more than two times higher than that for the fully breastfeeding pair; but, for the revised packages, the market value for the fully formula-feeding pair is less than a third higher. The revised food packages for the three possible feeding methods have similar market values.

The changes in the relative value of the mother/infant pairs, when combined with appropriate nutrition education efforts, are designed to encourage more breastfeeding. A switch to more breastfeeding (both full

TABLE 5-4 Estimated Costs of Basic Foods, Selected Substitutions, and Net Cost Changes Resulting from Selected Substitutions in WIC Food Packages (2002)[a]

	Food			
Food Item Substitution	Quantity	Unit	Cost per Unit ($)	Cost ($)
Milk, fluid, whole	1	qt	0.73	0.73
Yogurt	1	qt	2.28	2.28
Cheese	1	lb	3.30	3.30
Milk, fluid, fat-reduced	1	qt	0.69	0.69
Yogurt	1	qt	2.28	2.28
Soy beverage ("soy milk")	1	qt	1.64	1.64
Tofu	1	lb	1.76	1.76
Cheese	1	lb	3.30	3.30
Beans, dried	1	lb	0.77	0.77
Peanut butter	18	oz	0.10	1.80
Beans, canned (1 16-oz can)	16	oz	0.04	0.64
Bread, whole wheat	1	lb	1.80	1.80
Brown rice	1	lb	1.77	1.77
Tuna (5 6-oz cans)	30	oz	0.09	2.70
Salmon (2 14.7-oz cans)	29.4	oz	0.11	3.23
Children's food packages				
Fresh fruits and vegetables	9.76	lb	0.82	8.00
Canned fruits and vegetables	220	oz		9.21
Women's food packages				
Fresh fruits and vegetables	12.2	lb	0.82	10.00
Canned fruits and vegetables	280	oz		11.73

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data (see data sources).

NOTES: For women, 140 oz of canned fruit plus 140 oz of canned vegetables would be approximately equivalent to $10 fresh fruits and vegetables; for children (DHHS/USDA, 2005), 110 oz of canned fruit plus 110 oz of canned vegetables would be approximately equivalent to $8 fresh fruits and vegetables. Estimated average price for canned fruit is $0.80 per lb; estimated average price for canned vegetables is $0.54 per lb. Estimated average price

and partial) would have an impact on costs. The direction and magnitude of the change was investigated by simulating possible shifts in participation rates. As expected, shifting mother/infant pairs from the fully formula-feeding option to breastfeeding options has the effect of moving mother/infant pairs from the most expensive set of packages to less expensive ones (Table 5-5). In simulations with fewer fully formula-feeding mother/infant

Selected Substitution	
Food	Net Change in Cost of Food Item ($)
Yogurt (1 qt) for whole milk (1 qt)	+1.55
Cheese (1 lb) for milk (3 qt)	+1.11
Yogurt (1 qt) for milk (1 qt)	+1.58
Soy beverage(1 qt) for milk (1 qt)	+0.94
Tofu (1 lb) for milk (1 qt)	+1.06
Cheese (1 lb) for milk (3 qt)	+1.23
Peanut butter for dried beans	+1.03
Canned beans (4 16-oz cans) for dried beans (1 lb)	+1.79
Brown rice for whole wheat bread (1:1)	–0.03
Salmon for tuna (~30 oz:~30 oz)	+0.53
Canned fruits and vegetables only	+1.21
Canned fruits and vegetables only	+1.73

for fresh fruit is $0.69 per lb; estimated average price for fresh vegetables is $0.94 per lb. Details on costs of food items in the revised packages are presented in Tables E-3A and E-3B in Appendix E—*Cost Calculations*.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001 obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, 2002 price data).

pairs and more fully and partially breastfeeding mother/infant pairs (using a constant shift of 30 percent for 1 to 11 months of age from partial to full breastfeeding, and a smaller range of shifts from full formula feeding to full breastfeeding), the average 2002 cost fell from $34.57 to $33.93, a decrease of nearly 2 percent (for further detail, see Appendix E—*Cost Calculations*, section on *Possible Shifts in Participation Rates*).

TABLE 5-5 Comparison of the Market (Pre-Rebate) Value of Maximum Allowances for Current and Revised Food Packages for Mother/Infant Pairs (2002)[a]

	Fully Breastfeeding			Partially Breastfeeding	
Participant Category	Cost per Month	Cost for First Year Months	Cost per Postpartum	Month	Cost for First Year Months
Current Food Packages					
Mother	$50.61	12	$ 607	$ 41.23	12
Infant, 0–3.9 mo	—	4	—	$ 92.69	4
Infant, 4–11.9 mo	$ 7.68	8	$ 61	$100.37	8
Total Cost			**$ 668**		
Revised Food Packages					
Mother	$57.05	12	$ 685	$ 57.05	1[b]
	—	—	—	$ 48.45	11
Infant, 0–3.9 mo	0	4	—	$ 37.25	3[b]
Infant, 4–5.9 mo	0	2	—	$ 50.83	2
Infant, 6–11.9 mo	$57.10	6	$ 343	$ 55.14	6
Total Cost			**$1,028**		

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data (see data sources). Data on rates of participation are for 2002 (Bartlett et al., 2003).

[b]There are no packages for the partially breastfeeding mother/infant pair in the first month postpartum. In an attempt to promote successful breastfeeding, the mother and infant would be considered as fully breastfeeding for the first month. These estimates do not include the cost of one can of powdered formula available to mothers who are listed as partially breastfeeding in the first month.

PROJECTING THE EFFECTS OF CHANGES IN INFANT FORMULA AND MILK PRICES

Of course, any evaluation of costs based on prices of the base 2002 period (or 1999–2002 prices) is sensitive to changes in prices. Greater variability in prices for fruits and vegetables and increases in prices over time, for example, may mean that the amount of food obtained from a fixed valued instrument may change. From the perspective of the program costs, however, the fixed valued instrument for fresh fruits and vegetables isolates the program from the price variation. Current trends, such as relatively large price increases for milk products in 2004, changes in the types of infant formulas marketed, and unfavorable changes in the rebates for infant formulas have made the WIC program vulnerable to increased food costs. Because of changes in the relative amounts of formula and of

	Fully Formula Feeding		
Cost per Postpartum	Month	Cost for First Year Months	Postpartum
$ 495	$ 34.39	6	$ 206
$ 371	$ 92.69	4	$ 371
$ 803	$100.37	8	$ 803
$1,669			**$1,380**
$ 57	$ 37.41	6	$ 224
$ 533			
$ 112	$ 92.69	4	$ 371
$ 102	$101.66	2	$ 203
$ 331	$ 91.02	6	$ 546
$1,135			**$1,344**

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001 obtained through ERS, USDA); and Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, 2002 price data).

milk in the current and proposed packages, there may be some cost differences between the current and revised program costs due to shifts of the prices of these foods that represent a relatively large component of program package costs.

In order to evaluate the sensitivity of program costs to price changes, the committee considered (1) a decreased rebate rate for infant formula, shifting the post-rebate cost from 0.321 to 0.50 times the market price, and (2) an increase in milk prices of 20 percent. The effect of the reduced rebate rate on overall program food costs leads to an 8.2 percent increase for the current food packages and a 6.1 percent increase for the revised food packages. An increase of 20 percent in milk prices increases the program food cost by 5.6 percent for the current set of food packages and 4.5 percent for the set of revised food packages. These changes illustrate that, compared with the current set of food packages, the set of revised food

packages is less sensitive to changes in price for these two food components. **The greater diversity of food items included in the revised food packages will tend to reduce the sensitivity of the food package cost to a change in the price of any single food item.**

SUMMARY

The revised food packages are cost-neutral. Using identical methods to estimate the average cost per participant of the current and revised WIC food packages, the committee found essentially no change. In particular, the estimated average 2002 cost per participant for the current set of food packages was $34.76 per month, and for the set of revised food packages was $34.57 per month (and in the range of $34.03–$34.95), approximately equal to the estimated cost of the current package. Thus, given the same methods and prices for comparison, and assuming no shifts in participation by program categories, the changes proposed are likely to have little effect on program food costs. Furthermore, compared to the cost of the current food packages, the cost of the revised food packages would change less in response to changes in the costs of dairy products and infant formula.

The changes in the food packages greatly increase the relative market value (i.e., pre-rebate price) of the combined packages for the fully breastfeeding mother/infant pair; this change in the set of revised food packages could serve as an increased incentive for breastfeeding.

The costing method used includes a cash-value voucher that can be used to obtain a variety of fresh fruits and vegetables of the participants' choosing; the addition of the cash-value voucher could increase the cultural acceptability of the WIC food packages. Because an increase in the cost of fresh produce would lead to a reduced amount of fruits and vegetables that could be obtained with the cash-value voucher and this, in turn, would reduce the nutrient content of the packages, the committee recommends review and revision of the total value of the cash-value vouchers for fresh fruits and vegetables every 1 to 3 years.

The cost evaluation of the revised food packages encompassed major changes directed toward allowing healthier choices (e.g., the addition of fruits and vegetables, reduced-fat rather than whole milk for participants 2 years of age and older; allowed breakfast cereals are whole grain). These changes could serve to improve the diets of WIC participants. The cost evaluation also included specific amounts of substitutions that were requested by participants (e.g., allowing yogurt, tofu, and soy beverage ["soy milk"] as a substitute for milk); these substitutions could increase the incentive value of the food packages for families to participate in the WIC program.

6

How the Revised Food Packages Meet the Criteria Specified

The criteria used by the committee in proposing revisions for the food packages appear in Box 6-1. This chapter summarizes specific ways in which the revised food packages address each of the six criteria. During the committee's deliberations, stakeholders submitted comments regarding concerns about the current food packages. Many of the committee's recommendations address multiple concerns. In order to avoid text that would be repetitious, this chapter addresses each of the criteria in sequence and makes use of tables to illustrate how the revised food packages address both the criterion and some of the major concerns of stakeholders (Tables 6-4 to 6-6). A small amount of text highlights the major issue(s) for each criterion.

Criterion 1: The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.

The committee designed the revised food packages to provide priority nutrients in amounts that would improve overall nutrient consumption, reducing the prevalence of inadequate or excessive nutrient intakes among the WIC participants.

The impact of the revised food packages on nutrient intakes was evaluated in two ways. First, the nutrient contents of the current and revised packages were compared to determine if the amounts of the priority nutrients (as discussed in Chapter 2—*Nutrient and Food Priorities*) changed in the desired direction (i.e., increased for those with an undesirably high prevalence of inadequacy and decreased for those with an undesirably high prevalence of excessive intakes). The second evaluation examined changes

BOX 6-1
Criteria for a WIC Food Package

1. The package reduces the prevalence of inadequate and excessive nutrient intakes in participants.
2. The package contributes to an overall dietary pattern that is consistent with the *Dietary Guidelines for Americans* for individuals 2 years of age and older.
3. The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.
4. Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities
5. Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.
6. Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

in intakes that might occur as a result of the revised packages, and whether the prevalence of undesirable intakes would decrease, within the context of a risk assessment model (Appendix D—*Evaluating Potential Benefits and Risks*).

Most of the priority nutrients changed in the desired direction in the revised food packages. Priority nutrients that were low in the diets increased for most of the packages, while those that were excessive generally decreased in the packages. Table 6-1 summarizes the direction of changes in the amounts of the priority nutrients in each of the packages. Quantitative estimates of each change are given in the nutrient analyses in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*. Although the amount of energy content provided by the packages decreased for all but the youngest infants, the changes were minor (averaging approximately 80 kilocalories per day across the packages). The primary focus was on increasing the nutrient density of the packages, not on substantially decreasing their energy content.

Compared with the current food packages for children and women, the committee estimates that the revised packages provide greater amounts of nearly all of the nutrients of concern with regard to inadequate intake. The exceptions were potassium for children, calcium and vitamin D for pregnant and partially breastfeeding women, and vitamin C for pregnant and breastfeeding women. The amounts of calcium and vitamin C in most food

TABLE 6-1 Direction of Changes in the Level of Priority Nutrients in the Revised Food Packages (Criterion 1)

Participant Category	Priority Nutrients to Increase in the Packages	Changes in the Revised Packages[a]	Priority Nutrients to Decrease in the Packages	Changes in the Revised Packages[a]
Infants, younger than 1 y, non-breastfed				
	No specific priority nutrients; continue to provide a balanced set of essential nutrients	na	Zinc:	
			0–3.9 mo	No change
			4–5.9 mo	–
			6–11.9 mo	–
			Vitamin A, preformed:	
			0–3.9 mo	No change
			4–5.9 mo	+
			6–11.9 mo	–
			Food energy:	
			0–3.9 mo	No change
			4–5.9 mo	–
			6–11.9 mo	–
Infants, 6–11.9 mo, breast-fed (Food Package II-BF)				
	Iron	+		
	Zinc	+		
Children, 12–23.9 mo (Food Package IVA)				
	Iron	+	Zinc	+
	Vitamin E	++	Vitamin A, preformed	–
	Potassium	–	Sodium	–
	Fiber	++	Food energy	–
Children, 2–4.9 y (Food Package IVB)				
	Iron	+	Zinc	+
	Vitamin E	++	Vitamin A, preformed	–
	Potassium	–	Sodium	–
	Fiber	++	Food energy	–
Pregnant and partially breastfeeding women (Food Package V)				
	Calcium	–	Sodium	–
	Iron	+	Food energy	–
	Magnesium	+	Total fat	–
	Vitamin E	++	Fat as % of food energy intake	–
	Potassium	+		
	Fiber	++		
	Vitamin A	+		
	Vitamin C	–		
	Vitamin D	–		
	Vitamin B_6	+		
	Folate	+		

continues

TABLE 6-1 Continued

Participant Category	Priority Nutrients to Increase in the Packages	Changes in the Revised Packages[a]	Priority Nutrients to Decrease in the Packages	Changes in the Revised Packages[a]
Non-breastfeeding postpartum women (Food Package VI)				
	Calcium	–	Sodium	–
	Iron	+	Food energy	–
	Magnesium	+	Total fat	–
	Vitamin E	++	Fat as % of food energy intake	–
	Potassium	+		
	Fiber	++		
	Vitamin A	+		
	Vitamin C	–		
	Vitamin D	–		
	Vitamin B_6	+		
	Folate	+		
Fully breastfeeding women (Food Package VII)				
	Calcium	+	Sodium	–
	Iron	+	Food energy	–
	Magnesium	+	Total fat	–
	Vitamin E	++	Fat as % of food energy intake	–
	Potassium	+		
	Fiber	++		
	Vitamin A	–		
	Vitamin C	–		
	Vitamin D	+		
	Vitamin B_6	+		
	Folate	+		

[a]"+" indicates an increase and "–" indicates a decrease; "++" indicates an increase of at least 50 percent.

NOTES: na = not applicable.

packages are close to or exceed required amounts, according to the Dietary Reference Intakes appropriate in planning for population groups. WIC participants or caregivers could make choices within the options allowed that could increase the amount of specific nutrient(s) in the revised food packages above the committee's estimates. Indeed, considering various choices among commonly consumed foods (that is, foods used in the nutrient analyses), the committee found examples of choices of food items that provide nutrients in excess of the estimates in the current packages (as for potassium) or, in some cases, to exceed the Adequate Intake or Recommended Dietary Allowance (as for calcium, vitamin D, and vitamin C).

The revised food packages generally provide less of nutrients of concern with regard to excessive intakes. Preformed vitamin A was reduced in

both the infants' and children's packages, and sodium[1] was reduced in the packages for children and women. Although zinc was identified as a nutrient of concern for excessive intake in the diets of formula-fed infants and children, the committee did not find acceptable ways to revise food packages to reduce the amount of zinc. As noted in Chapter 2—*Nutrient and Food Priorities*—the committee recognizes that there are only small differences between the amounts of zinc and vitamin A recommended and the Tolerable Upper Intake Levels (ULs) for these two nutrients for infants and children. Because these ULs were extrapolated from limited data, there is controversy regarding whether they are appropriate (for example, Brown et al., 2004a).[2] The committee chose to continue to promote adequate zinc intake for the entire group of WIC infants and children, realizing that the zinc intakes of some formula-fed infants and some children would exceed the ULs. Compared to the current packages, in the revised packages: (1) the zinc content is unchanged for fully formula-fed infants 0 through 3 months;[3] (2) the zinc content is slightly lower for formula-fed infants 4 through 11 months;[4] and (3) the zinc content is higher in the revised package for children ages 1 through 4 years.[5]

Analyses of potential intakes showed changes that essentially paralleled the changes in the nutrients provided in the packages. Although several assumptions were required, the committee estimated the potential changes

[1]The sodium content of the revised packages is lower than the current packages in the nutrient analyses using fresh produce (Tables B-2A through B-2G and Tables B-3A through B-3G). This is not true when the processed option (i.e., canned fruits and vegetables as described in Tables B-4 and E-2) was used in separate nutrient analyses (data not shown). This is one reason the revised Food Packages IV through VII include fresh fruits and vegetable with processed fruits and vegetables as an option.

[2]The International Zinc Nutrition Consultative Group (IZiNCG) proposed that the ULs (Tolerable Upper Intake Levels) for zinc (IOM, 2001) be replaced with NOAELs (No Observed Adverse Effect Levels) (Brown et al., 2004a). This proposal was emphasized for children because the IZiNCG found that "insufficient data exist to set an upper limit with confidence" (Brown et al., 2004a; quote from p. S120). Further research is needed to establish NOAELs (Brown et al., 2004b).

[3]The revised package for infants 4 through 5 months of age (Food Package I) does not provide infant cereal to correspond better to current recommendations regarding the introduction of complementary foods (AAP, 2005); infant cereals are provided by the current package for infants in this age range (Food Package II). Some infant cereals are zinc fortified (manufacturer labeling, 2004).

[4]For infants ages 6 through 11 months, the amount of infant formula was reduced (in the revised package versus the current package—Food Package II) to better correspond with Estimated Energy Requirements (IOM, 2002/2005); infant formulas contain zinc.

[5]This is due to the difference in the zinc content of cereals used in the composites for the current and revised packages (see Table B-2A for zinc content of food packages and Table E-2 for description of cereal composites used).

in intakes that might occur as a result of offering the revised food packages. Importantly, these analyses assumed that any change in the nutrient profile of the packages would be reflected as a change in actual intake. It is not possible to estimate the precise impact of any changes in the packages on nutrient intakes because the full package is not always prescribed, the full prescription is not always obtained, and all the foods obtained may not be consumed by the WIC participant. Details of the analyses of potential intakes and the resulting changes in the predicted prevalence of inadequate and excessive intakes for the priority nutrients are presented in Appendix D—*Evaluating Potential Benefits and Risks*. Tables detailing changes in intake of over 30 micro- and macronutrients plus cholesterol and food energy for each of the current and revised WIC food packages are in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*. Following is a summary of the potential changes in intake for the priority nutrients.

Formula-Fed Infants Younger than One Year of Age—The only nutrient with a predicted change in intake in the non-desired direction is preformed vitamin A. The percentage of the population with intakes greater than the UL increases by approximately 10 percentage points for infants 4 through 5 months of age (see Table D-1B in Appendix D—*Potential Benefits and Risks*) because of a small increase in the amount of formula provided to these infants (see Table B-2B in Appendix B—*Nutrient Profiles of Current and Revised Food Packages*).

Children 1 Year of Age—Children one year of age (12–23 months of age) see improvement in almost all food components. Two priority nutrients have predicted changes in intake in the non-desired direction; mean predicted intake of potassium decreases by 7 percent (see Table D-1A) and the fraction of the population with predicted zinc intakes greater than the UL increases (observed %>UL is 56 percent; predicted %>UL with revised Food Package IV-B is 69 percent) (see Table D-1B).

Children 2 Through 4 Years of Age—The revised food package for children has many predicted benefits including sharp increases in intake of vitamin E and fiber (see Table D-1A) and reductions in consumption of sodium, food energy, saturated fat, and cholesterol (see Tables D-1B and D-1C). Two priority nutrients have predicted changes in intake in the non-desired direction; mean predicted intake of potassium decreases by 6 percent (see Table D-1A) and the fraction of the population with predicted zinc intakes greater than the UL increases (observed %>UL is 58 percent; predicted %>UL with revised Food Package IV-B is 73 percent) (see Table D-1B).

Pregnant Women and Partially Breastfeeding Women—For most of the priority nutrients, the revised food package (Food Package V) leads to decreases in predicted percentages of the population with inadequate intakes.[6] The benefits are especially large for magnesium, vitamin E, vitamin B_6, and folate. Other benefits include predicted increases in intake of fiber and potassium and decreases in sodium, total fat, saturated fat, and cholesterol. Two nutrients have predicted changes in the non-desired direction; the predicted mean intake of calcium decreases by 2 percent (see Table D-1A) because of a reduction in the amount of milk and milk products in the package, and the fraction the population with predicted intakes of vitamin C that are inadequate increases by 11 percentage points (observed %Inadequate is 33 percent; predicted %Inadequate with revised Food Package V is 44 percent) (see Table D-1A).

Non-Breastfeeding Postpartum Women—Other than a predicted decrease in calcium intake (see Table D-1A)and an increase in the percentage with inadequate vitamin C intake (see Table D-1A), the revised package (Food Package VI) makes progress toward addressing the priority nutrients identified by the committee. For example, there is a reduction in the percentage with inadequate intake of iron, magnesium, vitamin E, vitamin A, fiber, potassium, vitamin B_6, and folate (see Table D-1A). Predicted intakes of sodium, food energy, total fat, saturated fat, and cholesterol all decrease (see Tables D-1B and D-1C).

Fully Breastfeeding Women—The revised package (Food Package VII) addresses very well the priority nutrients for this group, with increased predicted mean intakes of calcium and fiber (see Table D-1A) and predicted decreases in the percentages with inadequate intakes of iron, magnesium, vitamin E, vitamin B_6, and folate (see Table D-1A). Again, intake of sodium, food energy, total fat, saturated fat, and cholesterol are all predicted to decrease (see Tables D-1B and D-1C). There is a small increase in the estimated percentage of the population with inadequate intake of vitamin A (see Table D-1A). For vitamin C, the analysis predicts an increase in the percentage of the population with inadequate intake (see Table D-1A).

[6]The amount of vitamin D decreases in Food Packages V and VI; however, dietary intake data for vitamin D were not available to allow evaluation of predicted intakes of vitamin D.

Criterion 2: The package contributes to an overall dietary pattern that is consistent with the* Dietary Guidelines for Americans *for individuals 2 years of age and older.

As outlined in previous chapters, the committee recommends specific changes in the WIC food packages to help make WIC participants' diets more consistent with the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005). The *Dietary Guidelines* report identifies 41 key recommendations—23 for the general public and 18 for special populations. The recommendations address seven of the nine general topics. The committee considered messages regarding physical activity and alcoholic beverages not to be relevant to WIC food packages. Table 6-2 summarizes characteristics of the revised food packages that relate to selected messages from the *Dietary Guidelines*. The revised packages also provide greater balance in food group intakes and are more consistent with the food group guidance in the *Dietary Guidelines*, as shown in Table 6-3. Although not included as a specific recommendation in *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005), the committee maintained consistency with a food safety recommendation of the Dietary Guidelines Advisory Committee (DHHS/USDA, 2004) concerning fish.

Table 6-3 compares food group contributions from the current and revised packages with the amounts suggested or recommended in *Dietary Guidelines for Americans* (DHHS/USDA 2005). This table shows that the revised packages provide greater balance in food groups and are more consistent with the food group guidance in the *Dietary Guidelines* than the current packages. For fruits and vegetables, the number of servings in the revised package is greater than in the current package, and the emphasis is on whole forms rather than juice. Similarly, the revised food packages for children and women provide whole grains but not refined grains, thus helping participants achieve the recommended three one-ounce-equivalents per day. Although the amounts of milk and equivalents are somewhat smaller in revised packages than in current packages, they are close to the amounts recommended by the *Dietary Guidelines*. The maximum allowances for eggs, which are counted in the meat and meat alternatives group, were reduced for Food Packages IV–VII.

Criterion 3: The package contributes to an overall diet that is consistent with established dietary recommendations for infants and children younger than 2 years of age, including encouragement of and support for breastfeeding.

The dietary guidance for infants and for children under the age of 2 years that was considered by the committee is summarized in Table 2-9 (Chapter 2—*Nutrient and Food Priorities*). This guidance addresses breast-

TABLE 6-2 Consistency of the Revised Food Packages[a] with Selected Recommendations from the *Dietary Guidelines for Americans 2005* for Individuals Two Years of Age and Older (Criterion 2)

Recommendation from the *Dietary Guidelines for Americans 2005*	How Revised Food Packages Contribute to an Overall Dietary Pattern That Is Consistent with the *Dietary Guidelines for Americans 2005*
Adequate Nutrients Within Food Energy Needs	
Consume a variety of nutrient-dense foods within and among the basic food groups while choosing foods that limit the intake of saturated fat, *trans* fat, cholesterol, added sugars, salt, and alcohol.	Nutrient density: the nutrient content of the packages was increased and the energy content was decreased, leading to an increase in nutrient density Food groups: foods included from each food group Variety: choices allowed within the food groups Food energy: reduced-calorie options allowed for some foods Limiting intakes: packages provide much smaller amounts of saturated fat and cholesterol and slightly less salt, and food specifications place certain restrictions on added sugars and added salt. The current and revised food packages contain insignificant amounts of industrial *trans* fats—the source of *trans* fat deemed to be of concern by the Dietary Guidelines Advisory Committee (DHHS/USDA, 2004).
Meet recommended intakes within energy needs by adopting a balanced eating pattern	Balanced eating pattern: The revised packages are more consistent with food group guidance.
Body Weight Management	
To maintain body weight in a healthy range, balance food energy from foods and beverages with energy expended	Full-fat milk products[a] and added sugars limited Reduced maximum quantities of foods that previously exceeded recommendations
To prevent gradual body weight gain over time, make small decreases in food energy from food and beverages and increase physical activity	Small decreases in total food energy provided by the packages
Food Groups to Encourage	
Consume a sufficient amount of fruits and vegetables while staying within energy needs	Fruits and vegetables: added to all the food packages beginning with infants age 6 mo and older
Choose a variety of fruits and vegetables each day.	Variety: choice allowed

continues

TABLE 6-2 Continued

Recommendation from the *Dietary Guidelines for Americans 2005*	How Revised Food Packages Contribute to an Overall Dietary Pattern That Is Consistent with the *Dietary Guidelines for Americans 2005*
Consume 3 or more ounce-equivalents of whole-grain products per day.	Whole grains: whole wheat bread and other whole-grain products added; choices of cereal (cooked and ready-to-eat) specified as whole grain
Consume 3 cups/d of fat-free or low-fat milk or equivalent milk products	Fat-reduced milk and milk products: includes recommended amounts or more than two thirds of recommended amounts
Fats	
Consume less than 10% of food energy from saturated fatty acids and less than 300 mg/day of cholesterol	For individuals 2 years of age and over, packages provide an average of 8.8% of food energy from saturated fat (range of 7.9 to 10.0% of food energy) and well under 300 mg/day of cholesterol (range of 111 to 227 mg/d).
Carbohydrates	
Choose fiber-rich fruits, vegetables, and whole grains often	Whole fruits and vegetables added to the package, replacing part of the juice Whole grains included
Choose and prepare foods with little added sugars	Added sugars limited
Sodium and Potassium	
Consume less than 2,300 mg/d of sodium.	Average sodium content of packages decreased. Options with no added salt or low sodium allowed for processed vegetables (including canned legumes), peanut butter, and canned fish.
Food Safety	
Recommendations focus on prevention of microbial foodborne illness, addressing the messages "clean, separate, cook, chill, and avoid selected raw unpasteurized foods."	Tuna allowed must be light rather than white (no albacore) to limit mercury intake.[b] Foods that carry high risk for contamination with *Listeria* were not included in any food package. For foods that have short safe storage times once the container is opened, the costing method allowed for container sizes that could be used within the recommended storage time.

[a]Does not apply to Food Package III for individuals with special dietary needs.
[b]Based on recommendation from the Dietary Guidelines Advisory Committee; applies only to Food Package VII for fully breastfeeding women.

DATA SOURCES: 2005 Dietary Guidelines for Americans Advisory Committee Report (DHHS/USDA, 2004); *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005).

feeding, formula-feeding, feeding other foods to infants and young children, developing healthy eating patterns, and promoting food safety. Most of the recommendations derive from dietary guidance provided by the Committee on Nutrition of the American Academy of Pediatrics or by the American Dietetic Association.

Table 6-4 provides a side-by-side comparison of how the revised food packages for infants and young children meet the established recommendations. The major revisions center on changes to the infants' food packages to help meet the developmental needs of infants (e.g., delaying the provision of complementary foods until 6 months of age; inclusion of commercial baby food for infants 6 months of age and older to introduce older infants to a wider variety of foods in appropriate forms). A major revision of the children's food package is the specification that whole milk with 3.5 to 4 percent milk fat be the type of milk provided for only one WIC subpopulation—children ages 12 through 23 months. The committee recognizes that it will not be convenient to obtain whole milk for a 1-year-old child and obtain other types of milk for other WIC participants in the household. However, the committee has a strong basis for the proposed change: (1) clear recommendations recently re-published by the American Academy of Pediatrics (AAP, 2004) and (2) the findings that a sizeable percentage of young children have fat intakes below the lower boundary of the Acceptable Macronutrient Distribution Range (AMDR) (IOM, 2002/2005; see Table 2-5, Chapter 2—*Nutrient and Food Priorities*). Nutrition education can help the parents or guardians learn about the importance of providing adequate fat intake for young children and the importance of separating certain items for use by one or more specific household members.

Criterion 4: Foods in the package are available in forms suitable for low-income persons who may have limited transportation, storage, and cooking facilities.

If adopted at the state agency level, the committee's recommendations allow local agencies a wide range of options for tailoring the food packages to meet specific participant needs and preferences. Table 6-5 summarizes how the changes recommended address Criterion 4, highlighting some of the major concerns expressed to the committee by various stakeholders.

Criterion 5: Foods in the package are readily acceptable, widely available, and commonly consumed; take into account cultural food preferences; and provide incentives for families to participate in the WIC program.

This criterion guided many of the committee's decisions with regard to recommendations for the revised food packages. The major revision that allows the food packages to address the issue of cultural suitability is the

TABLE 6-3 Amounts Provided by Current and Revised Food Packages Compared with Amounts Suggested for Caloric Level, by Major Food Group and Participant Category

Food Group and Participant Category (Food Package No.)	Estimated Amounts, Current Food Package
Fruits and Vegetables, expressed in cups per day	
Children, 2-4.9 y (IV-B)	~1.2 c†
Pregnant or partially breastfeeding women (V)	~1.2 c†
Non-breastfeeding postpartum women (VI)	~0.8 c†
Fully breastfeeding women (VII)	~1.5 c
Milk and Alternatives, expressed in 1-cup equivalents[c] per day	
Children, 2-4.9 y (IV-B)	3.2
Pregnant or partially breastfeeding women (V)	3.7
Non-breastfeeding postpartum women (VI)	3.2
Fully Breastfeeding Women (VII)	3.7
Grains, expressed in 1-ounce equivalents[d] per day	
Children, 2-4.9 y (IV-B)	1.2
Pregnant or partially breastfeeding women (V)	1.2
Non-breastfeeding postpartum women (VI)	1.2
Fully breastfeeding women (VII)	1.2
Meat and Alternatives, expressed in 1-ounce equivalents[e] per day	
Children, 2-4.9 y (IV-B)	2.9
Pregnant or partially breastfeeding women (V)	1.9
Non-breastfeeding postpartum women (VI)	0.9
Fully breastfeeding women (VII)	3.8

[a]Suggested amounts are from *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005, App A-2, p 53).

[b]Ranges of caloric levels used: children, 1,000–1,400 kilocalories; pregnant or partially breastfeeding women, 2,200–2,400 kilocalories; non-breastfeeding postpartum women, 1,600–2,000 kilocalories; and fully breastfeeding women, 2,400–2,600 kilocalories.

[c]A 1-cup equivalent equals 1 cup of milk or yogurt, 1.5 oz natural cheese, or 2 oz processed cheese.

[d]A 1-ounce equivalent equals 1 slice bread, 1 oz dry rice, or 1 oz dry breakfast cereal.

inclusion of fruits and vegetables with very few restrictions on choice.[7] The committee urges administrators in the WIC program at various levels to

[7]The committee recommendation not to allow potatoes (with the exception of yams and sweet potatoes) is based on the data that these starchy vegetables already are very widely consumed. The WIC program would provide no additional nutritional benefit by promoting the intake of potatoes. In certain local populations, WIC agencies may wish to restrict the purchase of other starchy vegetables for similar reasons.

Estimated Amounts, Revised Food Package	Suggested Amounts, *Dietary Guidelines*[a,b]
~1.3 c	2–3 c
~1.7 c	5 c
~1.5 c	3.5–4.5 c
~1.7 c	5–5.5 c
2.1	2
2.9	3
2.1	3
3.5	3
2.3 (whole grain only)	3–5 (aim toward 3 oz equiv whole grain)
1.7 (whole grain only)	7–8 (≥ 3 oz equiv whole grain)
1.2 (whole grain only)	6–7 (≥ 3 oz equiv whole grain)
1.7 (whole grain only)	8–9 (≥ 3 oz equiv whole grain)
2.4	2–4
2.4	6–6.5
1.4	5–5.5
3.4	6.5

[e]The number of meat and alternatives servings shown counts dry beans and peanut butter as meat alternatives. Examples of 1-ounce equivalents are 1 oz fish; 1 egg; 1/4 cup cooked dry beans, peas, or lentils; and 1/2 oz peanut butter. If dry beans were counted in the vegetable category, as is done usually, the serving size would be 1/2 cup cooked dry beans. One lb of dried beans per mo (or the equivalent of canned dry beans) provides less than 1/4 cup of cooked dry beans per day (that is, less than one 1-ounce equivalent per day as a meat alternative).

NOTES: † = all servings are from juice; c = cups; oz equiv = ounce equivalent. ~ indicates approximate amounts. Amounts are rounded, and amounts from the revised food package are based on yields of specified foods.

allow the maximum variety of choices for participants to obtain fruits and vegetables. By including a wide variety of fruits and vegetables, the food packages become much more responsive to the preferences of different cultures (ADA, 1994, 1995, 1998a-d, 1999a, 1999b, 2000; Kittler and Sucher, 2004) and are likely to offer more incentives to participate in the WIC program (Herman, 2004; Runnings, 2004). Table 6-6 summarizes how the recommended changes in food packages address Criterion 5, fo-

TABLE 6-4 Consistency of the Revised Food Packages for Infants and Children Under 2 Years of Age with Established Dietary Recommendations (Criterion 3)

Established Recommendation (derived from Table 2-9)	How Revised Food Packages Meet the Established Recommendation
Breastfeeding	
Breastfeeding is the preferred method of infant feeding because of the nutritional value and health benefits of human milk.	New policies, for which pilot testing and randomized, controlled trials are recommended, encourage full breastfeeding: • Delay the provision of formula for breast-fed infants during the crucial first month postpartum as mother/infants pairs initiate breastfeeding;[a] • For fully breastfeeding mother/infant pairs, the value of the revised food packages is increased substantially over the value of the current food packages; and, • Compared with formula-using pairs, and the *relative* value of food packages for fully breastfeeding mother/infant pairs is increased substantially.
Encourage breastfeeding with exclusion of other foods until infants are around 6 months of age.	Food Package II, which provides complementary foods, is now limited to infants ages 6–11.9 mo so that no complementary foods are provided for the first 6 mo after birth. Recent studies verify that foods introduced before the age of 6 mo serve to dilute the nutritional benefits of breast milk (Briefel et al., 2004a; Skinner et al., 2004).
Continue breastfeeding for first year after birth.	Food Package II-BF for fully breast-fed infants[b] provides commercial baby food meats to support their need for iron and zinc (in forms with good bioavailability) from complementary foods during age 6–11.9 mo and to provide an incentive for continued breastfeeding.
Continue breastfeeding into second year after birth if mutually desired by the mother and child.	No specific changes in the food package address this recommendation. (Current policy is unchanged.)
Formula Feeding	
For infants who are not currently breastfeeding, use infant formula throughout the first year after birth.	Infant formula is provided throughout the first year. (Current policy is unchanged.) Maximum formula allowances for infants 4–5.9 mo of age (Food Packages I-FF-B and

continues

TABLE 6-4 Continued

Established Recommendation (derived from Table 2-9)	How Revised Food Packages Meet the Established Recommendation
	I-BF/FF-B) were increased to correspond to higher nutritional needs at this age.
Infant formula used during the first year after birth should be iron-fortified.	Only iron-fortified formula is provided throughout the first year after birth. (Current policy is unchanged.)
Infants with specific medical conditions may require medical formula and this should be readily available through nutrition assistance programs such as the WIC program.	Medical formula is available to infants, with a doctor's prescription. (Current policy is unchanged.)
Feeding Other Foods to Infants and Young Children	
Introduce semisolid complementary foods gradually beginning around 6 mo of age.	Semisolid foods are provided in the food package for infants beginning at age 6 mo (Food Package II).[c] Infants 4–5.9 mo of age were moved to Food Package I so that only breast milk or iron-fortified formula are provided for the first 6 mo. Recent studies verify that foods introduced before the age of 6 mo serve to dilute the nutritional benefits of breast milk or formula (Briefel et al., 2004a; Skinner et al., 2004).
Introduce single-ingredient complementary foods, one at a time for a several day trial.	All of the allowed complementary foods (infant cereals; baby food fruits, vegetables, and meats) are commonly available in single-ingredient forms. See Table 4-3—*Proposed Specifications for Foods* (see Table B-1 for additional detail). Since some allowable fruits, vegetables, and cereals are not single-ingredient foods, nutrition education will need to address this recommendation.
Introduce a variety of semisolid complementary foods throughout ages 6–12 mo.	Starting at 6 mo of age, all infants receive infant cereal and baby food fruits and vegetables.[d] Fully breast-fed infants[b] also receive baby food meats[e] starting at 6 mo of age. All of these infants foods are available commercially in a variety of allowed choices.
Encourage consumption of iron-rich complementary foods during ages 6–12 mo.	Iron-fortified infant cereal is provided to all infants, starting at 6 mo of age. Fully breast-fed infants[b] also receive commercial baby food meats[e] starting at 6 mo of age. See Table 4-3—*Proposed Specifications for Foods* (see Table B-1 for additional detail).

continues

TABLE 6-4 Continued

Established Recommendation (derived from Table 2-9)	How Revised Food Packages Meet the Established Recommendation
Avoid introducing fruit juice before 6 mo of age.	No juice is provided in Food Package I (for infants under 6 mo of age).
Limit intake of fruit juice to 4–6 fl oz/d for children ages 1–6 y.	The maximum fruit juice allowance does not exceed 4 fl oz/d for children ages 1–4.9 y.
Encourage children to eat whole fruits to meet their recommended daily fruit intake.	Food packages for children include cash-value voucher(s) to obtain up to $8.00 of fresh produce per month. Some vitamin C-rich juice is retained in the children's packages to ensure an adequate source of vitamin C. Additionally, commercial baby food fruits and vegetables (with an option for fresh banana) are provided in the food package for older infants so that children are introduced to a variety of fruits and vegetables at an early age.
Delay the introduction of cow's milk until the second year after birth.	Cow's milk is not provided to infants. (Current policy is unchanged.)
Cow's milk fed during the second year should be whole milk.	Whole milk is provided to children in the second year after birth (ages 1–1.9 y).
Developing Healthy Eating Patterns	
Provide children with repeated exposure to new foods to optimize acceptance and encourage development of eating habits that promote selection of a varied diet.	Commercial baby food fruit and vegetables are provided in the food package for older infants so that children are introduced to a variety of fruits and vegetables at an early age. All of the foods in the current packages for children—cereal, milk, eggs, peanut butter, legumes, cheese, and juice—remain in the revised packages at adjusted amounts to achieve a more balanced set of foods. Packages provide more food types, such as fruits and vegetables and whole grains, and more choices among allowed foods.
Prepare complementary foods without added sugars or salt.	Specification for allowed foods limit added sugars and include sodium-reduced options. Nutrition education may be used to address the preparation of foods without added sugars and salt.

TABLE 6-4 Continued

Established Recommendation (derived from Table 2-9)	How Revised Food Packages Meet the Established Recommendation
Promote healthy eating early in life.	The packages provide more fiber, vitamin E, and iron through a greater variety of foods. The revised food packages for participants 2 y of age and older provide moderate amounts of saturated fat, cholesterol, and total fat. Fat-reduced and sodium-reduced (i.e., reduced salt) options are allowed.
Promoting Food Safety	
Avoid feeding hard, small, particulate foods up to age 2–3 y to reduce risk of choking.	The revised food packages for infants provide only strained, pureed, or diced commercial baby food or fresh bananas (intended to be mashed) to reduce the risk of choking. The processed fruit options exclude dried forms for children.

[a]The committee considered the potential benefits and consequences of the recommendation not to provide formula during the first month of breastfeeding. On balance, the empirical evidence on the relationship between early use of formula and reduced breastfeeding was considered paramount (Bergevin et al., 1983; Feinstein et al., 1986; Frank et al., 1987; Snell et al., 1992; Caulfield et al., 1998; Chapman et al., 2004).

[b]Fully breast-fed infants do not receive any formula from the WIC program.

[c]Although semisolid foods are not included in the food packages until 6 mo of age, this does not prevent the parents or caregivers from introducing semisolid foods to infants before 6 mo of age.

[d]Commercial baby food in Food Package II is the form of fruits and vegetables most consistent with the committee's criteria as applied to older infants, but this does not prevent the family from introducing other forms of fruits and vegetables (e.g., mashed foods from the family table).

[e]Commercial baby food meats provide iron and zinc with good bioavailability in the form that is most consistent with the committee's criteria.

DATA SOURCES: Established recommendations are from the American Academy of Pediatrics (AAP, 1992a, 1992b, 1997, 2001a, 2001b, 2004, 2005; Kleinman, 2000); the American Dietetic Associations (ADA, 1999c, 2004); and the World Health Organization (WHO, 2001a, 2002). (See Table 2-9, Chapter 2—*Nutrient and Food Priorities*.)

TABLE 6-5 How the Revised Food Packages Can Be Tailored for Suitability for Persons with Limited Resources (Criterion 4)

Suitability Requirements of Criterion 4	How the Revised Food Packages Correspond with the Suitability Requirements of Criterion 4
Food forms available are convenient to participants' transportation options	Food specifications allow for dried, powdered, or concentrated forms of a number of foods. See Appendix B, Table B-1—*Proposed Specifications for Foods*. Cost evaluation allowed for some small container sizes. See detail in Tables E-1 and E-2 (Appendix E—*Cost Calculations*). Small-denomination cash-value vouchers could ease transportation burdens.
Food forms available for different storage options	Food specifications allow for forms of foods that do not require refrigeration and are less perishable. See Table B-1. Cost evaluation allowed for some small package sizes allowing the entire contents to be consumed by the participant within a safe period without freezing. See detail in Tables E-1 and E-2. Small-denomination cash-value vouchers could ease storage burden for fresh fruits and vegetables. Food specifications allow for fruits, vegetables, and legumes in forms (fresh, canned, frozen, and/or dried) suitable for various storage conditions. See Table B-1.
Food available in forms for diverse cooking and food preparation facilities	Food specifications allow for ready-to-feed infant formulas, full-strength juices, and commercial baby foods. See Table B-1. Fruit and vegetable selection includes both fresh and processed options. See Table B-1. Dry beans and peas are allowed in dried and canned forms. Food specifications allow whole-grain selection to include ready-to-eat items (e.g., a loaf of bread), quick-cooking choices (e.g., parboiled brown rice), and slow-cooking grains (e.g., regular-cooking brown rice). See Table B-1.

cusing on some of the major concerns expressed to the committee by various stakeholders.

Criterion 6: Foods will be proposed giving consideration to the impacts that changes in the package will have on vendors and WIC agencies.

The committee considered the administrative and logistical impact of each of the revised changes in the WIC food packages for program staff at state and local levels and for retail food vendors serving the WIC population. The committee received numerous public comments from these stake-

TABLE 6-6 How the Revised Food Packages Were Tailored to Be Readily Acceptable (Criterion 5)

Suitability Requirements of Criterion 5	How the Revised Food Packages Correspond with the Suitability Requirements of Criterion 5
Commonly consumed foods	Widely accepted reference sources were consulted regarding foods commonly consumed in the U.S. (Smiciklas-Wright et al., 2002, 2003; Krebs-Smith et al., 1997; Cotton et al., 2004) and used to identify fruits and vegetables to include in the composites used in the nutrient and cost analyses.
Widely available foods	Availability was considered at state and regional levels as well as across the U.S. and territories. Current WIC foods are widely available and retained in packages. The options for fresh produce obtained with cash-value voucher(s), processed fruits and vegetables, or a combination of the two allow states to be responsive to availability in the local area.
Culturally appropriate foods 2000;	Reference sources from widely known sources were consulted regarding cultural suitability of foods by subpopulations in the U.S. (ADA, 1994, 1995, 1998a–d, 1999a, 1999b, Kittler and Sucher, 2004;). Information in these resources supports the importance of allowing milk substitutes and the value of allowing participants a broad selection of fruits and vegetables Participant choice is allowed for whole grains and for fruits and vegetables. Yogurt and tofu are allowed substitutes for a portion of fluid milk. For women, calcium- and vitamin D-rich soy beverage ("soy milk") is an allowed alternative for milk. Salmon and other canned fish are allowed as substitutions for tuna.
Foods that provide incentive for participation in the WIC program	More choices are allowed at the state and participant levels. Food packages for the fully breastfeeding mother/infant pair are enhanced. Commercial baby foods are provided for infants 6 mo of age and older, with higher amounts for fully breast-fed infants than for formula-fed infants. Except for Food Package I for infants ages birth to 5.9 mo, the array of foods in the food packages is greater.

