Chapter 10
Health Outcomes

Positive health outcomes are the ultimate goal of the WIC program. WIC enrolls individuals who are at nutritional risk and provides nutrient-dense foods, nutrition education, and health-service referrals aimed at improving health and nutrition status. One of the congressionally mandated research objectives of this study is to examine the impact of WIC cost-containment practices on achievement of positive health outcomes.

WIC cost-containment practices do not directly affect the health outcomes of WIC participants, but there is potential for an indirect effect. Cost-containment practices limit food choices. If limits on food choice result in reduced food instrument redemption or food use, then WIC's goal of improving health and nutrition status through provision of nutrient-dense foods is compromised. Thus the potential link between cost-containment practices and health outcomes consists of two behaviorally separate components:

- Relationship between cost-containment practices and food instrument redemption or food use.
- Relationship between food instrument redemption or food use and health outcomes.

It is beyond the scope of the current study to model the complex processes that relate WIC cost-containment practices to health outcomes. Nonetheless, this study examines each component relationship separately.

The first relationship—between cost-containment practices and food instrument redemption or food use—was examined in prior chapters. Within the six case study states, there is no consistent evidence that cost-containment practices reduced food instrument redemption rates. There is also little evidence that cost-containment practices reduced food use. Participants facing a binding constraint on cheese were less likely to purchase and consume their prescribed cheese (a cross-State average of 8.8 percent of participants faced a binding constraint). In addition, Oklahoma's food-item restrictions on cereal and dried beans/peas were related to reduced purchase and consumption of these items, but the State had since added more allowed brands of cereal brands.

The second relationship—between food instrument redemption and health outcomes—is examined in this chapter. The analysis is focused on whether there is a statistically significant relationship between WIC food instrument redemption rates and health outcomes, regardless of causality.[1] Data limitations prevent a full analysis of the causal relationship between food instrument redemption and health outcomes and, therefore, the results presented here are interpreted carefully and used primarily as indicators that future research is needed.

The analysis of health outcomes presented in this chapter is limited by three factors. First, it was beyond the scope of this study to model fully the complex processes determining health status.

[1] It is possible that food instrument redemption is related to health outcomes even if no causal relationship exists. For example, an illness that requires hospitalization may be associated with failure to redeem instruments and poor health status.

Nutrition is only one of many factors that affect health, and WIC foods are only a component of total dietary intake (WIC foods are intended to supplement the diet and not provide for all dietary needs). The study does not have data on other determinants of health status, such as non-WIC foods or use of health care services. If these unobserved determinants of health status are correlated with WIC food instrument redemption, estimates of the relationship between food instrument redemption and health status will be overstated.

The second limitation for the analysis of health outcomes is measurement error. The relationship of interest is between consumption of WIC foods and health outcomes, but consumption of WIC foods is not observable. Food instrument redemption is used as a proxy for food consumption.[2] The proxy (food instrument redemption) contains measurement error relative to the true value (food consumption) because some foods obtained with WIC food instruments may not be consumed by WIC participants. (For example, WIC foods may be eaten by other family members.) A second source of measurement error derives from the fact that food instrument redemption is observed as a binary outcome in WIC administrative data—a food instrument is redeemed or not. Food instruments may be partially redeemed, however, for a subset of foods listed on the food instrument.

Measurement error in the proxy for WIC food consumption results in estimates of the relationship between food instrument redemption and health status that are understated. This is because both sources of measurement error result in a measure of food instrument redemption that systematically overstates the true value of interest (on average, food instrument redemption overstates food consumption and observed redemption overstates actual redemption). As a result of this systematic upward bias, the estimated relationship between food instrument redemption and health outcomes is understated.

The third limitation for the analysis of health outcomes is the possibility of selection bias. Health outcomes are observed only for WIC participants who recertify in the program after the certification period in which food instrument use is observed. The direction of bias is unknown and may go either way. For example, if participants are not satisfied with the program and do not redeem their instruments, they are less likely to recertify; on the other hand, persons with improved health status may be unable to recertify if they no longer meet nutritional risk criteria.

