

## II. CURRENT USDA ESTIMATES AND ALTERNATIVES

This chapter describes current approaches that USDA has taken and key alternative methods that others have developed to estimate (1) the number of persons eligible for WIC, and (2) WIC participation rates. The goal of this chapter is to lay out clearly the data sources, estimation procedures, and assumptions that underlie current and recent estimates, as well as the history of their development. Chapters III to V discuss key issues concerning the USDA estimates and alternatives. Appendix A provides detailed descriptions of the key data sources referenced.

The first section describes USDA estimates of eligibles and likely participants. The core of USDA's approach has been to use the March CPS to estimate the numbers of infants and children under 5 who live in families with annual incomes less than 185 percent of the poverty guideline; this group is referred to as "income-eligible." Estimates of the numbers of income-eligible pregnant and postpartum women are built from the estimates of income-eligible infants. Estimates of breast-feeding rates and of the percentages of income-eligible people who are also at nutritional risk were developed from other surveys, which contain the necessary nutrition and health data, and then applied to the CPS-based income-eligibles estimates. For determining state allocations, state-level versions of the infant and child income-eligibles estimates are prepared each year as well. In the past four years, the state-level estimates have been prepared with a Bayesian shrinkage estimator that combines state-level sample estimates from the CPS with information from administrative data sources. The shrinkage estimator provides much more precise estimates than would be available through sample data alone.

The second section briefly describes several competing estimates, the most important being those of the Congressional Budget Office, which were drawn from the Survey of Income and Program Participation (SIPP).

### USDA ESTIMATES

This section describes the methods USDA uses to construct national and state estimates of WIC eligibles, as well as estimates of the percentage of eligibles likely to participate under full funding. As background, a brief history of WIC eligibles estimates is provided first.

## History of WIC Eligibles Estimates

In the early 1980s, USDA began funding major studies to refine estimates of WIC eligibles, the first being the WIC Eligibility Study (WES I), which was conducted by the Sigma One Corporation under contract to USDA (U.S. Department of Agriculture 1987a and 1987b).

This study used 1980 Census data (with some adjustments from state vital statistics data) to estimate the number of people at the national, state, and county levels who were eligible for WIC both categorically and by income. It also for the first time systematically used nutrition and health survey data to estimate rates of nutritional risk among income-eligible people in each WIC category.

Even before the results became available, the Census-based results from WES I were too dated for use in preparing the WIC program budget. The summary report for WES I projected the 1979 national results to 1984 using the CPS. USDA staff later updated the projections to 1986 (U.S. Department of Agriculture 1990). In 1991, USDA began to prepare annual estimates, starting with an estimate for 1989. The "core" estimates of the number of infants and children who were income-eligible for WIC were derived from the March CPS. Then, using the core estimates, USDA staff calculated the numbers of income-eligible women, and the number nutritionally eligible in each category, using adjustments from WES I. In addition, the state-level estimates from WES I continued to be used to develop state allocations through 1993 (Schirm and Long 1995).

In the early 1990s, USDA contracted with Sigma One Corporation for the WIC Eligibility Study II (WES II) to update WES I using the 1990 Census and updated vital statistics and health and nutrition data. Estimates of income-eligible persons in 1989 from the WES II were published in 1993, and a report on the methodology underlying those estimates was published in 1996 (U.S. Department of Agriculture 1993 and 1996a). These estimates were used in developing state allocations for FY 1994, and the updated breast-feeding rates are used in the current national estimates of eligibles. However, delays in the availability of data from the third National Health and Nutrition Examination Survey (NHANES III) delayed the updating of the nutritional-risk estimates; this work is not yet complete. USDA has continued to use nutritional-risk rates estimated in WES I in preparing the annual national estimates.

In 1995, MPR worked with USDA to develop a method for updating the Census estimates of income-eligible infants and children at the state level to 1992, using a Bayesian shrinkage estimator that optimally combined information from the CPS, the Census, and state-level administrative data (Schirm 1995a). This approach has been used for state estimates ever since, with improvements in the data and methodology each year, to be further discussed below.

## **National Estimates of Eligibility**

National estimates of eligibility based on the CPS are used in preparing program coverage estimates and budget requests each year. In recent years, they have also been used as a benchmark for the state-level estimates (in that the state-level estimates are made to sum to the national estimates). This section first reviews the "core" estimates of income-eligible infants and children from the CPS, then discusses how estimates of income-eligible pregnant and postpartum women are derived, and finally, explains how estimates of income-eligible persons are adjusted for nutritional risk to derive estimates of "fully eligible" persons for each WIC category.

### **a. Approach to Estimating the Number of Income-Eligible Infants and Children**

The number of income-eligible infants and children is estimated annually from the March CPS, and results are typically available one year after the data are collected. The March CPS provides a large sample that is statistically representative at both the national and the state level and includes detailed questions on income from a wide range of sources for the previous calendar year. The CPS also contains detailed information about household structure, which permits income to be assessed not just at the household level, but also at the level of the family and the subfamily.

In comparison with other available data sources, particularly SIPP, the key strengths of the CPS for the national estimates are that it is updated annually and released quickly.<sup>1</sup>

The estimates count the number of infants younger than age 1 and the number of children age 1 to 4 (with age measured at the time of the March survey) whose families' annual income in the previous calendar year was less than 185 percent of the WIC poverty guideline for their family size.<sup>2</sup> Families are defined as including related subfamilies. For example, if a child lives with her mother and grandparents, the income of the grandparents is counted in her family income. Total family income is defined using the value on the CPS public-use datafile. The WIC poverty guidelines are defined as the average of DHHS poverty guidelines for the

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<sup>1</sup>In making state-level estimates, the fact that it is representative at the state level is also important. Some databases (including SIPP) are representative at the national level but are not representative at the state level, because they do not have enough primary sampling units in some states to make it possible to generalize about those states (see Chapter III).

<sup>2</sup>One exception is in the case of "secondary individuals under age 15," that is, children living in households with no other family members. Many are foster children; they constitute one-person families. The CPS does not measure family income for these children, but they are all assumed to be poor.

relevant calendar year and the year before, because the WIC program updates the guidelines in use midway through each year.

Estimates of income-eligible infants and children in the CPS have been prepared by MPR under contract to USDA since the late 1980s. Table II.1 shows the estimates prepared for the years 1991 to 1996, using data from the March 1992 to March 1997 CPS. In 1994, USDA published revised estimates for 1992 and 1993 using revised CPS weights that were based on the 1990 Census and adjusted for the Census undercount, and these estimates are included in Table II.1. Estimates have been so adjusted ever since.

In 1991, USDA began to use family income to measure eligibility for WIC in the 1989 estimates, based on the March 1990 CPS. Earlier CPS estimates and Census estimates in WES I were based on total household income. USDA switched to using family income (including income of related subfamilies) because they became convinced that this was closer to how WIC agencies defined the WIC economic unit. Work by Lazere et al. (1991) is acknowledged to have influenced this change. Estimates based on household income continue to be produced as well, to permit ongoing assessment of how much difference this change in the income unit has made. At the same time, USDA recognized that neither the family nor the household corresponds precisely to the WIC unit definition (U.S. Department of Agriculture 1991). Use of family, rather than household, income slightly increases the count of income-eligibles under age 5. For example, the estimate for 1996 is 4 percent larger than if it had been based on household income. This is an increase of 330,000 in the number of income-eligibles under 5 (Tordella 1998).

USDA makes two adjustments to the "core" estimates that MPR prepares of income-eligibles. First, an upward adjustment is made because WIC counts infants and children as adjunct-eligible if they have family incomes above 185 percent of the WIC guideline but live with pregnant women who are eligible for and enrolled in Medicaid based on a family size that is one higher than the actual family size. This very small adjustment (about 1 percent) is derived from an analysis in the WES II report (U.S. Department of Agriculture 1996a). The adjustment was adopted in 1995 (for the 1993 estimate) and was based on Medicaid program rules in 1992, when about half the states set the eligibility level for pregnant women at 185 percent of poverty. More states set eligibility for pregnant women at 185 percent of poverty now, but the adjustment has not been updated to reflect this.<sup>3</sup> USDA also decided in 1993 not to

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<sup>3</sup>From 1993 until the WIC program began counting pregnant women as two persons for the purposes of determining income eligibility in late 1994, the estimates for pregnant women were also adjusted for the fact that Medicaid counted pregnant women as two using data from WES II.