TABLE 6-7 Concerns about Current Food Packages and the Potential Impact of Revised Food Packages on WIC Agencies and Retail Vendors (Criterion 6)

Impacts and Concerns Expressed by WIC Personnel and Retail Vendors	How the Revised Food Packages Address the Administrative Impact or Concern
WIC State Agencies	
It is difficult to obtain approval for changes in food package to address state or local needs.	Recommendations allow a greater number of substitutions, decreasing the need for special approvals. See Table 4-3—*Proposed Specifications for Foods* (see Table B-1 for additional detail).
Changes require retraining of administrators, staff, and vendors and education of participants; but if they address concerns effectively, the changes will be welcome.	Revised packages include many of the recommendations requested by state agencies.
WIC Local Agencies	
Current food packages aren't consistent with dietary guidance, making nutrition education difficult	Revised packages are more consistent with the *Dietary Guidelines*, with current dietary guidance for infants and young children, and with current information on nutritional deficits and needs.
Few options are available for addressing cultural diversity.	Increased variety and choice in several types of foods provided will provide flexibility in prescribing culturally appropriate packages for diverse groups.
Vendors	
Handling random-weight fresh produce at checkout would pose serious problems using the current food instruments.	Cash-value voucher(s) for fresh fruit and vegetable option could be seen as a benefit by many vendors. Handling of random-weight items will be simplified by allowing WIC participants to pay the difference when the amounts of fresh fruits and vegetables selected cost more than the value of the WIC cash-value voucher(s). Obtaining fresh produce with WIC cash-value voucher(s) could be simplified if vendors choose to price produce in $1 or $2 units (e.g. four oranges or one bunch of broccoli for $1).

holder groups. The recommended changes address their major concerns, appear manageable for both WIC agency staff and vendors, and provide a number of benefits. Table 6-7 summarizes how the proposed changes address Criterion 6, highlighting some of the major concerns expressed to the committee by various stakeholders. In general, the committee's final recommendations reflect the kinds of changes that were proposed by WIC administrators (Knolhoff and Dallavalle, 2004; Sallack, 2004; Tate, 2004; Jenks, 2004; Hoger, 2004) and vendor representatives (Gradziel et al., 2004) who communicated with the committee.

Vendors have indicated that WIC vouchers for fresh produce, prescribed as a dollar amount, need to be on a separate food instrument from the food instruments that itemize specific quantities of specific foods. This is because, to a large extent, fresh produce is sold by random weight rather than with consistent package weights and standard bar codes. Thus, to a large extent, produce cannot be tracked precisely like grocery items that are scanned at the checkout counter. Having both cash-value vouchers for fresh produce and quantity-denominated vouchers (that is, the current type of food instrument with an itemized list of specific grocery items) will facilitate transactions at the checkout stand, save embarrassment, and accommodate the accounting and billing systems currently used between the WIC state agencies and the grocery outlets.

SUMMARY

Recommendations for the revision of the current WIC food packages were based on a set of specified criteria. The committee also took into consideration the major concerns that were submitted to the committee by various stakeholder groups. This chapter illustrates how the recommended changes address the criteria and selected concerns of stakeholders. Overall, the revised packages meet the six criteria while remaining cost-neutral. Most nutrient intakes are expected to improve. The proposed changes would result in packages that are consistent with the *Dietary Guidelines for Americans 2005* for those ages 2 years and older and packages that are consistent with widely accepted dietary guidance for infants and children younger than 2 years of age. Since new food specifications expand offerings, more forms and types of foods are suitable for culturally diverse groups with limited transportation, food storage, and cooking facilities. WIC state and local agencies will have more flexibility in developing prescriptions, and the food packages can reinforce the WIC nutrition education efforts, and *vice versa*. Finally, allowing two types of food instruments—a cash-value voucher for fresh produce and the standard (itemized) food instrument for other foods—is expected to address some vendor concerns about adding fresh fruits and vegetables to the food packages.

7

Recommendations for Implementation and Evaluation of the Revised WIC Food Packages

The proposed revisions to the WIC food packages described in Chapter 4—*Revised Food Packages*—involve major changes—by far the most substantial changes in the WIC food packages since the program's inception in 1974. Additionally, this report is the first application of the Institute of Medicine's framework for dietary planning for groups (IOM, 2003a) using the Dietary Reference Intakes (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). Moreover, it is a new effort undertaken to incorporate the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005). During deliberations of the types and quantities of foods to offer, of incentives for breastfeeding, and of the timing of offering complementary foods to infants, the committee debated several difficult issues and considered various alternatives. The committee's recommendations for revising the WIC food packages resulted from a thorough and careful deliberation of how best to meet the criteria set out for the food packages while maintaining cost neutrality.

Nonetheless, the committee also recognized that it is impossible to predict *a priori* the effects of implementing the revised WIC food packages. It is not possible to estimate the precise impact of changes in the food packages on either food consumption or nutrient intakes. The WIC program can control only what is offered to participants, not what participants actually consume. With the revised food packages, consumption patterns may change in intended and in unintended ways, leading to changes in food choices and the distribution of usual nutrient intake. Moreover, the revised food packages could increase or decrease the incentive of different groups to participate in the WIC program, and they could increase or decrease

breastfeeding rates. Implementation procedures and the type of nutrition education (e.g., culturally sensitive) provided will influence the effectiveness of the revised food packages. Ultimately, data collection and analyses conducted after changes in the WIC food packages have been implemented will provide needed information on the impacts of the revised food packages.

This chapter focuses on recommendations relating to studies of the effects of the revised packages, flexibility and variety, workable procedures, breastfeeding promotion and support, nutrition education, and product availability. Following these recommendations would facilitate the gradual adoption of the revised WIC food packages and could lead to improved nutrition of the nation's mothers, infants, and young children. Recommendations are crafted specifically to address the range of stakeholders whose efforts will be integral to the successful implementation of the revised WIC food packages: the Food and Nutrition Service (FNS) (i.e., federal regulators); administrators in WIC regional, state, and local agencies; Competent Professional Authorities[1] (CPAs)at local WIC clinics; retail food vendors; and food manufacturers. All these stakeholders have a role in implementing one or more of these recommendations. It will take cooperation and communication among all these parties to maximize the beneficial impacts of suggested changes in the WIC food packages.

STUDIES RELATED TO IMPLEMENTATION AND ITS EFFECTS

Because of the magnitude of the changes proposed and because it is not possible to determine *a priori* the impacts of the proposed changes, the committee urges that well-designed pilot testing and randomized, controlled trials of the revised food packages be conducted before full-scale implementation of the revised food packages. Such testing could examine how WIC state and local agencies implement the revised food packages, effects of the revised food packages on participation rates, and the extent to which the food and nutrient goals of the proposed revisions are achieved. Impacts of the revised food packages need to be examined among diverse groups of WIC participants, with documentation of the influence of the mother's age, ethnicity/race, previous breastfeeding experience, education, employment status, and possibly other characteristics.

Among the broad range of implementation issues and dietary impacts that could be addressed through studies, some recommended changes in policies relating to WIC food packages and their contents are particularly important to examine in pilot tests before full-scale implementation.

[1]The term *Competent Professional Authorities* is used to refer to professionals and paraprofessionals who tailor the food packages and educate and counsel WIC participants.

Changes to Promote Breastfeeding

The committee recommends a number of changes to the WIC food packages to promote and support breastfeeding. One recommendation, in particular, is likely to be controversial, namely the recommendation that infant formula not routinely be provided during the first month postpartum for infant/mother pairs initiating breastfeeding. The rationale for this recommendation is the empirical evidence that shows early supplementation with formula (i.e., in the first month after birth) is associated with shorter duration of breastfeeding, particularly exclusive breastfeeding (Bergevin et al., 1983; Feinstein et al., 1986; Frank et al., 1987; Snell et al., 1992; Caulfield et al., 1998; Chapman et al., 2004).

However, the committee recognizes the potential for some undesirable consequences of the recommended changes in the WIC food packages. A breastfeeding mother—especially one who intends to combine breastfeeding and formula feeding, who needs to return to work, or who faces other personal challenges to breastfeeding—may need some formula to nourish her infant adequately during the first month postpartum. Some mothers who might otherwise try breastfeeding may choose formula feeding to be sure they can obtain formula (a high-cost item) if they run into breastfeeding difficulties. In addition, the reduced amount of formula offered to partially breastfeeding infants, as well as the increase in the maximum allowance of formula for 4- and 5-month-old infants in revised Food Package I-B, might increase the incentive for participants to choose formula feeding, especially if considered apart from other changes in the packages for mother/infant pairs. Thus, the committee recognizes the complexity of the infant-feeding choices faced by the postpartum women of the WIC program.

The committee intends for the revised WIC food packages and policies to be supportive of breastfeeding. Recognizing potential adverse consequences associated with this proposal, the committee urges that before full implementation, well-designed pilot studies be conducted to determine the effect of the recommended changes on the initiation and duration of breastfeeding, as well as on WIC participation rates. Specific questions to address in these pilot studies follow.

- What are the effects of the revised food packages and proposed infant-feeding practices on the initiation and duration of full or partial breastfeeding?
- How does the recommended approach of having only the fully breastfeeding and fully formula-feeding options for the first month after birth compare with (1) an option that allows the mother to change to partial breastfeeding after a breastfeeding trial period of about two weeks and (2) an option for a partially breastfeeding package from the beginning?

- Are breastfeeding initiation and duration affected by enhanced breastfeeding support during the first month after birth and, if deemed necessary, the provision of infant formula to breastfeeding mother during this time?

Delay in Offering Complementary Foods

The committee recommends that the WIC food packages not include complementary foods until the infant is 6 months of age. Several factors were considered in making this recommendation. First, delaying complementary foods until 6 months of age is consistent with the recommendation that infants be exclusively breast-fed until around 6 months of age (AAP, 2005). In addition, dietary recall data presented in Chapter 2—*Nutrient and Food Priorities*, as well as empirical evidence on the increasing prevalence of overweight, indicate that parents report dietary intakes of infants that provide more food energy than required for healthy growth and development. Finally, the supplemental nature of the WIC program suggests that it is not appropriate to provide complementary foods to infants before 6 months of age, especially if these foods (when fed in addition to breast milk or formula) exceed the energy needs of infants during this age period.

Nonetheless, the committee recognizes the controversy surrounding the timing of the introduction of complementary foods. Some experts contend that infants between the ages of 4 and 6 months may be developmentally ready for complementary foods. Currently, about 70 percent of infants consume complementary foods between the ages of 4 and 6 months (Briefel et al., 2004a), suggesting that parents consider them developmentally ready. In addition, if the omission of appropriate complementary foods (e.g., iron-fortified infant cereals) from the WIC food package leads to the introduction of inappropriate foods, the diets of infants 4 to 6 months of age could worsen.

Despite these considerations, the committee's interpretation of the evidence provides a sound basis for the WIC program to provide complementary foods beginning at 6 months rather than at 4 months of age. To understand the impacts of delaying the offering of complementary foods in WIC food packages for infants, however, the committee recommends that pilot studies and randomized, controlled trials examine the impact of this proposal on infant-feeding practices, food choices, and nutrient intakes.

Specific Changes to Promote Healthier Eating Patterns and Improved Nutrient Adequacy

The committee made several changes to the food packages that were intended to change the foods consumed by WIC participants, make their

diets more consistent with current dietary guidance and the *Dietary Guidelines of Americans*, and improve the nutrient adequacy of their diets. In particular, the following changes were proposed for reasons presented in Chapter 4—*Revised Food Packages*—and Chapter 6—*How the Revised Food Packages Meet the Criteria Specified*.

- A variety of fruits and vegetables would be added to the food packages.
- Only whole-grain cereals would be available in the breakfast cereal category and whole-grain bread or a substitute would be included in the food packages for children and many women.
- Only fat-reduced milk would be provided for women and children two years and older.

Such changes to the WIC food packages need to be accompanied by creative, effective, and culturally sensitive nutrition education that helps participants understand why the consumption of these foods is healthy for them and their children. Yet, these changes also hold the potential for unintended consequences. If participants will not eat whole-grain cereals or drink fat-reduced milk, then changing the food packages as proposed may reduce grain and milk consumption, leading to even lower intakes of priority nutrients and priority food groups. If the revised food packages (which emphasize fresh fruits and vegetables—somewhat perishable food items) pose more problems for participants than the current food packages (which emphasize 100 percent juice), then intakes of priority nutrients may decline. Because of the uncertainty over the effects of these specific changes, as well as the other numerous changes to the food packages, the committee reiterates the importance of pilot testing and randomized, controlled trials. Important questions to address follow.

- How are WIC participation rates, prescription rates, and voucher redemption rates affected by the changes in the food packages?
- To what extent do the assumptions regarding the demand for various forms and types of food align with actual food choices (e.g., the percentage of participants choosing canned dry beans)? How does this affect the amount of flexibility, variety, and participant choices that can be allowed while staying within necessary cost constraints?
- What are the impacts of the changes on food choices and nutrient adequacy of diets? Do diets conform more closely to the *Dietary Guidelines* and does the prevalence of inadequate intakes and excessive intakes decline?
- What is the feedback from WIC participants regarding the desirability of the revised food packages?

- How do the changes in the food packages affect the use of time by CPAs and the amount of time required by vendors to deal with each WIC participant after an initial adjustment period? What new skills and technology do they need to implement the revised food packages effectively?

FLEXIBILITY AND VARIETY

Food and Nutrition Service

A hallmark of the set of revised food packages is the increased flexibility to be offered to the WIC state and local agencies and the increased variety and choice to be offered to WIC participants. Flexibility provides a valuable means of responding to the needs of persons of different cultures and food preferences and/or with limited cooking facilities, skills, or time. The committee urges the Food and Nutrition Service (FNS) to retain, and possibly expand, the flexibility proposed for the revised food packages, so as to allow state and local agencies to adapt the packages to the needs of their WIC populations. Moreover, the committee recommends that FNS allow adjustments in the food packages consistent with newly developed scientific findings related to nutritional requirements, health promotion, and disease prevention. These might include working with food manufacturers to consider addressing the excessive sodium content of selected foods and fortification of selected foods with nutrients that are difficult to obtain in adequate amounts (e.g., fortification of milk products with vitamin D in an amount comparable to that provided by the fluid milk equivalent).

Special recommendation on vitamin D supplementation—Vitamin supplementation is outside the charge of this committee, and supplements are outside the purview of the WIC program. Nonetheless, because routine vitamin D supplementation of breast-fed infants (if ingesting less than 15 fluid ounces of vitamin D-fortified formula per day) is recommended by the American Academy of Pediatrics (AAP, 2005), the committee recommends that FNS find ways that breast-fed infants could be provided with vitamin D supplements. One possibility might be by means of the health referrals routinely provided for WIC participants.

Administrators in WIC State and Local Agencies

The committee recommends that state agencies aim for the maximum variety and choice in allowable food selections by participants, while remaining consistent with foods available in their area and with cost containment. Within the broad categories specified (e.g., breakfast cereals, milk products, whole wheat bread or other whole grains, fresh fruits and veg-

etables, processed fruits and vegetables, and dried peas and beans) allowing a wide range of products helps to accommodate various cultural groups, personal preferences, food allergies or intolerances, home storage, and cooking facilities or abilities. When WIC state agencies are able to implement electronic benefit transactions (EBT), they may be able to increase the variety and choices available to WIC participants even further.

The committee recommends that the package size specifications be consistent with safe food practices and consider a household's storage capabilities and the amount of the food suggested for daily consumption. Careful consideration of package sizes could help to ensure that the foods are eaten only by the participant (or participants in the case of family vouchers) and that food spoilage is minimized.

When CPAs are tailoring food packages, the committee recommends that they continue the practice of offering WIC participants choices that are allowed by the state agency. Examples of new choices include the substitution of yogurt for part of the milk and the form of fruits and vegetables (i.e., fresh, processed, or a combination).

WORKABLE PROCEDURES

Vouchers or Other Food Instruments

The design and ease of use of food instruments (cash-value vouchers and other food instruments) will be critical to effective implementation of the revised WIC food packages. The committee recommends that WIC state agencies obtain input from local agencies, CPAs, vendors, and participants regarding the design of new food vouchers, including food instruments that cover all WIC participants in the same family or household. The development and use of specialized computer software may facilitate the printing of customized food instruments. Similarly, software could be developed to facilitate checkout at the stores, given the increased variety and choice of foods.

The committee carefully considered feasible mechanisms for providing fresh fruits and vegetables as part of the WIC food packages. At present, the only relevant activity that has been published is related to the experience of the Farmers Market Nutrition Program in which cash-value vouchers are issued for WIC participants to obtain fresh produce at specified farmers markets (NAFMNP, 1996–2003). Employing several open sessions, the committee sought (1) the input of experienced grocery vendors (Gradziel et al., 2004) and (2) the experience gained from several pilot studies that issued cash-value vouchers for participants to obtain fresh produce at WIC grocery vendors (Herman, 2004; Runnings, 2004). Details of workshops are presented in Appendix H—*Open Sessions*. Together, this information

indicated that providing fresh produce to WIC participants using cash-value vouchers: (1) results in increases in the intake of fruits and vegetable; (2) adds variety to the diets of WIC participants; (3) is highly acceptable to WIC participants of various ethnic/cultural backgrounds; (4) appears to be a workable system for many grocery vendors; and (5) abuse of such vouchers is minimal. From this compelling information, albeit primarily unpublished at the present time, the committee concluded that cash-value vouchers are a feasible mechanism.

Thus, the committee recommends that all WIC states agencies allowing the fresh produce option develop cash-value vouchers (i.e., cash-value food instruments), to be issued in small denominations to redeem for fresh produce at WIC grocery vendors. These cash-value vouchers are to be issued in addition to the standard WIC food instruments used to prescribe specific quantities of other foods. (For clarification of definitions of WIC food instruments, see Box 4-1 in Chapter 4—*Revised Food Packages*.) In consideration of the perishable nature of fresh fruits and vegetables, small denominations are needed so the participant can obtain small amounts of fresh produce at various times during the month. Requiring the redemption of a large cash-value voucher at one time would tend to encourage participants to obtain more than they could eat in a short time, thus increasing the chance of food spoilage and waste (Kantor et al., 1997).

The committee recommends specific values for the cash-value vouchers in the revised food packages for children and women. Because an increase in the cost of fresh produce would lead to a reduced amount of fruits and vegetables that could be obtained with the cash-value voucher and this, in turn, would reduce the nutrient content of the packages, the committee recommends review and revision of the total value of the cash-value vouchers for fresh fruits and vegetables every 1 to 3 years.

Fresh Produce

The committee recommends that WIC state and local agencies work with vendors to ease the transition to the use of cash-value vouchers for fresh produce. Useful measures could include the following.

- Making scales readily available in the produce department and monitoring their accuracy so that customers can estimate the costs of the produce relatively accurately. Scales that allow entry of price per pound and compute total cost could be especially helpful if assistance is available for customers to learn how to use them.
- Training produce personnel in ways to assist their customers to estimate the total cost of their random-weight produce purchases.
- Identifying to participants and vendors items that are in the pro-

duce departments of retail stores but are not allowed through the local WIC program.

- Packaging or pricing produce so costs are easily understood.
- If the cost of the fresh produce brought to the checkout stand at a retail grocery outlet exceeds the value of the voucher(s) presented, the committee recommends that the WIC participant be allowed to pay for the excess cost if she chooses to do so. This could facilitate the checkout process, minimize the amount of fresh produce that stores will have to return to the produce department (or discard), minimize waste, and reduce embarrassment.

BREASTFEEDING PROMOTION AND SUPPORT

Many of the proposed package changes were intended to encourage breastfeeding. In support of the proposed package changes, the committee strongly recommends intensive support for breastfeeding mothers, particularly in the first few weeks postpartum, and further support to extend the duration of breastfeeding. Breastfeeding advice and support are important for all new mothers, regardless of their participation in the WIC program. An analysis of data from the 1988 National Maternal and Infant Health Survey found that, compared with the breastfeeding initiation rates of income-eligible nonparticipants, the initiation rates of WIC participants were lower only among those who did not receive breastfeeding advice (Schwartz et al., 1995). A more recent study, based on the Fragile Families and Child Well-Being Study from 1999–2000, also found a positive association of WIC participation on breastfeeding initiation by low-income women but no effect of WIC participation on the duration of breastfeeding (Chatterji and Brooks-Gunn, 2004).

A complex set of demographic, psychosocial, clinical, and breastfeeding management factors appears to influence breastfeeding duration. Regardless of socioeconomic status, breastfeeding problems requiring individualized counseling and support are common (Dewey et al., 2003). Family support, positive maternal attitudes towards breastfeeding, and appropriate suckling techniques are among the factors positively related to longer duration of breastfeeding (Rogers et al., 1997; Ceriani Cernadas et al., 2003) that may be influenced by breastfeeding support services. Lack of self-confidence in ability to breastfeed and the belief that a baby prefers formula have been negatively related to duration of breastfeeding in WIC participants (Ertem et al., 2001). One randomized, controlled trial, carried out in a WIC setting, found that peer counseling, compared to the usual WIC nutrition education, significantly increases the duration of breastfeeding among women whose infants received supplemental formula on the first day postpartum (Chapman et al., 2004). In sum, to continue nursing, WIC

participants need at least as much, if not more, breastfeeding advice and support than higher-income women.

While very few data are available to determine whether or not the WIC food packages can be designed to provide an incentive for breastfeeding, the committee has received public comments (written and oral testimony) that the current enhanced Food Package VII is not attractive enough, compared to WIC food packages for the partially breastfeeding mother and infant. Therefore, in addition to intensive breastfeeding education to promote breastfeeding, the committee recommends a comprehensive approach that involves:

- enhanced food packages for both the fully breastfeeding mother and infant, ages 6 months and older;
- reduced maximum amount of formula that is provided to all partially breast-fed infants and to the formula-fed infants ages 6 months and older;
- policy change of not routinely providing formula in the first month postpartum to breast-fed infants;
- policy change of not providing juice in the first year after birth;
- policy change of not providing complementary foods before 6 months of age; and
- provision of breastfeeding counseling to breastfeeding mothers who request formula in the first month postpartum.

Thus, the committee recommends that FNS and WIC state and local agencies continue or expand their efforts to increase the initiation and duration of breastfeeding. For example, the incentive value of the food packages for fully breastfeeding mother/infant pairs could be supported by new educational efforts that address the package changes, providing breast pumps, and guidance on initiating and sustaining full breastfeeding, such as peer counseling.

NUTRITION EDUCATION

The revised food packages provide new possibilities for nutrition education because the packages are more consistent with the *Dietary Guidelines for Americans*. Action is needed at many levels—demonstration projects funded by FNS, coordination of nutrition education efforts, CPA training by WIC regional and state agencies, and implementation of innovative culturally sensitive teaching methods by local WIC clinics. Changes in the food packages may trigger the need for nutrition education to address topics such as the following:

Foods

- Adapting to fat-reduced milk and milk products, becoming familiar with nutrient-dense fruits and vegetables;
- Adapting to whole-grain cereals and other whole-grain products, becoming familiar with labeling of whole-grain products;
- Honoring the cultural backgrounds of WIC participants by adapting traditional ways of preparing foods in the WIC food packages to fit within current dietary guidance (e.g., reducing fat and salt content of foods prepared by traditional methods); and
- Using new food packages to support body weight control or other aspects of the *Dietary Guidelines*.

Feeding Infants and Young Children

- Breastfeeding, in particular full breastfeeding, provides benefits for both infant and mother; food packages for mother/infant pairs are designed to encourage breastfeeding, in particular full breastfeeding;
- When and how to introduce semisolid foods into the infant's diet;
- Guidance on appropriate types and amounts of foods and fluids for infants and young children, including foods to offer beyond those provided by the WIC program and the importance of quenching thirst with water; and
- Encouragement to make appropriate choices among the variety of allowed fruits and vegetables to introduce infants and children to a varied diet that includes both fruits and vegetables.

Shopping

- Characteristics of good quality fresh fruits and vegetables;
- How to use cash-value vouchers for fresh produce—determining how much they can obtain with the cash-value vouchers they have and identifying best buys; and
- How to identify allowed processed fruits, vegetables, and other new food choices when shopping.

Handling Food in the Home

- Transporting, storing, preparing, and using fruits, vegetables, whole-grain products, and other new food choices for best taste and shelf life; and
- Following good food safety practices, especially with perishable foods.

However, in a recent report from the General Accounting Office (GAO, 2004), the WIC program is described by WIC administrators as having "limited ability to provide frequent and ongoing nutrition education because of competing program requirements."[2] For example, because of competing demands, the average WIC participant receives less than 20 minutes of nutrition education twice every six months. To realize fully the potential of the revised food packages to improve the nutritional status of the WIC population, a revised system for providing nutrition education may be needed that includes greater frequency and intensity of nutrition education efforts.

The committee also recommends that the FNS support demonstration projects to foster the development of educational approaches and materials to promote effective use of the revised food packages by WIC participants.

PRODUCT AVAILABILITY

The food specifications in Table B-1 (Appendix B—*Nutrient Profiles of Current and Revised Food Packages*) cover more items than have been allowed previously and, in some cases, limit the use of foods that contain added sugars, fat, or salt (i.e., sodium). The committee encourages food manufacturers to consider changes in some of their products to meet the nutritional needs of WIC participants. These changes might take the following forms:

- more product choices with reduced-sodium content;
- fortification of selected foods with nutrients that are difficult to obtain in adequate amounts (e.g., fortification of yogurt and other milk products with vitamin D to amounts equivalent to milk);
- ready-to-eat or quick-cooking whole grain products that meet the proposed specifications; and
- economical packaging that is re-sealable or in sizes sufficiently small to aid in keeping food safe over the time frame for a single participant to consume the contents.

By staying abreast of innovations in the food industry and keeping open the lines of communication with industry leaders, WIC administrators at the national, regional, state, and local levels could maintain a vibrant and

[2]Quote is from GAO (General Accounting Office). 2004. *Nutrition Education: USDA Provides Services through Multiple Programs, but Stronger Linkages among Efforts are Needed*. Report No. GAO-04-528, p. 28. Washington, DC: U.S. General Accounting Office.

BOX 7-1
Recommendations for Implementing the Revised WIC Food Packages

Food and Nutrition Service	1. The committee urges conducting pilot testing and randomized, controlled trials of the revised food packages prior to full-scale implementation of the revised food packages. Studies of the effects of recommendations regarding infant-feeding options during the first month after birth are a high priority and need to be conducted prior to implementing such changes in the packages for breastfeeding infants.
	2. The committee urges the Food and Nutrition Service (FNS) to retain, and possibly expand, the flexibility proposed for the revised food packages, so as to allow state and local agencies to adapt the packages to the needs of their WIC populations. It further recommends that state agencies aim for the maximum variety and flexibility in allowable food selections consistent with foods available in their area and with cost containment.
WIC Administrators at the Regional and State Level	3. The committee recommends that WIC state agencies: use input from Competent Professional Authorities (CPAs), vendors, and participants to inform the design of new food vouchers; implement cash-value vouchers issued in small denominations for obtaining fresh produce; and work with vendors to ease the transition to cash-value vouchers for fresh produce.
Local WIC Agencies	4. The committee recommends adapting culturally sensitive nutrition education to address changes in the food packages related to foods, shopping, handling foods in the home, incentives for breastfeeding, and feeding infants and young children.
	5. In tandem with the proposed package changes for fully breastfeeding mother/infant pairs, the committee recommends intensive support for breastfeeding mothers in the first few weeks after delivery and further support to extend the duration of breastfeeding for at least one year postpartum.
Food Manufacturers	6. The committee encourages food manufacturers to consider changes in some of their products to address the nutritional needs of WIC participants—for example, more choices with reduced sodium content, ready-to-eat or quick-cooking whole-grain products that meet the proposed nutritional specifications, and economical packaging that is re-sealable.

flexible WIC program that will continue to serve the nutritional needs of WIC recipients and improve the health of women, infants, and children in the United States.

SUMMARY

The set of revised WIC food packages holds potential to benefit the nutrition and health of the nation's low-income women, infants, and children. However, effective implementation and nationwide adoption of the changes need to be preceded not only by administrative adjustments of the WIC program but also by a series of pilot studies and randomized, controlled trials to test and, if necessary, to improve the revisions. In addition, careful planning is needed to develop workable implementation procedures among all parties (Box 7-1), improve breastfeeding promotion and support, and effectively relate nutrition education to the revised food packages. Adoption of the plan to increase flexibility, variety, and participant choices described in this report is integral to meeting the criteria used by this committee in the redesign of the WIC food packages.

8

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APPENDIXES

A

Comparison of Current and Revised Food Packages

LIST OF TABLES

SIDE-BY-SIDE COMPARISON OF THE CURRENT AND REVISED FOOD PACKAGES

TABLE A-1 Comparison of the Current and Revised Food Packages for Young Infants, Maximum Monthly Allowances

	Current Food Package I	Revised Food Package I
Partially Breast-Fed Infants[a]		
Specialty Food		
Infant Formula	*Birth through 3.9 months of age:* about 806 fluid ounces of iron-fortified formula[b] (example: 403 fluid ounces of liquid concentrate) [26 fluid ounces of formula per day]	*1 month through 3.9 months of age:* about 384 fluid ounces of iron-fortified formula[b] (example: 52 ounces of powdered formula) [12 fluid ounces of formula per day]
		4 through 5.9 months of age: about 442 fluid ounces of iron-fortified formula[b] (example: 221 fluid ounces of liquid concentrate) [14 fluid ounces of formula per day]
Fully Formula-Fed Infants[a]		
Specialty Food		
Infant Formula	*Birth through 3.9 months of age:* about 806 fluid ounces of iron-fortified formula[b] (example: 403 fluid ounces of liquid concentrate) [26 fluid ounces of formula per day]	*Birth through 3.9 months of age:* about 806 fluid ounces of iron-fortified formula[b] (example: 403 fluid ounces of liquid concentrate) [26 fluid ounces of formula per day]
		4 through 5.9 months of age: about 884 fluid ounces of iron-fortified formula[b] (example: 442 fluid ounces of liquid concentrate) [29 fluid ounces of formula per day]
Participant Eligibility		
Partially Breast-Fed Infants[a]	Birth through 3.9 months of age	1 month through 5.9 months of age
Fully Formula-Fed Infants[a]	Birth through 3.9 months of age	Birth through 5.9 months of age

[a]Infants are certified without respect to the feeding method to be used; however, the amount of formula prescribed for infants will vary depending on whether they are fully breast-fed, partially breast-fed, or fully formula-fed.

[b]The number of fluid ounces of formula refers to the amount as prepared according to directions on the container.

TABLE A-2 Comparison of the Current and Revised Food Packages for Older Infants, Maximum Monthly Allowances

	Current Food Package II	Revised Food Package II
Fully Breast-Fed Infants[a]		
Food Group		
Fruits and Vegetables	96 fluid ounces of vitamin C-rich juice [3.1 fluid ounces per day]	256 ounces of baby food fruits and vegetables [8.3 ounces per day]
Grains	24 ounces of iron-fortified infant cereal	24 ounces of iron-fortified infant cereal
Meat		77.5 ounces baby food meat [2.5 ounces per day]
Partially Breast-Fed Infants[a]		
Specialty Food		
Infant Formula	About 806 fluid ounces of iron-fortified formula[b] (example: 403 fluid ounces of liquid concentrate) [26 fluid ounces of formula per day]	About 312 fluid ounces of iron-fortified formula[b] (example: 156 fluid ounces of liquid concentrate) [10 fluid ounces of formula per day]
Food Group		
Fruits and Vegetables	96 fluid ounces of vitamin C-rich juice [3.1 fluid ounces per day]	128 ounces of baby food fruits and vegetables [4.1 ounces per day]
Grains	24 ounces of iron-fortified infant cereal	24 ounces of iron-fortified infant cereal
Fully Formula-Fed Infants[a]		
Specialty Food		
Infant Formula	About 806 fluid ounces of iron-fortified formula[b] (example: 403 fluid ounces of liquid concentrate) [26 fluid ounces of formula per day]	About 624 fluid ounces of iron-fortified formula[b] (example: 312 fluid ounces of liquid concentrate) [20 fluid ounces of formula per day]
Food Group		
Fruits and Vegetables	96 fluid ounces of vitamin C-rich juice [3.1 fluid ounces per day]	128 ounces of baby food fruits and vegetables [4.1 ounces per day]

continues

TABLE A-2 Continued

	Current Food Package II	Revised Food Package II
Grains	24 ounces of iron-fortified infant cereal	24 ounces of iron-fortified infant cereal
Participant Eligibility		
	Infants, 4 through 11.9 months of age	Infants, 6 through 11.9 months of age

[a]Infants are certified without respect to the feeding method to be used; however, the amount of formula prescribed for infants will vary depending on whether they are fully breast-fed, partially breast-fed, or fully formula-fed.

[b]The number of fluid ounces of formula refers to the amount as prepared according to directions on the container.

TABLE A-3 Comparison of the Current and Revised Food Packages for Participants with Special Dietary Needs, Maximum Monthly Allowances

	Current Food Package III	Revised Food Package III
Specialty Food		
Formula	About 806 fluid ounces of iron-fortified formula[a] (example: 403 fluid ounces of liquid concentrate), additional amounts may be approved for nutritional need (up to 104 fl oz of formula)	About 806 fluid ounces of iron-fortified formula[a] (example: 403 fluid ounces of liquid concentrate), additional amounts may be approved for nutritional need
Food Group		
Fruits and Vegetables	144 fluid ounces of vitamin C-rich juice [4.8 fluid ounces per day]	Any foods from the life stage-appropriate package are included, if consistent with the participant's special health needs.
Milk and Alternatives	Any foods as described above	
Grains	36 ounces of iron-fortified cereal	Any foods as described above
Meat and Alternatives		Any foods as described above
Participant Eligibility		
	Children and women	Infants, children, and women

[a]May be special formulas or medical formulas, not just infant formula. The number of fluid ounces of formula refers to the amount as prepared according to directions on the container.

TABLE A-4 Comparison of the Current and Revised Food Packages for Children, Maximum Monthly Allowances

	Current Food Package IV	Revised Food Package IV
Food Group		
Fruits and Vegetables	288 fluid ounces of vitamin C-rich juice [9.6 fluid ounces per day]	128 fluid ounces of vitamin C-rich juice [4.3 fluid ounces per day] $8 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	24 quarts of milk with some allowed substitutions [3.2 cups per day]	16 quarts of milk with more allowed substitutions [2.1 cups per day] • 1-year-old: whole milk (3.5–4% milk fat) • 2- through 4-year-old: 2% milk fat or less
Grains	36 ounces of iron-fortified cereal	36 ounces of iron-fortified whole grain cereal 2 pounds of whole grain bread or other whole grain options
Meat and Alternatives	2–2.5 dozen eggs 1 pound of dried beans or peas *or* 18 ounces of peanut butter	1 dozen eggs 1 pound of dried beans or peas or the equivalent canned *or* 18 ounces of peanut butter
Participant Eligibility		
	Children, 1 through 4.9 years of age	Children, 1 through 4.9 years of age

[a]Alternatively, a processed fruit and vegetable option is available.

TABLE A-5 Comparison of the Current and Revised Food Packages for Pregnant Women and Partially Breastfeeding Women, Maximum Monthly Allowances

	Current Food Package V	Revised Food Package V
Food Group		
Fruits and Vegetables	288 fluid ounces of vitamin C-rich juice [9.6 fluid ounces per day]	144 fluid ounces of vitamin C-rich juice [4.8 fluid ounces per day] $10 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	28 quarts of milk with some allowed substitutions [3.7 cups per day]	22 quarts of milk, 2% milk fat or less, with more allowed substitutions [2.9 cups per day]
Grains	36 ounces of iron-fortified cereal	36 ounces of iron-fortified whole grain cereal 1 pound of whole-grain bread or other whole-grain options
Meat and Alternatives	2–2.5 dozen eggs 1 pound of dried beans or peas *or* 18 ounces of peanut butter	1 dozen eggs 1 pound of dried beans or peas or the equivalent canned *and* 18 ounces of peanut butter
Participant Eligibility		
Length of Eligibility		
Eligibility During Pregnancy	Throughout pregnancy	Throughout pregnancy
Eligibility After Giving Birth	Up to 12 months after delivery	From 1 month through 11.9 months after delivery
Description of Breastfeeding		
	Definition of Breastfeeding: Breastfeeding an average of once per day	Definition of Partial Breastfeeding: Breastfeeding and requesting formula in amounts that do not exceed approximately half the amount of formula allowed for a fully formula-fed infant

[a]Alternatively, a processed fruit and vegetable option is available.

TABLE A-6 Comparison of the Current and Revised Food Packages for Non-Breastfeeding Postpartum Women, Maximum Monthly Allowances

	Current Food Package VI	Revised Food Package VI
Food Group		
Fruits and Vegetables	192 fluid ounces of vitamin C-rich juice [6.4 fluid ounces per day]	96 fluid ounces of vitamin C-rich juice [3.2 fluid ounces per day] $10 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	24 quarts of milk with some allowed substitutions [3.2 cups per day]	16 quarts of milk, 2% milk fat or less, with more allowed substitutions [2.1 cups per day]
Grains	36 ounces of iron-fortified cereal	36 ounces of iron-fortified whole-grain cereal
Meat and Alternatives	2–2.5 dozen eggs	1 dozen eggs 1 pound of dried beans or peas or the equivalent canned *or* 18 ounces of peanut butter
Participant Eligibility		
Length of Eligibility		
	Up to 6 months after delivery	Up to 6 months after delivery

[a]Alternatively, a processed fruit and vegetable option is available.

TABLE A-7 Comparison of the Current and Revised Food Packages for Fully Breastfeeding Women, Maximum Monthly Allowances

	Current Food Package VII	Revised Food Package VII
Food Group		
Fruits and Vegetables	336 fluid ounces of vitamin C-rich juice [11 fluid ounces per day] 2 pounds fresh carrots (canned or frozen carrots allowed)	144 fluid ounces of vitamin C-rich juice [4.8 fluid ounces per day] $10 cash-value voucher for fresh fruits and vegetables[a]
Milk and Alternatives	28 quarts of milk with some allowed substitutions [3.7 cups per day] 1 pound of cheese [about one-half ounce per day]	24 quarts of milk, 2% milk fat or less, with more allowed substitutions [3.2 cups per day] 1 pound of cheese [about one-half ounce per day]
Grains	36 ounces of iron-fortified cereal	36 ounces of iron-fortified whole-grain cereal 1 pound of whole grain bread or other whole grain options
Meat and Alternatives	2–2.5 dozen eggs 26 ounces canned fish (light tuna) 1 pound of dried beans or peas *and* 18 ounces of peanut butter	2 dozen eggs 30 ounces canned fish (light tuna or salmon) 1 pound of dried beans or peas or the equivalent canned *and* 18 ounces of peanut butter
Participant Eligibility		
Length of Eligibility		
	Up to 12 months after delivery	Up to 12 months after delivery

[a]Alternatively, a processed fruit and vegetable option is available.

B

Nutrient Profiles of Current and Revised Food Packages

INTRODUCTION

For the analyses presented in this report, the committee conducted detailed analyses of the nutrient content of the current and revised WIC food packages. Many of the details are presented in here in Appendix B. Additional details are presented in Appendix E—*Cost Calculations*. Specifically, details of the assumptions used in both the nutrient and cost analyses of the food packages are presented in Tables E-1 and E-2.

The following is a list of the tables presented here in Appendix B.