The first section of this chapter presents the research approach, including a description of the data, sample definitions, outcome measures, and estimation approach. The second section presents analysis results.

Research Approach

Overview

The analysis in this chapter employs a very simple model relating health outcomes to WIC participant demographics and rates of food instrument redemption (the proxy for food use).
The model is specified as:

---

[2] The Survey of WIC Participants asked about food consumption but the sample is too small for analyses of health outcomes; administrative data are used for the analyses in this chapter.

$$H_i = \beta_1 X_i + \beta_2 V_i + \nu_i \quad (1)$$

Equation (1) specifies that health outcomes (H) depend on demographic and household characteristics (X) and food instrument redemption (V); ν is an error term. The subscript *i* indicates that the model employs individual-level data. The difficulty with this simple model, however, is that food instrument redemption and health outcomes are determined simultaneously. It is likely that a WIC participant who is motivated to improve health status (by engaging in healthy behaviors) will also be motivated to redeem WIC food instruments and consume WIC foods. This simultaneity problem is one reason one cannot attribute causality from this analysis.[3]

The relationship between food instrument redemption and health outcomes is analyzed using statewide WIC administrative data from the six case study States. Two types of administrative data were collected: WIC food instrument records and WIC certification records.

WIC food instrument records consist of one record for each issued food instrument, with a participant identifier that links the food instrument record to the certification file. Each food instrument record contains a food package code and sequence or item number to indicate the food items listed for purchase on the food instrument. The record also contains an indicator of whether the food instrument was redeemed, and total amount of payment to the vendor on the redeemed food instrument. Four months of food instrument data were collected from each State, covering two-thirds of a typical 6-month certification period.

WIC certification records contain demographic information and measures of health and nutrition status. Demographic variables include age, race, sex, household size, household income, and receipt of public assistance (food stamps, TANF, and Medicaid). Health and nutrition status include anthropometric measurements (height and weight), blood iron measures (hemoglobin or hematocrit), and indicators of nutrition risk. These measures of health and nutrition status are recorded on certification records because nutrition risk is a criterion for WIC enrollment. Certification records were collected from each State at two points in time—November 2000 and April 2001. These two certification records provide two observations of health status for all WIC participants recertified between November and April.

Outcome Measures

Four health outcomes are examined in this chapter for samples of WIC participants observed in the November 2000 caseload and recertified by April 2001.

---

3 This simultaneity problem is not easily resolved because the root of the problem is that unobserved variables are correlated with both food instrument redemption and health outcomes. Theoretically, a structural simultaneous equations model can be specified with one equation for food instrument redemption and another for health outcomes. The structural model requires data on determinants of food instrument redemption that are not correlated with health outcomes (or vice versa) for estimation and identification. The current study lacks the required data.

Outcome measure	Sample
Birthweight of infant	Pregnant women
Growth in stature (measured by change in height-for-age)	All children
Probability of “exiting” anemic status	Anemic children
Probability of “exiting” underweight status	Underweight children

These outcomes are collected across all WIC agencies. Federal regulations require height, weight and blood measures be taken for all WIC participants at certification, with a few exceptions. In addition, WIC agencies record the birthweight of infants to comply with USDA reporting requirements for the biennial WIC Participant and Program Characteristics studies.[4] Weight and blood measures are not examined as outcomes for WIC women because these measures of status are confounded with changes that occur naturally during pregnancy.

WIC administrative data contain other health and nutrition measures that are not examined in this chapter—nutritional risks. Nutritional risk information collected at certification identifies medical conditions and nutritional factors that put WIC participants at risk for nutrient deficiencies. Nutritional risks are not examined as health outcomes because, for the most part, WIC foods are expected to improved nutrient intake but not act directly on the underlying risk condition.[5]

Health outcomes are not examined for postpartum nonbreastfeeding women because they are not eligible for recertification after an initial 6-month certification period (there is no follow-up measure of health status). Breastfeeding women are excluded because blood tests are not performed when they are recertified after an initial 6-month certification period. Infants are excluded because, in four of the six States, infants are certified for periods up to their first birthday and, as a result, a recertification record is not found in the April files. In addition, hematological tests are not required for infants less than 9 months of age (7 CFR 246.7) and other measures of nutrition risk are not recorded systematically for infants less than 6 months of age because WIC regulations allow infants to be certified on the basis of their mother’s nutritional risk.[6]