TABLE II.1

**"CORE" USDA ESTIMATES OF INCOME-ELIGIBLE  
INFANTS AND CHILDREN, 1991 TO 1996**  
(in Thousands)

	Infants	Children Age 1 to 4	Total Under Age 5
1991 <sup>a</sup>	1,784	6,620	8,404
1992	1,761	7,278	9,040
1993	1,809	7,679	9,487
1994	1,626	7,344	8,970
1995	1,669	6,963	8,631
1996	1,620	6,889	8,509

SOURCE: Heiser (1992), Trippe and Schirm (1994), and Tordella (1996, 1997, and 1998).

<sup>a</sup>Weights were based on the 1980 Census and not adjusted for the Census undercount. Weights for later years were based on the 1990 Census and adjusted for the undercount.

account for state Medicaid policies that could extend eligibility to pregnant women, infants, or children with incomes over 185 percent of poverty. As discussed in Chapter III, recent policy changes have likely led to substantial growth in those eligible only through Medicaid, which suggests that this issue may be worthy of further study.

Second, the estimates are adjusted for eligibles in U.S. territories, who are not included in the CPS universe. An upward adjustment of 3.88 percent is made, based on 1989 estimates of income-eligibles from the Census data (U.S. Department of Agriculture 1996a). This assumes that the income-eligible population of infants and children in the territories grows at the same rate as on the mainland. This adjustment is applied to estimates of eligible women as well.

#### **b. Approach to Estimating the Numbers of Pregnant and Postpartum Women**

USDA currently uses a simple approach to estimating the number of pregnant and postpartum income-eligible women. Specifically, the number of income-eligible pregnant women is now assumed to be 75 percent of the number of income-eligible infants (before the Medicaid adjunct-eligibility adjustment). This estimate assumes that infants less than 9 months old are 75 percent of infants less than 12 months old, and that the number of pregnant women equals the number of infants less than 9 months old. The number of income-eligible postpartum mothers of infants up to 12 months old is set to .9844 times the number of infants, that factor being derived from WES II estimates of postpartum women in 1989 that adjust for multiple births and infant deaths.

This simple approach to estimating the number of pregnant and postpartum women requires a number of assumptions, some based on research, others less so. In particular, the estimate for postpartum women is based on the following assumption:

- *Postpartum women have family incomes that are comparable to those of infants.* This approximation seems reasonable, but not all infants live with their mothers. Based on the 1990 Census, WES II estimated that 15 percent of income-eligible infants were not living with their mothers (U.S. Department of Agriculture 1996a, Appendix B, footnote 9; see also footnote 10).



The estimate of pregnant women as 75 percent of the number of infants is based on the following assumptions:

- ***The effects of fetal and infant mortality and multiple births offset each other.*** Data show that the net effects are small, but that multiple births are more common than fetal and infant deaths. Specifically, tabulations in WES II suggest that a more accurate adjustment would be to estimate pregnant women as .74 times the number of infants, a modest change.
- ***The number of births per year is constant in any two consecutive years.*** Birth rates do change over time, but so slowly that there is little change from year to year. Similarly, the number of women with the potential to give birth also changes slightly from year to year. In effect, the estimate of eligible pregnant women is 9 months older than the estimate of eligible infants and children.
- ***Pregnant women are potentially eligible for WIC for 9 months.*** This is based on the average length of pregnancy, which is just over 9 months. However, it does not take account of the fact that women do not generally learn they are pregnant until at least a month after conception, which implies that the potential period of eligibility is in fact shorter.<sup>4</sup>
- ***Family income is the same during pregnancy and after birth.*** In fact, since those who are infants in the March CPS were born sometime during the previous calendar year or after, the period for which family income data are collected inevitably covers some or all of the mother's pregnancy and may include parts of the period before the pregnancy and/or the period after birth. Thus, they may reflect income during pregnancy better than after a birth. However, this is some evidence that family income during a pregnancy tends to be higher than in the year after a birth. This issue is discussed further in Chapter IV.

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<sup>4</sup>Pregnant women may continue to participate in WIC without being recertified as postpartum until 6 weeks after the birth, but USDA does not intend to count eligible women in the 6 weeks after birth as pregnant. Instead, when preparing coverage estimates, participants in the first 6 weeks after birth who are classified as pregnant are subtracted from the total for pregnant participants and added to the total for postpartum participants.

The simple adjustment for pregnant women has been used in estimates prepared since late 1994, when WIC regulations concerning income-eligibility for pregnant women were changed to count them as two people in computing family size. (Before then, pregnant women were counted as one family member.) Use of the larger family size for a given income implies that more pregnant women are now counted as having incomes less than or equal to 185 percent of the WIC poverty guidelines than before the regulation changed. The change was made to conform to the rules used for Medicaid eligibility, as Medicaid had counted pregnant women as two for some time, and states were increasingly using 185 percent of poverty as their threshold for Medicaid eligibility for pregnant women.

Before pregnant women were counted as two, estimates of eligible pregnant women were lower, because their smaller family size made fewer income-eligible. The estimate of pregnant women as a percentage of infants was derived from WES I (from 1987 to 1992) or II (in 1993) and adjusted for fetal and infant mortality and multiple births, as noted earlier, as well as for the change in the family size threshold. For example, in WES II, income-eligible pregnant women were estimated to be 64.8 percent of income-eligible infants.

### **c. Approach to Estimating Breast-Feeding Rates**

National data on breast-feeding are collected in specialized surveys and updated much less frequently than data on income. USDA's approach has been to use the available data to develop estimates of breast-feeding for relevant categories of income-eligible WIC participants and to apply these rates to estimates of income-eligibles from the CPS. Breast-feeding estimates were developed as part of WES I and were based on data from the 1980 National Natality Survey (NNS). They were updated roughly a decade later as part of WES II. USDA currently uses WES II estimates of the prevalence of breast-feeding among postpartum mothers to adjust the estimate of postpartum women described above. This section describes how the WES II estimates were derived.

WES II used the 1988 National Maternal and Infant Health Survey (NMIHS), a national survey of new mothers, to estimate the percentage of postpartum mothers who would be classified as WIC-eligible breast-feeding and non-breast-feeding postpartum women. Breast-feeding data from the NMIHS were analyzed to estimate the probability that a woman would breast-feed her infant until a given month, using life table methods and controlling for the mother's age and income. The life table estimates of the duration of breast-feeding were used to predict, for each mother, how many months she would be eligible as a breast-feeding mother and, if she breast-fed less than 6 months, how many months she would be eligible as a non-breast-feeding postpartum mother.



The NMIHS is a nationally representative cross-sectional study of mothers who gave birth in 1988. Women were surveyed from 6 to 30 months after their child's birth. (The life table method adjusts for the fact that some mothers were still breast-feeding at the time of the interview.) The results suggest that the duration of breast-feeding varies significantly by maternal age and income level.

In turn, the duration of breast-feeding significantly affects the categorical eligibility of postpartum women. Of the 1.47 million postpartum, income-eligible women in 1989, approximately half were not categorically eligible for WIC benefits because they were not breast-feeding past 6 months postpartum. In fact, breast-feeding women account for only one-third of all postpartum women eligible both categorically and by income. Of women below 185 percent of the poverty level, 40 percent initiated breast-feeding at birth, 26 percent breast-fed for less than 6 months, and 14 percent breast-fed for 6 months or more (U.S. Department of Agriculture 1996a, Figure 7). When the results are fully adjusted for the duration of breast-feeding, WES II estimates indicated that, among postpartum women at a point in time, 37.4 percent were not breast-feeding and were less than 6 months postpartum, and 17.1 percent were breastfeeding (12.5 percent less than 6 months postpartum, and 4.6 percent more than 6 months postpartum). This implies that 54.5 percent of all postpartum income-eligible women with infants less than 12 months old are eligible for WIC both categorically and by income (U.S. Department of Agriculture 1996a, Figure 10).

The methodology for the current estimates determines breast-feeding status each month, although usual program practice is to certify breast-feeding mothers for 6-month periods, without checking that they continue to breast-feed for the full 6 months. In effect, women who breast-feed for 8 months are counted as WIC-eligible for 8 months, although the program may consider them eligible for a year. This difference between the estimates and actual practice does not affect eligibility estimates for women less than 6 months postpartum, as they may be eligible whether or not they are breast-feeding, but affects only whether they are counted as breast-feeding or non-breast-feeding. However, the methodology implies that the estimate of the number of women who are eligible past 6 months postpartum because they are breast-feeding (only about 10 percent of all postpartum or breast-feeding eligibles) is conservative relative to program practice.