TABLE B-1 Specifications for Foods in the Revised Food Packages

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
Infant Foods		
Infant formula	**I-FF, II-FF** Infants, fully formula-fed, 0–11.9 mo **I-BF/FF-B, II-BF/FF** Infants, partially breast-fed, 4–11.9 mo	No change from current specifications. All allowed infant formulas must meet the definitions and requirements for an infant formula as regulated by FDA: Federal Food, Drug, and Cosmetic Act, definitions [21 USC § 321(z)]; requirements [21 CFR § 106 and §107]; and any updates of these regulations. The iron fortification level must be 10 mg per liter of formula (as prepared for consumption as directed on the container). Liquid concentrate, powdered, or ready-to-feed forms of formula are allowed.[a]
Infant formula, powdered	**I-BF/FF-A** Infants, partially breast-fed, 1–3.9 mo	Only powdered formula is allowed (except when powdered formula is contraindicated).[b]
Infant formula, powdered	**I-BF** Infants, fully breast-fed	Allowed only during the first month after birth under special conditions. Only powdered formula is allowed (except when powdered formula is contraindicated).[b]
Baby food fruits and vegetables	**II** Infants, 6–11.9 mo	Commercial baby food fruits and vegetables without added sugars, starches, or salt (i.e., sodium). Texture may range from strained through diced. Fresh banana may replace up to 16 oz of baby food fruit (e.g., 4 4-oz jars per month) at a rate of 1 lb of bananas per 8 oz of baby food fruit.
Infant cereal	**II** Infants, 6–11.9 mo	No change from current specifications. Infant cereal, instant (must conform to USDA commercial item description A-A-20022B and any updates of these regulations) Must contain a minimum of 45 mg of iron per 100 g of dry cereal. Infant cereals containing infant formula, milk, fruit, or other noncereal ingredients are not allowed.
Baby food meat	**II-BF** Infants, fully breast-fed, 6–11.9 mo	Single major ingredient, commercial baby food meat without added sugars, starches, vegetables, or salt (i.e., sodium). Broth (unsalted; that is,

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
		without added sodium) may be an ingredient. Texture may range from pureed through diced.
Fruits and Vegetables		
Juice	**IV, V, VI, VII** Children and women	No change from current specifications. Must be pasteurized 100% unsweetened fruit juice (must conform to FDA standard of identity [21 CFR § 146] and any updates of these regulations) or vegetable juice (must conform to FDA standard of identity [21 CFR § 156] and any updates of these regulations) and contain at least 30 mg of vitamin C per 100 mL of juice. Juices that are fortified with other nutrients may be allowed at the state agency's option. Juice may be fresh, from concentrate, frozen, canned, or shelf-stable. Vegetable juice may be regular or lower in sodium.[c]
Fresh fruits and vegetables	**IV, V, VI, VII** Children and women	Any variety of fresh whole or cut fruit without added sugars. Any fresh whole or cut vegetable except white potatoes (orange yams and sweet potatoes are allowed); without added sugars, fats, or oils.
Processed fruits and vegetables[d]	**IV, V, VI, VII** Children and women	Any variety of canned[e] fruits (must conform to FDA standard of identity [21 CFR § 145] and any updates of these regulations); juice pack or water pack without added sugars. Any variety of frozen fruits without added sugars. Any variety of canned[e] or frozen vegetables (must conform to FDA standard of identity [21 CFR § 155] and any updates of these regulations) except white potatoes (orange yams and sweet potatoes are allowed); without added sugars, fats, or oils. May be regular or lower in sodium.[c] Excludes soups, condiments such as catsup, pickles, and olives.
	V, VI, VII Women	Any type of dried fruits without added sugars, fats, oils, or salt (i.e., sodium).

continues

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
Milk and Alternatives		
Milk	**IV-A** Children, 1–1.9 y	Similar in types and forms under current specification, except that only whole milk (not less that 3.25% milk fat) is allowed. Cow's milk (must conform to FDA standard of identity [21 CFR § 131.110]; USDA commercial item description A-A-20338; and any updates of these regulations) or goat's milk, pasteurized fluid whole milk, finished milk contains at least 400 IU (ca. 10 mcg) of vitamin D per quart of milk or reconstituted milk. May be fluid, shelf-stable, evaporated (21 CFR § 131.130; A-A-20072B), or dried (i.e., powdered) (21 CFR § 131.147). Lactose-reduced milk (must conform to FDA standard of identity [21 CFR § 184.1387 or § 184.1388] and any updates of these regulations) (i.e., must contain at least 70% less lactose than regular milk) is allowed. Buttermilk (must conform to FDA standard of identity for cultured milk [21 CFR § 131.112—cultured buttermilk, kefir cultured milk, acidophilus cultured milk] and any updates of these regulations) may be allowed at the state agency's option.
	IV-B, V, VI, VII Children (≥ 2 y) and women (adolescent and adult)	Similar in types and forms under current specification, except that no more than 2% milk fat allowed. Cow's milk (must conform to FDA standard of identity [21 CFR § 131.110]; USDA commercial item description A-A-20338; and any updates of these regulations) or goat's milk, pasteurized fluid fat-reduced milk (i.e., reduced-fat milk [2% or less milk fat]; lowfat milk [1% or less milk fat]; or nonfat milk [skim milk]), finished milk contains at least 400 IU (ca. 10 mcg) of vitamin D and 2,000 IU (ca. 600 mcg) vitamin A per quart of milk or reconstituted milk. May be fluid, shelf-stable, evaporated [21 CFR § 131.130; A-A-20072B], or

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
		powdered (i.e., dry whole milk) [21 CFR § 131.127]. Milk includes lactose-reduced milk and buttermilk as above except no more than 2% milk fat.
Cheese	**IV, V, VI, VII** Children and women	No change from current specifications. Domestic cheese (must conform to FDA standard of identity [21 CFR § 133] and any updates of these regulations); brick, cheddar, colby, jack, monterey, mozzarella, muenster, pasteurized processed American, provolone, Swiss, or blends of any of these cheeses are allowed. Allowed cheeses may be regular or reduced in content of fat, cholesterol, or sodium—that is, labeled low, free, reduced, less, or light in any of these nutrients.[c]
Yogurt, fat-reduced	**IV, V, VI, VII** Children and women	Yogurt (must conform to FDA standard of identity [21 CFR § 131.200] and any updates of these regulations; reduced-fat [FDA, 1998; that is, no more than 2% milk fat], low-fat [21 CFR § 131.203; FDA, 1998; that is, no more than 1% milk fat], or nonfat [21 CFR § 131.206; that is, less than 0.5% milk fat]); plain or flavored with ≤ 17 g of total sugars per 100 g yogurt. May contain low-calorie sweetener (i.e., sugar substitutes) approved by the FDA. Yogurts that are fortified with vitamin D, vitamin A, and other nutrients may be allowed at the state agency's option.[f]
Soy beverage	**V, VI, VII** Women	Soy beverage (sometimes referred to as "soy milk") must be fortified to contain nutrients in amounts similar to cow's milk. Specifications are to include at least 300 mg calcium and 120 IU (ca. 3 mcg) vitamin D per 8 fl oz. Soy beverages typically contain no cholesterol and are low in saturated fat.

continues

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
Tofu	Women	Calcium-set tofu (prepared with only calcium salts [e.g., calcium sulfate]). May not contain added fats, oils, or sodium.
Grains		
Cereal	**IV, V, VI, VII** Children and women	Ready-to-eat cereals and hot cereals (must conform to FDA standard of identity—21 CFR § 170.3[n][4]); USDA commercial item description A-A-20000B (for ready-to-eat cereals); and any updates of these regulations]: • contain a minimum of 28 mg iron per 100 g dry cereal; • contain ≤ 21.2 g sucrose and other sugars per 100 g dry cereal (≤ 6 g per dry oz); and • meet labeling requirements for making a health claim as a "whole-grain food with moderate fat content" (see CFSAN, 1999, 2003b): –contain a minimum of 51% whole grains—a minimum of 51% of the grain in the product must be whole grains—using dietary fiber as the indicator; –meet the regulatory definitions for "low saturated fat" (≤ 1 g saturated fat per RACC) and "low cholesterol" (≤ 20 mg cholesterol per RACC); –bear quantitative *trans* fat labeling; and –contain ≤ 6.5 g total fat per RACC and ≤ 0.5 g *trans* fat per RACC. Instant-, quick- and regular-cooking forms are allowed.
Whole grain bread	**IV, V, VII** Children and women except non-breastfeeding postpartum women	Whole wheat bread (must conform to FDA standard of identity [21 CFR § 136.180] and any updates of these regulations) *or* Bread must meet labeling requirements for making a health claim as a "whole-grain food with moderate fat content" (see CFSAN, 1999, 2003b): • contain a minimum of 51% whole grains—a minimum of 51% of the grain in the product must be whole grains—using dietary fiber as a marker;

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
		• meet the regulatory definitions for "low saturated fat" (≤ 1 g saturated fat per RACC) and "low cholesterol" (≤ 20 mg cholesterol per RACC); • bear quantitative *trans* fat labeling; and • contain ≤ 6.5 g total fat per RACC and ≤ 0.5 g *trans* fat per RACC.
Other whole grains	**IV, V, VII** Children and women except non-breastfeeding postpartum women	Brown rice, bulgur, oatmeal, whole-grain barley without added sugars, fats, oils, or salt (i.e., sodium). May be instant-, quick-, or regular-cooking. Soft corn or whole wheat tortillas without added fats or oils may be allowed at the state agency's option.
Meat and Alternatives		
Eggs	**IV, V, VI, VII** Children and women	Fresh shell domestic hens' eggs (no standard of identity has been established [21 CFR § 160.100]) or dried eggs (must confirm to FDA standard of identity [21 CFR § 160.105] and any updates of these regulations) made from whole eggs (liquid or shell eggs) that have been pasteurized and dried. No change from current specifications. Hard boiled eggs, where readily available in small quantities, may be provided for participants with limited cooking facilities.
Fish	**VII** Woman, fully breastfeeding	Canned only: • light tuna (no white tuna or albacore) (must conform to FDA standard of identity [21 CFR § 161.190]; USDA commercial item description A-A-20155C; and any updates of these regulations); • salmon (bones, if any, must be soft and friable) (must conform to FDA standard of identity [21 CFR § 161.170]; USDA commercial item description A-A-20158D; and any updates of these regulations); and • other varieties of fish that do not pose a mercury hazard (≤ 1.0 ppm, the standard set for tuna [USDA commercial item description A-A-20155C] as amended by

continues

TABLE B-1 Continued

Category / Food	Package Number and Participant Description	Allowable Foods and Minimum Requirements
		additional standards such as EPA's stricter Tissue Residue Criterion of ≤ 0.3 ppm for freshwater and estuarine fish [EPA, 2001]) as identified by advisories from the FDA and EPA. May be packed in water or oil. May be regular or lower in sodium content.[c]
Dry beans (legumes)	**IV, V, VI, VII** Children and women	Any type of mature dry beans, peas, or lentils in dry-packaged (i.e., dried) or canned[e] forms.[g] Examples include but are not limited to black beans ("turtle beans"), blackeye peas (cowpeas of the blackeye variety, "cow beans"), garbanzo beans (chickpeas), great northern beans, kidney beans, lima beans ("butter beans"), pinto beans, soybeans, split peas, and lentils. All categories exclude soups. May not contain added sugars, fats, or oils. Canned legumes may be regular or lower in sodium content.[c] Baked beans may be provided for participants with limited cooking facilities.
Peanut butter	**IV, V, VI, VII** Children and women	No change from current specifications. Peanut butter (must conform to FDA standard of identity [21 CFR §164.150]; USDA commercial item description A-A-20328; and any updates of these regulations); creamy or chunky, regular or reduced fat, salted or unsalted[c] forms are allowed.
Additional Foods for Food Package III		
Exempt infant formula	**III** Infants, children, and women with special dietary needs	Must meet the requirements for an exempt infant formula as regulated by FDA: Federal Food, Drug, and Cosmetic Act, definitions (21 USC § 350[a][h]; 21 CFR § 107.3); requirements (21 CFR § 106 and § 107); and any updates of these regulations.
Medical foods	**III** Infants, children, and women with special dietary needs	Certain enteral products that are specifically formulated to provide nutritional support for individuals with a diagnosed medical condition, allowable when the use of conventional foods is precluded, restricted, or inadequate.

TABLE B-1 Continued

[a]Following the current practice (see Table 1-1—*Current WIC Food Packages*), the revised maximum monthly allowances for infant formula are listed as fl oz of the liquid concentrate form (see Table 4-1—*Revised WIC Food Packages*). In converting a maximum monthly allowance for formula to powdered or ready-to-feed forms, the committee's recommendations for rounding to whole cans may vary from current practice if only rounding up to whole cans was used. For details, see Table B-6—*Substitution Rates for Various Volumes of Formula Concentrate*.

[b]An example of when powdered formula is contraindicated is any situation in which water quality is compromised.

[c]Any of the following lower sodium forms are allowable: (Adapted from FDA website [Kurtzweil, 1995].)

- *Sodium-free*—less than 5 mg sodium per serving;
- *Very low sodium*—35 mg sodium or less per serving or, if the serving is 30 g or less or 2 tablespoons or less, 35 mg sodium or less per 50 g of the food;
- *Low-sodium*—140 mg sodium or less per serving or, if the serving is 30 g or less or 2 tablespoons or less, 140 mg sodium or less per 50 g of the food;
- *Light in sodium*—at least 50 percent less sodium per serving than average reference amount for same food with no sodium reduction;
- *Lightly salted*—at least 50 percent less sodium per serving than reference amount (If the food is not "low in sodium," the statement "not a low-sodium food" must appear on the same panel as the Nutrition Facts panel.); and
- *Reduced or less sodium*—at least 25 percent less sodium per serving than reference food.

[d]Processed fruits and vegetables can be substituted for fresh produce on the basis of equivalent numbers of servings. The committee's calculations were based on information in USDA's *Food Buying Guide for Child Nutrition Programs* (FNS, 1884a, 1984b). For women, 140 oz of canned fruit plus 140 oz of canned vegetables would be approximately equivalent to $10 fresh fruits and vegetables; for children, 110 oz of canned fruit plus 110 oz of canned vegetables would be approximately equivalent to $8 fresh fruits and vegetables.

[e]For the purposes of this specifications table, the term *canned* refers to processed food items in cans or other shelf-stable containers.

[f]As more brands of fortified yogurt appear in the market, state agencies may decide to increase the total amount of yogurt that can be substituted for milk.

[g]Canned legumes could substitute for dried legumes at the rate or 64 oz of canned beans for 1 lb dried beans. The equivalence of 64 oz of canned beans for 1 lb dried beans was calculated using several methods. One method used the following conversion factors: 1 lb of dried beans = 6 cups of cooked beans (drained); and 1 15-oz can of beans (mature legumes) = 1 1/2 cups cooked beans (drained) (American Dry Bean Board, 2004). Thus, 1 lb of dried beans = 4 15-oz cans of beans (60 oz). Common can sizes for legumes currently on the market ranged from 15 to 16 oz; the equivalence was raised from 60 oz to 64 oz of canned beans for 1 lb dried beans to allow a participant to obtain 4 16-cans per month.

NOTES: BF = fully breast-fed (i.e., the infant receives no formula through the WIC program); BF/FF = partially breast-fed (i.e., the infant is breast-fed but receives some formula through the WIC program); ca. = calculated amount; CFR = Code of Federal Regulations; DHHS = U.S. Department of Health and Human Services; EPA = U.S. Environmental Protection Agency; FDA = U.S. Food and Drug Administration; FF = fully formula-fed; IU = International Units; mL = milliliter; RACC = reference amounts customarily consumed per eating occasion, defined in 21 CFR § 101.12; USC = U.S. Code; USDA = U.S. Department of Agriculture.

DATA SOURCES: CFR (U.S. Congress, 2004b); CFSAN (CFSAN, 1999, 2003b); USDA commercial item descriptions (USDA, 2005); FDA Standards of Identity (FDA, 2005); USC (U.S. Congress, 2005).

TABLE B-2A Nutrient Analysis of Current and Revised Food Packages Using NDS-R,[a] Elements

	Dietary Component		
	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)
Current Food Package I (0–3.9 mo)	417	9.5	4.9
Revised Food Package I-FF-A (0–3.9 mo)	417	9.5	4.9
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	555	19.6	6.4
Revised Food Package I-FF-B (4–5.9 mo)	457	10.4	5.4
Change from current package	–98	–9.2	–1.0
Current Food Package II (6–11.9 mo)	555	19.6	6.4
Revised Food Package II-FF (6–11.9 mo)	475	17.6	5.4
Change from current package	–80	–2.0	–1.0
Current Food Package II, breast-fed[b]	138	10.1	1.5
Revised Food Package II-BF (6–11.9 mo)	202	11.4	3.3
Change from current package	+64	+1.3	+1.8
Current Food Package IV (1–4.9 y)	1,219	13.8	9.3
Revised Food Package IV-A (1–1.9 y)	1,084	15.4	10.5
Change from current package	–135	+1.6	+1.2
Revised Food Package IV-B (2–4.9 y)	1,085	15.5	10.7
Change from current package	–134	+1.7	+1.4
Current Food Package V	1,374	13.9	9.9
Revised Food Package V	1,341	16.9	11.8
Change from current package	–33	+3.0	+1.9
Current Food Package VI	1,199	13.0	8.8
Revised Food Package VI	1,063	15.4	10.0
Change from current package	–136	+2.4	+1.2
Current Food Package VII	1,494	15.3	11.1
Revised Food Package VII	1,538	17.7	12.9
Change from current package	+44	+2.4	+1.8

NOTES: The sodium content of the revised food packages was increased when the processed option (i.e., canned fruits and vegetables as described in Tables B-4 and E-2) was substituted for fresh produce; using canned vegetables, the sodium content increased by 27% for Food Package IV, 32% for Food Package V, 48% for Food Package VI, and 24% for Food Package VII. See notes for Tables B-2A through B-2E following Table B-2E.

Selenium (mcg/d)	Magnesium (mg/d)	Phosphorus (mg/d)	Sodium (mg/d)	Potassium (mg/d)
13.3	45	262	145	567
13.3	45	262	145	567
0	0	0	0	0
16.0	81	359	175	858
14.6	49	287	159	622
–1.4	–32	–72	–16	–236
16.0	81	359	175	858
13.2	79	312	144	788
–2.8	–2	–47	–31	–70
2.7	36	97	29	290
10.0	67	209	71	642
7.3	+31	+112	+42	+352
38.7	158	969	875	1,683
35.4	192	803	791	1,522
–3.3	+34	–166	–84	–161
36.6	187	819	796	1,533
–2.1	+29	–150	–79	–150
41.6	173	1,093	940	1,883
38.5	232	1,023	848	2,026
–3.1	+59	–70	–92	+143
37.5	127	898	829	1,393
26.5	159	722	571	1,463
–11.0	+32	–176	–258	+70
64.5	215	1,302	1,198	2,237
68.0	255	1,267	1,033	2,235
–3.5	+40	–35	–165	–2

TABLE B-2B Nutrient Analysis of Current and Revised Food Packages Using NDS-R,[a] Fat-Soluble Vitamins

	Dietary Component		
	Vitamin A (mcg RAE/d)	Retinol (mcg/d)	Vitamin D (mcg/d)
Current Food Package I (0–3.9 mo)	424	413	7.8
Revised Food Package I-FF-A (0–3.9 mo)	424	413	7.8
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	426	413	7.8
Revised Food Package I-FF-B (4–5.9 mo)	465	453	8.6
Change from current package	+39	+40	+0.8
Current Food Package II (6–11.9 mo)	426	413	7.8
Revised Food Package II-FF (6–11.9 mo)	467	320	6.0
Change from current package	+41	–93	–1.8
Current Food Package II, breast-fed[b]	3	0	0.0
Revised Food Package II-BF (6–11.9 mo)	274	1	0.1
Change from current package	+271	+1	+0.1
Current Food Package IV (1–4.9 y)	612	596	7.5
Revised Food Package IV-A (1–1.9 y)	573	345	5.5
Change from current package	–39	–251	–2.0
Revised Food Package IV-B (2–4.9 y)	681	455	5.6
Change from current package	+69	–141	–1.9
Current Food Package V	680	663	8.9
Revised Food Package V	833	552	7.3
Change from current package	+153	–111	–1.6
Current Food Package VI	609	596	7.5
Revised Food Package VI	734	455	5.6
Change from current package	+125	–141	–1.9
Current Food Package VII	971	701	10.1
Revised Food Package VII	945	662	10.3
Change from current package	–26	–39	+0.2

See notes for Tables B-2A through B-2E following Table B-2E.

Vitamin E (mg AT/d)	Vitamin E (mg ATE/d)
5.8	8.1
5.8	8.1
0	0
6.4	9.2
6.4	8.9
0	–0.3
6.4	9.2
5.6	8.0
–0.8	–1.2
0.5	1.1
1.8	2.4
+1.3	+1.3
4.8	8.3
6.9	12.7
+2.1	+4.4
6.6	12.4
+1.8	+4.1
4.8	8.3
8.3	15.3
+3.5	+7.0
3.9	7.3
7.1	13.6
+3.2	+6.3
6.0	9.7
9.0	16.1
+3.0	+6.4

TABLE B-2C Nutrient Analysis of Current and Revised Food Packages Using NDS-R,[a] Water-Soluble Vitamins

	Dietary Component		
	Vitamin C (mg/d)	Thiamin (mg/d)	Riboflavin (mg/d)
Current Food Package I (0–3.9 mo)	58.5	0.45	0.76
Revised Food Package I-FF-A (0–3.9 mo)	58.5	0.45	0.76
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	82.7	0.78	1.17
Revised Food Package I-FF-B (4–5.9 mo)	64.2	0.49	0.83
Change from current package	–18.5	–0.29	–0.34
Current Food Package II (6–11.9 mo)	82.7	0.78	1.17
Revised Food Package II-FF (6–11.9 mo)	52.1	0.69	1.03
Change from current package	–30.6	–0.09	–0.14
Current Food Package II, breast-fed[b]	24.2	0.33	0.41
Revised Food Package II-BF (6–11.9 mo)	13.2	0.38	0.59
Change from current package	–11.0	+0.05	+0.18
Current Food Package IV (1–4.9 y)	116.4	1.04	2.08
Revised Food Package IV-A (1–1.9 y)	85.2	1.20	1.90
Change from current package	–31.2	+0.16	–0.18
Revised Food Package IV-B (2–4.9 y)	84.5	1.20	1.91
Change from current package	–31.9	+0.16	–0.17
Current Food Package V	117.5	1.09	2.30
Revised Food Package V	98.3	1.28	2.19
Change from current package	–19.2	+0.19	–0.11
Current Food Package VI	84.4	0.96	2.05
Revised Food Package VI	80.9	1.10	1.82
Change from current package	–3.5	+0.14	–0.23
Current Food Package VII	135.1	1.18	2.42
Revised Food Package VII	98.8	1.33	2.48
Change from current package	–36.3	+0.15	+0.06

See notes for Tables B-2A through B-2E following Table B-2E.

Niacin (mg/d)	Vitamin B_6 (mg/d)	Vitamin B_{12} (mcg/d)	Folate (mcg DFE/d)
5.3	0.32	1.49	124
5.3	0.32	1.49	124
0	0	0	0
8.3	0.51	1.54	126
5.8	0.35	1.64	135
–2.5	–0.16	+0.10	+9
8.3	0.51	1.54	126
7.5	0.46	1.20	113
–0.8	–0.05	–0.34	–13
3.0	0.18	0.05	3
5.8	0.36	0.99	34
+2.8	+0.18	+0.94	+31
10.3	1.31	5.56	494
13.7	1.63	4.89	512
+3.4	+0.32	–0.67	+18
13.7	1.62	5.09	512
+3.4	+0.31	–0.47	+18
10.4	1.36	6.07	500
15.0	1.79	6.34	571
+4.6	+0.43	+0.27	+71
9.0	1.21	5.56	439
12.7	1.57	5.40	506
+3.7	+0.36	–0.16	+67
15.1	1.56	6.88	551
18.4	1.93	7.89	587
+3.3	+0.37	+1.01	+36

TABLE B-2D Nutrient Analysis of Current and Revised Food Packages Using NDS-R,[a] Macronutrients, Fiber, Phytate, and Cholesterol

	Dietary Component		
	Food Energy (kcal/d)	Protein (g/d)	Protein (% of energy)
Current Food Package I (0–3.9 mo)	529	11.2	8.5
Revised Food Package I-FF-A (0–3.9 mo)	529	11.2	8.5
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	663	13.3	8.0
Revised Food Package I-FF-B (4–5.9 mo)	581	12.3	8.5
Change from current package	–82	–1.0	+0.5
Current Food Package II (6–11.9 mo)	663	13.3	8.0
Revised Food Package II-FF (6–11.9 mo)	547	11.4	7.8
Change from current package	–116	–1.9	–0.2
Current Food Package II, breast-fed[b]	134	2.1	6.1
Revised Food Package II-BF (6–11.9 mo)	257	11.7	16.3
Change from current package	+123	+9.6	+10.2
Current Food Package IV (1–4.9 y)	797	41.2	21.3
Revised Food Package IV-A (1–1.9 y)	753	31.9	17.4
Change from current package	–44	–9.3	–3.9
Revised Food Package IV-B (2–4.9 y)	668	32.1	19.9
Change from current package	–129	–9.1	–1.4
Current Food Package V	858	45.5	21.9
Revised Food Package V	823	42.4	21.2
Change from current package	–35	–3.1	+0.7
Current Food Package VI	676	37.0	22.5
Revised Food Package VI	577	29.5	19.6
Change from current package	–99	–7.5	–2.9
Current Food Package VII	1,061	60.1	23.3
Revised Food Package VII	981	58.1	24.4
Change from current package	–80	+2.0	+1.1

See notes for Tables B-2A through B-2E following Table B-2E.

Carbohydrate (g/d)	Carbohydrate (% of energy)	Fiber (g/d)	Phytic Acid (mg/d)	Cholesterol (mg/d)
57.8	43.6	<0.1	<1	6
57.8	43.6	<0.1	<1	6
0	0	0	0	0
86.4	52.1	0.3	44	6
63.4	43.6	<0.1	<1	7
–23.0	–8.5	–0.3	–44	+1
86.4	52.1	0.3	44	6
73.9	54.3	2.4	62	5
–12.5	+2.2	+2.1	+18	–1
28.7	85.7	0.3	44	<1
43.1	67.9	5.1	80	30
+14.4	–17.8	+4.8	+36	+30
95.5	49.6	6.0	303	279
102.3	55.0	10.6	534	156
+6.8	+5.4	+4.6	+231	–123
102.8	62.6	10.6	534	113
+7.3	+13.0	+4.6	+231	–166
101.6	49.0	4.6	303	288
117.8	57.3	12.5	705	118
+16.2	+8.3	+7.9	+402	–170
78.3	47.1	2.6	156	279
84.4	64.3	9.0	462	111
+6.1	+17.2	+6.4	+306	–168
116.2	44.4	7.3	453	307
121.6	49.6	12.6	710	227
+5.4	+5.2	+5.3	+257	–80

TABLE B-2E Nutrient Analysis of Current and Revised Food Packages Using NDS-R,[a] Fats

	Dietary Component		
	Total Fat (g/d)	Total Fat (% of energy)	Saturated Fat (% of energy)
Current Food Package I (0–3.9 mo)	28.2	48.0	19.4
Revised Food Package I-FF-A (0–3.9 mo)	28.2	48.0	19.4
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	29.3	39.7	15.8
Revised Food Package I-FF-B (4–5.9 mo)	31.0	48.0	19.4
Change from current package	+1.7	+8.3	+3.6
Current Food Package II (6–11.9 mo)	29.3	39.7	15.8
Revised Food Package II-FF (6–11.9 mo)	23.0	37.7	15.0
Change from current package	–6.3	–2.0	–0.8
Current Food Package II, breast-fed[b]	1.0	6.9	1.6
Revised Food Package II-BF (6–11.9 mo)	4.6	15.4	4.7
Change from current package	+3.6	+8.5	+3.1
Current Food Package IV (1–4.9 y)	29.2	30.6	15.6
Revised Food Package IV-A (1–1.9 y)	27.0	31.3	15.7
Change from current package	–2.2	+0.7	+0.1
Revised Food Package IV-B (2–4.9 y)	16.7	20.8	8.5
Change from current package	–12.5	–9.8	–7.1
Current Food Package V	31.3	30.4	15.8
Revised Food Package V	23.4	25.1	8.7
Change from current package	–7.9	–5.3	–7.1
Current Food Package VI	24.7	31.4	17.2
Revised Food Package VI	16.0	18.7	7.9
Change from current package	–8.7	–12.7	–9.3
Current Food Package VII	41.4	33.8	16.1
Revised Food Package VII	32.0	28.7	10.0
Change from current package	–9.4	–5.1	–6.1

NOTES FOR TABLES B-2A THROUGH B-2E: AT = α(alpha)-tocopherol; ATE = α(alpha)-tocopherol equivalents; BF = fully breast-fed; BF/FF = partially breast-fed; DFE = dietary folate equivalents (1 DFE = 1 mcg food folate = 0.6 mcg of folic acid from fortified food or as a supplement consumed with food = 0.5 mcg of a supplement taken on an empty stomach); FF = fully formula-fed; RAE = retinol activity equivalents.

[a]The primary nutrient analysis for this report (Tables B-2A through B-2E) used Nutrition Data System for Research software version 5.0/35 (2004) developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (Schakel et al., 1988, 1997; Schakel, 2001). A secondary nutrient analysis was prepared using the USDA Nutrient Database for Standard Reference (SR-17) (NDL, 2004) (Tables B-3A through B-3E). The analysis using SR-17 is presented only here in Appendix B.

Fatty Acids				
Saturated (g/d)	Monounsaturated (g/d)	Polyunsaturated (g/d)	*n*-6 / *n*-3[c] (g/d)	*Trans*[d] (g/d)
11.5	10.5	5.7	5.1 / 0.52	0.02
11.5	10.5	5.7	5.1 / 0.52	0.02
0	0	0	0 / 0	0
11.7	10.7	6.0	5.4 / 0.57	0.02
12.6	11.5	6.2	5.6 / 0.57	0.02
+0.9	+0.8	+0.2	+0.2 / 0	0
11.7	10.7	6.0	5.4 / 0.57	0.02
9.1	8.4	4.8	4.3 / 0.47	0.02
–2.6	–2.3	–1.2	–1.1 / –0.10	0
0.2	0.2	0.4	0.1 / 0.05	<0.01
1.4	1.6	0.9	0.1 / 0.11	0.14
+1.2	+1.4	+0.5	0 /+ 0.06	+0.14
13.8	10.0	2.9	2.5 / 0.28	0.59
13.1	8.8	3.0	2.6 / 0.35	0.69
–0.7	–1.2	+0.1	+0.1 / +0.07	+0.10
6.3	6.2	2.6	2.4 / 0.16	0.42
–7.5	–3.8	–0.3	–0.1 / –0.12	–0.17
15.1	10.8	3.0	2.6 / 0.31	0.66
7.9	8.7	4.6	4.3 / 0.30	0.45
–7.2	–2.1	+1.6	+1.7 / –0.01	–0.21
12.9	8.0	1.6	1.3 / 0.26	0.53
5.9	5.8	2.8	2.6 / 0.21	0.28
–7.0	–2.2	+1.2	+1.3 / –0.05	–0.25
19.0	14.5	4.8	4.2 / 0.44	0.81
12.0	11.6	5.6	5.0 / 0.53	0.58
–7.0	–2.9	+0.8	+0.8 /+ 0.09	–0.23

[b]For fully breast-fed infants, the formula was omitted in the nutrient calculations for current Food Package II.

[c]For *n*-6 polyunsaturated fatty acids, such as linoleic acid, the first double bond from the methyl end is at the sixth carbon atom; for *n*-3 fatty acids, such as linolenic acid, the first double bond from the methyl end is at the third carbon atom.

[d]The term *trans fatty acids* refers to unsaturated fatty acids that contain at least one double bond in the *trans* configuration (that is, with carbon atoms on opposite sides of the longitudinal axis of the double bond).

DATA SOURCES: FNS, 2004e; NDS-R software version 5.0/35, 2004 (Schakel et al., 1988, 1997; Schakel, 2001). Fresh fruits and vegetables were used in the analyses shown for Food Packages IV–VII. An additional analyses was conducted using canned fruits and vegetables (data not shown).

TABLE B-3A Nutrient Analysis of Current and Revised Food Packages Using **USDA Nutrient Database for Standard Reference (SR-17)**,[a] Elements

	Dietary Component		
	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)
Current Food Package I (0–3.9 mo)	401	9.3	4.8
Revised Food Package I-FF-A (0–3.9 mo)	401	9.3	4.8
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	603	20.6	5.3
Revised Food Package I-FF-B (4–5.9 mo)	439	10.2	5.3
Change from current package	–164	–10.4	0
Current Food Package II (6–11.9 mo)	603	20.6	5.3
Revised Food Package II-FF (6–11.9 mo)	533	18.7	4.3
Change from current package	–70	–1.9	–1.0
Current Food Package II, breast-fed[b]	203	11.3	0.5
Revised Food Package II-BF (6–11.9 mo)	266	13.1	2.2
Change from current package	+63	+1.8	+1.7
Current Food Package IV (1–4.9 y)	1,253	14.7	10.0
Revised Food Package IV-A (1–1.9 y)	1,098	17.4	11.6
Change from current package	–158	+2.7	+1.6
Revised Food Package IV-B (2–4.9 y)	1,077	17.4	11.5
Change from current package	–179	+2.7	+1.5
Current Food Package V	1,410	14.8	10.6
Revised Food Package V	1,445	18.4	12.7
Change from current package	+35	+3.6	+2.1
Current Food Package VI	1,236	13.9	9.5
Revised Food Package VI	1,153	17.1	11.1
Change from current package	–83	+3.2	+1.6
Current Food Package VII	1,544	16.0	11.8
Revised Food Package VII	1,658	19.2	13.9
Change from current package	+114	+3.2	+2.1

NOTES FOR TABLE B-3A: The sodium content of the revised food packages was increased when the processed option (i.e., canned fruits and vegetables as described in Tables B-4 and E-2) was substituted for fresh produce; using canned vegetables, the sodium content increased by 45% for Food Package IV, 36% for Food Package V, 49% for Food Package VI, and 25% for Food Package VII. See notes for Tables B-3A through B-3E following Table B-3E.

Selenium (mcg/d)	Magnesium (mg/d)	Phosphorus (mg/d)	Sodium (mg/d)	Potassium (mg/d)
12.8	37	258	138	558
12.8	37	258	138	558
0	0	0	0	0
15.6	90	401	152	764
14.0	41	283	152	612
–1.6	–49	–118	0	–152
15.6	90	401	152	764
12.9	89	353	126	690
–2.7	–1	–48	–26	–74
2.8	52	144	14	206
10.2	82	235	77	555
+7.4	+30	+91	+63	+349
44.7	152	976	800	1,695
41.2	179	819	598	1,542
–3.5	+27	–166	–202	–153
36.6	178	792	590	1,515
–8.1	+26	–184	–210	–180
48.8	166	1,100	854	1,890
41.7	222	1,055	719	2,041
–7.1	+56	–45	–135	–151
43.3	120	903	756	1,392
29.4	154	753	526	1,498
–13.9	+34	–150	–230	+106
71.4	208	1,307	1,122	2,270
71.6	245	1,303	1,008	2,249
+0.2	+37	–4	–114	–21

TABLE B-3B Nutrient Analysis of Current and Revised Food Packages Using **USDA Nutrient Database for Standard Reference (SR-17)**,[a] Fat-Soluble Vitamins

	Dietary Component	
	Vitamin A (mcg RAE/d)	Retinol (mcg/d)
Current Food Package I (0–3.9 mo)	462	462
Revised Food Package I-FF-A (0–3.9 mo)	462	462
Change from current package	0	0
Current Food Package II (4–5.9 mo)	462	462†
Revised Food Package I-FF-B (4–5.9 mo)	507	507
Change from current package	+45	+45
Current Food Package II (6–11.9 mo)	462	462†
Revised Food Package II-FF (6–11.9 mo)	500	358†
Change from current package	+38	–104
Current Food Package II, breast-fed[b]	0	0†
Revised Food Package II-BF (6–11.9 mo)	280	1†
Change from current package	+280	+1
Current Food Package IV (1–4.9 y)	576	565
Revised Food Package IV-A (1–1.9 y)	512	309
Change from current package	–64	–256
Revised Food Package IV-B (2–4.9 y)	622	420
Change from current package	+46	–145
Current Food Package V	642	631
Revised Food Package V	767	507
Change from current package	+125	–124
Current Food Package VI	573	565
Revised Food Package VI	677	421
Change from current package	+104	–144
Current Food Package VII	901	667
Revised Food Package VII	867	606
Change from current package	–34	–61

See notes for Tables B-3A through B-3E following Table B-3E.

Vitamin D (IU/d)	Vitamin E (mg AT/d)	Vitamin E (mg ATE/d)
314†	6.5	N/A*
314†	6.5	N/A*
0	0	
314†	7.6	N/A*
345†	7.1	N/A*
+31	–0.5	
314‡	7.6†	N/A*
243‡	6.7†	N/A*
–71	–0.9	
N/A*	1.2†	N/A*
N/A*	2.4†	N/A*
	+1.2	
311‡	4.6†	N/A*
218‡	6.0†	N/A*
–93	+1.4	
221‡	6.6†	N/A*
–90	+2.0	
368‡	4.7†	N/A*
318‡	7.5†	N/A*
–50	+2.8	
311‡	3.7†	N/A*
243‡	6.5†	N/A*
–68	+2.8	
409‡	5.9†	N/A*
419‡	7.9†	N/A*
+10	+2.0	

TABLE B-3C Nutrient Analysis of Current and Revised Food Packages Using **USDA Nutrient Database for Standard Reference (SR-17)**,[a] Water-Soluble Vitamins

	Dietary Component	
	Vitamin C (mg/d)	Thiamin (mg/d)
Current Food Package I (0–3.9 mo)	57.5	0.45
Revised Food Package I-FF-A (0–3.9 mo)	57.5	0.45
Change from current package	0	0
Current Food Package II (4–5.9 mo)	81.2	1.06
Revised Food Package I-FF-B (4–5.9 mo)	63.1	0.49
Change from current package	–18.1	–0.57
Current Food Package II (6–11.9 mo)	81.2	1.06
Revised Food Package II-FF (6–11.9 mo)	64.7	0.98
Change from current package	–16.5	–0.08
Current Food Package II, breast-fed[b]	23.7	0.62
Revised Food Package II-BF (6–11.9 mo)	40.3	0.66
Change from current package	+16.6	+0.04
Current Food Package IV (1–4.9 y)	110.7	1.27
Revised Food Package IV-A (1–1.9 y)	84.2	1.51
Change from current package	–26.5	+0.24
Revised Food Package IV-B (2–4.9 y)	84.5	1.46
Change from current package	–26.2	+0.19
Current Food Package V	110.7	1.32
Revised Food Package V	95.1	1.56
Change from current package	–15.6	+0.24
Current Food Package VI	79.0	1.17
Revised Food Package VI	78.8	1.37
Change from current package	–0.2	+0.20
Current Food Package VII	128.2	1.43
Revised Food Package VII	95.2	1.61
Change from current package	–33.0	+0.18

See notes for Tables B-3A through B-3E following Table B-3E.

Riboflavin (mg/d)	Niacin (mg/d)	Vitamin B_6 (mg/d)	Vitamin B_{12} (mcg/d)	Folate (mcg DFE/d)
0.74	5.3	0.32	1.45	140
0.74	5.3	0.32	1.45	140
0	0	0	0	0
1.27	12.6	0.46	1.45	146
0.82	5.8	0.35	1.59	154
–0.45	–6.8	–0.11	+0.14	+8
1.27	12.6	0.46	1.45	146
1.15	11.8	0.41	1.12	129
–0.12	–0.8	–0.06	–0.33	–17
0.53	7.3	0.14	0	6
0.75	10.2	0.32	0.95	37
+0.22	+2.9	+0.18	+0.95	+31
2.42	12.2	1.61	6.29	549
2.25	16.3	1.91	5.36	566
–0.17	+4.1	+0.30	–0.93	+17
2.18	16.2	1.90	5.31	563
–0.24	+4.0	+0.29	–0.98	+14
2.66	12.4	1.66	6.90	556
2.65	17.4	2.07	6.87	610†
–0.01	+5.0	+0.41	–0.03	+54
2.38	10.9	1.49	6.29	485
2.23	15.2	1.84	5.84	552†
–0.15	+4.3	+0.35	+0.45	+67
2.78	17.1	1.87	7.64	617
2.85	20.8	2.20	8.45	627†
+0.07	+3.7	+0.33	+0.81	+10

TABLE B-3D Nutrient Analysis of Current and Revised Food Packages Using **USDA Nutrient Database for Standard Reference (SR-17)**,[a] Macronutrients, Fiber, Phytate, and Cholesterol

	Dietary Component		
	Food Energy (kcal/d)	Protein (g/d)	Protein (% of energy)
Current Food Package I (0–3.9 mo)	523	10.9	8.4%
Revised Food Package I-FF-A (0–3.9 mo)	523	10.9	8.4%
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	657	12.7	7.7%
Revised Food Package I-FF-B (4–5.9 mo)	574	12.0	8.4%
Change from current package	–83	–0.7	0.7%
Current Food Package II (6–11.9 mo)	657	12.7	7.7%
Revised Food Package II-FF (6–11.9 mo)	541	10.8	7.6%
Change from current package	–116	–1.9	–0.1%
Current Food Package II, breast-fed[b]	134	1.8	5.3%
Revised Food Package II-BF (6–11.9 mo)	252	12.4	17.9%
Change from current package	+118	+10.6	+12.6%
Current Food Package IV (1–4.9 y)	784	41.1	21.5%
Revised Food Package IV-A (1–1.9 y)	737	31.3	17.0%
Change from current package	–47	–9.8	–4.5%
Revised Food Package IV-B (2–4.9 y)	636	30.4	18.5%
Change from current package	–148	–10.7	–3.0%
Current Food Package V	845	45.4	21.5%
Revised Food Package V	795	41.9	21.1%
Change from current package	–50	–3.5	–0.4%
Current Food Package VI	663	36.9	22.2%
Revised Food Package VI	563	29.6	21.0%
Change from current package	–100	–7.3	–1.2%
Current Food Package VII	1,046	60.0	22.9%
Revised Food Package VII	948	57.6	24.3%
Change from current package	–98	–2.4	+1.4%

See notes for Tables B-3A through B-3E following Table B-3E.

Carbohydrate (g/d)	Carbohydrate (% of energy)	Fiber (g/d)	Phytic Acid (mg/d)	Cholesterol (mg/d)
52.5	40.1%	<0.1	N/A*	11
52.5	40.1%	<0.1	N/A*	11
0	0	0		0
81.2	49.4%	0.2	N/A*	11
57.6	40.1%	<0.1	N/A*	12
–23.6	–9.3%	–0.2		+1
81.2	49.4%	0.2	N/A*	11
70.2	51.6%	2.6	N/A*	9
–11.0	+2.2%	+2.4		–2
28.7	85.5%	0.2	N/A*	<1
41.2	64.1%	4.9	N/A*	30
+12.5	–21.4%	+4.7		30
94.9	49.2%	6.2	N/A*	275
100.5	54.6%	10.1	N/A*	137
+5.6	+5.4%	+3.9		–138
100.0	61.9%	10.1	N/A*	112
+5.1	+12.7%	+3.9		–163
101.2	47.9%	4.8	N/A*	283
113.1	56.9%	12.0†	N/A*	124†
+11.9	+9.0%	+7.2		–159
77.8	46.9%	2.7	N/A*	275
82.3	58.4%	9.3†	N/A*	114†
+4.5	+11.5%	+6.6		–161
115.8	44.3%	7.7	N/A*	302
116.6	49.2%	12.0†	N/A*	233†
+0.8	+4.9%	+4.3		–69

TABLE B-3E Nutrient Analysis of Current and Revised Food Packages Using **USDA Nutrient Database for Standard Reference (SR-17)**,[a] Fats

	Dietary Component		
	Total Fat (g/d)	Total Fat (% of energy)	Saturated Fat (% of energy)
Current Food Package I (0–3.9 mo)	27.8	47.8%	19.3%
Revised Food Package I-FF-A (0–3.9 mo)	27.8	47.8%	19.3%
Change from current package	0	0	0
Current Food Package II (4–5.9 mo)	29.0	39.7%	15.7%
Revised Food Package I-FF-B (4–5.9 mo)	30.5	47.8%	19.3%
Change from current package	+1.5	+8.1%	+3.6%
Current Food Package II (6–11.9 mo)	29.0	39.7%	15.7%
Revised Food Package II-FF (6–11.9 mo)	22.8	37.8%	14.8%
Change from current package	–6.2	–1.9%	–0.9%
Current Food Package II, breast-fed[b]	1.2	8.2%	1.5%
Revised Food Package II-BF (6–11.9 mo)	4.8	16.8%	5.9%
Change from current package	+3.6	+8.6%	+4.4%
Current Food Package IV (1–4.9 y)	28.1	31.0%	15.7%
Revised Food Package IV-A (1–1.9 y)	26.0	31.8%	14.5%
Change from current package	–2.1	+0.8%	–1.2%
Revised Food Package IV-B (2–4.9 y)	15.3	20.6%	8.7%
Change from current package	–12.8	–10.4%	–7.0%
Current Food Package V	30.1	32.1%	15.9%
Revised Food Package V	22.7	25.7%	9.4%
Change from current package	–7.4	–6.4%	–6.5%
Current Food Package VI	23.5	32.0%	17.3%
Revised Food Package VI	15.4	24.6%	9.7%
Change from current package	–8.1	–7.4%	–7.6%
Current Food Package VII	39.9	34.4%	16.1%
Revised Food Package VII	30.9	29.3%	11.6%
Change from current package	–9.0	–5.1%	–4.5%

NOTES FOR TABLES B-3A THROUGH B-3E: AT = α(alpha)-tocopherol; ATE = α(alpha)-tocopherol equivalents; DFE = dietary folate equivalents (1 DFE = 1 mcg food folate = 0.6 mcg of folic acid from fortified food or as a supplement consumed with food = 0.5 mcg of a supplement taken on an empty stomach); IU = International Units; kcal = kilocalories; N/A = not available; RAE = retinol activity equivalents. † Estimate of nutrient content calculated from an incomplete data set due to data missing from the database, an inherent shortcoming of Standard Reference 17. ‡ Nutrient content is not listed because of substantial error in the calculation introduced due to data missing from the SR-17 database. * Data not available in database.

[a]The nutrient analysis in this table is part of the secondary analyses for this report using the USDA Nutrient Database for Standard Reference (SR-17) (NDL, 2004) (Tables B-3A through B-3E). The primary nutrient analysis is presented in Tables B-2A through B-2E, and uses Nutrition Data System for Research (NDS-R) software version 5.0/35 (2004) developed by

Fatty Acids				
Saturated (g/d)	Monounsaturated (g/d)	Polyunsaturated (g/d)	*n*-6 / *n*-3[c] (g/d)	*Trans*[d] (g/d)
11.2	10.4	5.6	N/A* / N/A*	N/A*
11.2	10.4	5.6	N/A* / N/A*	N/A*
0	0	0		
11.5	10.7	6.1	N/A* / N/A*	N/A*
12.3	11.4	6.2	N/A* / N/A*	N/A*
+0.8	+0.7	+0.1		
11.5	10.7	6.1	N/A* / N/A*	N/A*
8.9	8.4	4.9	N/A* / N/A*	N/A*
–2.6	–2.3	–1.2		
0.2	0.3	0.5	N/A* / N/A*	N/A*
1.7	1.7	0.9	N/A* / N/A*	N/A*
+1.5	+1.4	+0.4		
13.6	9.1	3.0	N/A* / N/A*	N/A*
11.9	7.9	3.3	N/A* / N/A*	N/A*
–1.7	–1.2	+0.3		
6.2	5.4	2.5	N/A* / N/A*	N/A*
–7.4	–3.7	–0.5		
14.9	9.6	3.1	N/A* / N/A*	N/A*
8.3	8.1	4.5	N/A* / N/A*	N/A*
–6.6	–1.5	+1.4		
12.7	7.0	1.7	N/A* / N/A*	N/A*
6.1	5.2	2.7	N/A* / N/A*	N/A*
–6.6	–1.8	+1.0		
18.7	13.3	4.9	N/A* / N/A*	N/A*
12.3	10.7	5.4	N/A* / N/A*	N/A*
–6.4	–2.6	+0.5		

the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (Schakel et al., 1988, 1997; Schakel, 2001).

[b]For fully breast-fed infants, the formula was omitted in the nutrient calculations for current Food Package II.

[c]For *n*-6 polyunsaturated fatty acids, such as linoleic acid, the first double bond from the methyl end is at the sixth carbon atom; for *n*-3 fatty acids, such as linolenic acid, the first double bond from the methyl end is at the third carbon atom.

[d]The term *trans fatty acids* refers to unsaturated fatty acids that contain at least one double bond in the *trans* configuration.

DATA SOURCES: FNS, 2004e; USDA Nutrient Database for Standard Reference, Release 17 (NDL, 2004). Fresh fruits and vegetables were used in the analyses shown for Food Packages IV–VII. An additional analyses was conducted using canned fruits and vegetables (data not shown).