Relationship Between Outcome Measures and Definitions of Analysis Sample

Birthweight is examined for infants of mothers enrolled in WIC prenatally, and birthweight is related to food instrument redemption during the prenatal period. The sample for analysis (described in the next section) is defined as pregnant women in the November caseload who certified their infant for

[4] Birthweight is the most important indicator of infant health and a significant predictor of infant mortality and morbidity.

[5] Nutritional risks include biochemical and medical conditions (e.g., failure to thrive, gastrointestinal disorders, cancer, chronic or recurrent infections), potentially toxic substances (e.g., lead poisoning, maternal smoking, maternal alcohol and drug use), predisposing conditions (e.g., homelessness, migrancy, low level of maternal education), and conditions specific to pregnancy (e.g., pregnancy at a young age, closely spaced pregnancies, lack of prenatal care). For a complete list of nutrition risks, see Bartlett *et al.*, *WIC Participant and Program Characteristics 1998*, Alexandria, VA, USDA/FNS, 2000.

[6] Federal regulations specify, “an infant under 6 months of age may be determined to be at nutritional risk if the infant’s mother was a Program participant during pregnancy or if medical records document that the woman was at nutritional risk during pregnancy” (7 CFR 246.7). The National Survey of WIC Participants found that 45 percent of WIC infants had no nutritional risk other than conferred risk (USDA, 2001).

WIC prior to April 2001. The measure of birthweight is obtained from the infant's certification record in the April file.[7] Mean birthweight in this sample is 7.36 pounds (or 117.74 ounces), with 5.1 percent of births identified as low birthweight (defined as birthweight below 5.5 pounds).

Growth in height for children is examined for all WIC children age 2 years and older, observed in the November caseload and recertified by April 2001. Growth in height is measured as the difference in height-for-age in the April file versus the November file. Height-for-age was obtained by comparing height measurements from WIC certification data, to age- and gender- specific reference curves developed by the Centers for Disease Control and Prevention (CDC).[8] The analysis sample contains children age 2 years and older because the CDC references curves for height were developed for persons age 2 years and older.[9] For the analysis sample of children observed in November and recertified by April, the mean height-for-age percentile in November and April, respectively, were 55.66 and 56.71; the mean difference was 1.04 percentiles.[10] It is important to note that height-for-age may decline over time, even though height does not decrease. The height-for-age percentile is a standardized score and slow growth can cause a decrease in a child's height-for-age percentile relative to the reference curve.

The analysis of anemia in children is modeled as the probability of "exiting" anemic status. WIC files contain hematological test results (hemoglobin or hematocrit), which were compared to CDC guidelines to identify anemia in children.[11] The records from the November and April certification files provide two observations of anemia status. The analysis sample is limited to children with anemia in November, who were recertified by April. Of all children recertified between November and April, approximately 10 percent were measured anemic in November; of these, 40 percent were still anemic in April.[12]

Similar to the analysis of anemia, the analysis of underweight children is modeled as the probability of "exiting" underweight status. Underweight children are identified as children with weight-for-age below the 10th percentile. Weight-for-age was obtained by comparing weight measurements from WIC certification data, to age- and gender- specific reference curves developed by the Centers for Disease Control and Prevention. The records from the November and April certification files provide two observations of underweight status. The analysis sample is limited to children measured

---

7 Texas records birthweight on the mother's recertification record. For Texas, the mother's pregnant record was matched to her postpartum record and her infant's record (to obtain information on the sex of the infant).

8 Kuczmarski RJ, Ogden C, Grummer-Strawn LM, *et al*., *CDC Growth Charts: United States,* Hyattsville, MD: U.S. Department of Health and Human Services, 2000. NCHS Advance Data Report No. 314.

9 CDC developed stature-for-age (or height-for-age) charts for people age 2 to 20 years old and recumbent length-for-age charts for children from birth through 36 months. Limiting the sample to children age 2 years and older avoids comparison of height-for-age measures based on different growth charts.