#### **d. Nutritional-Risk Estimates**

Just as with breast-feeding rates, nutritional-risk estimates are based on specialized health and nutrition surveys. Updated nutritional-risk estimates based on the 1988 NMIHS and the 1988-1994 NHANES III are forthcoming, but eligibles estimates to date have used the nutritional-risk results from WES I, except for a change in the risk assumption for infants,

which will be described below. (WES I used data from the 1980 NNS and the 1976-1980 NHANES II.)

WIC eligibility depends on the presence of at least one recognized nutritional-risk factor. Because nutritional-risk criteria varied across states, it was important first to decide upon the risks to measure and the appropriate thresholds to apply in developing national estimates. The approach taken in WES I was to use a common "modal" set of nutritional-risk criteria, based on the criteria most commonly used across states. The data did not permit developing separate estimates for different states based on their specific criteria.<sup>5</sup>

The "modal" set of nutritional-risk criteria was developed from the operational definitions of nutritional-risk criteria of the 50 states and the District of Columbia. This modal set was designed to represent the most prevalent or typical risks used by WIC programs to determine nutritional risk. To be included in the modal set, a risk criterion must have been used by at least half the states. Furthermore, because the threshold levels used to establish risk status for many common risks, such as anemia, also varied by state, threshold values for the modal set were determined by weighting the states' thresholds by the estimated number of income-eligible target group women in each state. Thus, the modal set focused on the risk criteria that are likely to affect the greatest number of potential WIC clients.

The next step in the process was to determine which variables in the available data sets could be used to measure the modal risks for each WIC category. Measuring modal risks in NHANES II and the NNS was challenging, for two reasons. First, not all risks in the modal set were captured in the data, as some modal risks could not be measured or could be measured only approximately. As noted in Chapter I, nutritional risks include both medical risks and dietary risks, and the two data sets differed in the types of risks they captured. For instance:

- The NNS included few medical-risk factors for infants under 6 months old and no dietary data for anyone. Infants under 6 months old were also not included in NHANES II. For this group of infants, nutritional risk was defined based on more limited information from two different data sets: (1) the infant's medical risk was defined largely by the mother's medical risk as reported in the NNS, and (2) the infant's rate of risk from only dietary factors was estimated as the percentage of WIC-participating infants certified for dietary risk, based on WIC program administrative

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<sup>5</sup> Even if state-level data were available, one could argue that, for reasons of equity, eligible estimates should not be sensitive to variations in nutritional-risk policy subject to state discretion. However, the lack of data made this policy judgment moot.

data collected in the 1984 Study of WIC Participants and Program Characteristics.

- Medical risks that could not be measured for women included factors such as toxemia, mental retardation, and drug abuse.

WES I argues that the effects of not measuring all risks are minimized because most eligible people have several overlapping risks, and the likelihood is that at least one of their risks is captured.

Second, proxy populations were sometimes used, since neither NHANES II nor the NNS was specifically designed to measure WIC eligibles. For example:

- In the NHANES II data set, the samples of pregnant and postpartum women were too small for useful analysis. Therefore, to determine the medical risks for WIC-eligible pregnant and postpartum women from these data, NHANES II data for all women served as proxy measures. However, some risk factors, such as anemia, are much more common among pregnant women than among all women. Again, the authors of WES I argue that anemic women who are missed are likely to be picked up under other risk factors.
- Dietary-risk information is available only for women and children above the age of 1 year. Only medical-risk data are available for infants age 6 to 12 months. The dietary-risk rate of such infants was estimated from the dietary-risk rate of a proxy: children age 12 to 24 months.

For each WIC category, models were estimated for the likelihood of any risk and the likelihood of medical risk, based on the set of modal risks that could be measured for that group (or its proxy). Risk prevalences were estimated separately for groups defined by age, race/ethnicity, and income categories, and by region, and then averaged. Data from the NNS were used for women and for infants under 6 months, while data from NHANES II were used for women, infants over 6 months, and children.

For women, some medical risks could be measured in the NNS, some could be measured in NHANES II, and some could be measured in both data sets. Medical-risk estimates for women were thus constructed as follows (see U.S. Department of Agriculture 1987a, Table 6):

- In each data set, the percentage of women with any medical risk (other than low or high maternal age) was estimated. Percentage with any risk was estimated from NHANES II only, as no dietary data were available in the NNS. The dietary-risk-only estimate was

derived as the percentage with any risk in NHANES II, minus the percentage with any medical risk in NHANES II.

- The midpoint of the medical-risk estimates from the two databases was chosen as the estimated percentage with medical risk. To determine the estimated percentage with any risk, the dietary-risk-only percentage from NHANES II was added to the midpoint medical-risk estimate.
- These percentages were then adjusted by setting all women under age 18 or over 35 to have a 100 percent risk probability, since low and high maternal age were in themselves risk factors in the modal set.

It is not clear why the midpoint of the medical-risk estimates from the two datasets was chosen. Since each data set captures some risks the other data set does not, it seems more plausible to choose an estimate that is higher than either one separately. The data in WES I do not provide a way to suggest how much higher the estimate could be.

Table III.2 summarizes the average nutritional-risk rates that were determined for each category of participant in the WES I. These estimates have been criticized for not capturing all possible risks and thus not capturing the extent to which income-eligible persons would be found nutritionally eligible by a local WIC agency (Lazere et al. 1991).

The nutritional-risk rates from WES I have been used up to the present, except for one change--the rate used for infants was increased in 1991 from 72 percent to 95 percent. USDA made this change in response to alternative estimates offered by CBO and criticism from the Center on Budget and Policy Priorities (Lazere et al. 1991). Their argument was as follows:

- Infants younger than 6 months were often certified as Priority II, which means that their mothers were either WIC participants during pregnancy or were at medical risk during pregnancy.
- States were increasingly allowing infants to be certified until their first birthday, which meant that those infants never had their risk reevaluated.
- As WIC funding increased, WIC participation among pregnant women was increasing, which also increased the proportion of infants at nutritional risk because their mothers participated during pregnancy. Because 91 percent of income-eligible pregnant women were assumed to be at nutritional risk, as many as 91 percent of infants could become eligible because their mothers participated during pregnancy, if funding were not limited.

**TABLE II.2**

**NUTRITIONAL-RISK RATES ESTIMATED IN THE WIC ELIGIBILITY STUDY I**

Category	Estimated Percentage at Nutritional Risk
Pregnant Women	91.3
Non-Breast-Feeding Postpartum Women	93.3
Breast-Feeding Women	88.9
Infants	72.0
Children Age 1 to 4	75.2

**SOURCE:** U.S. Department of Agriculture (1987a), Table 12.

- Since some infants were certified for other reasons, the estimate for infants should be more than 91 percent.

While the earlier 72 percent was apparently too low, there is insufficient information with which to assess the 95 percent factor that replaced it. First, the percentage of infants at risk (or potentially at risk if funding were not restricted) is unique in potentially depending on their mothers' participation. The assumption that all eligible pregnant women would participate under full funding seems high, and it is not consistent with what USDA has done in other parts of the estimation process. The appropriate assumption about the full-funding participation rate remains uncertain (see below and Chapter V). Second, even if all eligible pregnant women participated, it is not clear that this would imply that 91 percent of income-eligible infants would be at risk for that reason--it is possible some income-eligible infants had mothers who were not income-eligible during pregnancy. Third, some of the infants at risk through their mothers would also have their own risks--it is again simply not known how much the two categories overlap. Thus, the appropriate risk assumption for infants seems to be in need of additional research.

A new set of nutritional-risk estimates based on the NMIHS and NHANES III is forthcoming and was not available for this review.