TABLE B-4 Comparison of Food Items Used in Nutrient Analyses from Two Databases

	Source of Nutrient Data
Food[a]	Nutrition Data System for Research (NDS-R) v. 5.0/35, Univ. of Minnesota[b]
Infant Foods	
Formula	Enfamil with Iron (Mead Johnson) Similac with Iron (Ross/ Abbott) Good Start (Carnation)
Juice	Apple juice, unsweetened, reconstituted from frozen, vitamin C-rich ("with ascorbic acid added") Orange juice, unsweetened, reconstituted from frozen
Baby food, fruits	Applesauce, junior Peaches, junior Pears, junior
Baby food, vegetables	Carrots, junior Green beans, junior Squash, junior
Infant cereal	Rice cereal, dry
Baby food, meats	Beef, strained Chicken, strained Lamb, strained
Fruits and Vegetables	
Juice	Apple juice, unsweetened, reconstituted from frozen, vitamin C-rich ("with ascorbic acid added") Orange juice, unsweetened, reconstituted from frozen
Fruits, fresh	Apples, with skin Oranges Bananas
Fruits, canned	Applesauce, unsweetened Peaches, juice pack or unsweetened, not drained (i.e., packing liquid utilized) Pineapple, juice pack or unsweetened, not drained (i.e., packing liquid utilized)
Vegetables, fresh	Carrots, raw Carrots, cooked from fresh Tomatoes, raw Tomatoes, cooked from fresh Green or snap beans, cooked from fresh
Vegetables, canned	Carrots, regular,[e] drained

Nutrient Database for Standard Reference, Release 17 (SR-17), Nutrient Data Laboratory, USDA[c]	NDB No.[d]
Same	03803
Same	03850
Good Start Supreme with iron (Nestlé)	03800
Same	09411
Same	09215
Same	03117
Same	03131
Same	03133
Same	03100
Same	03092
Same	03105
Same	03194
Same	03002
Same	03012
Same	03010
Same	09411
Same	09215
Apples, with skin (8% refuse)	09003
Oranges, all commercial varieties (27% refuse)	09200
Bananas (36% refuse)	09040
Applesauce, unsweetened, without added ascorbic acid	09019
Peaches, juice pack, solids and liquid	09238
Pineapple, juice pack, solids and liquid	09268
Same (0% refuse)	11124
Carrots, cooked, boiled, drained (0% refuse)	11125
Tomatoes, red, ripe, raw, year round average (9% refuse)	11529
Tomatoes, red, ripe, cooked	11530
Beans, snap, green, cooked, boiled, drained (0% refuse)	11053
Carrots, regular pack, drained solids	11128

continues

TABLE B-4 Continued

Food[a]	Source of Nutrient Data: Nutrition Data System for Research (NDS-R) v. 5.0/35, Univ. of Minnesota[b]
	Tomatoes, regular,[e] drained
	Green beans, regular,[e] drained
Milk and Alternatives	
Milk	Whole, 3.5–4% milk fat
	Reduced-fat, 2% milk fat (appears to be with vitamin A added)
	Low-fat, 1% milk fat (appears to be with vitamin A added)
	Nonfat, skim (appears to be with vitamin A added)
Cheese	American cheese, process[f]
	Cheddar cheese, natural
	Monterey Jack cheese, natural
	Mozzarella cheese, part skim milk
Yogurt	Low-fat, plain[g]
	Low-fat, vanilla
	Nonfat, plain[g]
	Nonfat, vanilla
Soy beverage	Ready-to-drink, regular,[h] calcium-rich ("fortified")
Tofu	Calcium salts used in processing
Grains	
Cereal, ready-to-eat	Cheerios (General Mills)
	Corn flakes
	Kix (General Mills)
	Mini-Wheats, Frosted Bite Size (Kellogg's)
	Total Whole Grain (General Mills)
Cereal, hot	Cream of wheat, regular-cooking, regular salt option for preparation
	Oatmeal, instant-cooking, iron-fortified, regular salt option for preparation
Whole grains	Whole wheat bread
	Brown rice, cooked in salted water
Meat and Alternatives	
Eggs	Whole
Fish, canned	Tuna, water pack, regular,[e] drained
	Tuna, oil pack, regular,[e] drained
	Salmon, regular,[e] drained

Nutrient Database for Standard Reference, Release 17 (SR-17), Nutrient Data Laboratory, USDA[c]	NDB No.[d]
Tomatoes, red, ripe, whole, regular pack	11531
Beans, snap, green, regular pack, drained solids	11056
Whole, 3.25% milk fat	01077
Reduced-fat, fluid, 2% milk fat, with added vitamin A	01079
Low-fat, fluid, 1% milk fat, with added vitamin A	01082
Nonfat, skim, fat-free, fluid, with added vitamin A	01085
American cheese, pasteurized process, with disodium phosphate	01042
Cheddar cheese	01009
Monterey cheese	01025
Same	01028
Low-fat, plain,[g] 12 g protein/8 oz	01117
Low-fat, vanilla, 11 g protein/8 oz	01119
Skim, plain,[g] 13 g protein/8 fl oz	01118
Nonfat, vanilla or lemon flavor, sweetened with low-calorie sweetener	01184
"Soy milk", fluid, calcium-rich ("calcium fortified")	16139
Firm, prepared with calcium sulfate	16426
Same	08013
Corn Flakes (Kellogg's)	08020
Same	08048
Same	08319
Same	08077
Farina, regular-cooking, iron-fortified ("enriched")	08112
Cereal, oats, instant, iron-fortified ("fortified"), plain[g]	08122
Whole-wheat bread, commercially prepared	18075
Brown rice, long-grain	20036
Whole, large, fresh (12% refuse)	01123
Tuna, light, canned in water, drained solids	15121
Tuna, light, canned in oil, drained solids	15119
Salmon, pink, solids with bone and liquid	15084

continues

TABLE B-4 Continued

Food[a]	Source of Nutrient Data Nutrition Data System for Research (NDS-R) v. 5.0/35, Univ. of Minnesota[b]
Beans, dried	Black beans Garbanzo beans (chickpeas) Kidney beans Northern beans Pinto beans Lentils
Beans, canned	Black beans, regular[e] Garbanzo beans (chickpeas), regular[e] Kidney beans, regular[e] Northern beans, regular[e]
Peanut butter	Regular[e]

[a]All food items (edible portion) for nutrient analyses were chosen with no added salt and no added fat cooking preparation options unless otherwise noted in the table.

[b]The primary nutrient analysis for this report (Tables B-2A through B-2E) used Nutrition Data System for Research software version 5.0/35 (2004) developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (Schakel et al., 1988, 1997; Schakel, 2001).

[c]A secondary nutrient analysis was prepared using the USDA Nutrient Database for Standard Reference, Release 17 (SR-17) (NDL, 2004) (Tables B-3A through B-3E). The analysis using SR-17 is presented only here in Appendix B.

[d]Identification number for food item in USDA Nutrient Data Laboratory Nutrient Database (NDL, 2004).

[e]"Regular" in this instance means regular pack with salt added in processing. In some cases this assumption was made as representative of likely participant choices (e.g., salted peanut butter is a likely participant choice rather than unsalted peanut butter). In other cases this

Nutrient Database for Standard Reference, Release 17 (SR-17), Nutrient Data Laboratory, USDA[c]	NDB No.[d]
Black beans, mature seeds	16014
Chickpeas (garbanzo beans, Bengal gram), mature seeds	16056
Kidney beans, red, mature seeds	16032
Great northern beans, mature seeds	16024
Pinto beans, mature seeds	16042
Lentils, mature seeds	16069
Pinto beans, mature seeds	16044
Chickpeas (garbanzo beans, Bengal gram), mature seeds	16058
Kidney beans, red, mature seeds	16034
Great northern beans, mature seeds	16026
Smooth style, with salt	16098

assumption was made as representative of likely state agency restrictions (e.g., salted canned vegetables are likely state agency restrictions if unsalted canned vegetables are more costly).

*f*American cheese can be processed with or without a sodium salt (e.g., disodium phosphate) (Nutrition Data, 2004). The American cheese used in these analyses appears to be processed with disodium phosphate resulting in a sodium content twice that of the other cheeses used in the nutrient analyses. Even greater differences in sodium content have been reported (Nutrition Data, 2004).

g"Plain" in this instance means not flavored because flavored products customarily have added sugars.

h"Regular" in this instance means not a reduced calorie product.

NOTES: The medical formulas and medical foods required by individuals with special dietary needs were omitted from the nutrient analyses.

TABLE B-5A Comparison of Current and Revised Food Packages with Regard to Nutrients Offered, Nutrients of Concern with Regard to Inadequate Intake

Participant Category and Priority Nutrient	Dietary Reference Intakes		
	EAR	AI*	RDA
Infants, 6–11.9 mo, breast-fed			
Food Package No.			
Iron, mg/d	6.9	—	11.0
Zinc, mg/d	2.5	—	3.0
WIC Children, 1–1.9 y			
Food Package No.			
Iron, mg/d	3.0	—	7.0
Vitamin E, mg AT/d[a]	—	—	6.0
Vitamin E, mg ATE/d[a]	—	—	—
Potassium, mg/d	—	3,000*	—
Fiber, g/d	—	19*	—
WIC Children, 2–4.9 y[b]			
Food Package No.			
Iron, mg/d	3.0 / 4.1		7.0 / 10.0
Vitamin E, mg AT/d[a]	—	—	6.0 / 7.0
Vitamin E, mg ATE/d[a]	—	—	—
Potassium, mg/d	—	3,000* / 3,800*	—
Fiber, g/d	—	19* / 25*	—
Pregnant women and lactating women, 14–44 y			
Food Package No.			
Calcium, mg/d	—	1,000*–1,300*	—
Iron, mg/d	6.5–23.0	—	9.0–27.0
Magnesium, mg/d	255–335	—	310–400
Vitamin E, mg AT/d[a]	—	—	15.0–19.0
Vitamin E, mg ATE/d[a]	—	—	—
Fiber, g/d	—	28*–29*	—
Potassium, mg/d	—	4,700*–5,100*	—
Vitamin A, mcg RAE/d	530–900	—	750–1,300
Vitamin C, mg/d	66–100	—	80–120
Vitamin D, mcg/d	—	5.0*	—
Vitamin B_6, mg/d	1.6–1.7	—	1.9–2.0
Folate, mcg DFE/d[a]	450–520	—	500–600
Non-breastfeeding postpartum women, 14–44 y			
Food Package No.			
Calcium, mg/d	—	1,000*–1,300*	—
Iron, mg/d	7.9–8.1	—	15–18
Magnesium, mg/d	255–300	—	310–360
Vitamin E, mg AT/d[a]	—	—	15.0
Vitamin E, mg ATE/d[a]	—	—	—
Fiber, g/d	—	25*–26*	—

Nutrients Offered		
Current Package	Revised Package	Change
Current II	*Revised II-BF*	
10.1	11.4	+
1.5	3.3	+
Current IV	*Revised IV-A*	
13.8	15.4	+
4.8	6.9	+
8.3	12.7	+
1,683	1,536	–
6.0	10.6	+
Current IV	*Revised IV-B*	
13.8	15.5	+
4.8	6.6	+
8.3	12.4	+
1,683	1,546	–
6.0	10.6	+
Current V	*Revised V*	
1,374	1,341	–
13.9	16.9	+
173	232	+
4.8	8.3	+
8.3	15.3	+
4.6	12.5	+
1,883	2,026	+
680	833	+
117	98	–
8.9	7.3	–
1.4	1.8	+
500	571	+
Current VI	*Revised VI*	
1,199	1,063	–
13.0	15.4	+
127	159	+
3.9	7.1	+
7.3	13.6	+
2.6	9.0	+

continues

TABLE B-5A Continued

Participant Category and Priority Nutrient	Dietary Reference Intakes		
	EAR	AI*	RDA
Potassium, mg/d	—	4,700*	—
Vitamin A, mcg RAE/d	485–500	—	700
Vitamin C, mg/d	56–60	—	65–75
Vitamin D, mcg/d	—	5.0*	—
Vitamin B_6, mg/d	1.0–1.1	—	1.2–1.3
Folate, mcg DFE/d[a]	320–330	—	400
Lactating women, 14–44 y			
Food Package No.	—	—	—
Calcium, mg/d	—	1,000*–1,300*	—
Iron, mg/d	6.5–7.0	—	9.0–10.0
Magnesium, mg/d	255–300	—	310–360
Vitamin E, mg AT/d[a]	—	—	19.0
Vitamin E, mg ATE/d[a]	—	—	—
Fiber, g/d	—	29*	—
Potassium, mg/d	—	5,100*	—
Vitamin A, mcg RAE/d	885–900	—	1,200–1,300
Vitamin C, mg/d	96–100	—	115–120
Vitamin D, mcg/d	—	5.0*	—
Vitamin B_6, mg/d	1.7	—	2.0
Folate, mcg DFE/d[a]	450	—	500

See notes for Tables B-5A through B-5C following Table B-5C.

Nutrients Offered		
Current Package	Revised Package	Change
1,393	1,463	+
609	734	+
84	81	–
7.5	5.6	–
1.2	1.6	+
439	506	+
Current VII	*Revised VII*	
1,494	1,538	+
15.3	17.7	+
215	255	+
6.0	9.0	+
9.7	16.1	+
7.3	12.6	+
2,237	2,235	+
971	945	–
135	99	–
10.1	10.3	+
1.6	1.9	+
551	587	+

TABLE B-5B Comparison of Current and Revised Food Packages with Regard to Nutrients Offered, Nutrients of Concern with Regard to Excessive Intake

Participant Category and Priority Nutrient	Dietary Reference Intakes		
	UL	Mean EER	AMDR†
Infants, 0–3.9 mo, fully formula-fed			
Food Package No.			
Zinc, mg/d	4.0	—	—
Preformed vitamin A, mcg/d	600	—	—
Food energy, kcal/d	—	555[c]	—
Infants, 4–5.9 mo, fully formula-fed			
Food Package No.			
Zinc, mg/d	4.0	—	—
Preformed vitamin A, mcg/d	600	—	—
Food energy, kcal/d	—	623[c]	—
Infants, 6–11.9 mo, fully formula-fed			
Food Package No.			
Zinc, mg/d	5.0	—	—
Preformed vitamin A, mcg/d	600	—	—
Food energy, kcal/d	—	754[c]	—
Children, 1–1.9 y			
Food Package No.			
Zinc, mg/d	7.0	—	—
Preformed vitamin A, mcg/d	600	—	—
Food energy, kcal/d	—	942[c]	—
Children, 2–4.9 y			
Food Package No.			
Zinc, mg/d	7.0 / 12.0[b]	—	—
Sodium, mg/d	1,500 / 1,900[b]	—	—
Preformed vitamin A, mcg/d	600 / 900[b]	—	—
Food energy, kcal/d			1,282[c]
Pregnant women and lactating women, 14–44 y			
Food Package No.			
Sodium, mg/d	2,300	—	—
Food energy, kcal/d	—	2,465[c]	—
Total fat, g/d	—	—	—
Total fat, % of food energy	—	—	25–35†, <19y 20–35†, ≥ 19y
Non-breastfeeding postpartum women, 14–44 y			
Food Package No.			
Sodium, mg/d	2,300	—	—
Food energy, kcal/d	—	2,163[c]	—
Total fat, g/d	—	—	—
Total fat, % of food energy			25–35†, <19y 20–35†, ≥ 19y

Nutrients Offered		
Current Package	Revised Package	Change
Current I	*Revised I-FF-A*	
4.9	4.9	=
413	413	=
529	529	=
Current II	*Revised I-FF-B*	
6.4	5.4	–
413	453	+
663	581	–
Current II	*Revised II-FF*	
6.4	5.4	–
413	320	–
663	547	–
Current IV	*Revised IV-A*	
9.3	10.5	+
596	345	–
797	753	–
Current IV	*Revised IV-B*	
9.3	10.7	+
875	796	–
596	455	–
797	672	–
Current V	*Revised V*	
940	848	–
858	823	–
31.3	23.4	–
30.4	25.1	–
Current VI	*Revised VI*	
829	571	–
676	577	–
24.7	16.0	–
31.4	22.9	–

continues

TABLE B-5B Continued

Participant Category and Priority Nutrient	Dietary Reference Intakes		
	UL	Mean EER	AMDR†
Lactating women, 14–44 y			
Food Package No.			
Sodium, mg/d	2,300	—	—
Food energy, kcal/d	—	2,465[c]	—
Total fat, g/d	—	—	—
Total fat, % of food energy	—	—	25–35†, <19y 20–35†, ≥ 19y

See notes for Tables B-5A through B-5C following Table B-5C.

Nutrients Offered		
Current Package	Revised Package	Change
Current VII	*Revised VII*	
1,198	1,133	–
1,061	981	–
41.4	32.0	–
33.8	28.7	–

TABLE B-5C Comparison of Current and Revised Food Packages with Regard to Nutrients Offered, Nutrients and Ingredients to Limit in the Diet[e]

Participant Category and Priority Nutrient	Dietary Guidance	Nutrients Offered: Current Package	Nutrients Offered: Revised Package	Change
Infants, 6–11.9 mo, fully breast-fed				
Food Package No.		*Current II*	*Revised II-BF*	
Trans fatty acids, g/d[d]	—	<0.1	0.14	+
Infants, 6–11.9 mo, fully formula-fed				
Food Package No.		*Current II*	*Revised II-FF*	
Trans fatty acids, g/d[d]	—	0.02	0.02	–
Children, 1–1.9 y				
Food Package No.		*Current IV*	*Revised IV-A*	
Trans fatty acids, g/d[d]	—	0.59	0.69	+
Children, 2–4.9 y[e]				
Food Package No.		*Current IV*	*Revised IV-B*	
Saturated fat, g/d	—	13.8	6.3	–
Saturated fat, % of food energy	<10	15.6	8.4	–
Cholesterol, mg/d	<300	279	113	–
Trans fatty acids, g/d[d]	—	0.59	0.42	–
Pregnant women and lactating women, 14–44 y[e]				
Food Package No.		*Current V*	*Revised V*	
Saturated fat, g/d	—	15.1	7.9	–
Saturated fat, % of food energy	<10	15.8	8.7	–
Cholesterol, mg/d	<300	288	118	–
Trans fatty acids, g/d	—	0.66	0.45	–
Non-breastfeeding postpartum women, 14–44 y[e]				
Food Package No.		*Current VI*	*Revised VI*	
Saturated fat, g/d	—	12.9	5.9	–
Saturated fat, % of food energy	<10	17.2	9.1	–
Cholesterol, g/d	<300	279	111	–
Trans fatty acids, g/d	—	0.53	0.28	–
Lactating women, 14–44 y[e]				
Food Package No.		*Current VII*	*Revised VII*	
Saturated fat, g/d	—	19.0	12.0	–
Saturated fat, % of food energy	<10	16.1	11.0	–
Cholesterol, mg/d	<300	307	227	–
Trans fatty acids, g/d	—	0.81	0.58	–

NOTES FOR TABLES B-5A THROUGH B-5C: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); AMDR = Acceptable Macronutrient Distribution Range, indicated by a dagger (†); AT = α(alpha)-tocopherol; ATE = α(alpha)-tocopherol equivalents; DFE = dietary folate equivalents; EAR = Estimated Average Requirement, used when available; EER = Estimated Energy Requirement; kcal = kilocalories; RAE = retinol activity equivalents; RDA = Recommended Dietary Allowance; UL = Tolerable Upper Intake Level.

continues

TABLE B-5C Continued

[a]For discussion of important issues regarding differences between the Dietary Reference Intakes (DRIs) and dietary intake data in the units used for vitamin E and folate, please see the section *Data Set—Nutrients Examined* in Appendix A—*Nutrient Intake of WIC Subgroups*.

[b]Values are for children ages 2–3.9 y and children age 4 y, respectively.

[c]Mean EER (kcal/d) (Table B-5B) was calculated based on CSFII data (FSRG, 2000) using the method described in the DRI report (IOM, 2002/2005). For additional detail, see Appendix C—*Nutrient Intakes of WIC Subgroups*.

[d]*Trans* fatty acids have not specifically been identified as a hazard for infants and children, and thus are shown in Table 2-10 (Chapter 2—*Nutrient and Food Priorities*) as nutrients to limit only in the diets of adolescents and adults (IOM, 2002/2005). However, the current dietary guidance to limit *trans* fatty acids from processed foods in the diet is presumed to apply to all individuals regardless of age. The term *trans fatty acids* refers to unsaturated fatty acids that contain at least one double bond in the *trans* configuration.

[e]Added sugars were identified as an ingredient to limit in the diet for women and children over the age of 2 y; however, the committee did not include added sugars in the nutrient analyses because the databases used did not list added sugars as a separate component of foods.

DATA SOURCES: EARs, AIs, and RDAs (Table B-5A) are from the DRI reports (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). ULs and AMDRs (Table B-5B) are from the DRI reports (IOM, 2001, 2002/2005, 2005a). The dietary guidance in Table B-5C is from the American Heart Association (AHA, 2004) and the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005). Nutrients offered were calculated using data from the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN, using Nutrition Data System for Research software (NDS-R version 5.0/35, 2004) (Schakel et al., 1988, 1997; Schakel, 2001). The assumptions used for the calculations of nutrient content of the current and revised food packages are detailed in Appendix D—*Cost Calculations*.

TABLE B-6 Substitutions for Various Volumes of Formula Concentrate—Easy Reference Guide[a]

		Liquid Concentrate
Formula-Fed infants		
I-FF-A: 0–3.9 mo	**Maximum monthly allowance**	**403 fl oz**
	Available units (e.g., cans)	13-fl oz
	Number of units (total oz powder)	31
	Amount as reconstituted	806 fl oz
I-FF-B: 4–5.9 mo	**Maximum monthly allowance**	**442 fl oz**
	Available units (e.g., cans)	13-fl oz
	Number of units (total oz powder)	34
	Amount as reconstituted	884 fl oz
II-FF: 6–11.9 mo	**Maximum monthly allowance**	**312 fl oz**
	Available units (e.g., cans)	13-fl oz
	Number of units (total oz powder)	24
	Amount as reconstituted	624 fl oz
Partially Breast-Fed Infants		
I-BF/FF-A: 1–3.9 mo	**Maximum monthly allowance**	
	Available units (e.g., cans)	Not recommended[f]
	Number of units (total oz powder)	
	Amount as reconstituted	
I-BF/FF-B: 4–5.9 mo	**Maximum monthly allowance**	**221 fl oz**
	Available units (e.g., cans)	13-fl oz
	Number of units (total oz powder)	17
	Amount as reconstituted	442 fl oz
II-BF/FF: 6–11.9 mo	**Maximum monthly allowance**	**156 fl oz**
	Available units (e.g., cans)	13-fl oz
	Number of units (total oz powder)	12
	Amount as reconstituted	312 fl oz

[a]When determining the maximum number of cans of each type of formula, the committee recommends rounding to whole cans to approximate the target amount (the maximum monthly allowance shown in Table 4-1, Chapter 4—*Revised Food Packages*). In some cases this may be different from the rounding currently in use (e.g., rounding up to whole cans). The results of this method may differ from the rounding currently in use; some rounding methods (e.g., rounding up to whole cans) could result in providing excess formula in some cases.

	Powdered Formula[b]		
Ready-to-Feed	Similac with Iron[c] (~7 fl oz/oz)	Enfamil with Iron[d] (~7 fl oz/oz)	Carnation Good Start[e] (~5 fl oz/oz)
800 fl oz	**103–115 oz powder**		
32-fl oz	12.9-oz	14.3-oz	12-oz
25	8 (103.2 oz powder)	8 (114.4 oz powder)	9 (108 oz powder)
800 fl oz	768 fl oz	840 fl oz	783 fl oz
896 fl oz	**114–120 oz powder**		
32-fl oz	12.9-oz	14.3-oz	12-oz
28	9 (116.1 oz powder)	8 (114.4 oz powder)	10 (120 oz powder)
896 fl oz	864 fl oz	840 fl oz	870 fl oz
640 fl oz	**84–91 oz powder**		
32-fl oz	12.9-oz	14.3-oz	12-oz
20	7 (90.3 oz powder)	6 (85.8 oz powder)	7 (84 oz powder)
640 fl oz	672 fl oz	630 fl oz	609 fl oz
	51–60 oz powder		
Not recommended[f]	12.9-oz 4 (51.6 oz powder) 384 fl oz	14.3-oz 4 (57.2 oz powder) 420 fl oz	12-oz 5 (60 oz powder) 435 fl oz
448 fl oz	**57–65 oz powder**		
32-fl oz	12.9-oz	14.3-oz	12-oz
14	5 (64.5 oz powder)	4 (57.2 oz powder)	5 (60 oz powder)
448 fl oz	480 fl oz	420 fl oz	435 fl oz
320 fl oz	**38–48 oz powder**		
32-fl oz	12.9-oz	14.3-oz	12-oz
10	3 (38.7 oz powder)	3 (42.9 oz powder)	4 (48 oz powder)
320 fl oz	288 fl oz	315 fl oz	348 fl oz

[b]This table uses container sizes currently available for Similac with Iron (Ross), Enfamil with Iron (Mead Johnson), and Carnation Good Start Supreme (Nestlé) as examples of commonly prescribed formulas with reconstitution rates of ~7 fl oz of formula per oz powder (e.g., Similac with Iron, Enfamil with Iron) and ~5 fl oz of formula per oz powder (e.g., Carnation Good Start Supreme).

continues

TABLE B-6 Continued

[c]A 12.9-oz can of powdered formula reconstitutes to 94–96 fl oz of formula; for calculation purposes 96 fl oz was used as representative of Similac with Iron (Abbott Laboratories, 2004). The container sizes in this column are representative of other formulas currently being used in the WIC program: Similac Advance with Iron (Ross; reconstitutes to 96 fl oz); and Enfamil Lipil with Iron (Mead Johnson; reconstitutes to 94 fl oz).

[d]A 14.3-oz can of powdered formula reconstitutes to 105 fl oz of formula (Mead Johnson, 2004). The container sizes in this column are representative of Enfamil with Iron (Mead Johnson).

[e]A 12-oz can of powdered formula reconstitutes to 87 fl oz of formula (Nestlé, 2005). The container sizes in this column are representative of Carnation Good Start Supreme (Nestlé) and Carnation Good Start Essentials (Nestlé).

[f]Formula concentrate and ready-to-feed formula are not recommended because the partially breast-fed infant ages 0–3.9 mo will not routinely consume the entire contents of a can with a 24 h period leading to issues of food safety and wastage. For this reason, powdered formula is recommended. For the few circumstances where powdered formula is inappropriate (e.g., the water supply is inappropriate for preparation of formula from powder), formula can be prescribed in other forms at the following monthly maximum allowances: 208 fl oz liquid concentrate (e.g., 16 13-fl oz cans; 416 fl oz formula as reconstituted); or 416 fl oz ready-to-feed formula (e.g., 13 32-fl oz cans).

DATA SOURCES: Abbott Laboratories, 2004; Mead Johnson, 2004; Nestlé, 2005.

C

Nutrient Intake of WIC Subgroups

This appendix presents the details of the final analyses the committee conducted to identify priority nutrients to consider in revising the WIC food packages. Using the Dietary Reference Intakes (DRIs) and the methods described by the Institute of Medicine (IOM, 2000a) to assess nutrient adequacy, the committee assessed the nutrient adequacy of the diets of categorical WIC subgroups—WIC infants under 1 year of age, WIC children 1 through 4 years of age, and pregnant, lactating, and non-breastfeeding postpartum women. Chapter 2—*Nutrient and Food Priorities*—of this report presents a summary of the results. The first section of this appendix describes the DRIs and then discusses how to use them in assessing nutrient adequacy. The next section describes the data set used in the analyses, and the final section includes tables with the detailed analysis results. For a discussion and interpretation of the results, see Chapter 2 of this report.

The results presented in this appendix and summarized in Chapter 2—*Nutrient and Food Priorities*—update the results of similar analyses conducted by the committee for its first report, *Proposed Criteria for Selecting the WIC Food Packages: A Preliminary Report of the Committee to Review the WIC Food Packages* (IOM, 2004b). Based on comments received on that report and on initial analyses conducted in response to those comments, the committee expanded the set of nutrients examined and defined the WIC subgroups to correspond more closely to those served by the WIC program. The priority nutrients identified by the two analyses are essentially the same, but the specific results of the analyses differ.

DIETARY REFERENCE INTAKES (IOM, 1997–2005)

Over the past decade, knowledge of nutrient requirements has increased substantially, resulting in a set of new dietary reference standards called the Dietary Reference Intakes (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). The DRIs replace the earlier Recommended Dietary Allowances and are the appropriate standards to use in determining whether diets are nutritionally adequate without being excessive.

The DRIs for micronutrients include four reference standards—the Estimated Average Requirement, the Recommended Dietary Allowance, the Adequate Intake, and the Tolerable Upper Intake Level (IOM, 2003a)—as follows.

- **Estimated Average Requirement (EAR)** is the usual intake level that is estimated to meet the requirement of half the healthy individuals in a life stage and gender group. At this level of intake, the other half of the healthy individuals in the specified group would not have their needs met.
- **Recommended Dietary Allowance (RDA)** is the usual intake level that is sufficient to meet the nutrient requirement of nearly all healthy individuals in a particular age and gender group (97.5 percent of the individuals in a group). If the distribution of requirements in the group is assumed to be normal, the RDA can be derived as the EAR plus two standard deviations of requirements.
- **Adequate Intake (AI)**—When information is not sufficient to determine an EAR (and, thus, an RDA), then an AI is set for the nutrient. The AI is a recommended average daily nutrient intake level based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group (or groups) of apparently healthy people who are maintaining a defined nutritional state or criterion of adequacy.
- **Tolerable Upper Intake Level (UL)**—Many nutrients have a UL, which is the highest level of usual nutrient intake that is likely to pose no risks of adverse health effects to individuals in the specified life stage group. As intake increases above the UL, the risk of adverse effects increases. The absence of a UL does not imply that the nutrient does not have a tolerable upper intake level, but, rather, that the available evidence at this times does not permit its estimation.

Three of the four DRIs—the EAR, AI, and UL—are appropriate to use in assessing the nutrient intakes of population subgroups. The RDA, however, should not be used in assessing group intakes. Tables F-1A and F-1B in Appendix F—*Supplementary Information*—present the DRIs for the micronutrients examined in the assessment of the nutrient adequacy of the diets of WIC-eligible population subgroups.

TABLE C-1 Acceptable Macronutrient Distribution Ranges

	Range (percentage of food energy intake)		
Macronutrient	Children, 1–3 y	Children, 4 y	Women, 13–44 y
Protein	5–20	10–30	10–35
Carbohydrate	45–65	45–65	45–65
Fat	30–40	25–35	20–35

DATA SOURCE: DRI report (IOM, 2002/2005).

For macronutrients, a somewhat different set of DRIs has been developed (IOM, 2002/2005). In the case of food energy, dietary requirements are expressed in terms of Estimated Energy Requirements (EERs). An adult EER is defined as the dietary energy intake needed to maintain energy balance in a healthy adult of a given age, gender, body weight, height, and level of physical activity. In children, the EER is defined as the sum of the dietary energy intake predicted to maintain energy balance for an individual's age, body weight, height, and activity level, plus an allowance for normal growth and development. For fat, protein, and carbohydrate, the DRIs include Acceptable Macronutrient Distribution Ranges (AMDRs) for intakes as a percentage of energy intakes (Table C-1). Tables F-1C and F-1D in Appendix F—*Supplementary Information*—present the DRIs for macronutrients and subcategories (e.g., saturated fat) examined in the assessment of the diets of WIC-eligible population subgroups.

In addition to micronutrients and macronutrients, other nutrients and dietary components have DRIs. Potassium and fiber have AIs, and sodium has an AI for infants under 1 year of age and a UL for children and older adults. Current dietary guidance is that the percentage of food energy intake from added sugars not exceed 25 percent (IOM, 2002/2005). The *Dietary Guidelines* recommend food energy intake from saturated fat not exceed 10 percent and that the daily intake of cholesterol not exceed 300 milligrams (DHHS/USDA, 2005).

USING THE DRIS TO ASSESS NUTRIENT ADEQUACY

To assess the nutrient adequacy of WIC-eligible subgroups, three questions are important.

1. What are the characteristics of the usual nutrient intake distributions?

2. What proportion of the subgroup is at risk of inadequate usual intake?
3. What proportion is at risk of excessive intake levels?

What are the characteristics of the usual nutrient intake distributions?

In order to describe the characteristics of the usual intake distribution, and to use the DRIs in assessing diets, one needs information on the distribution of usual nutrient intakes. The usual intake of a nutrient is defined as the long-term average intake of the nutrient by the individual (NRC, 1986; Beaton, 1994; IOM, 2000a). Usual intake is not observed; rather, dietary recalls provide data on observed nutrient intakes over some specified period of time. Even discounting errors related to the dietary recall data and its analysis, observed daily intake measures usual intake with error. That is, nutrient intake varies from day to day within an individual. This day-to-day variability is "noise"—the individual-to-individual variability in usual nutrient intake provides the needed information. Because for most nutrients, the day-to-day variability in intakes can be larger than the individual-to-individual variability, it is very important to "remove" the effect of this additional variability when estimating the distribution of usual intakes (Beaton et al., 1979).

The National Research Council (NRC, 1986) proposed a simple additive measurement error model that permits adjusting the data for the presence of the day-to-day variability in intakes. The NRC model assumes that the observed daily intake for an individual can be expressed as a deviation from the individual's usual intake. Subsequently, researchers at Iowa State University (ISU) developed and modified approaches that permit estimating the usual intake distributions with a higher degree of accuracy. This method, proposed by Nusser et al., (1996), is known as the ISU method for estimating usual nutrient intake distributions, and is now widely used by the nutrition community (see, for example, Carriquiry, 1999; IOM, 2000a). Software packages are available that produce estimates of the mean and variance of usual intake in the group, as well as estimates of any percentile of interest. Importantly, these software packages produce estimates of the usual intake distributions of groups and are not appropriate for estimation of the usual intake of *individuals*.

What proportion of the subgroup has inadequate usual intake?

Assessing the prevalence of nutrient inadequacy in a group requires estimating the proportion of individuals in the group whose usual intakes of a nutrient do not meet requirements. For most nutrients with an EAR, the committee used the EAR cut-point method to estimate the prevalence of

inadequacy among categorical WIC subgroups. The EAR cut-point method involves estimating the proportion of individuals in a group whose usual nutrient intakes are less than the EAR. Under certain assumptions, the proportion with usual intakes less than the EAR is an estimate of the proportion of a group whose usual intakes do not meet requirements (Beaton, 1994; Carriquiry, 1999; IOM, 2000a).

Given the available information about the distribution of requirements for most nutrients, it appears that the underlying assumptions of the EAR cut-point method hold for most nutrients except iron in premenopausal women and energy. To assess iron adequacy, the probability approach proposed in the National Research Council report (1986) was used. With this approach, a probability model, based on the requirement distribution for iron, was used to estimate the probability of inadequacy at each level of usual iron intake.

When more than one EAR applied to a WIC subgroup (e.g., because the age range of the subgroup did not match an age range of the DRIs), the analytic approach to estimating the percentage with usual intakes involved (1) dividing observed intakes by the EAR, (2) adjusting the ratio using the usual intake adjustment software, and (3) estimating the percentage with the ratio less than 1. This approach was used for low-income children ages 1 through 4 years, vitamin C for smokers and nonsmokers, and, in some cases, for low-income pregnant and lactating women.

In the case of energy, the reference value used is the Estimated Energy Requirement (EER). Since populations in balance should have usual intake and EER distributions with roughly equal mean values, the analysis compares the mean usual intake of food energy with the mean EER for each subgroup to examine energy adequacy. In addition, for protein, carbohydrate, and fat, tables present (1) the usual distributions of intake as a percentage of observed energy intake and (2) estimates of the proportion outside the AMDR.

For nutrients without an EAR—that is, for nutrients with an AI—usual intake distributions are presented and mean intakes are compared with the AI. Importantly, however, limited inferences can be made regarding the prevalence of inadequacy for nutrients with an AI. If mean intake levels are equal to or exceed the AI, it is likely that the prevalence of inadequacy is low; but if mean intakes are less than the AI, no conclusions can be drawn about the prevalence of inadequacy (IOM, 2000a).

What proportion is at risk of excessive intake levels?

The proportion with usual intakes exceeding the UL is an estimate of the proportion of each subgroup at risk of excessive intake levels. Because ULs have not been established for all nutrients, this question can be ad-

dressed only for those nutrients with ULs. Because the data used in the analysis do not include intakes from supplements, the assessment of the risk of excessive intake was limited to considering nutrient intake from foods. This means that the committee could not assess the risk of excessive intake for those nutrients whose ULs refer to intakes from supplements only, and the assessment of risk is incomplete to the extent that subgroup members took nutrient supplements. The committee estimated the proportion at risk of excessive intake levels for calcium; iron; zinc; vitamins A, B_6, and C; and folate (folic acid). Risk of excessive intake levels for magnesium and vitamin E were not assessed.

DATA SET

The primary data set used in this analysis is the 1994–1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII). The 1994–1996 CSFII provides information on food and nutrient intake over two non-consecutive days for 16,103 individuals of all ages and gender, and of a variety of income levels, racial and ethnic groups, and sociodemographic characteristics. The three-year survey was designed so that the information collected on any one year would constitute a nationally representative sample of individuals of all ages. The samples were selected using stratified, clustered multistage sampling procedures, with an oversampling of low-income individuals. Food intake data were collected using 24-hour dietary recall questionnaires, which included information on the type and amounts of all foods consumed by individuals over two non-consecutive days. In addition, the survey provides sociodemographic information, including income and participation in food assistance programs.

The 1998 Supplemental Children's Survey was designed to be a one-time supplement to the 1994–1996 CSFII, using the same design and survey methodology of the CSFII. Dietary intake data were collected from 5,559 infants and children aged 0 through 9 years over two non-consecutive days between November 1997 and October 1998. The sample was designed to be a stand-alone, nationally representative sample of children in that age range; also, however, it could be combined with the dietary information collected for infants and children up to nine years of age in the 1994–1996 CSFII. Combining the data from the Supplemental Children's Survey sample and the 1994–1996 CSFII provides a large sample of children for the committee's analysis.

Analysis Sample[1]

The analysis sample includes respondents from the CSFII 1994–1996 and 1998 who completed 24-hour dietary recalls and were in one of the following categorical subgroups.

- *WIC Infants, Non-Breastfed, Less Than One Year of Age*—The analysis sample included WIC infants 0 through 3 months of age [sample size (n) = 152], WIC infants 4 through 5 months of age (n = 104), and WIC infants 6 through 11 months of age (n = 275). Because data are not available on the quantity of breast milk consumed, breast-fed infants were excluded from most analyses of nutrient intake.
- *Infants, Breast-Fed, 6 Through 11 Months of Age* (n = 143)—Because of concerns about the adequacy of iron and zinc intakes of older breast-fed infants, the committee assessed the adequacy of these nutrients for breast-fed infants 6 through 11 months of age. (Since the iron and zinc content of breast milk is very low for older breast-fed infants, the absence of data on the quantity of breast milk consumed does not affect the analysis of iron and zinc adequacy.) Because of small sample sizes for WIC (or low-income) breast-fed infants 6 through 11 months of age, the analysis examined *all* breast-fed infants in this age group.
- *WIC Children, 1 Through 4 Years of Age*—The analysis sample included WIC children one year of age (n = 287), and WIC children 2 through 4 years of age (n = 872).
- *Pregnant Women and Lactating Women, Ages 14 Through 44 Years* (n = 123)—This analysis sample included *all* pregnant women and *all* lactating women combined, regardless of participation in the WIC program; otherwise the samples would have been too small to analyze meaningfully.
- *Women, Non-Breastfeeding, up to One Year Postpartum, Ages 14 Through 44 Years* (n = 105)—Because of small sample sizes for non-breastfeeding women up to six months postpartum and low-income non-breastfeeding women up to one year postpartum, the analysis included all low-income and high-income non-breastfeeding women up to one year postpartum.

[1]In all of the analyses of the CSFII data, including the C-SIDE estimation procedures, the appropriate (one-day) weights were used to statistically allow for the complex design of the data set (that is, the appropriate weights were used to statistically allow the data set to be representative of the national population).

Nutrients Examined

The nutrients and dietary components examined include:

- Nutrients currently targeted by the WIC program—calcium, iron, vitamin A, vitamin C, and protein;
- Macronutrients—food energy and the percentage of food energy from protein, carbohydrate, and fat; and
- Other nutrients and dietary components considered of public health significance—selenium, magnesium, phosphorus, sodium, potassium, vitamin E, thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, folate, fiber, and cholesterol; also saturated fat and added sugars as a percentage of food energy intake.

An important issue is to ensure that comparable units for each nutrient are used among the various resources used. Specific issues arise regarding the units for vitamin E, niacin and folate.

- *Vitamin E*—The DRIs report vitamin E as AT [α(alpha)-tocopherol]. Thus, the EARs for vitamin E apply only to RRR-α(alpha)-tocopherol, the form of α(alpha)-tocopherol that occurs naturally in foods, and the 2R-stereoisomeric forms, a portion of the α(alpha)-tocopherol used in fortified foods and dietary supplements. Analysis of dietary intake (CSFII) was based on data in which the units for reporting vitamin E were ATE [α(alpha)-tocopherol equivalents which include the contribution of eight naturally occurring tocopherols]. Because of the differences in the units between the intake data and the EARs, the estimated prevalences of inadequacy of vitamin E intakes in this report are likely to be *underestimates*.
- *Niacin*—Analysis of dietary intake of niacin was based solely on preformed niacin; however, the EAR is based on niacin equivalents (which allows for some conversion of the amino acid tryptophan to niacin). Thus, the estimated prevalence of inadequacy of niacin intakes is likely to be an *overestimate*.
- *Folate in Dietary Folate Equivalents*—The DRIs report folate as microgram DFE (Dietary Folate Equivalents). Dietary intake data (CSFII) reports folate in micrograms. For this report, the amount of folate was calculated by applying the nutrient values from the Food and Nutrient Database for Dietary Studies (FSRG, 2004) to the CSFII folate data. The CSFII data included some food codes not included in the FNDDS; for those food codes the committee applied conversions developed by USDA's Center for Nutrition Policy and Promotion (CNPP database received from Tracy Von Ins, OANE, FNS, USDA, October, 2004) to obtain the total amount of folate (as microgram DFE) consumed per day for all foods eaten. The values of "folate as dietary folate equivalents" were compared to the EARs.

• *Folate as Folic Acid*—The UL for folate applies only to folic acid, the form of folate used in fortification and supplementation. For estimates of intake used in comparison to the UL for folate, the variable *folic acid* was obtained from the nutrient data, calculated by applying the nutrient values from the FNDDS Nutrient Values file (FSRG, 2004) to the amount of food eaten. This represents folate from fortification only. The committee was not able to obtain folic acid data for all foods because the CSFII data included some food codes not included in the FNDDS; the conversion database developed by CNPP did not contain folic acid values. The net effect of this small amount of missing data is to slightly *underestimate* the percentage with dietary intakes above the UL.

The following is a list of the data tables presented in this appendix.

TABLE C-2A Usual Intake Distributions of Selected Micronutrients and Electrolytes: WIC Infants, 0 Through 3 Months, Non-Breastfed

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)						AI*	UL	%>UL
		10th	25th	Median	Mean	75th	90th			
Calcium	mg	350	430	530	562	660	810	210*	ND	—
Iron	mg	7.5	9.5	11.8	12.7	14.8	18.8	0.27*	40	0.2
Zinc	mg	3.7	4.6	5.8	6.1	7.2	8.7	2*	4	86.0
Selenium	mcg	10	12	16	17	19	24	15*	45	0.3
Magnesium	mg	38	47	59	63	74	94	30*	na[a]	—
Phosphorus	mg	217	269	343	368	437	547	100*	ND	—
Sodium	mg	129	158	200	216	256	323	120*	ND	—
Potassium	mg	470	560	690	736	860	1,060	400*	ND	—
Vitamin A	mcg RAE	362	440	550	586	692	854	400*	—	—
Vitamin A, preformed	mcg	367	445	547	581	677	833		600	38.3
Vitamin E[b]	mg	6.5	8.2	10.2	11.1	12.9	16.4	4*	ND	—
Vitamin C	mg	44	55	71	78	93	121	40*	ND	—
Thiamin	mg	0.36	0.44	0.55	0.60	0.70	0.90	0.2*	ND	—
Riboflavin	mg	0.53	0.66	0.84	0.92	1.08	1.39	0.3*	ND	—
Niacin[b]	mg	4.5	5.4	6.8	7.5	8.7	11.3	2*	na[c]	—
Folate[b]	mcg DFE	95	123	158	166	200	246	65*	ND	—
Vitamin B_6	mg	0.26	0.32	0.40	0.42	0.50	0.61	0.1*	ND	—
Vitamin B_{12}	mcg	1.14	1.40	1.76	1.92	2.24	2.87	0.4*	ND	—

NOTES FOR TABLE C-2A: Analysis sample was data for non-breastfed infants from birth through 3.9 mo of age participating in the WIC program at the time of the survey (n = 152). See additional notes for Tables C-2A through C-2G following Table C-2G.