10 The percent of children with low height-for-age (at or below the 10th percentile) declined from 6.3 percent in November to 5.9 percent in April.

11 CDC guidelines identify anemia in children by hemoglobin below 11 g/dl or hematocrit below 33 percent. Source: Institute of Medicine, *WIC Nutrition Risk Criteria: A Scientific Assessment,* Washington, DC: National Academy Press, 1996.

12 As discussed in the next section, the study also examined the probability of "entering" anemic status: among children without anemia in November, 6 percent were anemic in April. For clarity, however, the discussion is focused on samples of children with nutritional risks at baseline.

underweight in November who were recertified by April. Of all children recertified between November and April, approximately 8 percent were measured underweight in November; of these, 55 percent were still underweight in April.

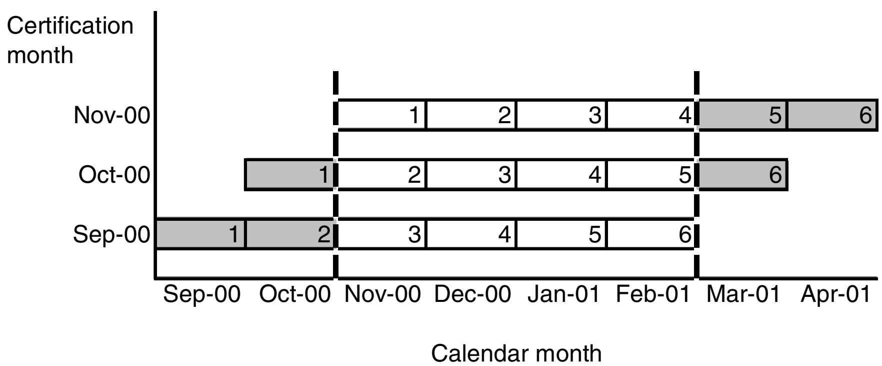
Analysis Samples

The relationship between food instrument redemption and health outcomes is examined using statewide WIC administrative data from the six case study States, collected at multiple points in time:

- WIC certification records for the active caseload in November 2000
- WIC certification records for the active caseload in April 2001
- WIC food instrument records for 4 months, November 2000 through February 2001

The November and April certification records provide measures of health status before and after the period over which food instrument redemption is observed. As shown in figure 10-1, a 6-month WIC certification period implies that three cohorts of WIC participants, defined by month of certification, potentially have 4 months of food instrument data and are recertified by April.

Figure 10-1—Definition of WIC participant cohorts for health outcomes analysis



For analysis of health outcomes in children, the definition of analysis samples is exactly as shown in the figure because children are certified in WIC for 6-month periods. The samples are initially defined by month of enrollment, and are further restricted to WIC participants observed in the April certification files (the sample is restricted to participants who reenroll) and who have 4 months of food instrument issuance data in the food instrument files. (This main sample is then restricted according to outcome measure, as discussed above: height-for-age is examined for children age 2 years and older; the probability of “exiting” anemia is examined for children identified as anemic in November; and the probability of “exiting” underweight status is examined for children identified as underweight in November.)

For analysis of birthweight, the sample contains pregnant women active in November with an infant in the April certification file. The sample for pregnant women includes women certified in the months of August through November 2000; the sample extended back to August because pregnant women may be certified for periods longer than 6 months depending on the trimester of enrollment. The sample sizes for analysis of birthweight and anemia are shown in table 10-1. The table also shows the analysis sample as a percent of the November caseload. For example, the analysis of birthweights is based on an analysis sample equal to 18.9 percent of all pregnant women certified as of November. The size of the analysis sample is determined first by the size of the cohorts (certified in August to November) relative to the entire November caseload (approximately 60 percent)—the subsample of cohorts from the caseload is random, based on certification month. Within the subsample of cohorts, the percentage of pregnant women who were recertified by April (i.e., delivered) and had 4 months of food instrument data was approximately 45 percent[13]—some selection bias is introduced because women with late deliveries (higher birthweights) are more likely to be excluded from the sample. Finally, the percent of the remaining sample with non-missing birthweight on an April certification record varied from less than 50 percent in North Carolina and Ohio to over 80 percent in the other States.[14]

Similarly, the number of children included in the analyses of anemia is about 20 percent of the entire November caseload of anemic children. The September through November cohorts represent approximately 50 percent of the November caseload; approximately 50 percent of children in these cohorts were recertified by April; and missing data on health status reduces the sample by about 5 percent. The analysis samples for change in height and for underweight status are also approximately 20 percent of the respective cases in the entire November caseload.