#### **e. Summary of Current USDA Approach**

Figures II.1 to II.5 summarize the steps in the current USDA approach. These figures are based on the actual spreadsheet USDA staff used to prepare the 1996 eligibility estimates, as well as information from WES II

#### **State-Level Estimates of Eligibility**

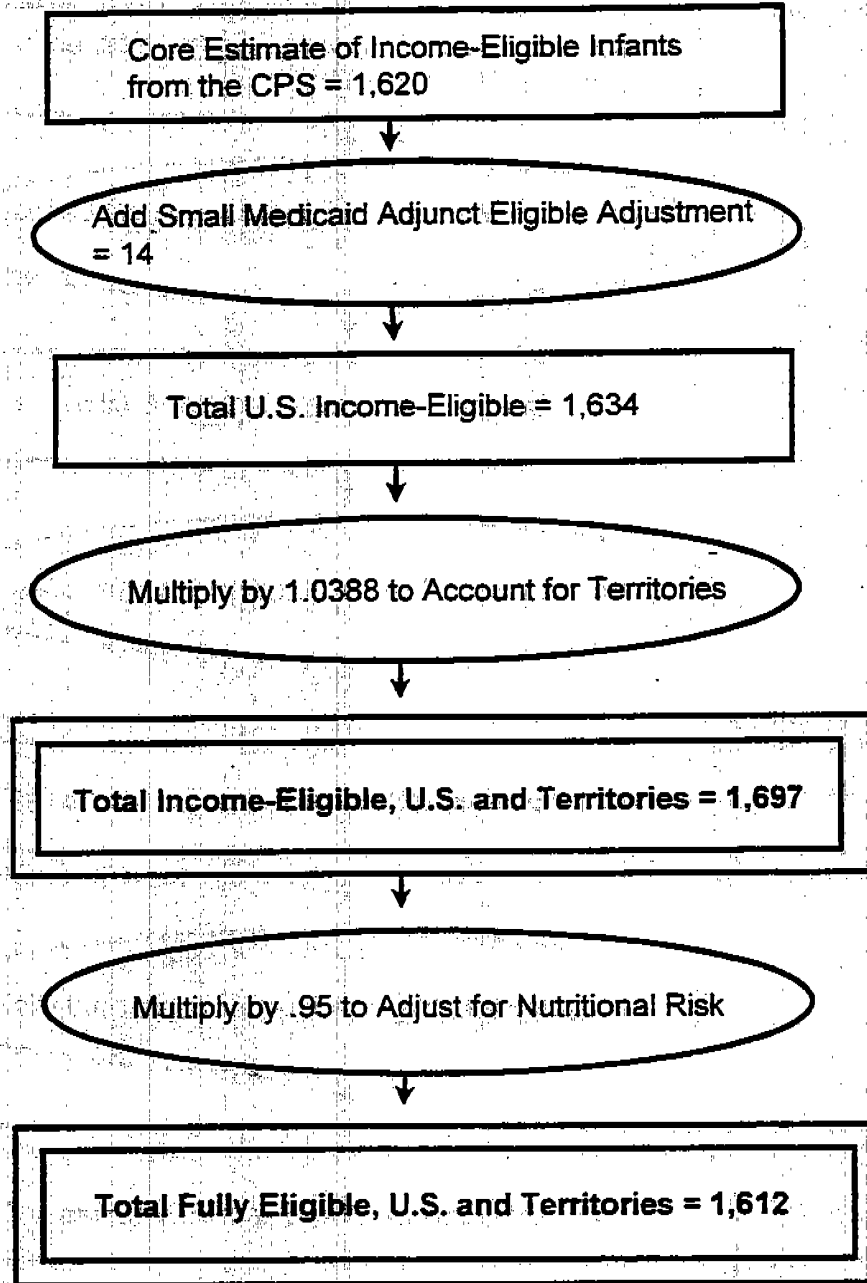
The formula established by law and by regulations for allocating WIC funds to the individual states depends, in part, upon the proportion of WIC eligibles in each state. In order to apply the formula, USDA has had to allocate among the states the national estimates of WIC eligibles.

Initially, the data source used for making these state allocations was the Decennial Census, as described above. However, after a Census, it takes several years for these data to become available, and they become increasingly dated during the period between Census years. An alternative is to use the CPS, the same data set used in preparing the national estimates. The CPS data are much more timely than those from the Decennial Census, and the data are representative at the state level. However, the CPS sample sizes for individual states can be quite low, which leads to high sampling variability in state-specific estimates.



FIGURE II.1

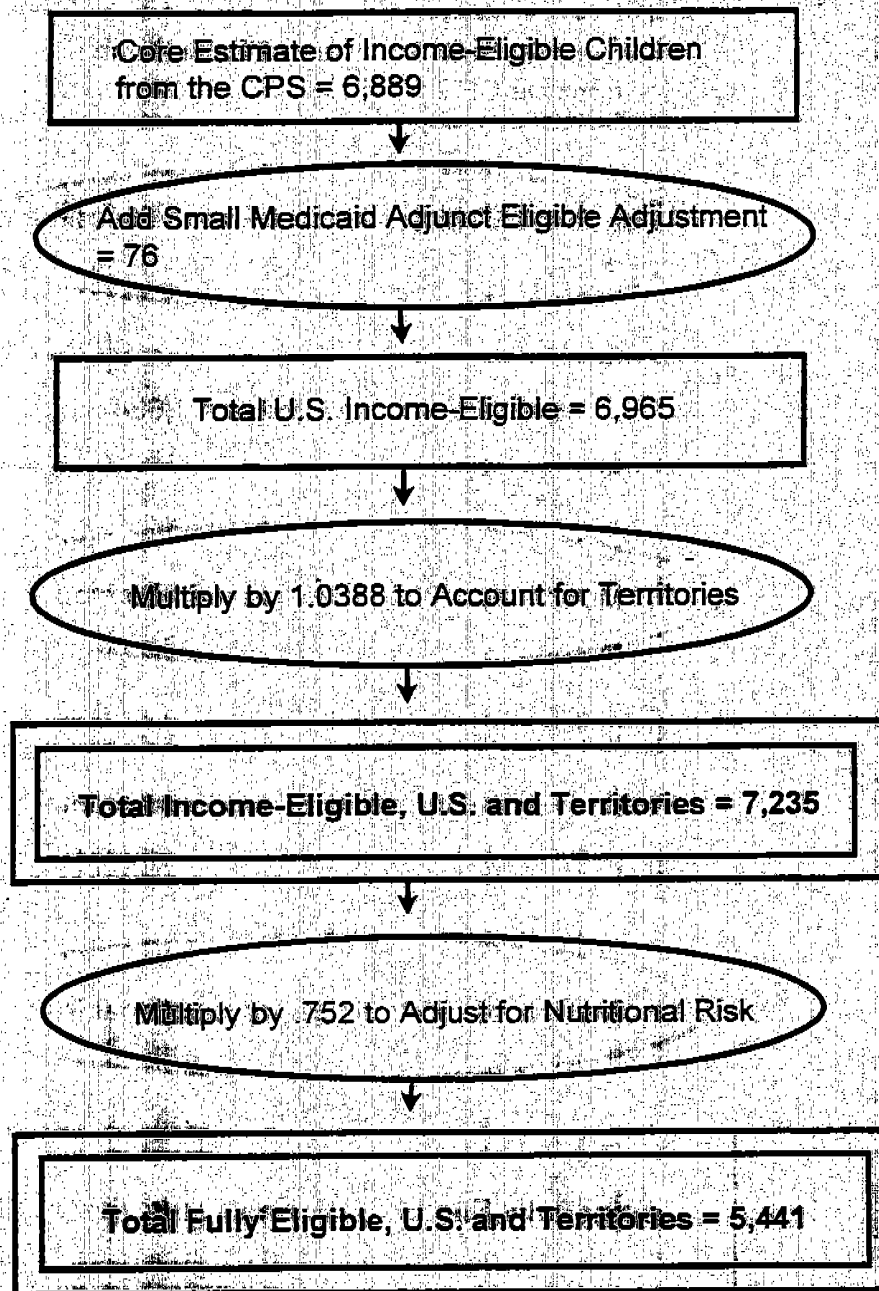
OVERVIEW OF STEPS IN USDA ESTIMATION  
OF WIC-ELIGIBLE INFANTS: 1996  
(Numbers in Thousands)



SOURCE: FNS Office of Analysis and Evaluation.