TABLE C-2B Usual Intake Distributions of Selected Micronutrients and Electrolytes: WIC Infants, 4 Through 5 Months, Non-Breastfed

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)						AI*	UL	%>UL
		10th	25th	Median	Mean	75th	90th			
Calcium	mg	467	562	665	675	776	893	210*	ND	—
Iron	mg	10.6	13.1	16.1	16.7	19.5	23.5	0.27*	40	0.3
Zinc	mg	4.9	5.9	6.9	7.0	8.1	9.3	2*	4	96.8
Selenium	mcg	14	17	20	20	23	27	15*	45	<0.1
Magnesium	mg	62	72	85	87	100	115	30*	na[a]	—
Phosphorus	mg	309	370	447	456	532	616	100*	ND	—
Sodium	mg	179	206	242	247	282	323	120*	ND	—
Potassium	mg	730	830	960	974	1,100	1,250	400*	ND	—
Vitamin A	mcg RAE	536	606	687	693	773	859	400*	—	—
Vitamin A, preformed	mcg	453	533	620	626	712	806		600	56.3
Vitamin E[b]	mg	8.8	10.1	12.2	12.6	14.7	16.9	4*	ND	—
Vitamin C	mg	78	93	115	124	145	181	40*	ND	—
Thiamin	mg	0.52	0.64	0.80	0.84	1.00	1.22	0.2*	ND	—
Riboflavin	mg	0.81	0.96	1.15	1.19	1.38	1.61	0.3*	ND	—
Niacin[b]	mg	6.8	8.2	10.0	10.5	12.1	14.7	2*	na[c]	—
Folate[b]	mcg DFE	137	163	194	196	227	258	65*	ND	—
Vitamin B_6	mg	0.41	0.46	0.53	0.53	0.60	0.67	0.1*	ND	—
Vitamin B_{12}	mcg	1.40	1.71	2.06	2.07	2.43	2.76	0.4*	ND	—

NOTES FOR TABLE C-2B: Analysis sample was data for non-breastfed infants 4–5.9 mo of age participating in the WIC program at the time of the survey (n = 104). See additional notes for Tables C-2A through C-2G following Table C-2G.

TABLE C-2C Usual Intake Distributions of Selected Micronutrients and Electrolytes: WIC Infants, 6 Through 11 Months, Breast-Fed and Non-Breastfed

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)						EAR or AI*	% Inadeq	UL	%>UL
		10th	25th	Median	Mean	75th	90th				
Breast-Fed Infants											
Iron	mg	2.7	4.9	8.5	10.0	13.5	19.3	6.9	39.5	40	0.3
Zinc	mg	0.6	1.1	2.0	2.5	3.4	5.0	2.5	60.3	5	10.0
Non-Breastfed Infants											
Calcium	mg	450	560	690	720	850	1,030	270*	—	ND	—
Iron	mg	10.5	13.4	16.8	17.5	20.8	25.2	6.9	1.7	40	0.3
Zinc	mg	4.8	5.8	7.0	7.2	8.4	9.7	2.5	0.3	5	87.6
Selenium	mcg	19	24	31	34	41	52	20*	—	60	5.1
Magnesium	mg	77	95	118	124	147	177	75*	—	na[a]	—
Phosphorus	mg	362	450	569	601	714	871	275*	—	ND	—
Sodium	mg	270	380	600	739	970	1,410	370*	—	ND	—
Potassium	mg	880	1,060	1,290	1,349	1,560	1,880	700*	—	ND	—
Vitamin A	mcg RAE	547	639	745	763	865	1,000	500*	—	ND	—
Vitamin A, preformed	mcg	350	451	562	618	736	974		—	600	42.7
Vitamin E[b]	mg	5.6	8.2	10.8	10.9	13.3	16.0	5*	—	ND	—
Vitamin C	mg	77	98	124	130	155	190	50*	—	ND	—
Thiamin	mg	0.63	0.79	0.98	1.03	1.22	1.49	0.3*	—	ND	—
Riboflavin	mg	0.92	1.13	1.38	1.44	1.68	2.02	0.4*	—	ND	—
Niacin[b]	mg	7.9	9.7	12.0	12.4	14.7	17.5	4*	—	na[c]	—
Folate[b]	mcg DFE	153	187	228	236	275	329	80*	—	ND	—
Vitamin B_6	mg	0.53	0.64	0.78	0.82	0.95	1.15	0.3*	—	ND	—
Vitamin B_{12}	mcg	1.43	1.76	2.17	2.56	2.81	4.00	0.5*	—	ND	—

NOTES FOR TABLE C-2C: Analysis sample was data for non-breastfed infants 6–11.9 mo of age participating in the WIC program at the time of the survey (n = 275). See additional notes for Tables C-2A through C-2G following Table C-2G.

TABLE C-2D Usual Intake Distributions of Selected Micronutrients and Electrolytes: WIC Children, 12 Through 23 Months

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)						EAR or AI*	% Inadeq	UL	%>UL
		10th	25th	Median	Mean	75th	90th				
Calcium	mg	540	700	900	937	1,130	1,380	500*	—	2.5	0.1
Iron	mg	6.5	8.4	11.1	11.9	14.6	18.3	3.0	1.6	40	<0.1
Zinc	mg	4.9	5.9	7.3	7.8	9.2	11.2	2.5	0.2	7	55.7
Selenium	mcg	34	43	54	56	67	79	17	0.3	90	4.0
Magnesium	mg	127	153	184	188	219	254	65	0.1	na[a]	—
Phosphorus	mg	645	784	952	980	1,143	1,349	380	0.6	3,000	<0.1
Sodium	mg	970	1,300	1,730	1,816	2,230	2,770	1,000*	—	1.5	63.5
Potassium	mg	1,380	1,650	1,980	2,029	2,350	2,740	3,000*	—	ND	—
Vitamin A	mcg RAE	361	447	570	612	730	914	210	0.5	—	—
Vitamin A, preformed	mcg	282	358	465	495	600	748		—	600	25.0
Vitamin E[b]	mg	2.8	3.6	4.7	5.3	6.3	8.5	5	55.3	200	<0.1
Vitamin C	mg	55	74	101	109	136	174	13	<0.1	400	<0.1
Thiamin	mg	0.78	0.93	1.12	1.15	1.34	1.58	0.4	0.1	ND	—
Riboflavin	mg	1.24	1.48	1.78	1.82	2.11	2.46	0.4	<0.1	ND	—
Niacin[b]	mg	7.0	9.1	11.9	12.6	15.3	18.9	5	2.5	na[c]	—
Folate[b]	mcg DFE	200	260	343	378	455	597	120	1.2	—	—
Folic acid[b,d]	mcg	—	—	—	—	—	—	—	300	7.7	
Vitamin B_6	mg	0.83	1.00	1.24	1.30	1.53	1.86	0.4	<0.1	30	<0.1
Vitamin B_{12}	mcg	2.00	2.55	3.27	3.47	4.17	5.21	0.7	0.1	ND	—

NOTES FOR TABLE C-2D: Analysis sample was data for non-breastfed children 12–23.9 mo of age participating in the WIC program at the time of the survey (n = 287). See additional notes for Tables C-2A through C-2G following Table C-2G.

TABLE C-2E Usual Intake Distributions of Selected Micronutrients and Electrolytes: WIC Children, 2 Through 4 Years

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)					
		10th	25th	Median	Mean	75th	90th
Calcium	mg	530	650	810	833	990	1,160
Iron	mg	8.8	10.6	13.0	13.6	16.0	19.1
Zinc	mg	6.1	7.2	8.7	9.1	10.6	12.6
Selenium	mcg	50	60	71	73	84	98
Magnesium	mg	141	169	203	208	242	283
Phosphorus	mg	720	857	1,021	1,041	1,204	1,388
Sodium	mg	1,700	2,030	2,440	2,519	2,930	3,440
Potassium	mg	1,480	1,790	2,160	2,211	2,580	3,000
Vitamin A	mcg RAE	394	483	603	657	764	975
Vitamin A, preformed	mcg	313	381	468	513	586	756
Vitamin E[b]	mg	3.4	4.3	5.4	6.0	7.0	9.0
Vitamin C	mg	65	86	113	118	146	178
Thiamin	mg	0.95	1.11	1.32	1.36	1.56	1.82
Riboflavin	mg	1.27	1.51	1.80	1.85	2.15	2.49
Niacin[b]	mg	10.7	13.0	15.9	16.4	19.2	22.8
Folate[b]	mcg DFE	335	404	494	517	604	727
Folic acid[b,d]	mcg	—	—	—	—	—	—
Vitamin B_6	mg	1.04	1.24	1.50	1.55	1.81	2.13
Vitamin B_{12}	mcg	2.30	2.71	3.25	3.57	4.01	5.11

NOTES FOR TABLE C-2E: Analysis sample was data for children 2–4.9 y of age participating in the WIC program at the time of the survey (n = 872). See additional notes for Tables C-2A through C-2G following Table C-2G.

EAR or AI*[a]	% Inadeq	UL[e]	%>UL
500* / 800*	—	2.5	<0.1
3.0 / 4.1	0.4	40	<0.1
2.5 / 4.0	0.1	7 / 12	58.1
17 / 23	<0.1	90 / 150	9.1
65 / 110	0.5	na[a]	—
380 / 405	0.2	3,000	<0.1
1,000* / 1,200*	—	1.5 / 1.9	92.8
3,000* / 3,800*	—	ND	—
210 / 275	0.4	—	—
	—	600 / 900	16.1
5 / 6	47.0	200 / 300	<0.1
13 / 22	<0.1	400 / 650	<0.1
0.4 / 0.5	<0.1	ND	—
0.4 / 0.5	<0.1	ND	—
5 / 6	0.1	na[c]	—
120 / 160	<0.1	—	—
	—	300 / 400	11.8
0.4 / 0.5	<0.1	30 / 40	<0.1
0.7 / 1.0	<0.1	ND	—

TABLE C-2F Usual Intake Distributions of Selected Micronutrients and Electrolytes: Adolescent and Adult Women, Pregnant or Lactating

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)					
		10th	25th	Median	Mean	75th	90th
Calcium	mg	590	740	920	956	1,140	1,360
Iron	mg	10.8	12.8	15.6	16.5	19.2	23.6
Zinc	mg	8.6	9.9	11.4	11.7	13.2	15.1
Selenium	mcg	71	84	99	103	117	139
Magnesium	mg	196	234	282	291	339	398
Phosphorus	mg	964	1,137	1,343	1,359	1,564	1,775
Sodium	mg	2,630	2,940	3,310	3,330	3,690	4,060
Potassium	mg	2,030	2,410	2,860	2,909	3,360	3,850
Vitamin A	mcg RAE	444	605	834	902	1,124	1,446
Vitamin A, preformed	mcg	299	405	552	589	732	926
Vitamin E[b]	mg	4.9	6.1	7.8	8.3	9.9	12.3
Vitamin C	mg	49	75	116	134	173	242
Thiamin	mg	1.08	1.31	1.60	1.67	1.96	2.34
Riboflavin	mg	1.43	1.73	2.12	2.19	2.57	3.04
Niacin[b]	mg	14.5	17.5	21.1	21.8	25.3	29.9
Folate[b]	mcg DFE	322	411	535	570	691	863
Folic acid[b,d]	mcg	—	—	—	—	—	—
Vitamin B_6	mg	1.20	1.49	1.88	1.95	2.33	2.81
Vitamin B_{12}	mcg	3.05	3.75	4.63	4.79	5.66	6.74

NOTES FOR TABLE C-2F: Analysis sample was data for pregnant or lactating adolescent and adult women ages 14–44 y (n = 123). Because of sample size limitations, the analysis sample combined all pregnant women and all lactating women. The DRIs shown in the table are for women ages 19–30 y of age only; however, the analysis was conducted on the entire sample. See additional notes for Tables C-2A through C-2G following Table C-2G.

EAR or AI* (19–30 y)			UL (19–30 y)		
Pregnant	Lactating	% Inadeq	Pregnant	Lactating	%>UL
1,000*	1,000*	—	2,500	2,500	<0.1
22	6.5	7.5	45	45	0.1
9.5	10.4	23.8	40	40	<0.1
49	59	1.4	400	400	<0.1
290	255	49.4	na[a]	na[a]	—
580	580	0.4	3,500	4,000	<0.1
1,500*	1,500*	—	2,300	2,300	97.2
4,700*	5,100*	—	ND	ND	—
550	900	31.2	ND	ND	—
		—	3,000	3,000	<0.1
12	16	94.4	1,000	1,000	<0.1
70	100	32.7	2,000	2,000	<0.1
1.2	1.2	17.2	ND	ND	—
1.2	1.3	3.8	ND	ND	—
14	13	8.1	na[c]	na[c]	—
520	450	41.5	—	—	—
		—	1,000	1,000	<0.1
1.6	1.7	34.0	100	100	<0.1
2.2	2.4	1.5	ND	ND	—

TABLE C-2G Usual Intake Distributions of Selected Micronutrients and Electrolytes: Adolescent and Adult Women, Non-Breastfeeding Postpartum

Nutrient	Units (per day)	Intake Distribution (percentiles and mean)					
		10th	25th	Median	Mean	75th	90th
Calcium	mg	430	530	640	668	780	930
Iron	mg	11.1	12.2	13.6	13.7	15.0	16.4
Zinc	mg	9.2	9.4	9.7	9.7	10.0	10.2
Selenium	mcg	72.2	79.0	87.0	87.8	95.8	104.4
Magnesium	mg	161	183	210	213	240	269
Phosphorus	mg	832	925	1,034	1,042	1,151	1,263
Sodium	mg	2,320	2,580	2,890	2,912	3,220	3,540
Potassium	mg	1,570	1,790	2,060	2,086	2,350	2,630
Vitamin A	mcg RAE	316	406	528	556	675	831
Vitamin A, preformed	mcg	195	264	361	388	482	615
Vitamin E[b]	mg	5.2	5.9	6.8	6.9	7.8	8.7
Vitamin C	mg	34	49	72	79	101	135
Thiamin	mg	1.03	1.18	1.36	1.38	1.57	1.77
Riboflavin	mg	1.15	1.34	1.57	1.60	1.83	2.10
Niacin[b]	mg	13.0	15.2	17.9	18.1	20.7	23.7
Folate[b]	mcg DFE	312	377	463	482	566	675
Folic acid[b,d]	mcg	—	—	—	—	—	—
Vitamin B_6	mg	1.01	1.17	1.37	1.39	1.59	1.80
Vitamin B_{12}	mcg	2.20	3.10	4.60	5.48	6.80	9.90

NOTES FOR TABLE C-2G: Analysis sample was data for non-breastfeeding postpartum adolescent and adult women ages 14–44 y (n = 105). See additional notes for Tables C-2A through C-2G following this table.

NOTES FOR TABLES C-2A THROUGH C-2G: AI = Adequate Intake, used when EAR could not be determined, indicated by an asterisk (*); DFE = dietary folate equivalents; EAR = Estimated Average Requirement; na = not applicable; ND = not determined, EAR could not be determined or UL not determined due to lack of data of adverse effects; RAE = retinol activity equivalents; RE = retinol equivalents; UL = Tolerable Upper Intake Level; %>UL, percentage with usual intake greater than UL; % Inadeq = percentage with inadequate intakes as estimated from percentage with usual intake less than EAR.

[a]The UL for magnesium represents intake from pharmacological agents only and does not include intake from food and water.

[b]For discussion of important issues regarding differences between the DRI and dietary intake data in the units used for vitamin E, niacin, and folate, please see the section *Data Set—Nutrients Examined*—here in Appendix C.

EAR or AI* (19–30 y)			UL (19–30 y)		
Pregnant	Lactating	% Inadeq	Pregnant	Lactating	%>UL
1,300*	1,000*	—	2.5	2.5	<0.1
7.9	8.1	9.5	45	45	<0.1
7.3	6.8	<0.1	34	40	<0.1
45	45	<0.1	400	400	<0.1
300	265	87.5	na[a]	na[a]	
1,055	580	0.7	4,000	4,000	<0.1
1,500*	1,500*	—	2.3	2.3	90.7
4,700*	4,700*	—	ND	ND	—
485	500	44.1	ND	ND	—
		—	2,800	3,000	<0.1
12	12	99.8	800	1,000	<0.1
56	60	42.2	1,800	2,000	<0.1
0.9	0.9	3.2	ND	ND	—
0.9	0.9	1.2	ND	ND	—
11	11	3.3	na[c]	na[c]	—
330	320	12.0	—	—	—
		—	800	1,000	<0.1
1	1.1	17.1	80	100	<0.1
2	2	6.6	ND	ND	—

[c]The UL for niacin represents intake of free niacin likely to be ingested only in supplements or fortified foods.

[d]For folic acid, the form of folate used in food fortification, the intake distribution could not be calculated because available dietary intake data were incomplete. For detailed explanation, please see the section *Data Set—Nutrients Examined*—here in Appendix C.

[e]Values are for children ages 2–3.9 y and children age 4 y, respectively. For this analyses, the intake of each child was compared to the age-appropriate DRI.

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations). Intake distributions were calculated using C-SIDE (ISU, 1997).

TABLE C-3A Usual Intake Distributions of Selected Macronutrients: WIC Infants, 0 Through 3 Months, Non-Breastfed

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	437	523	635	673	778	951
EER[a]	kcal/d	406	468	559	555	640	687
Protein	g/d	9.4	11.4	14.1	14.9	17.6	21.5
	% of energy	8	8	9	9	9	10
Carbohydrate	g/d	47	57	71	75	87	106
	% of energy	41	43	44	44	46	48
Fat, total	g/d	22	27	33	35	40	49
	% of energy	43	45	47	46	48	49
Saturated fatty acids	g/d	9	11	13	14	16	20
	% of energy	16	18	19	19	20	21

NOTES FOR TABLE C-3A: Analysis sample was data for non-breastfed infants from birth through 3.9 mo of age participating in the WIC program at the time of the survey (n = 152). See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3B Usual Intake Distributions of Macronutrients and Fiber: WIC Infants, 4 Through 5 Months, Non-Breastfed

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	603	684	786	802	903	1,021
EER[a]	kcal/d	471	541	614	623	675	765
Protein	g/d	12.6	14.9	17.5	17.8	20.3	23.2
	% of energy	8	8	9	9	9	10
Carbohydrate	g/d	73	83	96	98	111	126
	% of energy	43	46	48	49	52	57
Fat, total	g/d	28	33	38	38	44	49
	% of energy	37	40	42	42	45	47
Saturated fatty acids	g/d	11	13	15	15	17	20
	% of energy	14	16	17	17	18	19
Fiber	g/d	<1	<1	1	2	3	5

NOTES FOR TABLE C-3B: Analysis sample was data for non-breastfed infants 4–5.9 mo of age participating in the WIC program at the time of the survey (n = 104). See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3C Usual Intake Distributions of Macronutrients, Cholesterol, and Fiber: WIC Infants, 6 Through 11 Months, Non-Breastfed

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	691	821	970	992	1,137	1,319
EER[a]	kcal/d	570	641	740	754	854	958
Protein[b]	g/d	15.9	19.7	24.9	26.7	31.8	39.9
	% of energy	8	9	10	11	12	13
Carbohydrate	g/d	91	107	128	131	151	176
	% of energy	47	50	53	54	57	60
Fat, total	g/d	27	33	40	40	47	55
	% of energy	30	34	37	36	40	43
Saturated fatty acids	g/d	11	13	16	16	19	22
	% of energy	11	13	15	14	16	18
Cholesterol	mg/d	13	23	47	71	92	160
Fiber	g/d	2	3	5	5	6	8

[b]For protein, 0.6% of WIC infants ages 6–11.9 mo had inadequate intakes.

NOTES FOR TABLE C-3C: Analysis sample was data for non-breastfed infants 6–11.9 mo of age participating in the WIC program at the time of the survey (n = 275). See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3D Usual Intake Distributions of Macronutrients, Cholesterol, and Fiber: WIC Children, 12 Through 23 Months

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	901	1,065	1,262	1,288	1,482	1,708
EER[a]	kcal/d	729	827	935	942	1,050	1,165
Protein[b]	g/d	32	38	46	48	56	66
	% of energy	12	13	15	15	16	18
Carbohydrate	g/d	115	137	164	168	194	226
	% of energy	46	49	53	53	57	61
Fat, total	g/d	32	39	48	49	58	68
	% of energy	28	31	33	33	36	39
Saturated fatty acids	g/d	14	17	21	21	25	30
	% of energy	11	13	15	15	17	18
Cholesterol	mg/d	97	130	176	192	238	309
Fiber	g/d	4	6	8	8	10	12

[b]For protein, <0.1% of WIC children ages 1–1.9 y had inadequate intakes.

NOTES FOR TABLE C-3D: Analysis sample was data for non-breastfed children 12–23.9 months of age participating in the WIC program at the time of the survey (n = 287). See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3E Usual Intake Distributions of Macronutrients, Cholesterol, and Fiber: WIC Children, 2 Through 4 Years

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	1,112	1,312	1,553	1,585	1,822	2,095
EER[a]-Low Active	kcal/d	1,000	1,146	1,285	1,282	1,412	1,545
EER[a]-Active	kcal/d	1,019	1,207	1,411	1,389	1,567	1,700
Protein[b]	g/d	40	47	56	57	67	77
	% of energy	13	14	15	15	16	17
Carbohydrate	g/d	146	173	208	213	247	286
	% of energy	48	51	54	54	57	60
Added sugars	g/d	6	8	12	13	17	21
	% of energy	7	9	12	13	16	20
Fat, total	g/d	39	47	57	58	68	80
	% of energy	28	30	33	33	35	38
Saturated fatty acids[c]	g/d	15	18	22	22	26	30
	% of energy	10	11	13	13	14	15
Cholesterol[d]	mg/d	134	165	206	216	257	311
Fiber	g/d	7	8	11	11	13	16

[b]For protein, <0.1% of WIC children ages 2–4.9 y had inadequate intakes.

[c]For saturated fatty acids, 9% of WIC children ages 2–4.9 y had intakes that followed dietary guidance to limit to less than 10% of food energy intake.

[d]For cholesterol, 88% of WIC children ages 2–4.9 y had intakes that followed dietary guidance to limit intake to less than 300 mg per day.

NOTES FOR TABLE C-3E: Analysis sample was data for children 2–4.9 y of age participating in the WIC program at the time of the survey (n = 872). See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3F Usual Intake Distributions of Macronutrients, Cholesterol, and Fiber: Adolescent and Adult Women, Pregnant or Lactating

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	1,557	1,798	2,088	2,115	2,403	2,707
EER[a]-Low Active	kcal/d	2,279	2,355	2,451	2,465	2,560	2,671
Protein[b]	g/d	58	68	79	79	90	102
	% of energy	14	15	16	16	16	17
Carbohydrate	g/d	199	235	279	285	328	378
	% of energy	49	51	54	54	56	59
Added sugars	g/d	10	14	20	22	27	35
	% of energy	8	11	15	16	19	24
Fat, total	g/d	55	64	76	77	88	99
	% of energy	28	30	32	32	35	37
Saturated fatty acids[c]	g/d	19	23	27	27	32	37
	% of energy	9	10	12	12	13	14
Cholesterol[d]	mg/d	173	210	260	271	320	385
Fiber	g/d	10	13	17	18	21	26

[b]For protein, 17% of pregnant and lactating women had inadequate intakes.

[c]For saturated fatty acids, 19% of pregnant and lactating women had intakes that followed dietary guidance to limit to less than 10% of food energy intake.

[d]For cholesterol, 68% of pregnant and lactating women had intakes that followed dietary guidance to limit intake to less than 300 mg per day.

NOTES FOR TABLE C-3F: Analysis sample was data for pregnant or lactating adolescent and adult women ages 14–44 y (n = 123). Because of sample size limitations, the analysis sample combined all pregnant women and all lactating women. See additional notes for Tables C-3A through C-3G following Table C-3G.

TABLE C-3G Usual Intake Distributions of Macronutrients, Cholesterol, and Fiber: Adolescent and Adult Women, Non-Breastfeeding Postpartum

		Intake Distribution (percentiles and mean)					
Nutrient	Units	10th	25th	Median	Mean	75th	90th
Food energy	kcal/d	1,363	1,540	1,754	1,774	1,986	2,210
EER[a]-Low Active	kcal/d	1,988	2,058	2,148	2,163	2,253	2,359
Protein[b]	g/d	50	57	64	65	72	80
	% of energy	12	14	15	15	16	18
Carbohydrate	g/d	159	189	226	229	266	305
	% of energy	47	49	52	52	55	57
Added sugars	g/d	8	13	19	21	27	36
	% of energy	8	12	17	18	24	30
Fat, total	g/d	55	60	66	66	72	77
	% of energy	32	32	33	33	34	35
Saturated fatty acids[c]	g/d	17	20	23	23	26	29
	% of energy	10	11	11	11	12	12
Cholesterol[d]	mg/d	152	179	213	219	253	292
Fiber	g/d	7	9	12	12	15	18

[b]For protein, 4% of non-breastfeeding postpartum women had inadequate intakes.

[c]For saturated fatty acids, 4% of non-breastfeeding postpartum women had intakes that followed dietary guidance to limit to less than 10% of food energy intake.

[d]For cholesterol, 92% of non-breastfeeding postpartum women had intakes that followed dietary guidance to limit intake to less than 300 mg per day.

NOTES FOR TABLE C-3G: Analysis sample was data for non-breastfeeding postpartum adolescent and adult women ages 14–44 y (n = 105). See additional notes for Tables C-3A through C-3G following this table.

NOTES FOR TABLES C-3A THROUGH C-3G: EER = Estimated Energy Requirement; kcal = kilocalories.

[a]Mean EER (kcal/d) was calculated based on CSFII data (FSRG, 2000) using the method described in the DRI report (IOM, 2002/2005). For pregnant women, EER calculations assumed the second trimester. For lactating women, EER calculations assumed the first 6 month period postpartum.

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000); data set does not include intake from dietary supplements (e.g., multivitamin and mineral preparations). Intake distributions were calculated using C-SIDE (ISU, 1997).

TABLE C-4 Usual Intakes and Percentages with Reported Usual Intakes of Macronutrients and Added Sugars Outside Dietary Guidance

	Participant Category			
Nutrient (Dietary Guidance)	WIC Children, 1–1.9 y (n = 287)	WIC Children, 2–4.9 y (n = 872)	Pregnant Women and Lactating Women (n = 123)	Non-Breastfeeding Postpartum Women (n = 105)
Protein (AMDR†[a] as percentage of food energy)	(5–20†)	(5–20†, 2–3.9 y) (10–30†, 4–4.9 y)	(10–30†, <19 y) (10–35†, ≥19 y)	(10–35†)
Mean usual intake (g/d)	48	57	79	65
%<AMDR	<0.1	0.5	<0.1	0.3
%>AMDR	1.5	1.0	<0.1	<0.1
Carbohydrate, total (AMDR†[a] as percentage of food energy)	(45–65†)	(45–65†)	(45–65†)	(45–65†)
Mean usual intake (g/d)	168	213	285	229
%<AMDR	7.5	2.0	1.5	4.8
%>AMDR	2.8	1.1	0.2	0.1
Added Sugars (<25% of food energy)				
Mean usual intake (g/d)	—	13	22	21
%>25% of energy	na	2.9	7.3	20.4
Fat, total (AMDR†[a] as percentage of food energy)	(30–40†)	(30–40†, 2–3.9 y) (25–35†, 4–4.9 y)	(25–35†, <19 y) (20–35†, ≥19 y)	(25–35†, <19 y) (20–35†, ≥19 y)
Mean usual intake (g/d)	49	58	77	66
%<AMDR	20.8	18.1	0.2	<0.1
%>AMDR	5.5	10.4	24.5	4.9

continues

TABLE C-4 Continued

Nutrient (Dietary Guidance)	Participant Category			
	WIC Children, 1–1.9 y (n = 287)	WIC Children, 2–4.9 y (n = 872)	Pregnant Women and Lactating Women (n = 123)	Non-Breastfeeding Postpartum Women (n = 105)
Fat, saturated (<10% of food energy)[b]				
Mean usual intake (g/d)	21	22	27	23
%>10% of energy	na	91.0	80.9	96.2

[a]AMDRs are presented as a range of intakes expressed as percentage of food energy intake (IOM, 2002/2005). For this analyses, the intake of each individual was compared to the age-appropriate AMDR.

[b]The dietary guidance in this table for saturated fat is a part of the *Dietary Guidelines for Americans* (DHHS/USDA, 2005). The Dietary Reference Intake (DRI) guidance for saturated fat is to consume amounts as low as possible while consuming a nutritionally adequate diet (IOM, 2002/2005).

NOTES: This table is similar to Table 2-5; more detail is presented here in Appendix C. AMDR = Acceptable Macronutrient Distribution Range, indicated by a dagger (†); n = sample size; na = not applicable; %<AMDR, percentage with usual intake less than AMDR; %>AMDR, percentage with usual intake greater than AMDR.

DATA SOURCES: Intake data were obtained from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000). All young children were non-breastfed. Usual intake distributions were calculated using C-SIDE (ISU, 1997). AMDRs and dietary guidance for added sugars were obtained from the DRI report (IOM, 2002/2005). Dietary guidance for saturated fat was obtained from the *Dietary Guidelines* (DHHS/USDA, 2005) (see note *b*).

D

Evaluating Potential Benefits and Risks of the Revised Food Packages

Three of the six criteria guiding the development of the revised WIC food packages focused on nutrient and food intakes. Specifically, the committee aimed to develop WIC food packages that would (1) reduce the prevalence of inadequate nutrient intakes and of excessive nutrient intakes, (2) lead to dietary patterns that are consistent with the *Dietary Guidelines for Americans* for individuals two years and older,[1] and (3) contribute to dietary patterns that are consistent with dietary guidance for infants and children younger than 2 years of age.

This appendix summarizes the results from an evaluation of the potential nutrient benefits and risks for the WIC target population associated with the revised WIC food packages. Potential benefits are characterized as reductions in the prevalence of inadequate nutrient intake and reductions in the prevalence of excessive nutrient intake. Potential risks are characterized as increases in the prevalence of inadequate intake, increases in the prevalence of excessive nutrient intake, and any departures from consistency with the *Dietary Guidelines* and dietary guidance for those younger than 2 years of age. Chapter 6—*How the Revised Food Packages Meet the Criteria Specified*—addresses ways in which the revised packages provide

[1]Failure to meet the *Dietary Guidelines for Americans* was identified as a nutrition risk criteria for the WIC program (IOM, 1996).

potential benefits through improved consistency with the *Dietary Guidelines* and dietary guidance for those younger than 2 years of age.

This is not a complete assessment of risk and benefits in that it is not feasible to estimate what long-term health benefits and risks would be associated with a change in specific foods offered in the WIC program. Assuming that the recommendations in this report are adopted at the federal level, those benefits and risks would depend upon many factors, including the following:

- The extent to which the WIC state agencies allow local agencies to prescribe the maximum amounts of food in the revised food packages;
- The extent to which the WIC state agencies incorporate more allowed choices in the food package offerings;
- The success of approaches to nutrition education that address the revised food packages;
- The extent of redemption of the WIC food instruments for the revised packages;
- Whether the entire amount of food in the package is consumed by the WIC participant; and
- The association of consuming those foods with long-term health benefits.

Notably, the committee used current dietary guidance from the *Dietary Guidelines* and Dietary Reference Intakes (DRIs) when redesigning the food packages, and these sources incorporate information on reduced risk of chronic diseases into their dietary guidance. The *Dietary Guidelines for Americans 2005* "provide science-based advice [for people two years and older] to promote health and to reduce risk for chronic diseases through diet and physical activity" (DHHS/USDA, 2005, p. 1). The DRIs are intended to minimize the risk of nutrient inadequacy (including both classical deficiency states and the reduction of the risk of chronic disease and disorders) or nutrient excess and are intended to be applied to the healthy general population in the United States and Canada (IOM, 1997). Thus, the more closely that diets adhere to current dietary guidance, the greater the likelihood that they will result in long-term health benefits.

METHODS FOR EVALUATING NUTRITIONAL BENEFITS AND RISKS

The method for evaluating nutritional benefits and risks associated with changes in the WIC food packages is a modification of the risk assess-

ment method first outlined by the National Research Council in 1983 (NRC, 1983). In risk assessment, *hazard identification* is followed by *dose-response assessment* and *exposure assessment* before the results are combined in risk characterization.

In risk assessment, the term *hazard identification* refers to the characterization of potential adverse effects on human health and the conditions necessary to elicit those effects. Inadequate nutrition can be characterized for specific nutrients as either inadequate intake or excessive intake that increases the risk of poor health outcomes, i.e., the risk of hazards. Detailed discussions of the possible hazards associated with poor dietary choices and inadequate nutrient intake are available in the DRI reports (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). Concerns about excessive intake of some nutrients (e.g., excessive preformed vitamin A intake and excessive intake of food energy) arise because of potential toxicity or potential for unhealthy body weight gain, respectively, in the examples given.

In risk assessment, *dose-response assessment* describes how changes in dose (in this case, changes in the intake of nutrients) influence the likelihood of a hazard being realized (that is, the likelihood of changes in health status). It is outside the scope of this report to discuss changes in health status. Therefore, for the analysis presented in this report, there is no formal assessment of changes in the number or severity of health effects due to changes in intake. That is, there is no formal *dose-response assessment* describing the likelihood of changes in health status. This report focuses on dietary inadequacy or excess as the hazard, rather than on changes in health status.

In risk assessment, *exposure assessment* seeks to predict the change in exposure. In this case, *exposure assessment* for each WIC population addresses the changes in usual nutrient intake distributions that result from changes in individual intakes that are based on the changes in the nutrients provided by the revised food packages.

As the final step in risk assessment, *risk characterization* reflects the integration of the previous three steps in order to help inform decision makers about quantitative levels of risk to human health status under different scenarios. This report contains a modified *risk characterization* because the committee was able to consider only dietary status (that is, the risk of inadequate intake and the risk of excessive intake), not health status.

In summary, this evaluation of nutritional benefits and risks brings together information from (1) the assessment of inadequate nutrition (*hazard identification*), (2) considerations of the influence of potential changes in nutrients provided in the food packages on either inadequate intake or

excessive intake (a modified *dose-response assessment*), and (3) prediction of changes in usual intakes of nutrients (*exposure assessment*) to provide a quantitative description (that is, a modified *risk characterization*) of the potential change in nutritional status of the WIC population as the result of the recommended changes in the WIC food packages.

Nutrient Intake

The committee conducted a detailed evaluation to compare potential benefits and risks for the WIC participant subpopulations resulting from proposed changes in the food packages.

- *Potential benefits* are characterized as reductions in the prevalences of nutrient inadequacy or nutrient excess.
- *Potential risks* are characterized as increases in the prevalences of nutrient inadequacy or increases in the risk of excessive nutrient intakes.

The committee's analysis applied the framework proposed by the IOM Subcommittee on the Interpretation and Uses of the DRIs (IOM, 2003a). This framework considers improving the distribution of usual nutrient intakes as the ultimate goal of a group planning activity such as changing the WIC food packages. Specifically, the goal is to achieve usual nutrient intake distributions with an acceptably low prevalence of inadequate intakes and a low prevalence of excessive intakes.

Changes in the contents of a WIC food package alter the nutrient profile of the package and thus the amounts of nutrients offered to WIC participants. (See Tables C-5A through C-5C for comparison of current and revised food packages with regard to priority nutrients offered.) Increases in nutrient intakes that lead to reductions in the prevalence of inadequacy are considered as benefits of the revised WIC food packages, as are decreased intakes of nutrients of concern for excessive intake. In contrast, reductions in nutrient intakes that lead to increases in the prevalence of inadequate intake are considered as risks of the revised food package. In addition, increases in nutrient intakes that increase the prevalence of excessive intakes also are considered to be a risk of the revised food package. Because foods contain many different nutrient components and because package changes address many different attributes, a change in the types and amounts of foods in a package has the potential of having both positive effects (that is, benefits) and negative effects (that is, risks) on the nutrient profile.

Importantly, at this point, it is not possible to estimate the precise impact of any food package changes on nutrient intakes. The WIC program

can control only what is offered to participants, not what they actually consume. Some WIC participants consume a larger amount of a specific nutrient than is offered in their current food package. For example, such individuals consume the foods from the WIC food packages plus foods from the family resources, making their total intake of a nutrient greater than that offered in the food package. In contract, some WIC participants consume less of a specific nutrient than is provided by the maximum food package for their category. There are several reasons why estimated nutrient intakes may be less than nutrients offered through WIC food packages, including:

- Less than the maximum allowance of food may be prescribed for a WIC participant, and less food may be redeemed than prescribed (e.g., a participant does not use all her food instruments in a month);
- WIC foods may be shared with other people or discarded; and
- Food intakes may be underreported or misreported.

With the revised WIC food packages, consumption patterns may change, leading to changes in both the shape and position of usual nutrient intake distributions. The major challenge in estimating the benefits and risks of changes in the WIC food packages is to predict what the usual nutrient intake distributions would be after the changes in the WIC food packages are implemented. Ultimately, evidence of the benefits and risks will come from data collection and analyses that occur after changes in the WIC food packages have been implemented. Nonetheless, the committee considered several approaches to predicting the changes in the usual intake distributions resulting from the change in the WIC food packages.

The Delta Approach

The first, and most straightforward, approach (the delta approach) was based on a starting assumption that any changes in the WIC food packages would be reflected solely in the nutrient intake by the individual WIC participant (i.e., infant, child, woman). Thus, the analysis of benefits and risks would start with the existing distribution of usual nutrient intake of WIC participants (which presumably reflects the existing intrahousehold allocation of WIC food packages). Then, for each package and each nutrient, the difference between the nutrient content of the revised WIC food package minus that of the corresponding current package is added to the previously estimated usual intakes of WIC participants.

A shortcoming of this approach is that it ignores the reality that individuals do not always consume what is offered to them. Indeed, much of

the nutrient inadequacy reported in Chapter 2—*Nutrient and Food Priorities*—results from the fact that individuals do not consume all of the food offered in the current WIC food packages. For example, the mean amount of calcium offered in the maximum allowance for the non-breastfeeding postpartum food package is 1,199 mg per day, but the mean calcium intake by these women is 668 mg per day. In fact, even the 90th percentile of usual calcium intake by non-breastfeeding postpartum women (930 mg/d) is less than the amount offered by the maximum allowance in the current food package. Given that the mean intake of calcium is less than the amount currently offered, it is not reasonable to assume that a change in the amount of calcium offered through a revised WIC food package will lead to the same quantitative change in mean intake.

Results of analyses with this approach are reported in Tables D-1A through D-1C at the end of this appendix; because of the concerns in the application of the delta approach, the consideration of risks and benefits of the revised food packages will focus on results from the committee's second approach to predicting changes in population intake of nutrients—the proportional approach.

The Proportional Approach

The committee adopted a second approach (the proportional approach), with the following steps.

- For each usual intake, calculate the ratio of the intake to the amount offered in the current WIC food package. For example, at a usual calcium intake of 670 mg per day, the ratio is (670)/(1,200), or 0.56, indicating that at this intake, a non-breastfeeding postpartum woman would consume an average of 56 percent of the calcium offered in the WIC food package.
- If usual intake is less than the amount offered, the change in the amount offered is multiplied by this ratio to predict changes in the intake. Continuing with the calcium example, if the amount offered is reduced by 200 mg per day, the reduction in usual intake above is assumed to be (0.56) × (200 mg/d) = 112 mg/d. In contrast, under the delta approach, the reduction would be 200 mg per day, regardless of current usual intake of calcium. (In fact, the delta approach could lead to prediction of negative intakes.)
- If usual intake exceeds the amount offered, changes in the amount offered are simply added to usual intakes.

Several assumptions are associated with the proportional approach. First, it assumes that the ratio of intake to the amount offered is the same

before and after the change in the WIC food package. Since many of the changes proposed are expected to increase the consumption of WIC foods, this assumption is not likely to hold. On the other hand, this assumption appears to be better than the assumption that any difference in what is offered leads to a difference in what is consumed, even for those who are not consuming much of what is offered in the first place. In addition, until usual intake data are available *after* the change in WIC food package, using information on current consumption patterns provides a reasonable starting point.

A second key assumption is that individuals who consume more of a nutrient than is currently offered in the WIC food package will change their consumption by the extent of change in the amount offered by the revised food package relative to the current package. This approach does not account for certain food purchasing and consumption practices. For example, if more of a food is offered in the revised package, a participant may decrease the amount of that food (or of another food) that is bought with her own money but eat the same amount of the food. Similarly, if the amount of an offered food is reduced, the participant may buy more of that food and eat a similar amount. In the absence of data *a priori* on what changes in intake will result from changes in the food package, the assumption that consumption will change by a proportion of the difference between the current and revised package is a starting assumption.

APPLICATION OF METHODS

The WIC food packages are intended to supplement the diet of specific groups of low-income women, infants, and children. The potential risks and benefits of this intervention can be evaluated in several ways. As detailed in this report, the committee examined how the current and revised packages correspond with the *Dietary Guidelines*. The committee also evaluated the degree of inadequacy or excess nutrient intake predicted to occur in the participant subpopulations with the current and revised packages. Other benefits of the revised packages, such as the increased variety of foods available and the incentives for breastfeeding, are not quantified. Reliable data were not available to assess intakes of *trans* fatty acids; however, the amount of *trans* fatty acids in the current and proposed food packages were estimated and are included in the Appendix C—*Nutrient Profiles*. The current and revised WIC food packages contain insignificant amounts of industrial *trans* fats—the source of *trans* fat deemed to be of concern by the Dietary Guidelines Advisory Committee (DHHS/USDA, 2004).

Nutrient Intake Profiles

Changing the mix of foods offered in the WIC food packages leads to complex changes in the nutrients available to WIC participants. Efforts to address specific priority nutrients are challenging because foods contain many different components.

The committee characterized the effect of revised food packages in two ways. First, the change in nutrient content of packages was calculated. This measure can be estimated quite well; the only important assumptions are the choices of foods when options are presented (see Chapter 4—*Revised Food Packages*) (See details in Appendix D—*Cost Calculations*.). Next, predicted changes in nutrient intake were developed. The values of the predicted percentage inadequate or of the predicted changes in mean intake of a nutrient are subject to considerable uncertainty because of lack of knowledge of the consumption patterns and practices that will occur. Nonetheless, this approach provides useful insight into the possible benefits and risks of changes in the packages.

The committee characterized changes in nutrients available in each package and estimated how these changes would influence predicted nutrient intake. Tables detailing changes in predicted intake of more than 30 micro- and macronutrients plus cholesterol and food energy for each of the current and revised WIC food packages are in Appendix C—*Nutrient Profiles*. Here in Appendix D the focus is on the specific food components identified as priorities in Chapter 2—*Nutrient and Food Priorities*—because of concern about either inadequate or excessive intakes. For priority nutrients with inadequate intakes for WIC subpopulations (e.g., calcium, vitamin E, fiber), Table D-1A presents current and predicted mean intakes, and current and predicted percentages with inadequate intakes, if applicable. Similar information is presented in Table D-1B for nutrients of concern with regard to excessive intake (e.g., sodium, preformed vitamin A, food energy), but this table shows current and predicted percentages with intakes greater than the Tolerable Upper Intake Level (UL) or Acceptable Macronutrient Distribution Range (AMDR). Comparisons for nutrients to limit in the diet (i.e., saturated fat and cholesterol) are shown in Table D-1C.

Formula-Fed Infants Younger Than One Year of Age

For formula-fed infants younger than one year of age, the committee identified nutrients of concern with regard to excessive intake, and the proposed changes to Food Packages I and II address these nutrients. The only nutrient with a change in intake in the non-desired direction is pre-

formed vitamin A in Food Package I; for this nutrient, the percentage of infants 4 through 5 months of age with intakes greater than the UL (600 mcg retinol/d) is predicted to increase by approximately 10 percentage points (Table D-1B). The committee increased the maximum allowance of formula for formula-fed infants in this age range to address their increased nutritional needs. The composition of formula makes it impossible to increase formula intake without increasing the intake of preformed vitamin A. In Food Package II-FF, for formula-fed infants ages 6 through 11 months, the percentage of the population above the UL for preformed vitamin A is predicted to decrease by 13.6 percentage points (Table D-1B).

Children 1 Year of Age

Children one year of age (12–23 mo of age), served by Food Package IV-A, are predicted to show improvement in almost all food components. The substantial increase in predicted intake of fiber (Table D-1A), decreases in the predicted percentage of the population with inadequate intake of vitamin E (Table D-1A), and the predicted reductions in intakes of sodium and food energy are all benefits of the revised food package (Table D-1B).

The only priority nutrients with predicted changes in the non-desired direction are potassium, with an estimated 8 percent decrease in mean intake (Table D-1A), and zinc, with an increase in the percentage of the population above the 7 mg UL (Table D-1B). The committee has minimal concern regarding excessive intake of zinc because of the basis for setting the UL (IOM, 2001). The method used to set the ULs for zinc resulted in relatively narrow margins between the UL and the Recommended Dietary Allowance (RDA); the ULs are approximately 2.4 times the RDAs for children (IOM, 2001). There has been no evidence of adverse effects from ingestion of zinc as naturally occurring in food (IOM, 2001; Brown et al., 2004a). However, zinc is used as a fortificant in some foods that are commonly consumed by children (e.g., breakfast cereal). Further study is needed of the contribution of the zinc in such food products to possible overconsumption of zinc.