---

13 Pregnant women are certified up to 6 weeks postpartum, so a large number are not observed to be recertified within 6 months of their original certification date.

14 Birthweight data may be missing on the infant's WIC record, or it may be missing due to an inability to link the mother and infant WIC records, or because the infant was not certified by April when the data extract was drawn. The latter two reasons account for most of the missing birthweight data. For example, only 1.6 percent of infant records in North Carolina are missing birthweight; but 47 percent of pregnant women from the August to November cohorts could not be matched to the record of their infants' birthweight.

Table 10-1—Sample sizes for health outcomes analyses

	Birthweight analysis, pregnant women		Change in anemia, children measured anemic in November	
	n	Percent[a]	*n*	Percent[b]
California	23,921	16.9	8,839	15.9
Connecticut	1,080	20.6	489	23.9
North Carolina	2,861	11.8	1,718	20.5
Ohio	2,719	10.2	c	
Oklahoma	2,381	20.4	551	18.8
Texas	21,745	27.0	13,153	29.0
Total	54,707	18.9	24,750	21.7

a Percent of pregnant women in the November caseload.

b Percent of anemic children in the November caseload.

c Ohio was unable to provide anthropometric and hematological measures in the April administrative data extract.

Estimation Procedures

The procedure used to estimate the health outcome equation (equation 1, repeated below) varies by outcome measure. Ordinary least squares (OLS) regressions were estimated for birthweight and change in height-for-age; logistic regressions were estimated for the probability of exiting anemic status and the probability of exiting underweight status.

$$H_i = \beta_1 X_i + \beta_2 V_i + \nu_i \qquad (1)$$

The health outcome measures, H, were discussed above. The demographics included in the models (vector X in equation 1) vary according to the outcome measure examined. All models include the following household characteristics: income as a percent of poverty, household size, rural or urban residence, and indicators of participation in food stamps, TANF, and Medicaid. The birthweight models include the sex of the infant and characteristics of the mother: age, age squared, height, race/ethnicity.[15] The models for anemia, change in height-for-age, and underweight status include characteristics of the child: age, age squared, sex, race/ethnicity, and the number of days between health outcome measurements.

To test the relationship between food instrument redemption (V in equation 1) and health outcomes, the 4 months of food instrument data (November 2000 through February 2001) were summarized, for each WIC participant, in four alternate measures:

[15] Additional covariates were included in regressions run separately by State, according to the availability of data on the State files. These variables include an indicator of whether this was the first pregnancy for the mother, whether she had prior pregnancy losses, whether the interval between this and the prior pregnancy was less than 6 months, and the trimester of enrollment in WIC. These additional variables improved the predictive power of the model but did not change the results with respect to the statistical significance of the food instrument redemption variable.

PCTINSTRU	=	percentage of issued food instruments that were redeemed
PCTCOST	=	percentage of the estimated cost of issued food instruments redeemed
PCTCEREAL	=	percentage of prescribed cereal ounces on food instruments that were redeemed

The first measure is a simple count of redeemed food instruments divided by the total food instruments issued during the period for the WIC participant. A count of instruments is a crude measure, however, because it does not account for the fact that some food instruments are single-item food instruments (gallon of milk), whereas others are multiple-item food instruments (milk, cereal, juice). In other words, the percentage of redeemed instruments does not reflect the percent of WIC foods, or nutrients, redeemed. To create a proxy for the amount of food available from each voucher, each food instrument was valued using the average prices per State constructed for the food cost analysis, and PCTCOST is the percentage of the value of WIC foods redeemed.[16] The final measure—PCTCEREAL—was constructed for the analysis of anemia, because iron-fortified cereal is the only WIC food that provides dietary iron. For all analysis samples, the mean values of the food instrument redemption summary measures (PCTINSTR, PCTCOST, PCTCEREAL) are between 88 and 91 percent.