FIGURE II.2

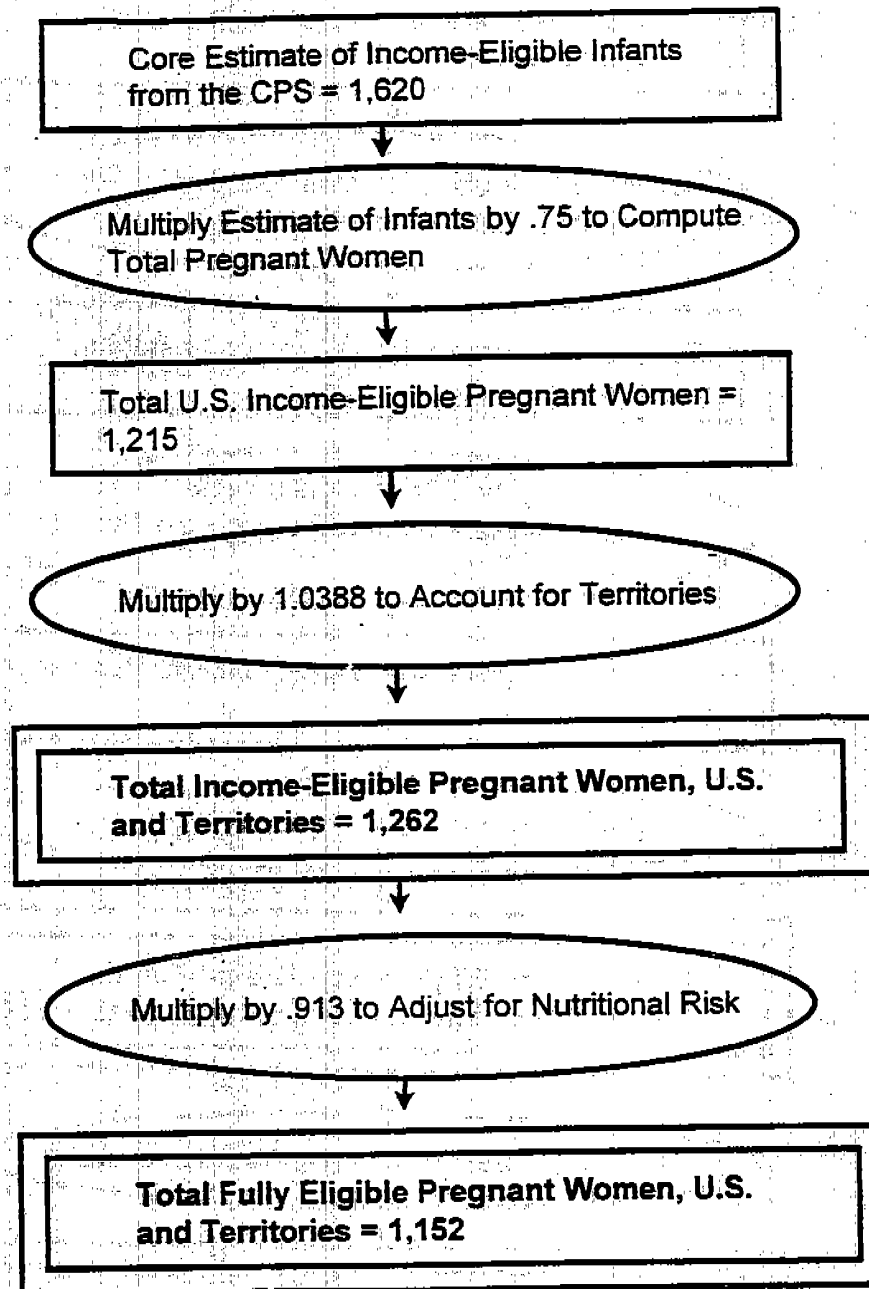
OVERVIEW OF STEPS IN USDA ESTIMATION  
OF WIC-ELIGIBLE CHILDREN: 1996  
(Numbers in Thousands)



SOURCE: FNS Office of Analysis and Evaluation.

FIGURE II.3

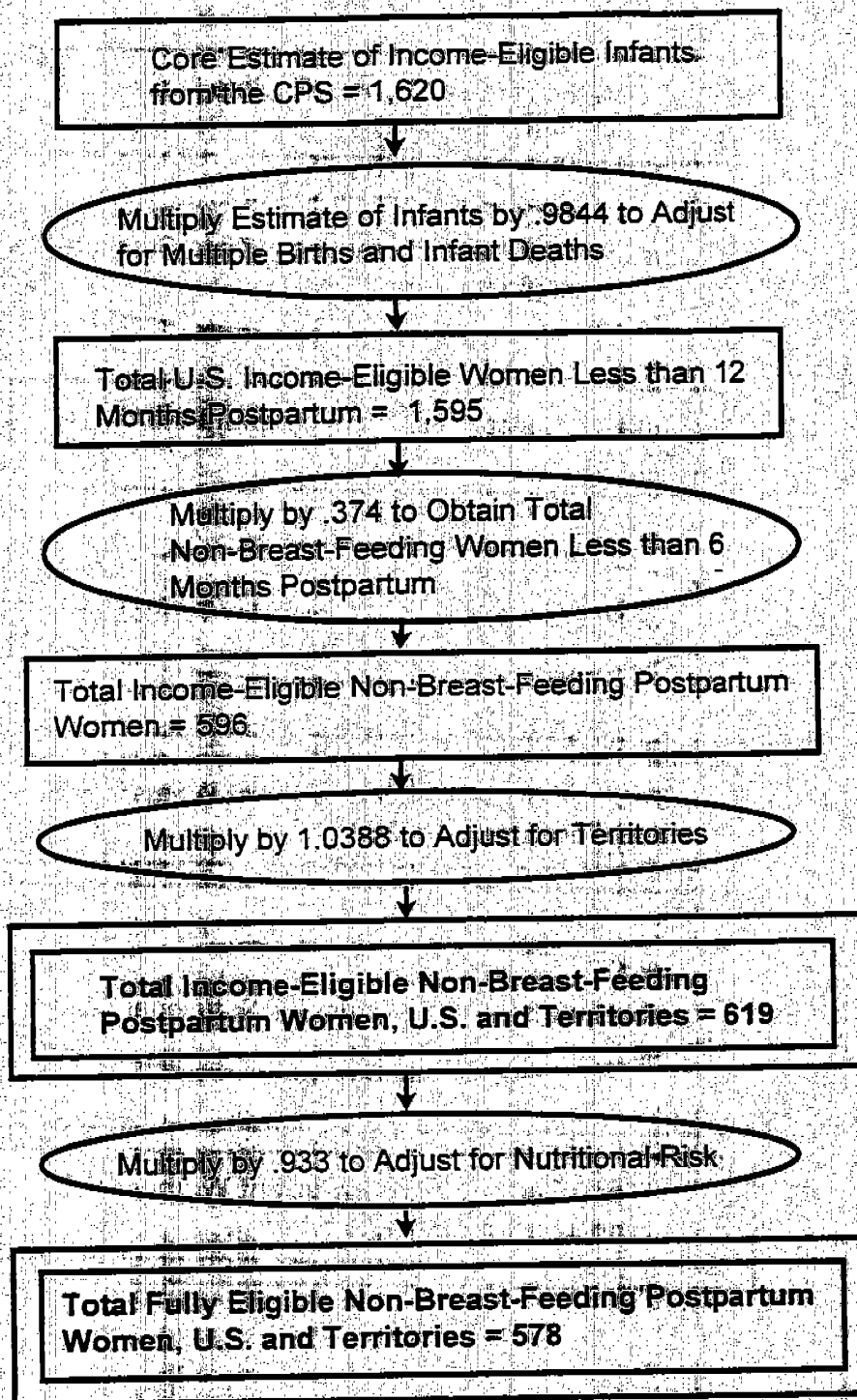
OVERVIEW OF STEPS IN USDA ESTIMATION  
OF WIC-ELIGIBLE PREGNANT WOMEN: 1996  
(Numbers in Thousands)



SOURCE: FNS Office of Analysis and Evaluation.

