

WIC provides food, nutrition counseling, and access to health services to low-income women, infants, and children. The program began as a pilot in 1972 and was made permanent in 1974. Pregnant or postpartum women are eligible, as are infants and children up to age 5, if they meet income guidelines and are determined to be at “nutritional risk” by a health professional. The income cutoff is 185 percent of the U.S. poverty threshold, somewhat higher than the cutoff for the FSP. The “nutritional risk” determination takes account of both medically based risks such as anemia or underweight, and diet-based risks such as an inadequate dietary pattern.

WIC participants generally receive a voucher or credit, for use in purchasing specific authorized foods selected for their nutritional content. WIC foods are high in one or more of the following nutrients: protein, calcium, iron, vitamin A, or vitamin C. WIC foods include infant formula, cereals, dairy products, peanut butter, and other foods high in the target nutrients. The WIC program also offers a substantial nutrition education program and serves as a gateway to other forms of health services (USDA Food and Nutrition Service, 1999).

Research on Nutrition Programs and Dietary Quality

In a recent article on the U.S. nutrition safety net, Eileen Kennedy observes that the major nutrition problems in the United States have changed over the last 50 years:

Problems of over-consumption and excesses and imbalances are now, on average, more prevalent than problems of under-consumption and deficiency. For example, childhood obesity is now more common than growth retardation. This is true across all income strata, although the nutrition-related disease burden is substantially greater in low-income groups (Kennedy, 1999, p. 331).

These low-income groups are the target population for the FSP and WIC. Levedahl and Oliveira (1999) note how little is known about the effect of nutrition assistance programs specifically on dietary quality: “[T]heir effect on the quality of the recipient’s diet has so far been uncertain” (Levedahl and Oliveira, 1999, p. 322).

A substantial body of applied research has attempted to measure this “uncertain” effect. The line of research pursued most frequently has been to estimate

regression models, using survey data, to explain the effects of economic and demographic variables — including program participation and benefit levels — on one or more food consumption variables. Devaney and Moffitt (1991) found that food stamps have a significant and positive effect on the availability of food energy, protein, and nine micronutrients. Rose, Habicht, and Devaney (1997) found that food stamps and WIC both have positive and significant effects on iron and zinc intake for preschool children. By contrast, Butler and Raymond (1996) reported that food stamps have no positive effect on intake of several nutrients, after controlling for endogenous self-selection into the program.

In the 1990’s, nutrition scientists with expertise in survey research developed a new method for measuring dietary quality using the same commonsense terms that are employed by the Federal Government in its dietary recommendations and the Food Guide Pyramid (Cleveland and others, 1997a). Krebs-Smith and others (1995) used this type of pyramid servings data to study fruit and vegetable intake. Another study, Krebs-Smith and others (1996) used such data to study food intake by children and adolescents. For adults, Cleveland and others (1997b) found that intake of each of the five main food groups increased as income increased from below 131 percent of the poverty line to 131-350 percent of the poverty line.

The one previous food assistance study that drew on these methods for measuring intake in pyramid servings was by Basiotis and others (1998). That study investigated how economic and demographic characteristics of families influence scores on the USDA’s “Healthy Eating Index” (HEI) -- a measure of how well diets adhere to the Federal Government’s dietary guidelines. Using data from the 1989-91 CSFII, Basiotis and others found that the HEI increased with food stamp participation if household weekly benefits exceeded \$17.54. The HEI increased strongly with WIC participation.

Data and Methods

The study reviewed here and in Wilde, McNamara, and Ranney (1999) employed data from the 1994-96 CSFII. That nationally representative survey collected basic demographic information for all members of each household and used a randomization strategy to select certain members to participate in a complete food intake survey. These “sample persons” were administered two 1-day survey modules about their food

intake, in each case asking them to recall all foods and beverages consumed in the preceding 24 hours. The data used in this study represent 3,642 sample persons in 1,901 households with income less than or equal to 130 percent of the poverty line. See USDA (1998) for more detail on the survey design and construction.