Results

The primary estimates of interest from the health outcome regressions are the estimated coefficients on the food instrument redemption variables. These estimates are shown in table 10-2 and discussed below. The complete results for each regression model are presented in appendix K.

Birthweight

The estimated relationship between food instrument redemption and birthweight is positive and statistically significant, although very small in magnitude. Furthermore, the estimated coefficients on food instrument redemption are the same regardless of whether redemption is measured by a count of food instruments or the estimated value of food instruments. The estimates suggest that a percentage point increase in the rate of food instrument redemption is associated with increased birthweight of 0.03 ounces.

The very small magnitude of the relationship between food instrument redemption and birthweight is at least partly due to the fact that mean food instrument redemption is quite high, at 88 to 90 percent. An additional factor is that the model specifications do not include many important determinants of birthweight, due to data limitations. For example, some but not all State WIC files contained data on pregnancy histories: number of prior pregnancies, number of pregnancy losses, date most recent pregnancy ended.

[16] PCTCOST is equal to the "value" of foods listed on redeemed instruments divided by the "value" of foods listed on all issued instruments. This percent is measured for each WIC participant based on food costs within their State. This measure is not a perfect proxy for percent of nutrients redeemed. Furthermore, as a proxy for nutrients, the measure varies across States if the relative costs of different food items (e.g., cost of milk relative to cereal) varies across States.

Table 10-2—Estimated relationship between food instrument redemption and health outcomes

	Health outcome			
Procedure:	Birthweight (ounces) OLS	Change in height-for-age OLS	Probability of "exiting" anemia Logistic	Probability of "exiting" underweight Logistic
Alternate measures of food instrument redemption		*Number*		
PCTINSTRU	0.03 (6.51)	0.02 (7.68)	-0.001 (1.58)	0.005 (25.28)
PCTCOST	0.03 (5.66)	0.02 (6.88)	-0.0008 (0.84)	0.004 (12.35)
PCTCEREAL	—	—	0.004 (30.33)	—
Sample size	*52,927*	*158,798*	*24,521*	*13,177*

Parentheses contain t-statistics for OLS regressions and Wald chi-square statistics for logistic regressions.

In State-by-State regressions, with the same specification as the all-state regression (i.e., same covariates), the estimated coefficient on food instrument redemption is statistically significant only for Texas. Pregnancy history variables were available for all States except Connecticut and North Carolina.[17] With pregnancy history variables added to the model, the estimated coefficient on food instrument redemption was positive and statistically significant in California and Texas.[18]

Change in Height-for-Age

Similar to the birthweight regressions, the estimated relationship between food instrument redemption and change in height-for-age is positive, statistically significant, and small in magnitude. A percentage point increase in the rate of food instrument redemption is associated with an increased change in the height-for-age percentile of 0.02 percentile points. The mean change in height-for-age percentile for the sample is 1.04, which implies that a percentage point increase in food instrument redemption is associated with a 2 percent increase in height-for-age percentile.

Although the estimated relationship between food instrument redemption and change in height-for-age is small, it is important to remember that the health outcome measure is taken over a 6-month period for an outcome that is standardized relative to the population mean for gender and age.

[17] The Connecticut file contained these data items but they were missing for one-third of the sample.

[18] The coefficient for Texas was slightly larger in this model (.045) compared to the base model (.038).

Anemia

Anemia in children was examined by modeling the probability that children identified as anemic at one WIC certification, would not be anemic at recertification. This model provides compelling results. The estimated relationship between food instrument redemption and change in anemia status is the wrong sign and not statistically significant when food instrument redemption is measured by PCTINSTRU or PCTCOST. The "wrong" sign suggests that an increase in food instrument redemption would decrease the likelihood of "exiting" anemia status.