FIGURE II.4

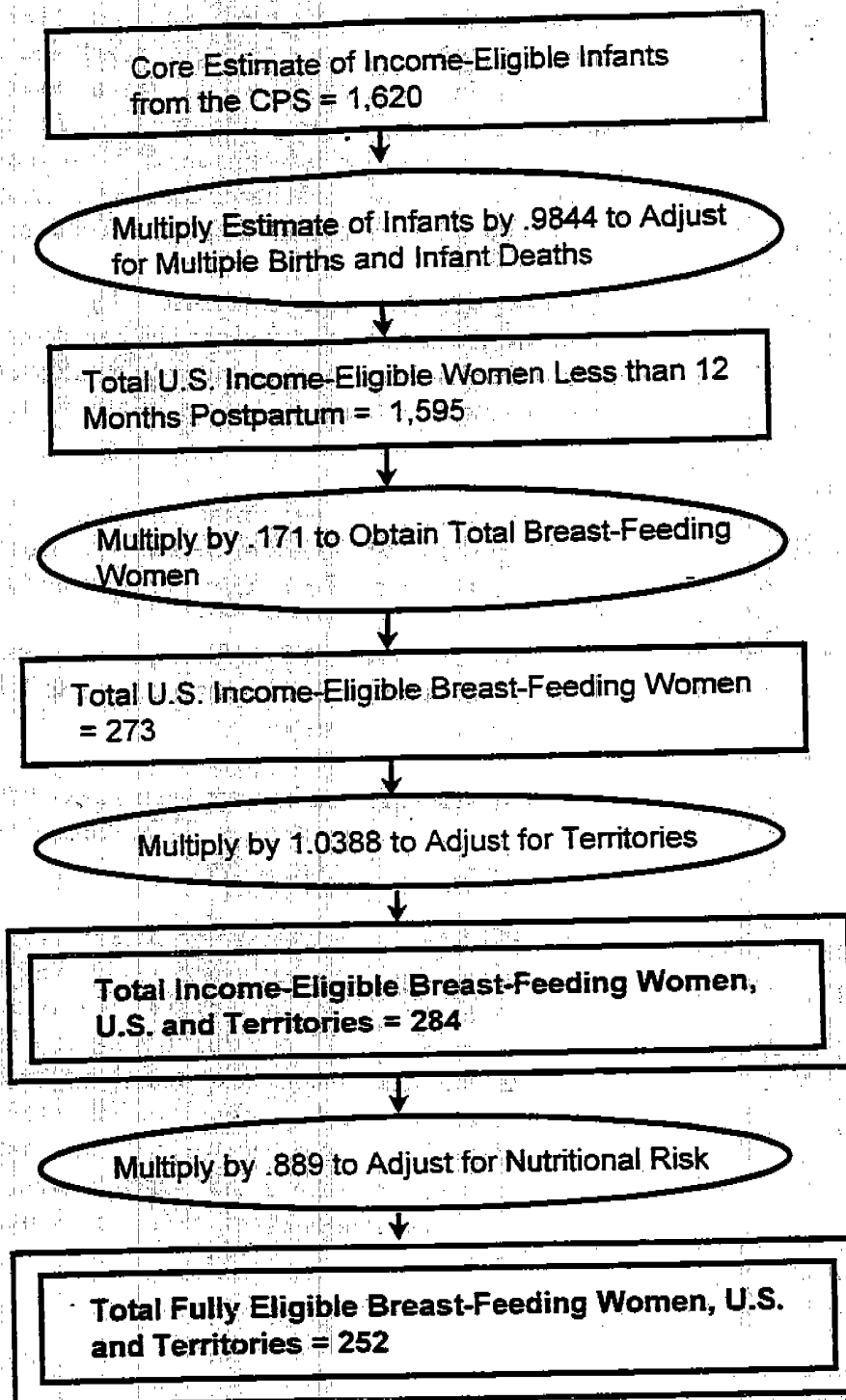
OVERVIEW OF STEPS IN USDA ESTIMATION OF  
WIC-ELIGIBLE NON-BREAST-FEEDING POSTPARTUM WOMEN: 1996  
(Numbers in Thousands)



SOURCE: FNS Office of Analysis and Evaluation, U.S. Department of Agriculture (1996a), Table 2 and Figure 10.

FIGURE II.5

OVERVIEW OF STEPS IN USDA ESTIMATION  
OF WIC-ELIGIBLE BREAST-FEEDING WOMEN: 1996  
(Numbers in Thousands)



SOURCE: FNS Office of Analysis and Evaluation; U.S. Department of Agriculture (1996a), Table 2 and Figure 10.

Confronted with this trade-off between timeliness and statistical accuracy, USDA has funded research to develop and apply a statistical methodology that improves the accuracy of the state-level estimates of WIC eligibles by combining three sources of data: (1) the Decennial Census, with its large sample sizes; (2) the CPS, with its timely reporting; and (3) a number of other social and economic indicators estimated from administrative data that are available at the state level on a timely basis.<sup>6</sup> These estimates focus on the number of income-eligible infants and children, because this is what can be measured in the CPS, and, as noted earlier, the national estimate of WIC-eligible persons is essentially just a multiple of the "core" estimate of income-eligible infants and children. The implicit assumption is that fully eligible women, infants, and children are distributed among the states in the same proportions as income-eligible infants and children.

**The Original Shrinkage Estimator.** In 1995, a new approach to estimating the number of infants and children income-eligible for WIC at the state level was developed and adopted by USDA (Schirm 1995a). The following steps were used to develop estimates for 1992 (see also Figure II.6).

1. Estimates of the percentage of infants and children income-eligible for WIC in 1989 were computed from the 1990 Census, as analyzed in WES II (U.S. Department of Agriculture 1993).

2. From the March 1993 CPS, sample estimates of the percentage of infants and children income-eligible for WIC in 1992 were derived for each state.

3. From the difference between the numbers derived in steps 1 and 2, state sample estimates of the change in the percentage income-eligible were derived.

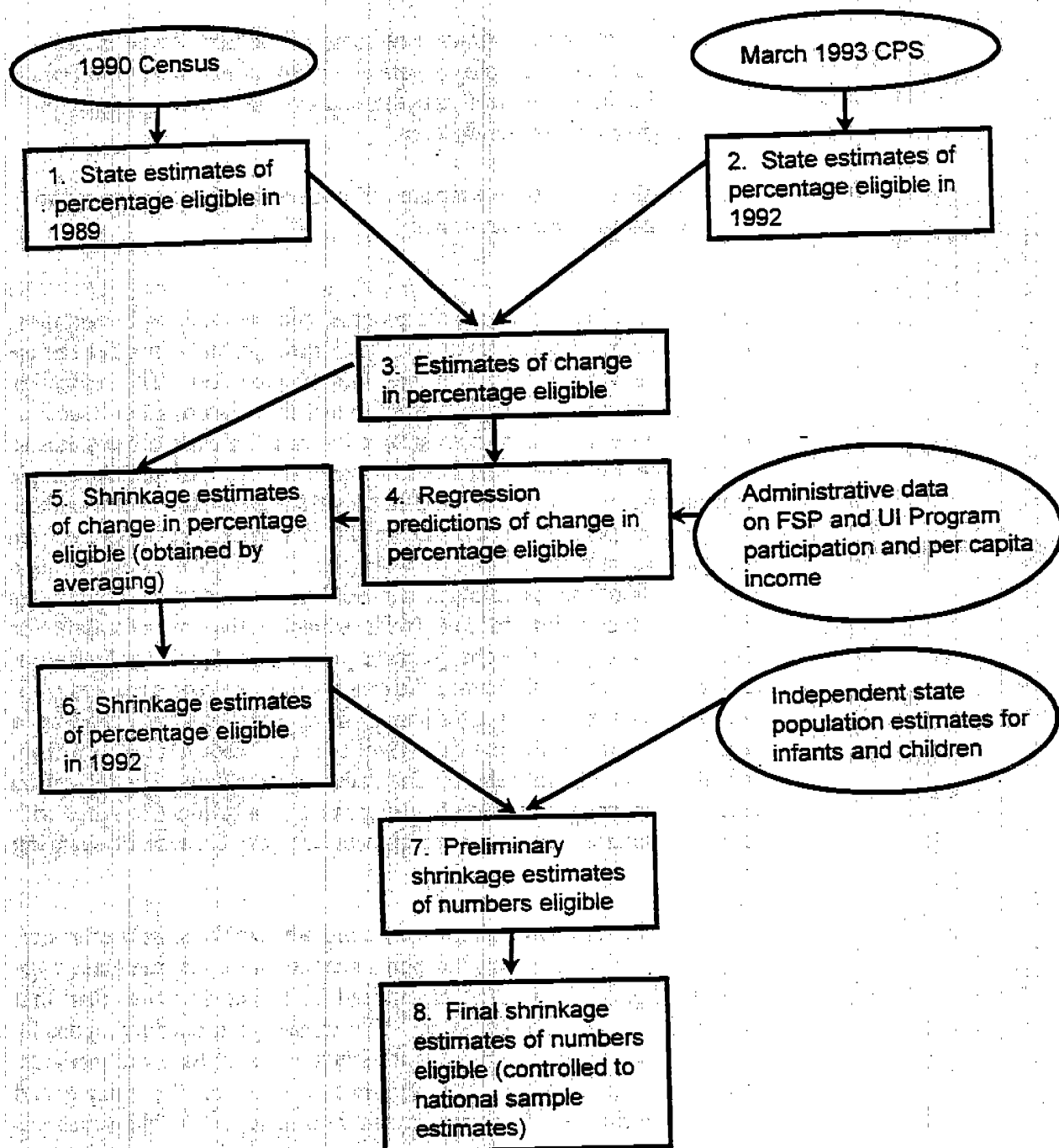
4. With a regression model, a predicted change in the percentage income-eligible for each state was estimated. The regression model included data for each state as an observation. The CPS sample estimate of the change in percentage eligible (step 3) was the outcome variable, and state demographic and economic indicators available from administrative data or other independent sources were the predictor variables. For the 1992 estimates, for example, the predictor variables were state FSP and Unemployment Insurance (UI) participation and per capita income.

<sup>6</sup> Another important advantage of administrative data is that they have no sampling error.