Children 2 Through 4 Years of Age

The revised Food Package IV-B serves children 2 through 4 years of age. The revised food package has many predicted benefits including sharp increases in intake of vitamin E and fiber (Table D-1A) and reductions in the consumption of sodium, food energy, saturated fat, and cholesterol (Tables D-1B and D-1C). Two nutrients have predicted changes in intake in the non-desired direction; mean predicted intake of potassium decreases by

7 percent (Table D-1A) and the fraction of the population with predicted zinc intakes greater than the zinc UL increases (Table D-1B).

Adolescent and Adult Women

A major aim of the WIC program is supporting the nutrition of pregnant, lactating and non-breastfeeding postpartum women. Chapter 2—*Nutrient and Food Priorities*—and Appendix A—*Nutrient Intake of WIC Subgroups*—detail the many apparent nutrient intake inadequacies and excesses in these subpopulations. The committee proposed substantial revisions to Food Packages V through VII to address this situation.

Food Package V—Pregnant Women and Partially Breastfeeding Women—The revised Food Package V leads to decreases in the predicted percentages of the population with inadequate intake for most of the priority nutrients, with particularly large benefits for magnesium, vitamin E, vitamin B_6, and folate (Table D-1A). Other benefits include predicted increases in the intake of fiber and potassium (Table D-1A) and decreases in sodium, total fat, saturated fat, and cholesterol (Tables D-1B and D-1C). Two nutrients have changes in the non-desired direction; the predicted mean intake of calcium decreases slightly because of a reduction in the amount of milk and milk products in the package, and the predicted percentage of the population with inadequate intake of vitamin C increases by 11 percentage points (Table D-1A). The amount of calcium offered in the food package, however, exceeds the Adequate Intake (AI) for calcium.

Food Package VI—Non-Breastfeeding Postpartum Women—Other than a predicted decrease in calcium and a predicted increase in the percentage with inadequate vitamin C intake, the revised Food Package VI makes progress toward addressing the priority nutrients identified by the committee (Table D-1A). For example, there is a reduction in the percentage with inadequate intake of iron, magnesium, vitamin E, vitamin A, fiber, potassium, vitamin B_6 and folate (Table D-1A). Intake of sodium, food energy, total fat, saturated fat, and cholesterol all decrease, as intended (Tables D-1B and D-1C).

Food Package VII—Fully Breastfeeding Women—The revised Food Package VII is intended both to enhance maternal nutrition in support of breastfeeding and (combined with changes in other packages) to provide an incentive for breastfeeding. The package addresses very well the priority nutrients for this group, with increased predicted mean intakes of calcium,

potassium, and fiber, and predicted decreases in the percentages with inadequate intakes of iron, magnesium, vitamin E, vitamin B_6, and folate (Table D-1A). Again, intakes of sodium, food energy, total fat, saturated fat, and cholesterol are all predicted to decrease (Tables D-1B and D-1C). There is a small increase in the percentage of the population predicted to have an inadequate intake of vitamin A (Table D-1A). For vitamin C, the analysis predicts an increase in the percentage of the population with inadequate intake (Table D-1A).

CAVEATS AND OTHER POTENTIAL BENEFITS AND RISKS

Because of the uncertainties and assumptions associated with predicting the usual intake distributions that would result from changes in the WIC food package, the estimates of changes in the prevalence of inadequacy and in the risk of excessive intakes are uncertain. Although the quantitative predictions are uncertain, the direction of the change is likely to be robust. The committee urges that the quantitative results of the benefit and risk analysis be interpreted with caution.

In addition, given the importance of assessing the benefits and risks of the revised WIC food packages, the committee recommends that USDA conduct pilot studies and randomized, controlled trials to estimate the changes in the usual nutrient intake distribution and the resulting changes in the prevalence of inadequacy and excessive intakes (see Chapter 7—*Recommendations for Implementation and Evaluation*).

Non-Quantified Benefits and Risks

Among the benefits and risks that are not amenable to quantification are the following. The first two benefits listed and the first risk listed would affect the accuracy of the predictions of the prevalence of inadequate or excess nutrient intake presented in Tables D-1A and D-1B.

Benefits

- *Increased choice of foods, if adopted, may increase the consumption of WIC foods by the participants in whole or in part.* Participants who choose the additional options might consume all or consume somewhat more of the food in the package (possibly sharing the remainder with other household members). More food instruments may be redeemed, and less food may be discarded (or possibly given away). In these cases, the estimated prevalence of inadequacy may decrease and mean intakes of certain nutrients having an AI may increase more than predicted in Table D-1A.

• *Certain changes in food packages could have multiplier effects*. By reinforcing the *Dietary Guidelines*, the packages may help some participants make more healthful food selections with other food purchases.

• *Benefits could come from the increased variety of foods available and the incentives for breastfeeding in the revised packages*. For example, breastfeeding rates might increase.

Risks

• *Specific changes in allowed foods could lead to decreased consumption of certain WIC foods*. The change from whole milk to fat-reduced milks could lead to lower milk consumption, and the requirement that grain products be whole grain could lead to lower grain consumption—especially if nutrition education efforts are not implemented to decrease these possibilities. In this case, certain prevalences of inadequacy may increase and mean intakes of selected nutrients having an AI may increase.

• *Dietary changes could lead to undesirable nutrient-nutrient interactions*

–Increases in dietary fiber could possibly interfere with absorption of minerals. The analyses in this report did not adjust for mineral bioavailability. The intake analyses assumed the same average availabilities for minerals as were used in the development of the DRIs (18 percent for iron, 30 to 40 percent for zinc,[2] and 61 percent for calcium) (IOM, 1997, 2001). Because the diets of WIC participants generally are typical American diets, it seemed reasonable to use these average availabilities when evaluating intakes. It is the committee's hope that the revised packages will increase intakes of dietary fiber. Although this likely also will increase phytate intakes (from whole grains), the committee does not anticipate that this change will be large enough to substantially affect mineral bioavailability in the children's package (see Table B-2D in Appendix B—*Nutrient Profiles*). However, increases in some of the women's packages (up to an additional 400 mg of phytate per day) may reduce zinc availability (see Table B-2D).

–Increases in dietary oxalates could possibly interfere with the absorption of calcium. Unless participants consistently choose high-oxalate vegetables such as spinach, calcium availability should be unchanged.

[2]The fractional absorption for zinc used in the DRI reports was 0.4 for adults and 0.3 for preadolescent children (IOM, 2001).

SUMMARY

In summary, the revised food packages lead to improvements in nutritional adequacy in almost all cases under the assumptions used in these analyses. In addition, food components identified as priorities because of possible excess consumption are almost always reduced. The committee anticipates that the set of revised food packages will provide a clear net benefit to WIC participants.

The following is a list of tables presented in this appendix.

TABLE D-1A Comparison of Current and Revised Food Packages: Nutrients of Concern with Regard to Inadequate Intake

Participant Category and Priority Nutrient	EAR or AI*	Current Food Package, Usual Intake[a] Mean
Infants, 6–11.9 mo, breast-fed		
Food Package No.		*Current II*
Iron, mg/d	6.9	10.0
Zinc, mg/d	2.5	2.5
WIC Children, 1–1.9 y		
Food Package No.		*Current IV*
Iron, mg/d	3.0	11.9
Potassium, mg/d	3,000*	2,029
Vitamin E, mg ATE/d[c]	5.0	5.3
Fiber, g/d	19*	8.0
WIC Children, 2–4.9 y[d]		
Food Package No.		*Current IV*
Iron, mg/d	3.0 / 4.1	13.6
Potassium, mg/d	3,000* / 3,800*	2,211
Vitamin E, mg ATE/d[c]	5.0 / 6.0	6.0
Fiber, g/d	19* / 25*	10.9
Pregnant women and lactating women, 14–44 y[e]		
Food Package No.		*Current V*
Calcium, mg/d	1,000* – 1,300*	956
Iron, mg/d	6.5 – 23.0	16.5
Magnesium, mg/d	255 – 335	291
Potassium, mg/d	4,700* – 5,100*	2,909
Vitamin E, mg ATE/d[c]	12 / 16	8.3
Fiber, g/d	28* – 29*	17.7
Vitamin A, mcg RAE/d	530 – 900	902
Vitamin C, mg/d	66 – 100	134
Vitamin D, mcg/d	5.0*	N/A
Vitamin B_6, mg/d	1.6 – 1.7	2.0
Folate, mcg DFE/d)	450 – 520	570

Revised Food Package, Predicted Usual Intake[b]				Current Food Package[a]	Revised Food Package[b]
Mean	25th Percentile	Median	75th Percentile	%Inadequate	Predicted %Inadequate
Revised II-BF				*Current II*	*Revised II-BF*
10.9	5.5	9.5	14.7	39.5	34.0
4.0	2.5	3.9	5.2	60.3	25.4
Revised IV-A				*Current IV*	*Revised IV-A*
13.2	9.4	12.4	16.2	1.6	0.9
1,885	1,506	1,827	2,195	—	—
8.0	5.5	7.2	9.7	55.3	18.5
12.3	10.3	12.3	14.4	—	—
Revised IV-B				*Current IV*	*Revised IV-B*
15.0	11.9	14.6	17.6	0.4	0.1
2,078	1,651	2,022	2,438	—	—
8.7	6.4	8.1	10.5	47.0	11.4
15.4	12.9	15.1	17.6	—	—
Revised V				*Current V*	*Revised V*
934	721	902	1,113	—	—
19.3	15.6	18.5	22.2	7.5	3.4
349	292	341	398	49.4	20.3
3,052	2,548	3,005	3,506	—	—
14.3	11.2	14.4	16.9	94.4	43.6
25.6	21.0	24.8	29.2	—	—
1,041	741	987	1,277	31.2	20.2
119	63	97	154	32.7	43.5
—	—	—	—	—	—
2.4	1.9	2.3	2.8	34.0	11.9
633	469	606	761	41.5	29.2

continues

TABLE D-1A Continued

Participant Category and Priority Nutrient	EAR or AI*	Current Food Package, Usual Intake[a] Mean
Non-breastfeeding postpartum women, 14–44 y		
Food Package No.		*Current VI*
Calcium, mg/d	1,000* – 1,300*	668
Iron, mg/d	7.9 – 8.1	13.7
Magnesium, mg/d	255 – 300	213
Potassium, mg/d	4,700*	2,086
Vitamin E, mg ATE/d[c]	12	6.9
Fiber, g/d	25* – 26*	12.2
Vitamin A, mcg RAE/d	485 – 500	556
Vitamin C, mg/d	56 – 60	79
Vitamin D, mcg/d	5.0*	N/A
Vitamin B_6, mg/d	1.0 – 1.1	1.4
Folate, mcg DFE/d[c]	320 – 330	482
Lactating women, 14–44 y[e]		
Food Package No.	*Current VII*	*Revised VII*
Calcium, mg/d	1,000* – 1,300*	956
Iron, mg/d	6.5 – 7.0	16.5
Magnesium, mg/d	255 – 300	291
Potassium, mg/d	5,100*	2,909
Vitamin E, mg ATE/d[c]	16.0	8.3
Fiber, g/d	29*	17.7
Vitamin A, mcg RAE/d	885 – 900	902
Vitamin C, mg/d	96 – 100	134
Vitamin D, mcg/d	5.0*	N/A
Vitamin B_6, mg/d	1.7	2.0
Folate, mcg DFE/d[c]	450	570

See notes for Tables D-1A through D-1C following Table D-1C.

Revised Food Package, Predicted Usual Intake[b]				Current Food Package[a]	Revised Food Package[b]
Mean	25th Percentile	Median	75th Percentile	%Inadequate	Predicted %Inadequate
Revised VI	*Current VI*	*Revised VI*			
593	466	570	694	—	—
16.0	14.6	16.0	17.4	9.5	4.6
246	216	243	273	87.5	66.0
2,156	1,859	2,129	2,424	—	—
12.5	11.0	12.6	14.1	99.8	40.4
18.6	15.6	18.0	21.0	—	—
655	488	633	797	44.1	26.9
77	47	69	98	42.2	47.1
—	—	—	—	—	—
1.7	1.5	1.7	2.0	17.1	2.4
543	434	530	633	12.0	5.0
Current VII	*Revised VII*				
984	760	952	1,173	—	—
18.7	14.8	18.0	21.6	7.5	4.2
330	273	322	379	49.4	29.1
2,909	2,404	2,861	3,361	—	—
13.4	10.2	13.0	16.4	94.4	54.3
22.9	18.4	22.1	26.6	—	—
881	589	812	1,098	31.2	35.7
107	55	85	137	32.7	51.9
—	—	—	—	—	—
2.3	1.8	2.2	2.7	34.0	15.8
601	438	570	726	41.5	35.5

TABLE D-1B Comparison of Current and Revised Food Packages: Nutrients of Concern with Regard to Excessive Intake

Participant Category and Priority Nutrient	UL, Mean EER, or AMDR†	Current Food Package, Usual Intake[a] Mean
WIC Infants, 0–3.9 mo, formula-fed		
Food Package No.		*CurrentI*
Zinc, mg/d	4.0	6.1
Preformed vitamin A, mcg/d	600	581
Food energy, kcal/d	555[f]	673
WIC Infants, 4–5.9 mo, formula-fed		
Food Package No.		*Current II*
Zinc, mg/d	4.0	7.0
Preformed vitamin A, mcg/d	600	626
Food energy, kcal/d	623[f]	802
WIC Infants, 6–11.9 mo, formula-fed		
Food Package No.		*Current II*
Zinc, mg/d	5.0	7.2
Preformed vitamin A, mcg/d	600	618
Food energy, kcal/d	754[f]	992
WIC Children, 1–1.9 y		
Food Package No.		*Current IV*
Zinc, mg/d	7.0	7.8
Sodium, mg/d	1,500	1,816
Preformed vitamin A, mcg/d	600	495
Food energy, kcal/d	942[f]	1,288
WIC Children, 2–4.9 y[d]		
Food Package No.		*Current IV*
Zinc, mg/d	7.0 / 12.0	9.1
Sodium, mg/d	1,500 / 1,900	2,519
Preformed vitamin A, mcg/d	600 / 900	513
Food energy, kcal/d	1,282[f]	1,585
Pregnant women and lactating women, 14–44 y[e]		
Food Package No.		*Current V*
Sodium, mg/d	2,300	3,330
Food energy, kcal/d	2,465[f]	2,115
Total fat, g/d	na	76.7
Total fat, % of food energy	25–35†, <19 y 20–35†, ≥ 19 y`	32.3

Revised Food Package, Predicted Usual Intake[b]				Current Food Package[a]	Revised Food Package[b]
Mean	25th Percentile	Median	75th Percentile	%>UL or %>AMDR	Predicted %>UL or %>AMDR
Revised I-FF-A				*Current I*	*Revised I-FF-A*
6.1	4.6	5.8	7.2	86.0	86.0
581	445	547	677	38.3	38.3
673	523	635	778	—	—
Revised I-FF-B				*Current II*	*Revised I-FF-B*
6.1	4.9	5.9	7.1	96.8	91.5
666	573	660	752	56.3	68.0
721	602	704	820	—	—
Revised II-FF				*Current II*	*Revised II-FF*
6.2	4.9	6.0	7.4	87.6	72.3
530	358	470	644	42.7	29.5
877	705	853	1,021	—	—
Revised IV-A				*Current IV*	*Revised IV-A*
8.7	6.6	8.3	10.3	55.7	68.8
1,733	1,217	1,641	2,145	63.5	58.4
304	207	270	350	25.0	5.1
1,248	1,026	1,222	1,441	—	—
Revised IV-B				*Current IV*	*Revised IV-B*
10.3	8.3	10.0	11.9	58.1	72.6
2,440	1,949	2,363	2,851	92.8	90.1
405	291	358	449	16.1	7.2
1,460	1,188	1,429	1,697	—	—
Revised V				*Current V*	*Revised V*
3,241	2,850	3,218	3,606	97.2	95.8
2,082	1,762	2,054	2,372	—	—
68.8	56.6	67.7	79.9	—	—
27.2	24.6	27.1	29.6	24.5	1.4

continues

TABLE D-1B Continued

Participant Category and Priority Nutrient	UL, Mean EER, or AMDR†	Current Food Package, Usual Intake[a] Mean
Non-breastfeeding postpartum women, 14–44 y		
Food Package No.		*Current VI*
Sodium, mg/d	2,300	2,912
Food energy, kcal/d	2,163[f]	1,774
Total fat, g/d	na	66.1
Total fat, % of food energy	25–35†, <19 y 20–35†, ≥ 19 y	33.1
Lactating women, 14–44 y[e]		
Food Package No.		*Current VII*
Sodium, mg/d	2,300	3,330
Food energy, kcal/d	2,465[f]	2,115
Total fat, g/d	na	76.7
Total fat, % of food energy	25–35†, <19 y 20–35†, ≥ 19 y	32.3

See notes for Tables D-1A through D-1C following Table D-1C.

Revised Food Package, Predicted Usual Intake[b]				Current Food Package[a]	Revised Food Package[b]
Mean	25th Percentile	Median	75th Percentile	%>UL or %>AMDR	Predicted %>UL or %>AMDR
Revised VI				*Current VI*	*Revised VI*
2,646	2,319	2,623	2,948	90.7	76.4
1,674	1,442	1,654	1,885	—	—
57.4	51.4	57.0	62.9	—	—
24.6	23.8	24.6	25.4	4.9	<0.1
Revised VII				*Current VII*	*Revised VII*
3,267	2,877	3,245	3,633	97.2	96.3
2,037	1,717	2,009	2,327	—	—
67.4	55.1	66.3	78.4	—	—
27.6	25.3	27.5	29.8	24.5	1.6

TABLE D-1C Comparison of Current and Revised Food Packages: Nutrients of Concern to Limit in the Diet

Participant Category and Priority Nutrient	Dietary Guidance	Current Food Package, Usual Intake[a] Mean
WIC Children, 2–4.9 y		
Food Package No.		*Current IV*
Saturated fat, g/d	na	22.2
Saturated fat, % of food energy	<10	12.5
Cholesterol, mg/d	<300	216
Pregnant women and lactating women, 14–44 y[e]		
Food Package No.		*Current V*
Saturated fat, g/d	na	27.5
Saturated fat, % of food energy	<10	11.7
Cholesterol, mg/d	<300	271
Non-breastfeeding postpartum women, 14–44 y		
Food Package No.		*Current VI*
Saturated fat, g/d	na	22.9
Saturated fat, % of food energy	<10	11.3
Cholesterol, mg/d	<300	219
Lactating women, 14–44 y[e]		
Food Package No.		*Current VII*
Saturated fat, g/d	na	27.5
Saturated fat, % of food energy	<10	11.7
Cholesterol, mg/d	<300	271

NOTES FOR TABLES D-1A THROUGH D-1C: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); AMDR = Acceptable Macronutrient Distribution Range, indicated by a dagger (†); AT = α(alpha)-tocopherol; ATE = α(alpha)-tocopherol equivalents; DFE = dietary folate equivalents; EAR = Estimated Average Requirement, used when available; EER = Estimated Energy Requirement; kcal = kilocalories; na = not applicable; N/A = not available, intake data were not available for vitamin D; RAE = retinol activity equivalents; UL = Tolerable Upper Intake Level; %Inadequate = percentage with inadequate intakes as estimated from percentage with usual intake less than EAR; %>AMDR = percentage with usual intake greater than AMDR; %>UL = percentage with usual intake greater than UL.

[a]Observed usual intakes were calculated using 1994–1996 and 1998 CSFII data.

[b]Mean intakes were predicted from the observed mean intakes by adding the difference between the current food package and the revised food package as appropriate for the individual's age and life stage, using the proportional method described in the text.

[c]For discussion of important issues regarding differences between the Dietary Reference Intake (DRI) and dietary intake data in the units used for vitamin E and folate, please see the section *Data Set—Nutrients Examined* in Appendix A—*Nutrient Intake of WIC Subgroups*.

Revised Food Package, Predicted Usual Intake[b]				Current Food Package[a]	Revised Food Package[b]
Mean	25th Percentile	Median	75th Percentile	% Following Dietary Guidance	Predicted % Following Dietary Guidance
Revised IV-B				*Current IV*	*Revised IV-B*
14.7	10.3	14.1	18.4	—	—
6.8	6.0	6.7	7.4	9.0	99.0
93	67	84	104	87.8	99.6
Revised V				*Current V*	*Revised V*
20.4	15.4	19.9	24.8	—	—
6.4	5.7	6.4	7.1	19.1	99.8
127	86	107	152	67.6	97.5
Revised VI				*Current VI*	*Revised VI*
15.8	12.4	15.5	18.9	—	—
6.0	5.7	6.0	6.3	3.8	>99.9
89	71	84	100	92.0	>99.9
Revised VII				*Current VII*	*Revised VII*
20.6	15.6	20.0	25.0	—	—
8.0	7.1	7.9	8.8	19.1	94.2
207	156	193	242	67.6	88.9

[d]Values are for children ages 2–3.9 y and children age 4 y, respectively.

[e]Because of sample size limitations, the analysis sample combined all pregnant women and all lactating women. Thus, the current mean intakes and current prevalence values (i.e., %Inadequate; %>AMDR; %>UL) are identical for any categories containing pregnant women or lactating women (i.e., recipients of current Food Packages V and VII).

[f]Mean EER (kcal/d) (Table D-1B) was calculated based on CSFII data (FSRG, 2000) using the method described in the DRI report (IOM, 2002/2005). For additional detail, see Appendix C—*Nutrient Intakes of WIC Subgroups*.

DATA SOURCES: Intake data are from 1994–1996 and 1998 Continuing Survey of Food Intake by Individuals (CSFII) (FSRG, 2000). EARs, AIs, ULs, and AMDRs are from the DRI reports (IOM, 1997, 1998, 2000b, 2001, 2002/2005, 2005a). Dietary guidance in Table D-1C is from the American Heart Association (AHA, 2004) and the *Dietary Guidelines for Americans 2005* (DHHS/USDA, 2005).

E

Cost Calculations

For the cost analyses presented in this report, the committee conducted detailed analyses of nationally representative pricing data for foods in the current and revised WIC food packages. The details, not presented in body of the report, are presented in this appendix.

A large part of the methodology for cost calculations involves the assumptions necessary for the analyses. Tables E-1 and E-2 show a side-by-side comparison of the assumptions used for the nutrient analyses and the cost analyses. Table E-3 is an easy reference guide of the costs used in the cost calculations. Details of the calculations used for program costs of the current and revised food packages are presented in Tables E-4 and E-5. These tables can be found at the end of this appendix.

List of tables:

- **Table E-5** Estimated Program Costs for Food per Month Using Revised Packages (2002), 352

In addition to the assumptions listed in Tables E-1 and E-2, several assumptions were used to distribute mother/infant pairs by the feeding method used. These are described as follows.

Assumptions on Infant Feeding in the WIC Program

A recent survey by the CDC on breastfeeding practices showed that among women participating in the WIC program, at 3 months postpartum 64 percent of mothers report breastfeeding in any amount with 36 percent reporting breastfeeding exclusively (CDC, 2004b). Based on these estimates, 28 percent (64 percent minus 36 percent) were partially breastfeeding at 3 months postpartum. The same survey indicated that at 6 months postpartum, 28 percent of mothers were breastfeeding in any amount with 11 percent exclusively breastfeeding (CDC, 2004b). Based on these estimates, 17 percent (28 percent minus 11 percent) were partially breastfeeding at 6 months postpartum. From these estimates (partial breastfeeding rates of 28 percent at 3 months and 17 percent at 6 months), a partially breastfed rate of 20 percent for infants ages 4 through 5 months of age was extrapolated.

For older infants, survey estimates of reported breastfeeding rates at 6 months (29 percent) and 12 months (14 percent) were used to extrapolate a rate of 21 percent breast-fed infants for the 6 through 11 month period (CDC, 2004b). The 21 percent of mothers who breast-fed infants were either fully or partially breastfeeding; the committee distributed them as 5 percent fully breastfeeding and 16 percent partially breastfeeding based on 2002 data from the Feeding Infants and Toddlers Study (Briefel et al., 2004a).

For the program cost analyses, breastfeeding rates were assumed to remain the same for both the current and revised food packages. Therefore, the following assumptions were used for the calculations:

- *Infants Ages 0 Through 3 Months*—36 percent fully breast-fed; 28 percent partially breast-fed (that is, 64 percent "ever breast-fed"); 36 percent fully formula-fed;
- *Infants Ages 4 and 5 Months*—11 percent fully breast-fed; 20 percent partially breast-fed (that is, 31 percent "ever breast-fed"); 69 percent fully formula-fed; and
- *Infants Ages 6 Through 11 Months*—5 percent fully breast-fed; 16 percent partially breast-fed (that is, 21 percent "ever breast-fed"); 79 percent fully formula-fed.

These percentages are estimates of what package use might be for the revised packages.

An additional term, *exclusively breast-fed*, is used among lactation professionals. That term, when used in the WIC program, does not necessarily mean that an infant is only receiving breast milk; it means, in this context, that an infant does not receive formula from the WIC program. Under the current system, exclusively breast-fed infants can receive cereal and juice, as early as four months of age. Therefore, they may not truly be *exclusively breast-fed*, as a lactation expert might define them.

Assumptions on Feeding Method for Women in the WIC Program

According to data from *WIC Participant and Program Characteristics: PC2002*, approximately 24 percent of all WIC participants are women (Kresge, 2003; Bartlett et al., 2003). Among these women, 45 percent are pregnant, 24 percent are breastfeeding, and 31 percent are non-breastfeeding postpartum women. The percentage of WIC women who were fully breastfeeding was not included in that report (Kresge, 2003; Bartlett et al., 2003).

Based on the distribution of infants by age (Kresge, 2003; Bartlett et al., 2003) and the assumptions on feeding method for infants, it was estimated that of the total infants participating in the WIC program that are breast-fed (in the WIC program sense), 45 percent are partially breast-fed and 55 percent are fully breast-fed. Breastfeeding women were distributed by the same percentage.[1] Thus, for women, estimates of 13 percent fully breastfeeding and 11 percent partially breastfeeding were used; that is, the calculations of program costs assumed a total of 24 percent of women participating in the WIC program were breastfeeding as cited by Kresge (2003) and Bartlett et al. (2003).

Possible Shifts in Participation Rates

In order to evaluate the sensitivity of the estimated program costs for food with the revised packages (Tables 5-3 and E-5) to changes in participation rates among the infant and women categories, the committee simulated

[1]In fact, the number of breast-fed infants reported participating in the WIC program is greater than the number of breastfeeding women reported: 678,560 versus 458,131 (Kresge, 2003). By applying the ratio of partially versus fully breast-fed infants to breastfeeding women, the committee assumed that the participation by women regarding partial versus exclusive breastfeeding is the same proportion as for infants.

costs with some shifting in categories. One such evaluation assumed the following:

- For infants age 0 through 3.9 months, there would be a 20 percent shift in infants from fully formula-fed to fully breast-fed;
- For infants age 1 through 3.9 months, there would be a 30 percent shift from partially breast-fed to fully breast-fed;
- For infants age 4 through 5.9 months, there would be a 10 percent shift from fully formula-fed to partially breast-fed, and a 30 percent shift from partially breast-fed to fully breast-fed; and
- For infants age 6 through 11.9 months, there would be an 8 percent shift from fully formula-fed to partially breast-fed, and a 30 percent shift from partially breast-fed to fully breast-fed.

The shifts in the infant categories were accompanied by the appropriate shift in the mother's classification. The result of these shifts was to decrease the average food package cost per participant from $34.57 to $33.93 per month for the revised packages.

TABLE E-1 Bases of Assumptions Used in Nutrient and Cost Analyses of Food Packages for Infants

	Assumption used in
Food[a]	Nutrient Analyses[b]
Formula	*Current and Revised Packages I and II*
	Milk-based formula (versus soy-based formula)
	Weighted mean of: Enfamil with Iron (Mead Johnson), 67.8%; Similac with Iron (Ross/ Abbott), 27.2%; and Good Start (Carnation/Nestlé), 5.0%
Juice	*Current Package II*
	Apple juice (vitamin C-rich)
Baby food, fruits	*Revised Package II* Fruit(s) as the only major ingredient(s)[d]
	Junior (stage 2), 4–8 oz/d
	Equal weighting of: Applesauce; Peaches; and Pears

Cost Analyses[a,c]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Container sizes: na, used cost per fl oz data		**Oliveira et al., 2001**
	Representative of market share	Oliveira et al., 2001
	Market share within WIC program, 2001	Oliveira et al., 2001
Cost per fl oz data		Oliveira et al., 2001
Equal weighting of: Frozen concentrate, 6–12 fl oz container: Shelf-stable, 32–48 fl oz container; and	Representative of likely participant choices and state agency restrictions	**ACNielsen Homescan, 2001**
Same as for nutrient analyses	Representative of likely participant choices	Assumption based on age of participants
Same as for nutrient analyses	Nutritional and developmental appropriateness	AAP, 2004
	Representative of nutritional content	Assumption for analyses
Weighted mean (for total of 6 mo) of: • **Strained (stage 1) for 1 mo, 2.5 oz container;** • **Junior (stage 2) for 2 mo, 4 oz container; and** • **Advanced (stage 3) for 3 mo, 6 oz container**	Representative of developmental stages and nutritional needs	**ACNielsen Homescan, 2001** Manufacturer labeling and websites, 2004
Fresh banana substituted at a rate of 1 medium banana per 4 oz container for the maximum allowed (for 16 oz of baby food fruits). Assumed equivalence of 4 bananas for 2 pounds of fresh bananas.	Representative of likely participant choices	Assumption for analyses **ERS, 2004b** FNS, 1984b
Weighting of other choices assumed not relevant to pricing		Reflects all available data

continues

TABLE E-1 Continued

Food[a]	Assumption used in Nutrient Analyses[b]
Baby food, vegetables	*Revised Package II* Vegetable(s) as the only major ingredient(s)[e] Junior (stage 2), 4–8 oz/d Equal weighting of: Carrots; Green beans; and Squash, assumed to be winter squash
Cereal, baby	*Current and Revised Package II* Grain(s) as the only major ingredient(s)[f] Rice cereal, dry

Cost Analyses[a,c]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	Nutritional and developmental appropriateness	AAP, 2004
	Representative of nutritional content	Assumption for analyses
Weighted mean (for total of 6 mo) of: **• Strained (stage 1) for 1 mo, 2.5 oz container;** **• Junior (stage 2) for 2 mo, 4 oz container; and** **• Advanced (stage 3) for 3 mo, 6 oz container**	Representative of developmental stages and nutritional needs	**ACNielsen Homescan, 2001** Manufacturer labeling and websites, 2004
	Representative of likely participant choices	Assumption for analyses
Weighting of choices assumed not relevant to pricing		Reflects all available data
Container sizes: 8–16 oz		**ACNielsen Homescan, 2001**
Same as for nutrient analyses	Nutritional and developmental appropriateness	AAP, 2004
	Representative of likely participant choices	Assumption for analyses
Dry baby cereal, all types[c,f]	Representative of market share	ACNielsen Homescan, 2001
	Weighting assumed not relevant to pricing	Reflects all available data

continues

TABLE E-1 Continued

Food[a]	Assumption used in Nutrient Analyses[b]
Baby food, meats	*Revised Package II-BF* Meat as the only major ingredient(s)[g]
	Strained (stage 1), 2.5 oz/d
	Equal weighting of: Beef; Chicken; and Lamb

[a]For clarity, the food, container sizes, and source of pricing data are indicated in bold.

[b]The nutrient analyses referred to in this table use Nutrition Data System for Research (NDS-R) software version 5.0/35 (2004) developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (Schakel et al., 1988, 1997; Schakel, 2001). A second set of nutrient analyses using the USDA Nutrient Database for Standard Reference, Release 17 (SR-17) (NDL, 2004) is presented in Tables B-3A through B-3D, Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

[c]Organic baby foods were omitted from the cost analyses.

[d]Strained fruit prepared for infants without added sugars, starches, or salt. Mixtures of fruits are allowed for older infants. Texture may range from pureed through diced.

[e]Strained vegetable prepared for infants without added sugars, starches, or salt. Mixtures of vegetables are allowed for older infants. Texture may range from pureed through diced.

[f]Grain cereal products prepared for infants without added sugars, salt, or "formula ingredients" (e.g., nonfat dry milk). Mixtures of grains are allowed for older infants.

Cost Analyses[a,c]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	Nutritional and developmental appropriateness	AAP, 2004
	Representative of nutritional content	Reflects available data
Weighted mean (for total of 6 mo) of: • **Strained (stage 1) for 2 mo, 2.5–3 oz container;** and • **Junior (stage 2) for 4 mo, 2.5–3 oz container**	Representative of nutritional and developmental needs; reflects available data	**ACNielsen Homescan, 2001**
	Representative of likely participant choices	Assumption for analyses
Weighting of choices assumed not relevant to pricing		Reflects all available data

[g]Strained meat prepared for infants without added starches, vegetables, or salt. Broth (unsalted; that is, without added sodium) may be an ingredient. Texture may range from pureed through diced.

NOTES : na = not applicable. The medical formulas required by infants with special dietary needs were omitted from this table. For additional detail on food specifications, see Table B-1, Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

DATA SOURCES: Price data and other information were obtained from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data), and ACNielsen Homescan (ACNielsen, 2001, 2001 price data obtained through ERS, USDA). Additional information was obtained from the American Academy of Pediatrics (AAP, 2004), USDA (FNS, 1984b), and manufacturer labeling and websites (Abbott Laboratories Online, 2004; Mead Johnson, 2004; Nestlé, 2005).

TABLE E-2 Bases of Assumptions Used in Nutrient and Cost Analyses of Food Packages for Children and Women

Food[a]	Assumption used in Nutrient Analyses[b,c]
Fruits and Vegetables	
Juice	*Current and Revised Packages* Equal weighting of: Apple juice; and Orange juice
Apple juice	*Current and Revised Packages* Reconstituted from frozen
	Vitamin C-rich
Orange juice	*Current and Revised Packages* Reconstituted from frozen
	Not fortified
Fruits	
Fruits, fresh	*Revised Packages*
	Equal weighting of: Apples; Oranges; and Bananas

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses
	Representative of nutritional content	Assumption for analyses
Equal weighting of: Frozen concentrate, 6–12 fl oz container; and Canned, 32–48 fl oz container	Representative of likely participant choices within state agency restrictions	**ACNielsen Homescan, 2001**
Same as for nutrient analyses		Assumption for analyses
	Representative of nutritional content	Assumption for analyses
Weighted mean of: Frozen concentrate, 6–12 fl oz container, 75%; and Canned, 36–46 fl oz container, 25%	Market share within likely state agency restrictions	**ACNielsen Homescan, 2001**
Not fortified or assumed not fortified from available data	Representative of likely state agency restrictions	Assumption for analyses
Container sizes: na, used cost per pound data		**ERS, 2004b** Assumptions for some types of analyses were based on data from a standard reference: FNS, 1984a, 1984b
Same as for nutrient analyses	Representative of consumer purchases and consumption data	Assumptions for analyses were based on data from various sources: Krebs-Smith et al., 1997; Putnam and Allshouse,

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
Fruits, canned	*Revised Packages*
	Juice pack or unsweetened
	Not drained (i.e., packing liquid utilized)
	Equal weighting of: Applesauce; Peaches; and Pineapple
Vegetables	
Vegetables, fresh	*Current and Revised Packages*
	Current Package VII Carrots

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
		1999; Smiciklas-Wright et al., 2002; Cotton et al., 2004; Reed et al., 2004
Container sizes: na, used cost per pound data	Nominal container size of 15 oz used in some types of analyses	**ERS, 2004b** Assumptions for some types of analyses were based on data from a standard reference: FNS, 1984a, 1984b
Same as for nutrient analyses	Representative of likely participant choices (i.e., participants are likely to choose juice pack rather than water pack)	Assumption for analyses
na	Representative of likely participant practices	Assumption for analyses
Same as for nutrient analyses	Representative of consumer purchases and consumption data	Assumptions for analyses were based on data from several sources: Krebs-Smith et al., 1997; Putnam and Allshouse, 1999; Smiciklas-Wright et al., 2002; Cotton et al., 2004; Reed et al., 2004
Container sizes: na, used cost per pound data		**ERS, 2004b** Assumptions for some types of analyses were based on data from a standard reference: FNS, 1984a, 1984b
Same as for nutrient analyses	Representative of likely participant choices (i.e., participants are likely to choose fresh carrots rather than canned)	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
	Revised Packages Equal weighting of: Carrots; Tomatoes; and Green beans
Vegetables, canned	*Revised Packages*
	Regular[d]
	Drained
	Equal weighting of: Carrots; Tomatoes; and Green beans
Milk and Alternatives	
Milk	*Current and Revised Packages*
	Weighted mean of: Maximum allowance as milk, 50% (see †); and Milk with maximum of cheese, yogurt, and tofu allowed as substitutes for milk, 50% (see †) *Current Packages* Equal weighting of: Whole, 3.5–4% milk fat; Reduced-fat, 2% milk fat; Low-fat, 1% milk fat; and Nonfat, Skim

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	Representative of consumer purchases and consumption data	Assumptions for analyses were based on data from several sources: Krebs-Smith et al., 1997; Putnam and Allshouse, 1999; Smiciklas-Wright et al., 2002; Cotton et al., 2004; Reed et al., 2004
Container sizes: na, used cost per pound data	Nominal container size of 14.5 oz used in some types of analyses	**ERS, 2004b** Assumptions for some types of analyses were based on data from a standard reference: FNS, 1984a, 1984b
Same as for nutrient analyses	Representative of likely state agency restrictions	Assumption for analyses
na	Representative of likely participant practices	Assumption for analyses
Same as for nutrient analyses	Representative of consumer purchases and consumption data	Assumptions for analyses were based on data from several sources: Krebs-Smith et al., 1997; Putnam and Allshouse, 1999; Smiciklas-Wright et al., 2002; Cotton et al., 2004; Reed et al., 2004
Container size weighting: Gallon, 75%; and Half gallon, 25%		**ACNielsen Homescan, 2001**
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
	Revised Packages Whole milk (3.5–4% milk fat) only for 1-y-old children
	2 y and above, equal weighting of: Reduced-fat, 2% milk fat; Low-fat, 1% milk fat; and Nonfat, Skim Plain[f]
	Revised Packages for Women †Weighted mean of: Milk, 90%; and Soy beverage, 10%
Cheese	*Current and Revised Packages*
	Equal weighting of: American cheese, process;[e] Cheddar cheese, natural; Monterey Jack cheese, natural; and Mozzarella cheese, part skim milk
Yogurt	*Revised Packages*
	Women, equal weighting of: Low-fat, 1% milk fat; and Nonfat Children, low-fat (1% milk fat) only
	Equal weighting of: Plain;[f] and Vanilla
Soy beverage ("soy milk")	*Revised Packages for Women* Ready-to-drink, regular,[g] calcium-rich ("fortified")

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	AAP recommendation	AAP, 2004
Same as for nutrient analyses	AHA recommendations Representative of likely participant choices	AHA, 2004 Assumption for analyses
Same as for nutrient analyses	Representative of likely national and state agency restrictions	Assumption for analyses
Same as for nutrient analyses	Representative of likely participant choices	Wenrich and Cason, 2004
Container size: 16 oz		**ACNielsen Homescan, 2001**
Market purchase weighting of: American Cheddar cheese, natural; and Mozzarella cheese	Representative of likely participant choices within available data specifications for market share	ACNielsen Homescan, 2001
Container sizes: 16–32 oz		**ACNielsen Homescan, 2001**
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses
Children, equal weighting of: Low-fat, 1% milk fat; and Nonfat	Minimal effect of weighting on pricing—calculated same as for women	ACNielsen Homescan, 2001
Same as for nutrient analyses	Representative of likely participant choices within allowed substitutions	Assumption for analyses
Container sizes: 32–64 fl oz		**ACNielsen Homescan, 2001**
Equal weighting of: Refrigerated, assumed to be calcium-rich ("fortified"); and	Representative of likely participant choices	Assumption for analyses ACNielsen Homescan, 2001

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
	Plain[f]
Tofu	*Revised Packages for Women*
	Calcium salts used in processing
Grains	
Cereal	*Current and Revised Packages* Weighted mean of: Ready-to-eat cereal, 90%; and Hot cereal, 10%
Cereal, ready-to-eat	*Current and Revised Packages*
	Current Packages Equal weighting of: Cheerios (General Mills); Corn flakes; Kix (General Mills); Mini-Wheats, Frosted Bite Size (Kellogg's); and Total Whole Grain (General Mills)
	Revised Packages Equal weighting of: Cheerios (General Mills); Mini-Wheats, Frosted Bite Size (Kellogg's); and Total Whole Grain (General Mills)

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Shelf-stable, assumed to be calcium-rich	For soy beverage purchases, data were not available on addition of calcium in shelf-stable products.	ACNielsen Homescan, 2001
	Representative of likely national and state agency restrictions	Assumption for analyses
Container sizes: 12–16 oz		**ACNielsen Homescan, 2001**
	Negligible contribution to calcium intake unless calcium salts are used in processing	Manufacturer labeling, 2004
Tofu was assumed to be processed with calcium salts.	For tofu purchases, data were not available regarding whether calcium salts were used in processing.	ACNielsen Homescan, 2001
Same as for nutrient analyses	Representative of market share	ACNielsen Homescan, 2001
Container sizes: 12–36 oz		**ACNielsen Homescan, 2001**
Equal weighting of: Cheerios (General Mills); Corn Flakes (Kellogg's); Kix (General Mills); Mini-Wheats, Frosted Bite Size (Kellogg's); and Total Whole Grain (General Mills)	Representative of likely participant choices within likely state agency restrictions	Assumption for analyses
Same as for nutrient analyses	Whole grain only	Manufacturer labeling, 2004
	Representative of likely participant choices within likely state agency restrictions	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
Cereal, hot	*Current and Revised Packages* Regular salt option for preparation *Current Packages* Equal weighting of: Cream of wheat, regular-cooking; and Oatmeal, instant-cooking, iron-fortified *Revised Packages* Oatmeal, instant-cooking, iron-fortified
Whole grains	*Revised Packages* Equal weighting of: Whole wheat bread; and Brown rice
Whole wheat bread	*Revised Packages*
Brown rice	*Revised Packages* Cooked in salted water

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Container sizes: 10–28 oz		**ACNielsen Homescan, 2001**
na	Representative of likely participant practices	Assumption for analyses
Equal weighting of: Cream of Wheat (Nabisco) (14–28 oz container)	Representative of likely participant choices	Assumption for analyses
Oatmeal, instant-cooking, assumed to be iron-fortified (10–18 oz outer container)	For instant-cooking oatmeal purchases, data were not available on iron-fortification.	Assumption for analyses
Oatmeal, instant-cooking, assumed to be iron-fortified (10–18 oz outer container)	Whole grain only For instant-cooking oatmeal purchases, data were not available on iron-fortification.	Manufacturer labeling, 2004 ACNielsen Homescan, 2001
Same as for nutrient analyses		Assumption for analyses
Container size: 16 oz		**ACNielsen Homescan, 2001**
Container sizes: 9.5–16 oz		**ACNielsen Homescan, 2001**
Market purchase weighting of: Regular-cooking; Parboiled; and Instant-cooking	Market share	Assumption for analyses
Omit basmati rice	Representative of likely state agency restrictions	Assumption for analyses
na	Representative of likely participant practices	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
Meat and Alternatives	
Eggs	*Current and Revised Packages*
	Whole, fresh eggs
Fish, canned	*Revised Package VII* Weighted mean of: Canned tuna, 80% Canned salmon, 20%
Tuna	*Current and Revised Package VII*
	Equal weighting of: Water pack, regular[b] Oil pack, regular[b]
	Drained
Salmon	*Revised Package VII*
	Salmon, regular[d]
	Drained
Beans, dry (legumes)	*Current Packages* Dried beans only (i.e., no canned beans)
	Revised Packages Equal weighting of: Dried beans, 1 lb; and Canned beans, 4 15–16-oz cans
Beans, dried	*Current and Revised Packages*
	Equal weighting of: Black beans; Garbanzo beans (chickpeas); Kidney beans;

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Container size: 1 doz		**BLS, 2004a**
Same as for nutrient analyses	Representative of market share	ACNielsen Homescan, 2001
Same as for nutrient analyses	Representative of market share	ACNielsen Homescan, 2001
Container sizes: 6 oz or less		**ACNielsen Homescan, 2001**
	Representative of likely participant choices	Assumption for analyses
Market purchase weighting of: Water pack, regular;[b] and Oil pack, regular[b]	Market share	ACNielsen Homescan, 2001
na	Representative of likely participant practices	Assumption for analyses
Container sizes: 14–16 oz		**ACNielsen Homescan, 2001**
Pink salmon	Representative of market share	Assumption for analyses
na	Representative of likely participant practices	Assumption for analyses
Same as for nutrient analyses	Current restrictions	Assumption for analyses
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses
Container size: 16 oz		**ACNielsen Homescan, 2001**
	Representative of likely participant choices	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
	Northern beans; Pinto beans; and Lentils
Beans, canned	*Revised Packages*
	Equal weighting of: Black beans; Garbanzo beans (chickpeas); Kidney beans; and Northern beans
	Regular[d]
	Plain[i]
Peanut butter	*Current and Revised Packages*
	Regular[d]

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Market purchase weighting of: Black beans; Garbanzo beans (chickpeas); Kidney beans; Northern beans; and Pinto beans	Market share within available data specifications	ACNielsen Homescan, 2001
Container sizes: 15–16 oz		**ACNielsen Homescan, 2001**
	Representative of likely participant choices	Assumption for analyses
Market purchase weighting of: Black beans; Garbanzo beans (chickpeas); Kidney beans; and Northern beans	Market share	ACNielsen Homescan, 2001
	Representative of likely state agency restrictions in most cases	Assumption for analyses
Pack assumed to be regular[d]	Data were not available on type of pack.	ACNielsen Homescan, 2001
	Representative of likely state agency restrictions in most cases	Assumption for analyses
Pack assumed to be plain[i]	Data were not available on flavorings.	ACNielsen Homescan, 2001
Container size: 18 oz		**ACNielsen Homescan, 2001**
Type not specified	Representative of likely participant choices	Assumption for analyses

continues

TABLE E-2 Continued

Food[a]	Assumption used in Nutrient Analyses[b,c]
Peanut butter *or* **Beans (legumes)**	*Current Packages* Equal weighting of: Peanut butter (18 oz); and Dried beans (16 oz) *Revised Packages* Weighted mean of: Peanut butter, 50% (18 oz); Dried beans, 25% (16 oz); and Canned beans, 25% (4 cans)

[a]For clarity, the food, container sizes, and source of pricing data are indicated in bold.