In contrast, when food instrument redemption is measured by the percent of cereal ounces on redeemed food instruments, the estimated relationship is positive and statistically significant, although very small in magnitude. A 10-percentage-point increase in the percent of cereal redeemed is associated with a 0.04 percentage point increase in the probability of "exiting" anemia.[19]

The evidence from the anemia models is compelling. Recall that one of the difficulties with this simple model of health outcomes is that food instrument redemption and health outcomes are determined simultaneously. It is likely that a WIC participant who is motivated to improve health status (by engaging in healthy behaviors) will also be motivated to redeem WIC food instruments and consume WIC foods. Because all three measures of food instrument redemption are correlated, the evidence that food instrument redemption, measured generally, is not related to anemia, whereas cereal redemption is related to anemia, suggests that food instrument redemption is not acting as a proxy for unobserved healthy behaviors.

Underweight

Similar to anemia, underweight in children was examined by modeling the probability that children identified as underweight at one WIC certification, would not be underweight at recertification. The estimated coefficients are nearly the same regardless of whether redemption is measured by a count of food instruments or the estimated value of food instruments. The estimates suggest that a percentage point increase in the rate of food instrument redemption is associated with a 0.005 increased likelihood of no longer being underweight.

An additional model, not shown in the table, was specified to examine the relationship between food instrument redemption and overweight status—the probability that overweight children in November are no longer overweight in April. This model provides another way to test whether the food instrument redemption measures are acting as a proxy for unobservable behaviors. If food instrument redemption is a proxy for healthy behavior, then one might expect food instrument redemption to increase the likelihood that overweight children lose weight.[20] On the other hand, if food instrument redemption provides a reasonable measure of WIC food consumption, one would expect food instrument redemption to be negatively related to the likelihood that overweight children lose weight. The estimated coefficient on food instrument redemption in the overweight model is negative and statisti-

---

19 Similar results are found when examining the probability of "entering" anemia. Six percent of children who were not anemic in November became anemic by April. The probability of "entering" anemia is positively related to PCTINSTR and PCTCOST, suggesting that consumption of WIC foods is related to anemia (wrong-signed results). The probability of "entering" anemia, however, is negatively related to PCTCEREAL and is statistically significant.

20 Food instrument redemption may also increase the likelihood of "exiting" overweight status if nutrient-dense WIC foods replace higher calories foods with less nutritional value.

cally significant (–0.006), suggesting that WIC food instrument redemption decreases the likelihood of exiting overweight status.

Conclusions

This chapter provides evidence of the relationship between WIC food instrument redemption and health outcomes. Four health outcomes are examined: birthweight for women enrolled in WIC prenatally, change in height-for-age percentiles for children, the probability that anemic children identified at WIC certification will no longer be anemic at recertification, and the probability that underweight children identified at WIC certification will no longer be underweight at recertification.

The estimated models are simple due to data limitations, and the main determinant of interest—food instrument redemption—is an imperfect proxy for food consumption. Nonetheless, the results show a positive and statistically significant relationship between food instrument redemption and positive health outcomes.

The magnitude of the estimated relationship between food instrument redemption and health outcomes is very small for all outcomes examined. This is partly due to the fact that, in most models, health outcomes are measured as changes in status over a short time period. The estimates are also understated to the extent that measurement error in the food instrument redemption variables puts a downward bias on the estimated coefficients. Better information on the relationship between WIC benefits and health outcomes requires examination of WIC outcomes over a longer time period, with more precise measures of WIC food use.

For cost-containment practices to have an adverse effect on health outcomes, it is necessary to show (1) that cost-containment practices reduce food instrument redemption or food use, and (2) that a positive relationship exists between food instrument redemption and positive health outcomes. This chapter has demonstrated the second relationship. Previous chapters have presented evidence that some food-item restrictions affect the purchase and consumption of cheese and cereal, but the effects are targeted toward specific subgroups of the entire WIC caseload (mostly those participants for whom restrictions impose a binding constraint). Furthermore, there was no consistent evidence that food-item restrictions reduced rates of food instrument redemption. Thus, the study concludes that it is unlikely that the cost-containment practices used in the six case study States had any measurable negative effect on health outcomes.