FIGURE II.6

OVERVIEW OF PROCEDURE FOR DEVELOPING STATE ESTIMATES  
OF INCOME-ELIGIBLE INFANTS AND CHILDREN FOR 1992



NOTE: Figure adapted from Schirm (1995a).

5. The two change estimates (sample-based and regression-based) were then averaged in a way designed to minimize mean-squared error, using a Bayesian shrinkage estimator.<sup>7</sup>
6. The averaged estimate of the change in the percentage eligible was then added to the 1990 Census estimate of the percentage eligible for each state to produce an estimate of the percentage eligible in each state for 1992.
7. Next, the new shrinkage estimate of the percentage income-eligible was multiplied by state population estimates of infants and children to yield state estimates of the number of income-eligible infants and children.
8. Finally, these state estimates of income-eligibles were scaled to conform to national totals.

Steps 4 and 5 are the key to the process, and the intuition behind these steps is worthy of some discussion. The main problem with the sample estimates derived in step 3 is their lack of precision. The regression estimate "borrows strength" from nonsample information (such as administrative data) and from sample information from other states to increase the precision of each state's estimates. For example, the sample estimates derived in step 3 use data only from Delaware to estimate the change in the percentage of eligible infants and children in Delaware, even though Delaware has a small CPS sample. Step 4 involves estimating a regression line from sample and administrative records data for all states and using the estimated line (with administrative records data for Delaware) to predict the change in the percentage eligible for Delaware. Schirm and Long (1995) write, "In other words, the regression estimator not only uses the sample estimates from every state to develop a regression estimate for a single state, but also incorporates data from outside the sample, namely, administrative records data. The regression estimator improves precision by using more data to identify states with sample estimates that seem too high or too low because of sampling error."

The regression estimator is much more precise than the sample estimator, but it may be biased for any individual state, because the true percentage of WIC eligibles in a state may indeed be higher or lower than that predicted by the regression line. The shrinkage procedure optimally combines the sample and regression estimator, using Bayesian methods. The shrinkage estimate is a weighted average of the sample and regression estimates. Generally, the more precise the sample estimate is for a state, the closer to it the shrinkage estimate will be. For a given state

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<sup>7</sup>See Schirm (1995a and 1996) for technical details on this estimator.

sample size, the shrinkage estimate will be closer to the regression estimate when the regression fits better by including stronger predictors.

**Improvements Each Year.** Since developing the 1992 estimates, USDA has used essentially the same approach to estimating the number of income-eligible infants and children each year for the years 1993 to 1995. (Estimates are currently being prepared for 1996 and 1997.) Each year, however, the approach has been refined by including more or better data or by making minor changes in the methodology. The changes are summarized briefly here:

- Starting with the estimates for 1993, the estimates “borrow strength” across both space and time, by using data from all the years of the CPS since the last Census as well as all the states to develop the regression estimates for the most recent year (Schirm 1995b and 1996).
- Starting with the estimates for 1993, adjustments for the Census undercount were incorporated (Schirm 1995b).
- Each year, the administrative variables used in the regressions have been chosen to best fit the data. Thus, there have been changes in the variables used from year to year. Table II.3 reviews the variables used each year.
- For the 1995 estimates, the regression model was reformulated in terms of levels, rather than changes since the 1990 Census, and the 1990 Census estimate was included as an independent variable in the regression. This less restrictive specification fit more recent years of data better, and fit earlier years of data about as well as the model used previously.
- For the 1996 and 1997 estimates, new predictor variables derived from income tax return data were used along with another new predictor variable based, in part, on decennial Census estimates. In addition, the procedure for adjusting population estimates for Census undercounts was refined.<sup>8</sup>

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<sup>8</sup>Personal communication from Allen Schirm, February 8, 1999.

TABLE II.3

REGRESSIONS MODELS USED IN DEVELOPING  
STATE ELIGIBLES ESTIMATES, BY YEAR

Year	Outcome Variable	Predictor Variables
1992	Change in Percentage Income-Eligible	Change in FSP participation rate Change in UI participation rate Change in per capita income
1993	Change in Percentage Income-Eligible	Change in FSP participation rate Change in UI participation rate Change in per capita income 1989 FSP participation rate 1989 per capita income
1994	Change in Percentage Income-Eligible	Change in FSP participation rate 1989 per capita income 1989 AFDC participation rate
1995	Percentage Income-Eligible	1995 FSP participation rate 1995 UI participation rate 1989 FSP participation rate 1989 AFDC participation rate 1989 percentage income-eligible (from Census)
1996 and 1997	Percentage Income-Eligible	Current FSP participation rate Current per capita income Current state population Current tax child poverty rate <sup>a</sup> Current tax nonelderly nonfiler rate <sup>b</sup> Census regression residual <sup>c</sup>

NOTES: All models include an intercept. Change variables are always calculated as the difference between the value in the current year and in 1989. Participation rates in each state are calculated as total state participants divided by total state population. Per capita income is normalized by dividing by the WIC poverty guideline for a one-person family. UI participants are the number of first payment beneficiaries.

<sup>a</sup>The tax child poverty rate is the percentage of child exemptions claimed on tax returns with incomes below the poverty level.

<sup>b</sup>The tax nonelderly nonfiler rate is the percentage of the nonelderly population that is not claimed as exemptions on tax returns.

<sup>c</sup>The Census regression residuals are the residuals from the regression of the Census estimates of 1989 WIC income-eligibles on the 1989 values of the other five predictor variables.

## Coverage Estimates

USDA computes national coverage rates for the WIC program every year. The coverage rate for calendar year  $x$  is calculated, for each WIC participant category and overall, as the quotient of the following two numbers:

1. *Numerator:* Average monthly number of persons issued WIC food instruments in calendar year  $x$
2. *Denominator:* Average number of persons fully eligible for WIC in calendar year  $x$

The numerator of the coverage rate is based on counts of participants receiving food instruments reported by states to USDA and maintained in the USDA National Databank. These data are sometimes incomplete when first reported, but full data are generally available within 6 months. These data are full counts and so should have no sampling error associated with them. USDA staff compute a simple average of the 12 months, and move some pregnant participants (15 percent) to the postpartum column to account for the fact that pregnant women can participate for 6 weeks after giving birth.<sup>9</sup>

The eligibility estimates are derived as discussed above. Coverage rates and their components, as reported by USDA for the years 1991 to 1996, are summarized in Table II.4. It is noteworthy that coverage rates for infants and postpartum women have exceeded 100 percent from 1994 on. Also, coverage rates for pregnant women should be interpreted in light of the fact that most women do not enter WIC until they are several months pregnant. If all eligible women participated in WIC for 6 of the 9 months of pregnancy, for example, the coverage rate would be 67 percent.

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<sup>9</sup>This adjustment was based on data from the 1992 Study of WIC Participant and Program Characteristics. USDA is planning to reduce this adjustment to 10 percent for 1997 coverage estimates, based on data from the 1996 Study of WIC Participant and Program Characteristics indicating that pregnant women are being recertified more quickly after giving birth.

TABLE II.4

**USDA ESTIMATES OF WIC ELIGIBLES, PARTICIPANTS,  
AND COVERAGE RATES, 1991 TO 1996**  
(in Thousands)

	Number Income- Eligible	Number Fully Eligible	Average Monthly Participants	Coverage Rates (Percentage)
<b>Infants</b>				
1991 <sup>a</sup>	NA	1,762	1,603	91
1992	NA	1,751	1,697 <sup>c</sup>	97
1993	NA	1,798	1,757	98
1994	1,703	1,618	1,796	111
1995	1,748	1,661	1,817	109
1996	1,697	1,612	1,835	114
<b>Children</b>				
1991 <sup>a</sup>	NA	5,173	2,296	44
1992	NA	5,743	2,555 <sup>c</sup>	44
1993	NA	6,058	2,910	48
1994	7,709	5,797	3,298	57
1995	7,313	5,499	3,541	64
1996	7,235	5,426	3,769	69
<b>Pregnant Women</b>				
1991 <sup>a, b</sup>	NA	819	730	89
1992	NA	1,203	NA	NA
1993	NA	1,286	673	52
1994	1,266	1,156	682	59
1995	1,300	1,187	689	58
1996	1,262	1,148	712	62
<b>Postpartum/ Breast-Feeding Women</b>				
1991 <sup>a</sup>	NA	876	425	49
1992	NA	901	NA	NA
1993	NA	926	731	79
1994	906	832	842	101
1995	931	855	900	105
1996	903	822	963	117
<b>Total</b>				



	Number Income- Eligible	Number Fully Eligible	Average Monthly Participants	Coverage Rates (Percentage)
1991 <sup>a</sup>	NA	8,630	5,054	59
1992	NA	9,598	5,505 <sup>c</sup>	57
1993	NA	10,068	6,071	60
1994	11,584	9,403	6,619	70
1995	11,292	9,202	6,947	75
1996	11,097	9,009	7,279	81

SOURCE: U.S. Department of Agriculture (1995, 1996b, 1997, and 1998a).