[b]The nutrient analyses referred to in this table use Nutrition Data System for Research software version 5.0/35 (2004) developed by the Nutrition Coordinating Center (NCC), University of Minnesota, Minneapolis, MN (Schakel et al., 1988, 1997; Schakel, 2001). A second set of nutrient analyses using the USDA Nutrient Data Laboratory Standard Reference 17 (SR-17) (NDL, 2004) is presented in Tables B-3A through B-3D, Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

[c]All foods for nutrient analyses were chosen with no added salt and no added fat cooking preparation options unless otherwise noted in the table.

[d]"Regular" in this instance means "regular pack" or "regular pack with salt added in processing." In some cases this assumption was made as representative of likely participant choices (e.g., salted peanut butter is a likely participant choice rather than unsalted peanut butter). In other cases this assumption was made as representative of likely state agency restrictions (e.g., salted canned vegetables are likely state agency restrictions if unsalted canned vegetables are more costly).

[e]American cheese can be processed with or without a sodium salt (e.g., disodium phosphate) (Nutrition Data, 2004). The American cheese used in these analyses appears to be processed with disodium phosphate resulting in a sodium content twice that of the other cheeses used in the nutrient analyses. Even greater differences in sodium content have been reported (Nutrition Data, 2004).

Cost Analyses[a]	Type of Data Considered as Basis of Assumption	Source of Data[a]
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses
Same as for nutrient analyses	Representative of likely participant choices	Assumption for analyses

f"Plain" in this instance means not flavored because flavored products customarily have added sugars.

g"Regular" in this instance means not a reduced calorie product.

h"Regular" in this instance means regular pack with salt added in processing but no fat or oil added in processing.

i"Plain" in this instance means not flavored because flavored products customarily have added sugars and salt.

NOTES FOR TABLE E-2: na = not applicable. The medical foods required by children and women with special dietary needs were omitted from this table. For additional detail on food specifications, see Table B-2, Appendix B—*Nutrient Profiles of Current and Revised Food Packages*.

DATA SOURCES: Price data and other information were obtained from Economic Research Service, USDA (ERS, 2004b, 1999 price data); ACNielsen Homescan (ACNielsen , 2001, price data for 2001 obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a, equal weight for monthly 2002 price data). Additional information was obtained from American Academy of Pediatrics (AAP, 2004), American Heart Associations (AHA, 2004), Food and Nutrition Service (FNS, 1984a, 1984b), manufacturer labeling, and published resources (Krebs-Smith et al., 1997; Putnam and Allshouse, 1999; Smiciklas-Wright et al., 2002; Cotton et al., 2004; Reed et al., 2004; Wenrich and Cason, 2004).

TABLE E-3A Calculated Costs of Representative Amounts of Foods in Revised Packages for Infants (2002)[a]

Food Item	Unit	Approximate Cost per Unit ($)
Food Package I-FF-A		
Infant formula, liquid concentrate	fl oz concentrate	0.23
Post-rebate		
Food Package I-FF-B		
Infant formula, liquid concentrate	fl oz concentrate	0.23
Post-rebate		
Food Package I-BF/FF-A		
Infant formula, powder	fl oz reconstituted	~0.10
Food Package I-BF/FF-B		
Infant formula, powder	fl oz reconstituted	0.23
Post-rebate		
Food Package II-FF		
Infant formula, liquid concentrate	fl oz concentrate	0.23
Post-rebate		
Infant cereal	oz	0.20
Baby food fruits and vegetables [b,c]	oz	0.12
Fresh bananas [b,c]	lb	0.51
Total		
Food Package II-BF/FF		
Infant formula, liquid concentrate	fl oz concentrate	0.23
Post-rebate		
Infant cereal	oz	0.20
Baby food fruits and vegetables [b,c]	oz	0.12
Fresh bananas [b,c]	lb	0.51
Total		
Food Package II-BF		
Infant cereal	oz	0.20
Baby food fruits and vegetables [b,c]	oz	0.12
Fresh bananas [b,c]	lb	0.51
Baby food meats	oz	0.29
Total		

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data as described in Chapter 5—*Evaluation of Cost*. See data sources. This table is a simplification using prices that have been rounded off; small discrepancies between this table and other sections of the report are due to errors introduced by rounding for the purposes of constructing this table. Tables E-3A and E-3B are intended as easy reference guides of the costs used in cost calculations. These costs are illustrated well using the revised food packages; therefore the current food packages were not included in these tables.

[b]Assumptions for the cost analyses included weighting alternate choices shown in this table as various quantities used in calculating costs. As an example using Food Package II-FF, the cost of the maximum allowance (128 oz) of baby food fruits and vegetables was calculated

Representative Amount in Food Package			
Quantity Used in Calculation[b]	Assumption, Proportion Used	Example	Cost ($)
403 fl oz concentrate	1	31 13-oz cans	92.69
			29.75
442 fl oz concentrate	1	34 13-oz cans	101.66
			32.63
384 fl oz reconstituted (51–60 oz powder)	1	4 12.9-oz cans	37.25
			11.96
221 fl oz concentrate	1	17 13-oz cans	50.83
			16.32
312 fl oz concentrate	1	24 13-oz cans	71.76
			23.04
24 oz	1	3 8-oz boxes	4.80
112 oz [d]	1	28 4-oz jars	13.44
2 lb [d]	1	2 lb fresh bananas	1.02
			42.30
156 fl oz concentrate	1	12 13-oz cans	35.88
			11.52
24 oz	1	3 8-oz boxes	4.80
112 oz [d]	1	28 4-oz jars	13.44
2 lb [d]	1	2 lb fresh bananas	1.02
			30.78
24 oz	1	3 8-oz boxes	4.80
240 oz [d]	1	60 4-oz jars	28.80
2 lb [d]	1	2 lb fresh bananas	1.02
77.5 oz	1	31 2.5-oz jars	22.48
			57.10

using a choice of 112 oz of baby food fruits and vegetable plus 2 lb of fresh bananas. For additional detail, see Table E-1.

[c]Allowed substitutions used in the calculations are indented below the food item; the total allowance for the food item is reflected in the sum of these entries.

[d]In Food Package II, 2 lb of fresh bananas may be substituted for 16 oz of baby food fruit.

NOTES FOR TABLE E-3A: ~ indicates approximate amount.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data) and ACNielsen Homescan (ACNielsen, 2001, price data for 2001 obtained through ERS, USDA).

TABLE E-3B Calculated Costs of Representative Amounts of Foods in Revised Packages for Children and Women (2002)[a]

Food	Unit	Approximate Cost per Unit ($)
Food Package IV-A		
Juice	fl oz	~0.03
Milk, whole[b,c]	qt	0.73
Yogurt[b,c]	qt	2.28
Cheese[b,c,d]	lb	3.30
Cereal	oz	~0.20
Eggs	doz	1.03
Fresh fruits[b,c]	lb	~0.69
Canned fruits[b,c]	oz	~0.05
Fresh vegetables[b,c]	lb	~0.94
Canned vegetables[b,c]	oz	~0.03
Bread, whole wheat[b,c]	lb	1.80
Brown rice[b,c]	lb	1.77
Beans, dried[b,c]	lb	0.77
Beans, canned[b,c]	oz	~0.04
Peanut butter[b,c]	oz	0.10
Total		
Food Package IV-B		
Juice	fl oz	~0.03
Milk, fat-reduced[b,c]	qt	0.69
Yogurt[b,c]	qt	2.28
Cheese[b,c,d]	lb	3.30
Cereal	oz	~0.20
Eggs	doz	1.03
Fresh fruits[b,c]	lb	~0.69
Canned fruits[b,c]	oz	~0.05
Fresh vegetables[b,c]	lb	~0.94
Canned vegetables[b,c]	oz	~0.03
Bread, whole wheat[b,c]	lb	1.80
Brown rice[b,c]	lb	1.77
Beans, dried[b,c]	lb	0.77
Beans, canned[b,c]	oz	~0.04
Peanut butter[b,c]	oz	0.10
Total		
Food Package V		
Juice	fl oz	~0.03
Milk, fat-reduced[b,c]	qt	0.69
Soy beverage ("soy milk")[b,c]	qt	1.64

Representative Amount in Food Package			
Quantity Used in Calculation	Assumption, Proportion Used[b]	Example	Cost ($)
128 fl oz	1	3 32-fl oz cans	3.71
14 qt	1	7 half-gallons	10.22
1 qt	0.5	1 1-qt container	1.14
1 lb	0.5	1 1-lb package	1.65
36 oz	1	3 12-oz boxes	7.20
1 doz	1	1 doz	1.03
4.88 lb	0.5	—	1.70
110 oz	0.5	—	2.78
4.88 lb	0.5	—	2.30
110 oz	0.5	—	1.87
1 lb	1	1 1-lb loaf	1.80
1 lb	1	1 1-lb bag	1.77
1 lb	0.25	1 1-lb bag	0.19
64 oz	0.25	4 16-oz cans	0.72
18 oz	0.5	1 18-oz jar	0.90
			38.98
128 fl oz	1	3 32-fl oz cans	3.67
14 qt	1	7 half-gallons	9.66
1 qt	0.5	1 1-qt container	1.14
1 lb	0.5	1 1-lb package	1.65
36 oz	1	3 12-oz boxes	7.31
1 doz	1	1 doz	1.03
4.88 lb	0.5	—	1.70
110 oz	0.5	—	2.78
4.88 lb	0.5	—	2.30
110 oz	0.5	—	1.87
1 lb	1	1 1-lb loaf	1.80
1 lb	1	1 1-lb bag	1.77
1 lb	0.25	1 1-lb bag	0.19
64 oz	0.25	4 16-oz cans	0.72
18 oz	0.5	1 18-oz jar	0.90
			38.49
144 fl oz	1	3 46-fl oz cans	4.13
19 qt	0.9	6 gallons	11.80
19 qt	0.1	9 64-oz containers + 1 32-oz container	3.12

continues

TABLE E-3B Continued

Food	Unit	Approximate Cost per Unit ($)
Yogurt[b,c]	qt	2.28
Tofu[b,c]	lb	1.76
Cheese[b,c,d]	lb	3.30
Cereal	oz	~0.20
Eggs	doz	1.03
Fresh fruits[b,c]	lb	~0.69
Canned fruits[b,c]	oz	~0.05
Fresh vegetables[b,c]	lb	~0.94
Canned vegetables[b,c]	oz	~0.03
Bread, whole wheat[b,c]	lb	1.80
Brown rice[b,c]	lb	1.77
Beans, dried[b,c]	lb	0.77
Beans, canned[b,c]	oz	~0.04
Peanut butter	oz	0.10
Total		
Food Package VI		
Juice	fl oz	~0.03
Milk, fat-reduced[b,c]	qt	0.69
Soy beverage ("soy milk")[b,c]	qt	1.64
Yogurt[b,c]	qt	2.28
Tofu[b,c]	lb	1.76
Cheese[b,c,d]	lb	3.30
Cereal	oz	~0.20
Eggs	doz	1.03
Fresh fruits[b,c]	lb	~0.69
Canned fruits[b,c]	oz	~0.05
Fresh vegetables[b,c]	lb	~0.94
Canned vegetables[b,c]	oz	~0.03
Beans, dried[b,c]	lb	0.77
Beans, canned[b,c]	oz	~0.04
Peanut butter[b,c]	oz	0.10
Total		
Food Package VII		
Juice	fl oz	~0.03
Milk, fat-reduced[b,c]	qt	0.69
Soy beverage ("soy milk")[b,c]	qt	1.64
Yogurt[b,c]	qt	2.28
Tofu[b,c]	lb	1.76
Cheese[b,c,d]	lb	3.30
Cheese	lb	3.30
Cereal	oz	~0.20

Representative Amount in Food Package			
Quantity Used in Calculation	Assumption, Proportion Used[b]	Example	Cost ($)
1 qt	1	1 1-qt container	2.28
1 lb	0.5	1 1-lb container	0.88
1 lb	0.5	1 1-lb package	1.65
36 oz	1	3 12-oz boxes	7.30
1 doz	1	1 doz	1.03
6.1 lb	0.5	—	2.12
140 oz	0.5	—	3.48
6.1 lb	0.5	—	2.88
140 oz	0.5	—	2.38
1 lb	0.5	1 1-lb loaf	0.90
1 lb	0.5	1 1-lb bag	0.89
1 lb	0.5	1 1-lb bag	0.39
64 oz	0.5	4 16-oz cans	1.42
18 oz	1	1 18-oz jar	1.80
			48.45
96 fl oz	1	246-fl oz cans	2.76
14 qt	0.9	3 gallons + 1 half-gallon	8.69
14 qt	0.1	7 64-oz containers	2.30
1 qt	0.25	1 1-qt container	0.57
1 lb	0.25	1 1-lb container	0.44
1 lb	0.5	1 1-lb package	1.65
36 oz	1	3 12-oz boxes	7.30
1 doz	1	1 doz	1.03
6.1 lb	0.5	—	2.12
140 oz	0.5	—	3.48
6.1 lb	0.5	—	2.88
140 oz	0.5	—	2.38
1 lb	0.25	1 1-lb bag	0.19
64 oz	0.25	4 16-oz cans	0.72
18 oz	0.5	1 18-oz jar	0.90
			37.41
144 fl oz	1	3 46-fl oz cans	4.13
21 qt	0.9	6 gallons	13.04
21 qt	0.1	12 64-oz containers	3.45
1 qt	1	1 1-qt container	2.28
1 lb	0.5	1 1-lb container	0.88
1 lb	0.5	1 lb	1.65
1 lb	1	1 lb	3.30
36 oz	1	3 12-oz boxes	7.30

continues

TABLE E-3B Continued

Food	Unit	Approximate Cost per Unit ($)
Eggs	doz	1.03
Fresh fruits[b,c]	lb	~0.69
Canned fruits[b,c]	oz	~0.05
Fresh vegetables[b,c]	lb	~0.94
Canned vegetables[b,c]	oz	~0.03
Bread, whole wheat[b,c]	lb	1.80
Brown rice[b,c]	lb	1.77
Canned fish[b,c]		
Tuna[b,c]	oz	~0.09
Salmon[b,c]	oz	~0.11
Beans, dried[b,c]	lb	0.77
Beans, canned[b,c]	oz	~0.04
Peanut butter	oz	0.10
Total		

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data as described in Chapter 5—*Evaluation of Cost*. See data sources. This table is a simplification using prices that have been rounded off; small discrepancies between this table and other sections of the report are due to errors introduced by rounding for the purposes of constructing this table. Tables E-3A and E-3B are intended as easy reference guides of the costs used in cost calculations. These costs are illustrated well using the revised food packages; therefore the current food packages were not included in these tables.

[b]Assumptions for the cost analyses included weighting alternate choices shown in this table as proportions used for calculating costs. For example, the cost of the fruit was calculated using 0.5 as the proportion for both canned and fresh fruits; that means the cost was calculated using a choice of 50% canned and 50% fresh fruits. For additional detail, see Table E-2.

Representative Amount in Food Package			
Quantity Used in Calculation	Assumption, Proportion Used[b]	Example	Cost ($)
2 doz	1	2 doz	2.06
6.1 lb	0.5	—	2.12
140 oz	0.5	—	3.48
6.1 lb	0.5	—	2.88
140 oz	0.5	—	2.38
1 lb	0.5	1 1-lb loaf	0.90
1 lb	0.5	1 1-lb bag	0.89
30 oz	0.8	5 6-oz cans	2.08
29.4 oz	0.2	2 14.7-oz cans	0.62
1 lb	0.5	1 1-lb bag	0.39
64 oz	0.5	4 16-oz cans	1.42
18 oz	1	1 18-oz jar	1.80
			57.05

[c]Allowed substitutions used in the calculations are indented below the food item in the package; the total allowance for this food item is reflected in the sum of these entries.

[d]Cheese may be substituted for milk at the rate of 1 lb of cheese for 3 qt of milk.

NOTE FOR TABLE E-3B: ~ indicates approximate amount.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a , 2002 price data).

TABLE E-4 Estimated Program Costs for Food per Month Using Current Packages (2002)[a]

Group	Age/Participant Category[b]	Description	Package
Infants	0–3.9 mo	Fully formula-fed	I
		Partially breast-fed[d]	I
		Fully breast-fed[d]	—
	Subtotals[e]		
	4–5.9 mo	Fully formula-fed	II
		Partially breast-fed [f]	II
		Fully breast-fed [f]	II
	Subtotals[e]		
	6–11.9 mo	Fully formula-fed	II
		Partially breast-fed [g]	II
		Fully breast-fed [g]	II
	Subtotals[e]		
	Totals for infant[e]		
Children	1–4.9 y[h]		IV
	Totals for children[e]		
Women	Pregnant[e]		V
	Partially breastfeeding[i]		V
	Non-breastfeeding postpartum [e]		VI
	Fully breastfeeding[i]		VII
	Totals for women[e]		
Totals for program			
Average food package cost per participant (per month)			

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data as described in Chapter 5—*Evaluation of Cost*. Data on number of participants were obtained from 2002 (Bartlett et al., 2003).

[b]See footnote *b* for Table E-5.

[c]The committee used data provided by FNS (public communication during open session, February, 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA) to estimate that the average post-rebate cost of formula was 32.1%of the pre-rebate cost in 2002.

[d]Percentage of infants fully breast-fed at 3 mo of age was reported (CDC, 2004b, 2004c). Percentage of partially breast-fed infants was calculated from these data and data on the percentage of infants who had ever been breast-fed at 3 mo of age (CDC, 2004b, 2004c).

[e]Number of participants was calculated using data Exhibit 3.1 from USDA's *WIC Participant and Program Characteristics, 2002* (Bartlett et al., 2003), recognizing that some discrepancies exist in these data. An infant is defined as a participant who, at certification, is under 1 year of age and who would be classified as a child at the age of 366 d. However, in 2002, about 2.84% of WIC participants categorized as 1-y-old children are, in fact, 11-mo-old infants who have been recertified as 1-y-old children; additionally, about 0.38% of WIC participants who are classified as infants are participants who are older than 366 d.

[f]Percentage of infants fully or partially breast-fed at 4–5.9 mo of age was extrapolated

Percentage within Age/ Participant Category	Number of Participants[b]	Cost (pre-rebate, if applicable)	Post-Rebate Cost[c]	Program Cost (post-rebate, if applicable)
36	668,309	$ 92.69	$ 29.75	$ 19,882,193
28	519,796	$ 92.69	$ 29.75	$ 15,463,931
36	668,309	0		
100	**1,856,414**			**$ 35,346,124**
69	38,428	$ 100.37	$ 37.43	$ 1,438,360
20	11,138	$ 100.37	$ 37.43	$ 416,895
11	6,126	$ 7.68		$ 47,048
100	**55,692**			**$ 1,902,303**
79	118,955	$ 100.37	$ 37.43	$ 4,452,486
16	24,092	$ 100.37	$ 37.43	$ 901,764
5	7,529	$ 7.68		$ 57,823
100	**150,576**			**$ 5,412,073**
	2,062,682			**$ 42,660,500**
100	4,020,032	$ 39.29		$ 157,947,057
100	**4,020,032**			**$ 157,947,057**
45	878,619	$ 41.23		$ 36,225,461
11	205,559	$ 41.23		$ 8,475,198
31	597,451	$ 34.39		$ 20,546,340
13	252,572	$ 50.61		$ 12,782,669
100	**1,934,201**			**$ 78,029,668**
	8,016,915			**$ 278,637,225**
				$ 34.76

from data for infants at 3 and 6 mo of age (CDC, 2004b, 2004c; Abbott Labs, 2002, 2003 [2001 data]).

[g]Percentages of infants fully or partially breast-fed at 6–11.9 mo of age were calculated as the average of data reported for infants at 6 mo (CDC, 2004b, 2004c) and 12 mo of age (CDC, 2004b, 2004c; Briefel et al., 2004a).

[h]Includes 0.8% of children, age 1–4.9 y, who were reported as "age not reported."

[i]Percentage distribution of women as fully breastfeeding (55% of the total) or partially breastfeeding (45%of the total) was calculated according to the distribution of infants identified as fully or partially breast-fed (see notes *f* and *g*).

NOTES FOR TABLE E-4**:** This table is similar to Table 5-2; more detail is presented here in Appendix E.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a , 2002 price data). Data on rates of participation are from resources published by USDA (Bartlett et al., 2003, 2002 data; Kresge, 2003, 2002 data). Data on percentages of infants breast-fed were obtained from the *2003 National Immunization Survey* (CDC, 2004b, 2004c) and published resources (Abbott Labs, 2002, 2003; Briefel et al, 2004a).

TABLE E-5 Estimated Program Costs for Food per Month Using Revised Packages (2002)[a]

Group	Age or Participant Category[b]	Description	Package
Infants	0–3.9 mo	Fully formula-fed	I
		Partially breast-fed[d,e]	— (0–0.9 mo)
		Partially breast-fed[d,e]	I (1–3.9 mo)
		Fully breast-fed[d]	—
	Subtotals[g]		
	4–5.9 mo	Fully formula-fed	II
		Partially breast-fed[h]	II
		Fully breast-fed[h]	II
	Subtotals[g]		
	6–11.9 mo	Fully formula-fed	II
		Partially breast-fed[i]	II
		Fully breast-fed[i]	II
	Subtotals[g]		
	Totals for infants[g]		
Children	1–1.9 y [j]		IV-A
	2–4.9 y [j]		IV-B
	Totals for children[g]		
Women	Pregnant[g]		V
	Partially breastfeeding[k]		V
	Non-breastfeeding postpartum[g]		VI
	Fully breastfeeding[k]		VII
	Totals for women[g]		
Totals for program			
Average food package cost per participant (per month)			

[a]All costs use market purchase-weighted prices estimated using 1999–2002 price data as described in Chapter 5—*Evaluation of Cost*. Data on number of participants were obtained from 2002 (Bartlett et al., 2003).

[b]The analyses presented in Tables E-4 and E-5 used published data for FY2002 from FNS (Bartlett et al., 2003, Exhibits 3.1 and 5.7) for the number of participants in total and in each participant category, including age groups within the infant category. The data presented by Bartlett et al. were derived from data collected on participants *at the time of certification* in the WIC program. If the analyses are done using the assumption that infant ages were distributed equally across twelve months, instead of by age at certification, the average package cost per participant would be $37.10 for the current packages and $38.02 for the revised packages. This represents an increase of $0.92 for the revised packages compared to the current packages. Thus, by these estimates the revised packages would be 2.5 percent higher in cost than the current packages. These estimates represent the upper bound of effects on costs because attrition in participation rates occurs as infants mature; for example, FY2002 enrollment was 2.1 million for infants and 1.4 million for one-year-olds (Bartlett et al., 2003). In using the data presented by Bartlett et al., the participant numbers throughout FY2002 were

Percentage Within Age or Participant Category	Number of Participants[b]	Cost (pre-rebate, if applicable)	Cost Post-Rebate[c]	Program Cost (post rebate, if applicable)
36	668,309	$ 92.69	$ 29.75	$ 19,882,193
7	129,949	$ 4.65[f]	$ 1.49	$ 193,624
21	389,847	$ 37.25	$ 11.96	$ 4,662,570
36	668,309	0		
100	**1,856,414**			**$ 24,738,387**
69	38,428	$ 101.66	$ 32.63	$ 1,253,906
20	11,138	$ 50.83	$ 16.32	$ 181,772
11	6,126	0		
100	**55,692**			**$ 1,435,678**
79	118,955	$ 91.02	$ 42.30	$ 5,031,797
16	24,092	$ 55.14	$ 30.78	$ 741,552
5	7,529	$ 57.10		$ 429,906
100	**150,576**			**$ 6,203,255**
	2,062,682			**$ 32,377,320**
36	1,447,212	$ 38.98		$ 56,412,324
64	2,572,820	$ 38.49		$ 99,027,842
100	**4,020,032**			**$ 155,440,166**
45	878,619	$ 48.45		$ 42,569,090
11	205,559	$ 48.45		$ 9,959,334
31	597,451	$ 37.41		$ 22,350,642
13	252,572	$ 57.05		$ 14,409,233
100	**1,934,201**			**$ 89,288,299**
	8,016,915			**$ 277,105,785**
				$ 34.57

overestimated. If the analyses were done using FY2002 data presented as totals per participant category calculated from monthly averages (FNS, 2004f) instead of the annual totals from data collected at certification (Bartlett et al., 2003), the average package cost per participant would be $34.75 for the current packages and $34.57 for the revised packages. This represents a decrease of $0.18 for the revised packages compared to the current packages. Please note that the material in footnote b of Table E-5 was added after the report was released.

[c]The committee used data provided by FNS (public communication during open session, February, 2004, J. Hirschman, Office of Analysis, Nutrition and Evaluation, Food and Nutrition Service, USDA) to estimate that the average post-rebate cost of formula was 32.1% of the pre-rebate cost in 2002.

[d]Percentage of infants fully breast-fed at 3 mo of age was reported (CDC, 2004b, 2004c). Percentage of partially breast-fed infants was calculated from these data and data on the percentage of infants who had ever been breast-fed at 3 mo of age (CDC, 2004b, 2004c).

continues

TABLE E-5 Continued

[e]For the category of partially breast-fed infants 0–3.9 mo, the committee estimated that the number of infants aged 0–0.9 mo was 25% of the category total and the number of infants aged 1–3.9 mo was 75% of the total. In the absence of data on the proportion of infants to anticipate in each of the first 4 mo after birth, the committee assumed the distribution would be approximately equal in each month, using the census data for children under the age of 5 y as a model (20.0% ± 0.3% , mean ± SD) (U.S. Census Bureau, 2004).

[f]One alternative is to provide one small can (up to 15 oz) of powdered formula to breast-fed infants during the first mo postpartum if requested by the mother. The committee used the assumption that the number of breastfeeding mothers requesting formula in the first mo would approximate 50% of the current number of partially breastfeeding mother/infants pairs. The additional monthly cost per participant who choose this option would be $9.30 in pre-rebate costs and $2.98 in post-rebate costs. Using the estimate of 50% of the current partially breastfeeding participants (0.5 × 129,949 = 64,747) for the first mo postpartum, the additional monthly program cost would be $193,626 or an additional 2.4¢ in the average cost per participant.

[g]Number of participants was calculated using data Exhibit 3.1 from USDA's *WIC Participant and Program Characteristics, 2002* (Bartlett et al., 2003), recognizing that some discrepancies exist in these data. An infant is defined as a participant who, at certification, is under 1 y of age and who would be classified as a child at the age of 366 d. However, in 2002, about 2.84% of WIC participants categorized as 1-y-old children are, in fact, 11-mo-old infants who have been recertified as 1-y-old children; additionally, about 0.38% of WIC participants who are classified as infants are participants who are older than 366 days.

[h]Percentage of infants fully or partially breast-fed at 4–5.9 mo of age was extrapolated from data for infants at 3 and 6 mo of age (CDC, 2004b; Abbott Labs, 2002, 2003 [2001 data]).

[i]Percentages of infants fully or partially breast-fed at 6–11.9 mo of age were calculated as the average of data reported for infants at 6 mo (CDC, 2004b, 2004c) and 12 mo of age (CDC, 2004b, 2004c; Briefel et al., 2004a).

[j]The committee calculated the number of participants in each category using data from the USDA sponsored *WIC Participant and Program Characteristics 2002* (Bartlett et al., 2003); data from Exhibit 3.1 (Bartlett et al., 2003) were used to estimate the number of participants ages 1–1.9 y and 2–4.9 y.

[k]Percentage distribution of women as fully breastfeeding (55% of the total) or partially breastfeeding (45% of the total) was calculated according to the distribution of infants identified as fully or partially breast-fed (see notes *h* and *i*).

NOTES FOR TABLE E-5: This table is similar to Table 5-3; more detail is presented here in Appendix E.

DATA SOURCES: Price data are from Economic Research Service, USDA (ERS, 2004b, 1999 price data; Oliveira et al., 2001, 2000 infant formula price data); ACNielsen Homescan (ACNielsen, 2001, price data for 2001obtained through ERS, USDA); and the Bureau of Labor Statistics, U.S. Department of Labor (BLS, 2004a , 2002 price data). Data on rates of participation are from resources published by USDA (Bartlett et al., 2003, 2002 data; Kresge, 2003, 2002 data). Data on percentages of infants breast-fed were obtained from the *2003 National Immunization Survey* (CDC, 2004b, 2004c) and published resources (Abbott Labs, 2002, 2003; Briefel et al, 2004a).

F

Supplementary Information

LIST OF BOX, FIGURES, AND TABLES

BOX F-1
Chronology of Statutes Pertaining to the Definition of WIC Supplemental Foods

September 26, 1972: Public Law No. 92-433. The term *supplemental foods* is defined in the original WIC statute, Child Nutrition Act, as amended.

> § 17(f)(3): "Supplemental foods" shall mean those foods containing nutrients known to be lacking in the diets of populations at nutritional risks and, in particular, those foods and food products, containing high-quality protein, iron, calcium, vitamin A, and vitamin C. Such term may also include (at the discretion of the Secretary) any food product commercially formulated preparation specifically designed for infants.

July 11, 1973: In what appears to be the first WIC rule (*Fed Reg* p. 18447):

> § 246.2(v): "Supplemental food" means any food authorized to be made available under the WIC program.

October 7, 1975: Public Law No. 94-105. Child Nutrition Act §17(f)(3) is amended to include a new, final sentence:

> The contents of the food package shall be made available in such a manner as to provide flexibility, taking into account medical and nutritional objectives and cultural eating patterns.

January 12, 1976: Interim "Revision, Reorganization, and Republication" (*Fed Reg* p. 1743) reads:

> § 246.2(t): "Supplemental foods" means the foods authorized by FNS in this part to be made available under the WIC program.

August 26, 1977: Final "Revision, Reorganization, and Republication" (*Fed Reg* p. 43206) reads:

> § 246.2 (no "letter" designation): "Supplemental foods" means foods which meet the specifications of this part.

November 10, 1978: Public Law No. 95-627, the Child Nutrition Amendments of 1978, completely revised Child Nutrition Act § 17. In the revision, definitions were moved to subsection (b), with supplemental foods found at § 17(b)(14). The reference to nutrients of particular interest was deleted and additional direction was included at (f)(11).

> § 17(b)(14): "Supplemental foods" means those foods containing nutrients determined by nutritional research to be lacking in the diets of pregnant, breastfeeding, and postpartum women, infants, and children, as prescribed by the Secretary. State agencies may, with the approval of the Secretary, substitute different foods providing the nutritional equivalent of foods prescribed by the Secretary, to allow for different cultural eating patterns.
>
> In subparagraph (f)(11): The Secretary shall prescribe by regulation the supplemental foods to be made available in the program under this section. To the de-

gree possible, the Secretary shall assure that the fat, sugar, and salt content of the prescribed foods is appropriate.

January 9, 1979: Proposed Rule, to comply with section 3 of Public Law No. 95-627 § 3 (beginning *Fed Reg* p. 2114) deletes the definition of supplemental foods (no explanation is provided for this change):

§ 246.2 (no "letter" designation): "Supplemental foods" [Reserved]

July 27, 1979: Final Rule, to comply with Public Law No. 95-627 § 3 (beginning *Fed Reg* p. 44422):

§ 246.2 (no "letter" designation): "Supplemental foods" [Reserved].

July 8, 1983: Proposed Rule (beginning on *Fed Reg* p. 31502) issued to "reduce the regulatory burden on State and local agencies." It states:

A definition of "supplemental foods" was reserved in the 1979 regulations because of the pending issuance of the proposed food package Regulations. A definition consistent with the legislative definition and past regulatory definitions is proposed in this rulemaking.

§ 246.2 (no "letter" designation): "Supplemental foods" means those foods containing nutrients determined to be beneficial for pregnant, breastfeeding, and postpartum women, infants and children, as prescribed by the Secretary in section 246.10.

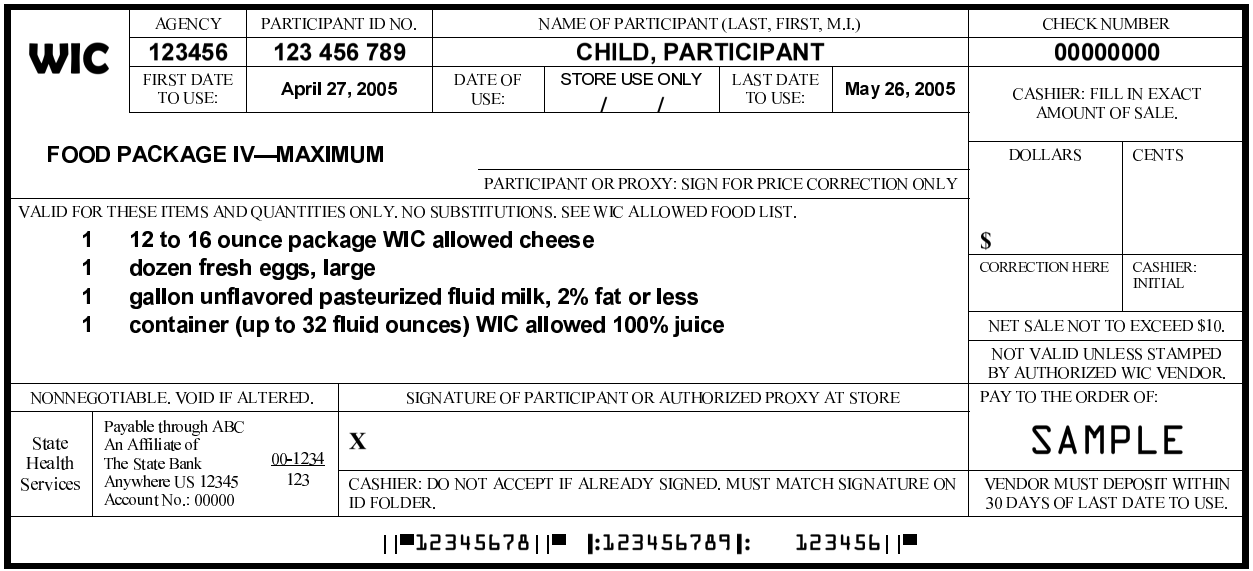
November 10, 1989: Public Law No. 101-147. Child Nutrition and WIC Reauthorization Act of 1989 continues the statutory emphasis on providing nutrients for which WIC participants are most vulnerable to deficiencies and adds concern regarding nutrient density and how to effectively provide the priority nutrients

June 30, 2004: Public Law No. 108-265. Child Nutrition and WIC Reauthorization Act of 2004 continues the statutory emphasis on nutrients that are lacking. It also adds language about foods to the definition, still at (b)(14), and adds material to (f)(11) without altering the sentences inserted in 1978. The new (b)(14) reads:

(b)(14): "Supplemental foods" means those foods containing nutrients determined by nutritional research to be lacking in the diets of pregnant, breastfeeding, and postpartum women, infants, and children, and those foods that promote the health of the population served by the program authorized by this section, as indicated by relevant nutrition science, public health concerns, and cultural eating patterns, as prescribed by the Secretary. State agencies may, with the approval of the Secretary, substitute different foods providing the nutritional equivalent of foods prescribed by the Secretary, to allow for different cultural eating patterns.

Child Nutrition Act § 17, includes the following relevant provisions in a paragraph primarily addressing state operations:

"(f)(11) SUPPLEMENTAL FOODS—
(A) IN GENERAL—The Secretary shall prescribe by regulation the supplemental foods to be made available in the program under this section.
(B) APPROPRIATE CONTENT—To the degree possible, the Secretary shall assure that the fat, sugar, and salt content of the prescribed foods is appropriate."



WIC

AGENCY	PARTICIPANT ID NO.	NAME OF PARTICIPANT (LAST, FIRST, M.I.)			CHECK NUMBER
123456	123 456 789	CHILD, PARTICIPANT			00000000
FIRST DATE TO USE:	April 27, 2005	DATE OF USE:	STORE USE ONLY / /	LAST DATE TO USE:	May 26, 2005

CASHIER: FILL IN EXACT AMOUNT OF SALE.

FOOD PACKAGE IV—MAXIMUM

PARTICIPANT OR PROXY: SIGN FOR PRICE CORRECTION ONLY

DOLLARS | CENTS

$

VALID FOR THESE ITEMS AND QUANTITIES ONLY. NO SUBSTITUTIONS. SEE WIC ALLOWED FOOD LIST.

1 12 to 16 ounce package WIC allowed cheese
1 dozen fresh eggs, large
1 gallon unflavored pasteurized fluid milk, 2% fat or less
1 container (up to 32 fluid ounces) WIC allowed 100% juice

CORRECTION HERE | CASHIER: INITIAL

NET SALE NOT TO EXCEED $10.

NOT VALID UNLESS STAMPED BY AUTHORIZED WIC VENDOR.

NONNEGOTIABLE. VOID IF ALTERED.

SIGNATURE OF PARTICIPANT OR AUTHORIZED PROXY AT STORE

PAY TO THE ORDER OF:

State Health Services

Payable through ABC
An Affiliate of
The State Bank
Anywhere US 12345
Account No.: 00000

00-1234
123

X

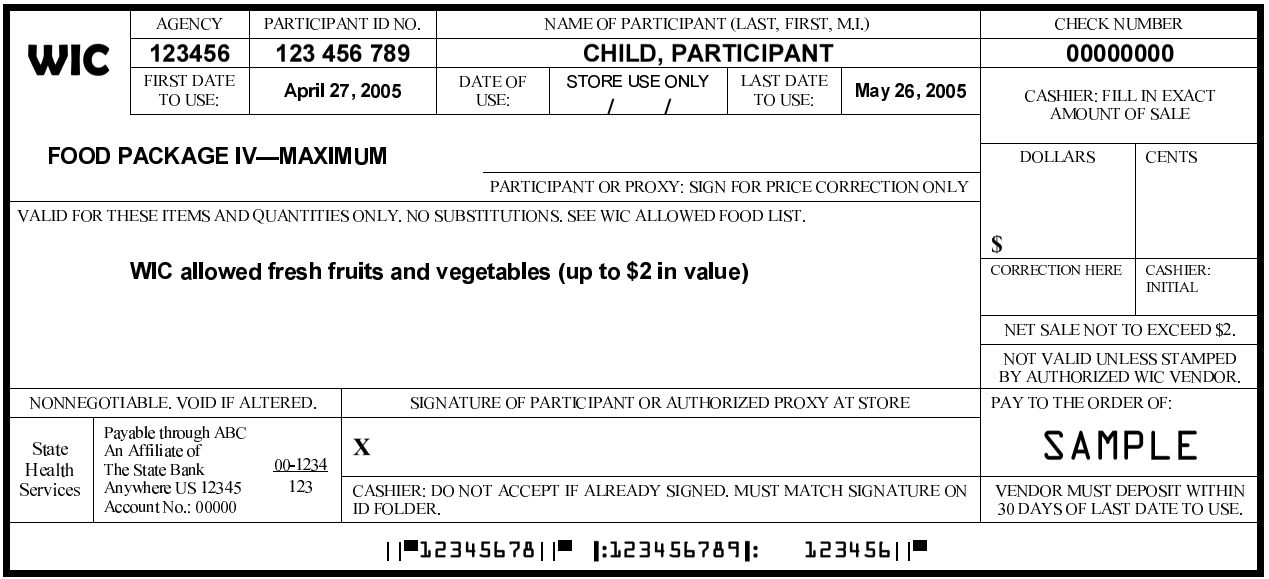
SAMPLE

CASHIER: DO NOT ACCEPT IF ALREADY SIGNED. MUST MATCH SIGNATURE ON ID FOLDER.

VENDOR MUST DEPOSIT WITHIN 30 DAYS OF LAST DATE TO USE.

||⑈12345678||⑈ ⑆:123456789⑆: 123456||⑈

FIGURE F-1A Representation of a standard WIC food instrument (net sale not to exceed $10).
NOTE: This sample of a standard food instrument is one of set that would be issued to the participant with a sum total equal to the entire prescription of food per month for this child participant. Some WIC state agencies currently issue a series of standard food instruments to be used throughout the month. This representation was constructed using food instruments received from a number of WIC state agencies; this sample illustrates features drawn from various food instruments and does not reflect the food instruments issued by a specific WIC state agency.



WIC

AGENCY	PARTICIPANT ID NO.	NAME OF PARTICIPANT (LAST, FIRST, M.I.)			CHECK NUMBER
123456	123 456 789	CHILD, PARTICIPANT			00000000
FIRST DATE TO USE:	April 27, 2005	DATE OF USE:	STORE USE ONLY / /	LAST DATE TO USE: May 26, 2005	CASHIER: FILL IN EXACT AMOUNT OF SALE

FOOD PACKAGE IV—MAXIMUM

PARTICIPANT OR PROXY: SIGN FOR PRICE CORRECTION ONLY

VALID FOR THESE ITEMS AND QUANTITIES ONLY. NO SUBSTITUTIONS. SEE WIC ALLOWED FOOD LIST.

WIC allowed fresh fruits and vegetables (up to $2 in value)

DOLLARS	CENTS
$	
CORRECTION HERE	CASHIER: INITIAL

NET SALE NOT TO EXCEED $2.

NOT VALID UNLESS STAMPED BY AUTHORIZED WIC VENDOR.

NONNEGOTIABLE. VOID IF ALTERED.		SIGNATURE OF PARTICIPANT OR AUTHORIZED PROXY AT STORE	PAY TO THE ORDER OF:
State Health Services	Payable through ABC An Affiliate of The State Bank Anywhere US 12345 Account No.: 00000 00-1234 123	X	SAMPLE
		CASHIER: DO NOT ACCEPT IF ALREADY SIGNED. MUST MATCH SIGNATURE ON ID FOLDER.	VENDOR MUST DEPOSIT WITHIN 30 DAYS OF LAST DATE TO USE.

||⁼12345678||⁼ ⁞:123456789⁞: 123456||⁼

FIGURE F-1B Representation of a cash-value WIC food instrument (net sale not to exceed $2).
NOTE: This sample of a cash-value food instrument for fresh fruits and vegetables is one of a set that would be issued to the participant with a sum total cash-value of $8 per month for this child participant. Some WIC state agencies currently issue a series of standard food instruments to be used throughout the month. This example is representative of a WIC state agency in which food instruments are issued as four sets per month, easily accommodating participants who obtain groceries on an average of once per week. The cash-value voucher for fresh produce is a workable procedure in other scenarios; however, in situations were WIC foods are obtained on an average of once per month, the fresh fruit and vegetable option may not be optimal. In these situations, the processed fruit and vegetable option or a combination of the fresh and processed options may be more workable. From the committee's discussion with representatives of grocery vendors, an important feature is that the fresh produce is obtained on a food instrument separate from other grocery items.

TABLE F-1 Dietary Reference Intakes Used for Assessing Intakes of WIC-Eligible Subgroups, Elements

	Dietary Component		
Participant Category	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)
Infants, 0 through 5 mo			
AI*[a]	210* (breast-fed) 320* (formula-fed)	0.27*	2.0*
UL	ND[b]	40.0	4.0
Infants, 6 through 11 mo			
EAR	—	6.9	2.5
RDA or AI*	270* (breast-fed) 340* (formula-fed)	11.0	3.0
UL	ND	40.0	5.0
Children, 1 through 3 y			
EAR	—	3.0	2.5
RDA or AI*	500*	7.0	3.0
UL	2,500	40.0	7.0
Children, 4 y			
EAR	—	4.1	4.0
RDA or AI*	800*	10.0	5.0
UL	2,500	40.0	12.0
Females, 14 through 18 y			
EAR	—	7.9	7.3
RDA or AI*	1,300*	15.0	9.0
UL	2,500	45.0	34.0
Females, 19 through 30 y			
EAR	—	8.1	6.8
RDA or AI*	1,000*	18.0	8.0
UL	2,500	45.0	40.0
Females, 31 through 44 y			
EAR	—	8.1	6.8
RDA or AI*	1,000*	18.0	8.0
UL	2,500	45.0	40.0
Pregnant females, < 19 y			
EAR	—	23.0	10.5
RDA or AI*	1,300*	27.0	12.0
UL	2,500	45.0	34.0

Selenium (mcg/d)	Magnesium (mg/d)	Phosphorus (mg/d)	Sodium (mg/d)	Potassium (mg/d)
15*	30*	100*	120*	400*
45	ND[b]	ND[b]	ND[b]	ND[b]
—	—	—	—	—
20*	75*	275*	370*	700*
60	ND	ND	ND	ND
17	65	380	—	—
20	80	460	1,000*	3,000*
90	65[c]	3,000	1,500	ND
23	110	405	—	—
30	130	500	1,200*	3,800*
150	110[c]	3,000	1,900	ND
45	300	1055	—	—
55	360	1,250	1,500*	4,700*
400	350[c]	4,000	2,300	ND
45	255	580	—	—
55	310	700	1,500*	4,700*
400	350[c]	4,000	2,300	ND
45	265	580	—	—
55	320	700	1,500*	4,700*
400	350[c]	4,000	2,300	ND
49	335	1,055	—	—
60	400	1,250	1,500*	4,700*
400	350[c]	3500	2,300	ND

continues

TABLE F-1 Continued

Participant Category	Dietary Component		
	Calcium (mg/d)	Iron (mg/d)	Zinc (mg/d)
Pregnant females, 19 through 30 y			
EAR	—	22.0	9.5
RDA or AI*	1,000*	27.0	11.0
UL	2,500	45.0	40.0
Pregnant females, 31 through 44 y			
EAR	—	22.0	9.5
RDA or AI*	1,000*	27.0	11.0
UL	2,500	45.0	40.0
Lactating females, < 19 y			
EAR	—	7.0	10.9
RDA or AI*	1,300*	10.0	13.0
UL	2,500	45.0	34.0
Lactating females, 19 through 44 y			
EAR	—	6.5	10.4
RDA or AI*	1,000*	9.0	12.0
UL	2,500	45.0	40.0

[a]For calcium, AIs were set for breast-fed and formula-fed infants. All other AIs presented for infants ages 0 to 5.9 mo are based on mean intake of healthy breast-fed infants. AIs for formula-fed infants ages 0 to 5.9 mo have not been set for these nutrients, although bioavailability of some nutrients, especially iron and zinc (Lönnerdal et al., 1981; Pabon and Lönnerdal, 2000), is known to be lower in infant formula than in breast milk.

[b]The UL was not determinable for infants birth through 5 months of age due to lack of data of adverse effects in this age group and due to concern with regard to lack of ability to handle excess amounts. The source of intake should be only from food (e.g., breast milk, infant formula) to prevent high levels of intake (IOM, 1997, 1998, 2000b, 2001, 2005a).

[c]The UL for magnesium represents intake from pharmacological agents only and does not include intake from food and water.

Selenium (mcg/d)	Magnesium (mg/d)	Phosphorus (mg/d)	Sodium (mg/d)	Potassium (mg/d)
49	290	580	—	—
60	350	700	1,500*	4,700*
400	350[c]	3,500	2,300	ND
49	300	580	—	—
60	360	700	1,500*	4,700*
400	350[c]	3,500	2,300	ND
59	300	1,055	—	—
70	360	1,250	1,500*	5,100*
400	350[c]	4,000	2,300	ND
59	265	580	—	—
70	320	700	1,500*	5,100*
400	350[c]	4,000	2,300	ND

NOTES FOR TABLE F-1: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); EAR = Estimated Average Requirement, used when available; ND = not determined, UL not determined due to lack of data of adverse effects RDA = Recommended Dietary Allowance; UL = Tolerable Upper Intake Level.

DATA SOURCES: Institute of Medicine (IOM, 1997, 2000b, 2001, 2005a) (see IOM, 2005b).

TABLE F-2 Dietary Reference Intakes Used for Assessing Intakes of WIC-Eligible Subgroups, Vitamins

Participant Category	Dietary Component		
	Vitamin A[a] (mcg/d)	Vitamin D (mcg/d)	Vitamin E[b] (mg AT/d)
Infants, 0 through 5 mo			
AI*	400*	5*	4*
UL	600[e]	25	ND
Infants, 6 through 11 mo			
AI*	500*	5*	5*
UL	600[e]	25	ND
Children, 1 through 3 y			
EAR	210	—	5
RDA or AI*	300	5*	6
UL	600[e]	50	200
Children, 4 y			
EAR	275	—	6
RDA or AI*	400	5*	7
UL	900[e]	50	300
Females, 14 through 18 y			
EAR	485	—	12
RDA or AI*	700	5*	15
UL	2,800[e]	50	800
Females, 19 through 44 y			
EAR	500	—	12
RDA or AI*	700	5*	15
UL	3,000[e]	50	1,000
Pregnant females, < 19 y			
EAR	530	—	12
RDA or AI*	750	5*	15
UL	2,800[e]	50	800
Pregnant females, 19 through 44 y			
EAR	550	—	12
RDA or AI*	770	5*	15
UL	3,000[e]	50	1,000
Lactating females, < 19 y			
EAR	885	—	16
RDA or AI*	1,200	5*	19
UL	2,800[e]	50	800
Lactating females, 19 through 44 y			
EAR	900	—	16
RDA or AI*	1,300	5*	19
UL	3,000[e]	50	1,000

[a] The EAR and AI for vitamin A are expressed as retinol activity equivalents (RAEs) per day. 1 RAE = 1 mcg retinol, 12 mcg β-carotene, 24 mcg α-carotene, or 24 mcg β-cryptoxanthin.

[b] The EAR and AI for vitamin E are expressed as mg α-tocopherol (AT) per day. The EAR and AI for vitamin E include RRR-α-tocopherol, the only form of α-tocopherol that occurs naturally in foods, and the 2R-stereoisomeric forms of α-tocopherol that occur in fortified foods and dietary supplements. The UL for vitamin E applies to any form of α-tocopherol used in dietary supplements or added to foods as a fortificant or antioxidant. Note that the CSFII data used elsewhere in this report were originally calculated as mg α-tocopherol equivalents (ATE) per day, an older unit of measure for vitamin E.

Vitamin C (mg/d)	Thiamin (mg/d)	Riboflavin (mg/d)	Niacin[c] (mg/d)	Vitamin B_6 (mg/d)	Vitamin B_{12} (mcg/d)	Folate[d] (mcg/d)
40*	0.2*	0.3*	2*	0.1*	0.4*	65*
ND	ND	ND	ND	ND	ND	ND
50*	0.3*	0.4*	4*	0.3*	0.5*	80*
ND	ND	ND	ND	ND	ND	ND
13	0.4	0.4	5	0.4	0.7	120
15	0.5	0.5	6	0.5	0.9	150
400	ND	ND	10	30.0	ND	300
22	0.5	0.5	6	0.5	1.0	160
25	0.6	0.6	8	0.6	1.2	200
650	ND	ND	15	40.0	ND	400
56	0.9	0.9	11	1.0	2.0	330
65	1.0	1.0	14	1.2	2.4	400[f]
1,800	ND	ND	30	80.0	ND	800
60	0.9	0.9	11	1.1	2.0	320
75	1.1	1.1	14	1.3	2.4	400[f]
2,000	ND	ND	35	100.0	ND	1,000
66	1.2	1.2	14	1.6	2.2	520
80	1.4	1.4	18	1.9	2.6	600[f]
1,800	ND	ND	30	80.0	ND	800
70	1.2	1.2	14	1.6	2.2	520
85	1.4	1.4	18	1.9	2.6	600[f]
2,000	ND	ND	35	100.0	ND	1,000
96	1.2	1.3	13	1.7	2.4	450
115	1.4	1.6	17	2.0	2.8	500
1,800	ND	ND	30	80.0	ND	800
100	1.2	1.3	13	1.7	2.4	450
120	1.4	1.6	17	2.0	2.8	500
2,000	ND	ND	35	100.0	ND	1,000

[c] The AI for infants 0 through 5 months is expressed as preformed niacin (not niacin equivalents, NE).The EAR and AI for niacin for individuals above the age of 5 months are expressed as niacin equivalents (NE) per day. 1 mg of niacin = 60 mg of tryptophan. The UL for niacin is in mg/d and applies to synthetic forms obtained from fortified foods or dietary supplements.

[d] The EAR and AI for folate are expressed as dietary folate equivalents (DFE) per day. 1 DFE = 1 mcg food folate = 0.6 mcg of folic acid from fortified food or as a supplement

continues

TABLE F-2 Continued

consumed with food = 0.5 mcg of a supplement taken on an empty stomach. The UL for folate is expressed as mcg per day and applies to synthetic forms (i.e., folic acid) obtained from fortified foods or dietary supplements.

[e] The UL applies only to preformed vitamin A (i.e., retinol).

[f] In view of evidence linking folate intake with neural tube defects in the fetus, it is recommended that all women capable of becoming pregnant consume 400 mcg of folate as folic acid from fortified foods or supplements in addition to intake of food folate from a varied diet.

NOTES FOR TABLE F-2: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); AT = α-tocopherol; DFE = dietary folate equivalents; EAR = Estimated Average Requirement, used when available; ND = not determined, UL not determined due to lack of data of adverse effects; RDA = Recommended Dietary Allowance; UL = Tolerable Upper Intake Level.

DATA SOURCES: Institute of Medicine (IOM, 1997, 1998, 2000b, 2001) (see IOM, 2005b).

TABLE F-3 FOLLOWS

TABLE F-3 Dietary Reference Intakes Used for Assessing Intakes of WIC-Eligible Subgroups, Selected Macronutrients

Participant Category	Dietary Component	
	Food Energy (kcal/d)	Protein (% of food energy)
Infants, 0 through 5 mo		
EER or AI*	570 (3 mo M) 520 (3 mo F)	ND
Infants, 6 through 11 mo		
EAR		
EER, RDA, or AI*	743 (9 mo M) 676 (9 mo F)	ND
Children, 1 through 3 y		
EAR		
EER, RDA, AI* or AMDR†	1046 (2 y M) 992 (2 y F)	5–20†
Children, 4 y		
EAR		
EER, RDA, AI* or AMDR†	1742 (6 y M) 1642 (6 y F)	10–30†
Females, 14 through 18 y		
EAR		
EER, RDA, AI* or AMDR†	2368 (16 y)	10–30†
Females, 19 through 44 y		
EAR		
EER, RDA, AI* or AMDR†	2403 (19 y)	10–35†
Pregnant females, < 19 y		
EAR		
EER, RDA, AI* or AMDR†	2368 (1st trimester) 2708 (2nd trimester) 2820 (3rd trimester)	10–30†
Pregnant females, 19 through 44 y		
EAR		
EER, RDA, AI* or AMDR†	2403 (1st trimester) 2743 (2nd trimester) 2855 (3rd trimester)	10–35†
Lactating females, < 19 y		
EAR		
EER, RDA, AI* or AMDR†	2698 (1st 6 mo) 2768 (2nd 6 mo)	10–30†
Lactating females, 19 through 44 y		
EAR		
EER, RDA, AI* or AMDR†	2733 (1st 6 mo) 2803 (2nd 6 mo)	10–35†

Total Carbohydrate (% of food energy)	Total Fat (% of food energy)	Protein[a] (g/d)	Total Carbohydrate (g/d)	Added Sugars[b] (% of food energy)	Fiber, total dietary (g/d)
ND	55‡ (31 g/d*)	9.1*	60*	<25	ND
ND	40‡ (30 g/d*)	11.0	95*	<25	ND
45–65†	30–40†[c]	13.0	100 130	<25	19*
45–65†	25–35†	19.0	100 130	<25	25*
45–65†	25–35†	46.0	100 130	<25	26*
45–65†	20–35†	46.0	100 130	<25	25*
45–65†	25–35†	71.0	135 175	<25	28*
45–65†	20–35†	71.0	135 175	<25	28*
45–65†	25–35†	71.0	160 210	<25	29*
45–65†	20–35†	71.0	160 210	<25	29*

continues

TABLE F-3 Continued

[a] The Dietary Reference Intakes (DRIs) for protein include an AI of 1.52 g/kg body weight/d for infants age 0 through 5 months and EARs of 1.2 g/kg body weight/d for infants age 6 through 11 months, 0.87 g/kg body weight/d for children ages 1 through 3 years, 0.76 g/kg body weight/d for children ages 4 through 8 years, 0.71 g/kg body weight/d for adolescent women (nonpregnant, nonlactating) ages 14 through 18 years, and 0.66 g/kg body weight/d for adult women (nonpregnant, nonlactating) ages 19 through 50 years. The EAR for protein intake per day is 0.88 g/kg body weight plus 21 g for pregnant women of all age groups and 1.05 g/kg body weight plus 21.2 g for lactating women of all age groups (IOM, 2002/2005).

[b] The DRI reports establish some dietary guidance for macronutrient intake beyond the AMDR. Part of this dietary guidance is that added sugars be limited to no more than 25% of total energy intake (IOM, 2002/2005).

[c] The American Academy of Pediatrics recommends that whole milk, rather than reduced fat milk, be consumed by children ages 13 through 23 mo (AAP, 2004). Dietary guidance from AAP to avoid atherogenic diets during childhood were applied to children 2 years of age and older (AAP, 1992b, 1998). The AAP recommendations, when taken out of context, might be interpreted that there should be no restriction of fat intake for children age 1 y. However, the AAP recommendation is not in conflict with the DRI reports that recommend a transitioning of dietary fat from the high fat diet of infancy (55% of energy from fat for ages 0 through 5 mo; 40% of energy from fat for ages 6 through 11 mo) to the moderate fat diet of childhood (25 to 35% of energy from fat) (IOM, 2002/2005). Thus it is appropriate to follow the AMDR recommendations for dietary fat to contribute 30 to 40% of food energy intake for children ages 13 through 23 mo (IOM, 2002/2005).

NOTES FOR TABLE F-3: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); AMDR = Acceptable Macronutrient Distribution Range, indicated by a dagger (†); EAR = Estimated Average Requirement, used when available; EER = Estimated Energy Requirement; F = female; kcal = kilocalories; M = male; ND = not determined; RDA = Recommended Dietary Allowance. An AMDR for total fat has not been set for infants; however, the AIs for total fat (indicated by an asterisk (*) represent a high fat diet as indicated by the usual intake of total fat as the percentage of food energy intake for breast-fed infants (indicated by a double dagger [‡]).

DATA SOURCES: The American Heart Association (Krauss et al., 1996; AHA, 2004); and the Institute of Medicine (IOM, 2002/2005) (see IOM, 2005b).

TABLE F-4 FOLLOWS

TABLE F-4 Dietary Reference Intakes and Other Dietary Guidance Used for Assessing Intakes of WIC-Eligible Subgroups, Selected Fats

	Dietary Component	
Participant Category	Total Fat (% of food energy)	Saturated Fat[a] (% of food energy)
Infants, 0 through 5 mo		
AI*	55‡ (31 g/d*)	<10
UL	ND	ND
Infants, 6 through 11 mo		
AI*	40‡ (30 g/d*)	<10
UL	ND	ND
Children, 1 through 3 y		
AI* or AMDR†	30–40†[g]	<10
UL	ND	ND
Children, 4 y		
AI* or AMDR†	25–35†	<10
UL	ND	ND
Females, 14 through 18 y		
AI* or AMDR†	25–35†	<10
UL	ND	ND
Females, 19 through 44 y		
AI* or AMDR†	20–35†	<10
UL	ND	ND
Pregnant females, < 19 y		
AI* or AMDR†	25–35†	<10
UL	ND	ND
Pregnant females, 19 through 44 y		
AI* or AMDR†	20–35†	<10
UL	ND	ND
Lactating females, < 19 y		
AI* or AMDR†	25–35†	<10
UL	ND	ND
Lactating females, 19 through 44 y		
AI* or AMDR†	20–35†	<10
UL	ND	ND

[a]The dietary guidance for saturated fat presented in Table F-1D is from the American Heart Association (Krauss et al., 1996; AHA, 2004) and the *Dietary Guidelines for Americans* (USDA/DHHS, 2000; DHHS/USDA, 2005). The dietary guidance for saturated fat from the DRI report is to consume amounts as low as possible while consuming a nutritionally adequate diet (IOM, 2002/2005).

[b]The dietary guidance for monounsaturated fatty acids presented in Table F-1D is from the American Heart Association (Krauss et al., 1996).

[c]The AIs for *n*-6 fatty acids shown in Table F-1D are for linoleic acid (18:2, *n*-6). The AMDR for total *n*-6 fatty acids is 5 to 10% of food energy intake with at least 90% as linoleic acid and up to 10% from longer-chain *n*-6 fatty acids (IOM, 2002/2005). For *n*-6

Monounsaturated Fatty Acids[b] (% of food energy)	Polyunsaturated Fatty Acids (g/d)	*n*-6 Fatty Acids[c] (g/d)	*n*-3 Fatty Acids[d] (g/d)	*Trans* Fatty Acids[e]	Cholesterol[f] (mg/d)
≤ 15	4.4*	4.4*	0.5*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	4.6*	4.6*	0.5*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	7.0*	7.0*	0.7*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	10.0*	10.0*	0.9*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	11.0*	12.0*	1.1*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	12.0*	12.0*	1.1*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	13.0*	13.0*	1.4*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	13.0*	13.0*	1.4*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	13.0*	13.0*	1.3*	limit	<300 mg
ND	ND	ND	ND	ND	ND
≤ 15	13.0*	13.0*	1.3*	limit	<300 mg
ND	ND	ND	ND	ND	ND

polyunsaturated fatty acids, the first double bond from the methyl end is at the sixth carbon atom.

[d]The AIs for *n*-3 fatty acids shown in Table F-1D are for α(alpha)-linolenic acid (18:3, *n*-3). The AMDR for total *n*-3 fatty acids is 0.6 to 1.2% of food energy intake with at least 90% as α(alpha)-linolenic acid and up to 10% from longer-chain *n*-6 fatty acids (IOM, 2002/2005). For *n*-3 fatty acids, the first double bond from the methyl end is at the third carbon atom.

[e]The dietary guidance from the DRI report for *trans* fatty acids is to consume in amounts as low as possible while consuming a nutritionally adequate diet (IOM, 2002/2005). The term *trans fatty acids* refers to unsaturated fatty acids that contain at least one double bond in the

continues

TABLE F-4 Continued

trans configuration (that is, with carbon atoms on opposite sides of the longitudinal axis of the double bond).

*f*The dietary guidance for cholesterol presented in Table F-1D is from the American Heart Association (Krauss et al., 1996; AHA, 2004) and the *Dietary Guidelines* (USDA/DHHS, 2000; DHHS/USDA, 2005). The dietary guidance for cholesterol from the DRI report is to consume an amount as low as possible while consuming a nutritionally adequate diet (IOM, 2002/2005).

*g*The American Academy of Pediatrics recommends that whole milk, rather than reduced fat milk, be consumed by children ages 13 through 23 mo (AAP, 2004). Dietary guidance from AAP to avoid atherogenic diets during childhood were applied to children 2 years of age and older (AAP, 1992b, 1998). The AAP recommendations, when taken out of context, might be interpreted that there should be no restriction of fat intake for children age 1 y. However, the AAP recommendation is not in conflict with the DRI reports that recommend a transitioning of dietary fat from the high fat diet of infancy (55% of energy from fat for ages 0 through 5 mo; 40% of energy from fat for ages 6 through 11 mo) to the moderate fat diet of childhood (25 to 35% of energy from fat) (IOM, 2002/2005). Thus it is appropriate to follow the AMDR recommendations for dietary fat to contribute 30 to 40% of food energy intake for children ages 13 through 23 mo (IOM, 2002/2005).

NOTES FOR TABLE F-4: AI = Adequate Intake, used when necessary, indicated by an asterisk (*); AMDR = Acceptable Macronutrient Distribution Range, indicated by a dagger (†); ND = not determined; UL = Tolerable Upper Intake Level. An AMDR for total fat has not been set for infants; however, the AIs for total fat (indicated by an asterisk [*]) represent a high fat diet as indicated by the usual intake of total fat as the percentage of food energy intake for breast-fed infants (indicated by a double dagger [‡]).

DATA SOURCES: The American Heart Association (Krauss et al., 1996; AHA, 2004); and the Institute of Medicine (IOM, 2002/2005) (see IOM, 2005b).

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Biographical Sketches of Committee Members

BARBARA L. DEVANEY, Ph.D., is an economist and senior fellow at Mathematica Policy Research, Inc. (Princeton, NJ). Dr. Devaney's expertise is in the areas of food assistance and child health programs and the nutrition policies that affect these programs. She has over 20 years of experience in designing and conducting program evaluations and has conducted numerous studies of the WIC Program, the Food Stamp Program, and school nutrition programs. She was the project director for the Feeding Infants and Toddlers Study (FITS) for the Gerber Products Company in which data on food and nutrient intakes of infants and toddlers were collected and analyzed (2001–2003). In addition, Dr. Devaney conducted analyses of the effects of WIC participation on infant mortality and very low birth-weight among Medicaid newborns, and has investigated the infant feeding practices, and health care utilization of infant WIC participants. Dr. Devaney has served on several Institute of Medicine panels including the Subcommittee on Interpretation and Uses of Dietary Reference Intakes and the Committee on Scientific Evaluation of the WIC Nutrition Risk Criteria. Dr. Devaney earned a B.A. degree in economics from Mount Holyoke College (South Hadley, MA) and a Ph.D. degree in economics from the University of Michigan.

GEORGE M. GRAY, Ph.D., is lecturer on risk analysis in the Department of Health Policy and Management in the School of Public Health at Harvard University. Dr Gray is also Executive Director of the Harvard Center for Risk Analysis. His primary research interests are risk characterization and risk communication (with an emphasis on agriculture, food safety, and

chemicals in the environment). Other interests include the scientific basis of human health risk assessment, application of risk assessment to policy decisions, and risk/risk tradeoffs in risk management. Dr. Gray receives research support from numerous sources, including the National Food Processors Association Research Foundation. Dr. Gray has served on various panels including the Risk Assessment Task Force of the Society of Toxicology, the Food Advisory Committee of the Center for Food Safety and Applied Nutrition (CFSAN) at FDA, and the National Advisory Environmental Health Science Council of NIEHS. Dr. Gray earned a B.S. degree from the University of Michigan and M.S. and Ph.D. degrees from the University of Rochester.

GAIL G. HARRISON, Ph.D., is professor in the Department of Community Health Sciences at the School of Public Health of the University of California—Los Angeles (UCLA). Dr. Harrison is also Senior Research Scientist in the UCLA Center for Health Policy Research and associate director of the Program for Healthy and At-Risk Populations in the Division of Cancer Prevention and Control, UCLA/Jonsson Comprehensive Cancer Center. Dr. Harrison's interests include pediatric and maternal nutrition, dietary and nutritional status assessment, food security, and international health and nutrition. Her recent research interests include assessment of variation in dietary intake patterns, cancer-protective interventions, estimation of dietary content of isoflavones, and changes in diet and prevalence of chronic diseases in developing countries. Dr. Harrison has been a member of the Food and Nutrition Board and has served on several Institute of Medicine panels including the Committee on Implications of Dioxin in the Food Supply, the Committee on Scientific Evaluation of WIC Nutrition Risk Criteria, the Committee on Food Consumption Patterns, and the Committee on International Nutrition Programs. She has served as a technical consultant to the WIC program of the Public Health Foundation of Los Angeles and to USDA's Agricultural Research Service and Economic Research Service. Dr. Harrison earned a B.S. degree in foods and nutrition from the University of California—Santa Barbara, an M.N.S. (nutritional sciences) degree from Cornell University, and a Ph.D. degree in biological anthropology at the University of Arizona. She was elected to the Institute of Medicine in 2003.

HELEN H. JENSEN, Ph.D., is professor in the Department of Economics in the College of Agriculture at Iowa State University (ISU). Dr. Jensen is also head of the Food and Nutrition Policy Division in the Center for Agricultural and Rural Development (CARD) at ISU. Her research focuses on nutrition policies, food assistance programs, food security issues, analysis of food demand, food hazard control options, food safety (with empha-

sis on the economics of food safety), and health economics. Dr. Jensen's current research includes participation in an evaluation of the nutrition education component of the WIC Program; her part in this competitive grant to the Iowa Department of Public Health from the Food and Nutrition Service of the USDA is analysis of the cost-effectiveness of the nutrition education intervention. Dr. Jensen currently serves on the Committee on National Statistics' (CNSTAT) Panel to review USDA's Measurement of Food Insecurity and Hunger and has served on several National Research Council panels including the Committee on Assessing the Nation's Framework for Addressing Animal Diseases (where she is currently serving), the Committee on Biological Threats to Agricultural Plants and Animals, and the Panel on Animal Health and Veterinary Medicine. Dr. Jensen earned a B.A. degree in economics from Carleton College (Northfield, MN), an M.S. degree in agricultural and applied economics from the University of Minnesota, and a Ph.D. degree in agricultural economics from the University of Wisconsin—Madison.

LUCIA L. KAISER, Ph.D., R.D., is Cooperative Extension Specialist in the Department of Nutrition in the College of Agriculture and Environmental Sciences at the University of California—Davis. Dr. Kaiser's research interests include the impact of acculturation and food security on the child/parent feeding relationship among Latinos and evaluation of nutrition education. She served in WIC programs in California for six years as supervising public health nutritionist and regional nutrition consultant. Dr. Kaiser currently administers a USDA/ Economic Research Service Small Grants Program to examine the impact of food assistance on nutrition. Dr. Kaiser earned a B.S. degree in biology from the College of William and Mary, and M.S. and Ph.D. degrees in nutrition from the University of California—Davis.

JEAN D. KINSEY, Ph.D., is professor of consumption economics in the Department of Applied Economics in the College of Agricultural, Food and Environmental Sciences at the University of Minnesota. Dr. Kinsey is also the Co-Director of The Food Industry Center that focuses on how various retailers in the food industry serve consumers and how retailers and suppliers interact in food distribution channels. The Food Industry Center at the University of Minnesota is one of 13 industry study centers funded by the nonprofit Sloan Foundation. Dr. Kinsey's research interests include food consumption trends, consumer buying behavior, food safety and consumer confidence, demographic changes in households, food industry structure, trends in food distribution and retail sales, effects of electronic technology on efficiency in retail outlets, economic effects of health and safety regulations, and regulation in the food industry. Dr. Kinsey earned a B.A. degree

in home economics from St. Olaf College (Northfield, MN) and M.S. and Ph.D. degrees from the University of California—Davis in consumer economics and agricultural economics, respectively. Dr. Kinsey was appointed a resident fellow at the National Center for Food and Agricultural Policy, Resources for the Future (1986–1987, Washington, DC); a distinguished fellow of the American Council on Consumer Interests (1997); and a fellow of the American Agricultural Economics Association (2000).

SUZANNE P. MURPHY, Ph.D., R.D., is a research professor at the Cancer Research Center of Hawaii at the University of Hawaii (Honolulu, HI) and director of the Nutrition Support Shared Resource at the center. Dr. Murphy's research interests include dietary assessment methodology, development of food composition databases (with emphasis on inclusion of ethnic foods), communication of nutrition principles (with emphasis on multicultural populations), and nutritional epidemiology of chronic diseases (with emphasis on cancer and obesity). She has served as a member of the National Nutrition Monitoring Advisory Council and as vice-chair of the 2000 Dietary Guidelines Advisory Committee. Dr. Murphy has served on several Institute of Medicine panels including the Subcommittee on Interpretation and Uses of Dietary Reference Intakes, which she chaired for two years; the Subcommittee on Upper Safe Reference Levels of Nutrients, and the Panel on Calcium and Related Nutrients; Dr. Murphy earned a B.S. degree in mathematics from Temple University, Philadelphia, an M.S. degree in molecular biology from San Francisco State University, and a Ph.D. degree in nutrition from the University of California—Berkeley.

ANGELA M. ODOMS-YOUNG, Ph.D., is an assistant professor of Public and Community Health in the School of Allied Health Professions of the College of Health and Human Sciences at Northern Illinois University (Dekalb, IL). Prior to her current position, Dr. Odoms-Young completed a Family Research Consortium Postdoctoral Fellowship focused on understanding family processes in diverse populations at the Pennsylvania State University and University of Illinois—Urbana-Champaign and a Community Health Scholars Fellowship in community-based research at the University of Michigan School of Public Health. Her research and teaching focus on race, poverty, and health; community-based participatory research; obesity prevention and management; religion and health (with emphasis on health issues impacting Muslim women); minority health (with emphasis on health disparities in minority populations and health perceptions among low-income families); health promotion (with emphasis on the lay health advisor model); and health education (with emphasis on communicating nutrition principles to minority families). Dr. Odoms-Young's research experience included participation in Welfare, Children, and Families: A Three-

City Ethnographic Study where she was interested in the influence of poverty on the nutrition and health beliefs of low-income women with young children. Dr. Odoms-Young earned a B.S. degree in foods and nutrition from the University of Illinois—Urbana/Champaign and M.S. and Ph.D. degrees from Cornell University in human nutrition and community nutrition, respectively.

KAREN E. PETERSON, Sc.D., R.D., is Associate Professor and Director of Public Health Nutrition in the Department of Nutrition with a joint appointment in the Department of Society, Human Development and Health in the School of Public Health at Harvard University. Her research focuses on biosocial and environmental determinants of body size and growth during critical periods of behavioral and biologic adaptation and the application of these principles to the design and evaluation of surveillance systems and of community-based interventions addressing overweight and undernutrition among low-income, multiethnic populations in the United States and Latin America. Dr. Peterson served for seven years in the Massachusetts WIC Program as a nutritionist and as a program director. Her current research includes examination of dietary behaviors on weight statue of children and new mothers enrolled in WIC. Dr. Peterson earned a B.S. degree in foods and nutrition from the University of Utah, completed her dietetics internship at Peter Bent Brigham Hospital, Boston, MA, and received a D.Sc. degree in nutrition from the School of Public Health at Harvard University. She chaired the CDC-funded "Building Comprehensive Obesity Surveillance" national workgroup and is currently President of the Maternal and Child Health Council of the Association of Schools of Public Health and President of the Graduate Faculties of Public Health Nutrition.

ANNA MARIA SIEGA-RIZ, Ph.D., R.D., is associate professor in the Department of Maternal and Child Health and the Department of Nutrition in the School of Public Health at the University of North Carolina (UNC)—Chapel Hill. Dr. Siega-Riz is a fellow at the Carolina Population Center and director of the Nutrition Epidemiology Core for the Clinical Nutrition Research Center in the Department of Nutrition also at UNC—Chapel Hill. Her research focuses on reproductive and minority health (with emphasis on maternal nutritional status and how it affects birth outcomes). Dr. Siega-Riz expertise includes maternal and early childhood health, maternal nutrition (with emphasis on iron, zinc, folate, and vitamin C), reproductive epidemiology, and effects of participation in the WIC Program. She approaches her research from a multidisciplinary team perspective as an effective way to address complex problems such as prematurity, fetal programming, and racial disparities in reproductive outcomes. Dr. Siega-Riz earned

a B.S.P.H. degree in nutrition from the School of Public Health at the UNC—Chapel Hill; an M.S. degree in food, nutrition, and food service management from UNC—Greensboro; and a Ph.D. degree in nutrition and epidemiology from the School of Public Health at UNC—Chapel Hill. She received the Mary C. Egan Award (2000; from the American Public Health Association—Food and Nutrition Section) which recognizes professional contributions and outstanding services of public health nutritionists.

VIRGINIA A. STALLINGS, M.D., is the Jean A. Cortner Endowed Chair in Pediatric Gastroenterology, director of the Nutrition Center, and deputy director of the Joseph Stokes Jr. Research Institute at Children's Hospital of Philadelphia. Dr. Stallings is also professor of pediatrics at the University of Pennsylvania School of Medicine. Her research interests include pediatric nutrition, nutrition science (with emphasis on evaluation of dietary intake and energy expenditure), and chronic disease (with emphasis on nutrition-related issues of children and adolescents with chronic illnesses). Dr. Stallings is on the board of the Dannon Institute and serves as a consultant on pediatric nutrition and educational issues to the Bristol-Myers/Squibb Foundation and Mead-Johnson Nutritionals. Dr. Stallings has served on several Institute of Medicine panels including the Food and Nutrition Board, the Committee on the Scientific Basis of Dietary Risk Eligibility Criteria for the WIC Program, and the Committee on Nutrition Services for Medicare Beneficiaries. Dr. Stallings received a B.S. degree in nutrition and foods from Auburn University, an M.S. degree in human nutrition and biochemistry from Cornell University, and an M.D. degree from the University of Alabama School of Medicine. Her medical training was completed with a pediatric residency at The University of Virginia and a pediatric nutrition fellowship at the Hospital for Sick Children, Toronto, Ontario. Dr. Stallings is board certified in pediatrics and clinical nutrition.

CAROL WEST SUITOR, Sc.D., is a nutrition consultant is a nutrition consultant who recently has worked with the World Health Organization, Abt Associates, and the Year 2005 Dietary Guidelines Advisory Committee. Pervious consulting work includes assisting the March of Dimes' Task Force for Nutrition and Optimal Human Development; assisting the year 2000 Dietary Guidelines Advisory Committee; studying school children's diets in conjunction with Mathematica Policy Research Inc.; and serving on the Advisory Committee for the Harvard School of Public Health's Dietary Intake Grant (ERS/USDA). Dr. Suitor served as study director for the Institute of Medicine for 8 years; studies included Nutritional Status During Pregnancy and Lactation (4 studies), Scientific Evaluation of WIC Nutrition Risk Criteria, and Dietary Reference Intakes on the B Vitamins and Choline. At Georgetown University in the National Center for Education in

Maternal and Child Health, Dr. Suitor managed projects on maternal and child nutrition. At the Harvard School of Public Health, she worked on the development and testing of instruments for collecting dietary information from low-income women. Dr. Suitor has served on several Institute of Medicine panels including the Committee on the Scientific Basis for Dietary Risk Eligibility Criteria for WIC Programs and the Committee on Evaluation of USDA's Methodology for Estimating Eligibility and Participation for the WIC Program. Dr. Suitor earned a B.S. degree in food and nutrition from Cornell University, an M.S. degree in nutrition from the University of California—Berkeley, and M.S. and Sc.D. degrees in maternal and child health from the School of Public Health at Harvard University.

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Open Sessions

PRELIMINARY OPEN SESSION

February 26, 2004
The National Academy of Sciences
2101 Constitution Avenue, NW
Washington, DC

Suzanne Murphy, Committee Chair, moderated discussion with representatives from:

U. S. Department of Agriculture

- Dawn Aldridge, Executive Assistant; Office of the Secretary; Food, Nutrition and Consumer Services
- Jay Hirschman, Director, Special Nutrition Staff; Office of Analysis, Nutrition, and Evaluation; Food and Nutrition Service
- Laura Castro, Branch Chief, Special Nutrition Analysis; Office of Analysis, Nutrition, and Evaluation; Food and Nutrition Service
- Tracy Von Ins, Program Analyst; Office of Analysis, Nutrition, and Evaluation; Food and Nutrition Service
- Patricia Daniels, Director, National WIC Program; Food and Nutrition Service
- Jim Schaub, Director, Office of Risk Assessment and Cost-Benefit Analysis (ORACBA)

DISCUSSION OF METHODOLOGICAL APPROACHES

May 18, 2004
The Keck Center of the National Academies
500 Fifth Street, NW
Washington, DC

Suzanne Murphy, Committee Chair, moderated discussion with representatives from:

U. S. Department of Agriculture

- Dawn Aldridge, Executive Assistant; Office of the Secretary; Food, Nutrition and Consumer Services
- Tracy Von Ins, Program Analyst; Office of Analysis, Nutrition, and Evaluation; Food and Nutrition Service

National WIC Association

- Cecilia Richardson, MS, RD, LD; Nutrition Programs Director
- Jan Kallio, MS, RD; Vice President, Board of Directors, NWA; Asst. Director, Nutrition Services, WIC Program, Massachusetts Department of Public Health, Boston, MA

Local WIC State Agency

- Kathleen Knolhoff; Director, WIC Administration; Maryland Department of Health and Mental Hygiene
- Mary Dallavalle, MS, RD, LD; Nutrition Education Specialist, Office of the Maryland WIC Program

CALIFORNIA PANEL DISCUSSIONS

July 22, 2004
University of California–Los Angeles Campus
Neuropsychiatric Institute (NPI) Auditorium
740 Westwood Plaza
Los Angeles, CA

Possibilities for Incentivizing Breastfeeding
Kiran Saluja, Deputy Director, Public Health Foundation Enterprises WIC Program

Impact of Changes in the WIC Food Packages on WIC Agencies
Moderated by Suzanne Murphy, Committee Chair:

- Linnea Sallack, Director, California WIC Program
- Margaret Tate, Director, Arizona WIC Program

- Fatima Hoger, Nutrition and Breastfeeding Coordinator, Alaska WIC Program
- Eloise Jenks, Executive Director, WIC Program, Public Health Foundation Enterprises, Los Angeles
- Deana Herman, School of Public Health, University of California—Los Angeles
- Shirlee Runnings, Program Director, Human Resources Council, Mother Lode WIC Program, Amador and Calaveras Counties, California
- Douglas Greenaway, Executive Director, National WIC Association

Impact of Changes in the WIC Food Packages on Vendors
Moderated by Patricia Gradziel, Food Policy Unit, Nutrition Policy and Quality Improvement Section, California WIC Branch:

- Trisha Belisle, Manager, Retail Technology, Cub Foods, Stillwater, Minnesota
- Tina Luisoni, Training Specialist, Ralph's Foods, Los Angeles, California
- Rich Kuchinski, Training Manager, Raley's Foods, West Sacramento, California
- Don Bachman, Grocer Supervisor, Superior Super Warehouse, Santa Fe Springs, California
- Michael Amiri, Nutrición Fundamental, Los Angeles, California

Testimony by individuals or representatives from organizations:

- Douglas Greenaway, National WIC Association
- Alexis Forbes, Post/Kraft Foods
- Luz Amador, Garuda International, Inc.
- Zoey Goore
- Diane Woloshin, California WIC Association
- Evie Hansen, National Seafood Educators

WASHINGTON, DC PUBLIC FORUM

September 9, 2004
The Keck Center of the National Academies
500 Fifth Street, NW
Washington, DC

This session consisted of testimony by individuals or representatives from organizations:

- Cecilia Richardson representing the National WIC Association
- Nicholas Pyle representing Welch's

- Tracy Fox representing the Produce for Better Health Foundation
- Luz Amador representing Garuda International, Inc.
- Margaret Tate representing the USDA National Council on Maternal, Infant and Fetal Nutrition
- Karen Kafer representing the National Dairy Council
- Geraldine Henchy representing the Food Research and Action Center (FRAC)
- Joy Johanson representing the Center for Science in the Public Interest (CSPI)
- Regina Hildewine representing the National Food Processors Association
- Lawrence Kern representing the United Fresh Fruit and Vegetable Association
- Mike Wootton representing Sunkist Growers, Inc.
- Jessica Donze Black representing the American Dietetic Association
- Sandra Trinidad
- Maria Prince
- Diana Zuckerman representing the National Center for Policy Research for Women and Families
- Paul Weller representing the Apple Processors Association
- Jim Heimbach representing the U.S. Tuna Foundation and the National Fisheries Institute
- Maya Edmonds representing Soyfoods Association of North America
- Berry Friesen representing the Pennsylvania Hunger Action Center

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Acronyms and Abbreviations

~	Approximate amount
*	Asterisk
†	Dagger
‡	Double dagger
§	Section
α	Alpha
β	Beta
AAP	American Academy of Pediatrics
ADA	American Dietetic Association
AHA	American Heart Association
AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Range
ARS	Agricultural Research Service, U.S. Department of Agriculture
ASCN	American Society for Clinical Nutrition
AT	Alpha-tocopherol
ATE	Alpha-tocopherol equivalents
ATSDR	Agency for Toxic Substance and Disease Registry, U.S. Department of Health and Human Services
BARC	Beltsville Agricultural Research Center, U.S. Department of Agriculture
BLS	U.S. Bureau of Labor Statistics
BMI	Body mass index

c	Cup or cups
C-SIDE	C compiler version of SIDE
ca.	Approximately (that is, the calculated amount)
cc	Cubic centimeter
CDC	Centers for Disease Control and Prevention, U.S. Department of Health and Human Services
CDD	Chlorinated dibenzo-*p*-dioxin
CFR	Code of Federal Regulations, U.S. Congress
CFSAN	Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration
CNPP	Center for Nutrition Policy and Promotion, U.S. Department of Agriculture
CPA	Competent Professional Authority
CSFII	Continuing Survey of Food Intakes by Individuals
d	Day or days
DFE	Dietary Folate Equivalents
DHEW	U.S. Department of Health, Education, and Welfare
DHHS	U.S. Department of Health and Human Services
DLC	Dioxin-like compounds
doz	Dozen or dozens
DQI	Dietary Quality Index
DQI-R	Dietary Quality Index Revised
DRI	Dietary Reference Intake
EAR	Estimated Average Requirement
EBT	Electronic benefit transfer
EER	Estimated Energy Requirement
EPA	U.S. Environmental Protection Agency
ERS	Economic Research Service, U.S. Department of Agriculture
et al.	*et alia* (that is, and others)
FASEB	Federation of American Societies of Experimental Biology
FDA	Food and Drug Administration, U.S. Department of Health and Human Services
FITS	Feeding Infants and Toddlers Study
fl oz	Fluid ounce or fluid ounces
FNB	Food and Nutrition Board, Institute of Medicine, The National Academies
FNDDS	Food and Nutrient Database for Dietary Studies

FNS	Food and Nutrition Service, U.S. Department of Agriculture
FSIS	Food Safety and Inspection Service, U.S. Department of Agriculture
FSRG	Food Surveys Research Group, U.S. Department of Agriculture
FY	Fiscal year
g	Gram or grams
GAO	U.S. General Accounting Office (became U.S. Government Accountability Office on July 7, 2004)
h	Hour or hours
HEI	Healthy Eating Index
Inadeq	Inadequate
IOM	Institute of Medicine, The National Academies
IRI	Information Resources, Inc., Chicago, IL
ISU	Iowa State University
IU	International Unit or International Units
IZiNCG	International Zinc Nutrition Consultative Group
kcal	Kilocalorie or kilocalories
kg	Kilogram or kilograms
lb	Pound or pounds
LSRO	Life Sciences Research Office
m	Meter or meters
mcg	Microgram or micrograms
mg	Milligram or milligrams
mL	Milliliter of milliliters
mo	Month or months
n	Sample size (e.g., number of individuals included in analysis sample)
na	Not applicable
N/A	Not available
NAS	National Academy of Sciences, The National Academies
NAWD	National Association of WIC Directors (currently National WIC Association)
NCC	Nutrition Coordinating Center, University of Minnesota

ND	Not determined
NDL	Nutrient Data Laboratory, U.S. Department of Agriculture
NDS-R	Nutrient Data System for Research
NFCS	Nationwide Food Consumption Survey
NHANES	National Health and Nutrition Examination Survey
NIH	National Institutes of Health, U.S. Department of Health and Human Services
no.	Number or numbers
NRC	National Research Council, The National Academies
NWA	National WIC Association (formerly National Association of WIC Directors)
oz	Ounce or ounces
oz equiv	Ounce equivalent
PA	Physical activity
PAL	Physical activity level
PHS	Public Health Service, U.S. Department of Health and Human Services
ppm	Parts per million
Pub. L.	Public Law, U.S. Congress
qt	Quart or quarts
RACC	Reference amounts customarily consumed per eating occasion
RAE	Retinol Activity Equivalent
RDA	Recommended Dietary Allowance
RMA	Recognized Medical Authority
SD	Standard deviation
SIDE	Software for Intake Distribution Estimation
SKU	Stock-keeping unit
SR-17	Standard Reference 17, Nutrient Data Laboratory, U.S. Department of Agriculture
tsp	Teaspoon or teaspoons
UL	Tolerable Upper Intake Level
U.S.	United States
USC	U.S. Code
USDA	U.S. Department of Agriculture

VRG	Vegetarian Resource Group
WHO	World Health Organization, United Nations
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children, Food and Nutrition Service, U.S. Department of Agriculture
wk	Week or weeks
y	Year or years

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