<sup>a</sup>For the 1991 estimates, weights were based on the 1980 Census and not adjusted for the Census undercount. Estimates for later years have weights based on the 1990 Census and adjusted for the undercount.

<sup>b</sup>1991 estimates are from before pregnant women were counted as two.

<sup>c</sup>FNS did not publish coverage estimates for 1992 but provided MPR with participation data.

NA = not available.

## Full Participation Assumptions

Because WIC is not an entitlement program and has generally not had enough funding to serve all those who might wish to participate, it is difficult to know what proportion of eligible persons would participate if they could. Since 1995 (in estimates for 1993), USDA has assumed that, on average, 80 percent of those fully eligible for the program would participate under full funding (U.S. Department of Agriculture 1995a).

This assumption was based on data on participation rates in the AFDC and Food Stamp programs in the late 1980s (Greenstein et al. 1997; and U.S. Department of Agriculture 1998b). In more recent estimates (starting with the 1995 estimates) USDA has recognized that this estimate of the full-funding participation rate is likely to be too low, for several reasons:

- Participation rates in AFDC and the FSP rose substantially from the mid-1980s through the mid-1990s, particularly among children younger than 5. For example, the rate of participation in the FSP for children under 5 was estimated to be 94.5 in 1996 but was less than 80 percent in the late 1980s (Cody 1998b).
- Estimated WIC coverage rates have exceeded 80 percent for several categories of participants for several years, and exceeded 80 percent overall in 1996. Thus, the number of total WIC participants in 1996 was greater than the number that would be predicted from current eligibles estimates and an 80 percent average participation rate (Table II.4).
- An analysis by Greenstein et al. (1997) indicated that WIC participation rates exceed 80 percent on average in the 15 states with the highest levels of WIC funding per eligible.

Although recognizing that the 80 percent participation assumption appears to be too low, USDA has not developed an explicit alternative (U.S. Department of Agriculture 1997). Instead, USDA has developed budget requests to meet a goal of funding 7.5 million participants. For FY 1997, this was equivalent to assuming an 83 percent participation rate. Although the House Appropriations Committee argued that this is an arbitrary and politically motivated adjustment, USDA believes that it is in fact a conservative adjustment, given the facts just described (U.S. House Committee on Appropriations 1998; and U.S. Department of Agriculture 1998b).

USDA recognizes the importance of developing a better approach to this issue, and thus has included the full-funding participation rate assumption in the topics for this review.

## ALTERNATIVE ESTIMATES OF ELIGIBILITY AND PARTICIPATION

### CBO Estimates

Several alternatives to the USDA estimates of the numbers of WIC eligibles and of full-funding participation rates have been published. This section briefly reviews the most important of these alternative estimates: those published by the Congressional Budget Office (CBO) and by the GAO and some developed internally by state WIC agencies.<sup>10</sup> The CBO estimates in the early 1990s were particularly influential.

The CBO developed estimates of WIC eligibles and of the costs of fully funding the WIC program in 1990 and in 1993 (U.S. Congressional Budget Office 1990 and 1993). This section focuses on estimates developed in 1993 for FY 1994.<sup>11</sup> It also discusses how these estimates differed from USDA estimates.

The CBO estimates were developed from the SIPP wave files for 1990 (based on the 1990 SIPP panel). For each month of 1990, estimates of the number of infants and children with incomes below 185 percent of the DHHS poverty guidelines were developed, with infants and children defined by their age in that month. In addition, CBO staff estimated for each month the numbers of infants and children who had incomes above 185 percent of poverty but who were on Medicaid. They added these infants and children to the estimate of those below 185 percent of poverty each month to develop an estimate of the total income-eligible each month. They then calculated a simple average of the 12 monthly estimates to develop the estimates of income-eligible infants and children.<sup>12</sup>

Estimates of women were developed from estimates of infants, as in the USDA estimates, but with slightly different numbers. Pregnant women were calculated as .7631 times the number of infants (incorporating an upward adjustment to 75 percent for fetal and infant mortality based on 1989 Vital Statistics but apparently with no adjustment for multiple births). The number of postpartum women with infants under 12 months was simply assumed to equal the number of infants. CBO used data on breast-feeding rates from the Ross Laboratories Mothers' Survey and the WIC Breast-Feeding Study (U.S. Department of Agriculture 1993) to develop estimates of breast-feeding rates. They thus estimated that the number of non-breast-feeding women less than 6 months postpartum equaled 40 percent of infants, and the number of breast-feeding women less than 12 months postpartum equaled 13 percent of infants (instead of

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<sup>10</sup> Alternative estimates constructed as part of research undertaken by USDA or its contractors are not reviewed here but are covered extensively in Chapters III and IV.

<sup>11</sup> Additional information on methodology was provided by Valerie Baxter of the CBO in a telephone conversation October 20, 1998.

<sup>12</sup> The CBO estimates also adjust for the territories using Census data.

the USDA estimates of 37 percent and 17 percent). In total, their estimate of those eligible both categorically and by income for WIC in 1990 was 11.4 million.

CBO then used Census Bureau population projections to project this estimate to FY 1994. They assumed that the proportions of the population who were income-eligible would be unchanged. Based on this assumption, they estimated that 11.6 million people would be eligible for WIC both categorically and by income in FY 1994. In contrast, USDA has generally used more recent data for their budget estimates but has never projected them to the budget year. For example, USDA used 1992 CPS data to inform the FY 1994 budget estimates.

The CBO estimates also used higher nutritional-risk assumptions than USDA uses and assumed a different full-funding participation rate. Based on discussions with local WIC agencies who stated that they almost never turned women and infants away, CBO assumed that 100 percent of income-eligible pregnant women and infants, 95 percent of income-eligible postpartum and breast-feeding women, and 75 percent of income-eligible children were at nutritional risk.<sup>13</sup> From this, they estimated that 9.6 million persons would be fully eligible for WIC in 1994. They also assumed that the full-funding participation rate would be 90 percent for women and infants but 80 percent for children age 1 to 4.<sup>14</sup> This led them to an estimate of 7.6 million participants under full funding.

Table II.5 compares the estimates of total WIC eligibles and projected full-funding participants put out by USDA and CBO for use in preparing budgets for FY 1991 and for FY 1994. Based on an analysis by Lazere et al. (1991), the 1991 CBO estimates of those income-eligible differed from those of USDA for four reasons: (1) they accounted for population growth between 1987 and 1991; (2) they estimated more eligible pregnant women as CBO assumed pregnant women were counted as two persons in estimating eligibility, while USDA did not; (3) they used family rather than household income; and (4) they used monthly income from SIPP rather than annual income from the CPS. The Center attributed roughly half the difference to the first two factors and half to the last two factors.

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<sup>13</sup>The number of agencies who provided information is unknown. In 1990, CBO assumed slightly lower nutritional-risk rates for women and infants than in 1993, but their rates were still higher than the rates used by USDA (Lazere et al. 1991). Again, the source of these alternative estimates is unclear.

<sup>14</sup>In 1990, CBO used an 85 percent full-funding participation rate (U.S. Congressional Budget Office 1990).

**TABLE II.5**  
**ALTERNATIVE ESTIMATES OF WIC ELIGIBLES AND OF PARTICIPANTS**  
**UNDER FULL FUNDING**

	Income-Eligible	Fully Eligible	Full-Funding Participants
<b>Estimates Prepared for FY 1991</b>			
Budget			NA
USDA (1986 data from March 1987 CPS)	9.1 million	7.0 million	
CBO (1987 SIPP data projected to 1991)	10.0 million	8.6 million	7.3 million
<b>Estimates Prepared for FY 1994</b>			
Budget			7.5 million
USDA (1991 data from March 1992 CPS)	10.6 million	8.6 million	
CBO (1990 SIPP data projected to 1994)	11.3 million	9.6 million	7.6 million

**SOURCE:** Row 1: U.S. Department of Agriculture (1990). Estimates do not include U.S. territories.  
 Row 2: Lazere et al. (1991). This document provides CBO estimates that are revised versions of those published in U.S. Congressional Budget Office (1990).  
 Row 3: U.S. Department of Agriculture (1995a), also cited in Ku et al. (1994).  
 Row 4: U.S. Congressional Budget Office (1993).

NA = not available.