The detailed responses about food intake were used to construct the pyramid servings variables used in this study (USDA, 1998). The definition of a serving differs for each food group, but corresponds as closely as possible to common usage. One slice of bread is one serving in the grains group, and so forth for fruits, vegetables, and dairy. The units for the meats group are ounces of lean meat or “ounce equivalents” of meat substitutes, such as eggs or red beans. Added sugars are measured in teaspoons, and total fats are measured in grams.

The 1994-96 CSFII had several characteristics that make it suitable for addressing the three types of complications discussed in the introduction. First, because the survey asked detailed questions about actual food intake, rather than just overall food spending, it permitted investigation of how economic and demographic factors affect the composition of a whole list of food intake variables jointly. Second, because the survey reported program participation and economic variables, and also measured food intake in the same intuitive terms as the Federal Government’s “Food Guide Pyramid” and dietary guidelines, this data source lends itself to interdisciplinary approaches drawing on both applied economics and nutrition. Third, because the data contain information on more than one member of many families, they permit an exploration of how food choices are similar or different for members of the same family.

The statistical model used here is a regression model with seven equations, one for each of the seven main food intake variables. It differs from the most familiar ordinary least squares regression model in the way it addresses the “random” aspects of food intake decisions — those characteristics of families and individuals that cannot be observed and explained by the analyst, and that are therefore treated as “random errors” in the statistical model. The model measures how random factors that contribute to food intake outcomes are correlated for individuals in the same families and correlated across food groups. That means, for example, that if one member of a household is more likely to consume high amounts of vegetables, other members of the same household may also consume high

amounts. Likewise, if a person is particularly fond of vegetables, the same person might also tend to consume larger amounts of fruit than average. One advantage of taking account of such correlations is that it permits more precise estimates of the effects of food stamps and WIC. However, in this particular study, this gain in precision proved modest. The most important advantage of this statistical model turned out simply to be that the correlations it measures are themselves interesting.

The main explanatory variables in the model are income and two variables indicating whether anyone in the family received FSP or WIC benefits. Other explanatory variables include age, education, sex, race, ethnicity, household structure, smoking habits, homeownership, body mass index, health status, rural residence, and region of the country. Because food intake patterns change with age in a complex way, the effect of age in the model is allowed to be highly nonlinear, and the effect of income on food intake is allowed to be different for people at different ages. Moreover, food intake often does not increase in a linear way with income, so a quadratic term is included to permit the effect of income on food intake to be nonlinear.

The model produces two types of results. The first type of result is the regression parameter estimates. Because of the nonlinear specification for the age and income variables, a table of parameter estimates is not easy to interpret on its own. The most straightforward way of explaining the implications of these parameter estimates is through a simple type of simulation. In this simulation, the model’s predictions are illustrated in terms of food intake for a person with “typical” characteristics — mean values of the economic and demographic variables. Then, one can illustrate how food intake would change if the person were older, for example, or if the person had higher income. Most important, one can illustrate how expected food intake patterns would change, according to the model, if the person shifted from nonparticipation in nutrition assistance programs to participation in the FSP or WIC, or both. There are more sophisticated simulations one could run, but this approach suffices to show the most important results. For those who want more detail, the complete table of the parameter estimates is available in Wilde, McNamara, and Ranney (1999).

The second type of result describes the correlations discussed above. The statistical model assumes the “random errors” that influence food intake have one component that is shared by all members of the same

household, and another component that is idiosyncratic for each individual. For example, if the main food buyer for a family has a special preference for pork chops, that might show up in the household error component for the meat equation, because it affects the meat intake of each family member. On the other hand, one family member's special preference for milk at lunch might be part of the individual error component, because it is not necessarily correlated with the dairy intake of other family members. Both error components are permitted to be correlated across the seven food equations — so, for example, the family with the pork chops might also have higher intake of total fats. For each error component, cross-equation correlation coefficients show how the random factors influencing intake of each food group are correlated with those for the other food groups. A correlation coefficient of zero means two variables are uncorrelated, while a correlation coefficient of one means the two variables are perfectly correlated.

Effects of Age, Income, and Program Participation on Dietary Quality

The analysis found that age, income, and program participation had significant dietary effects. Moreover, random factors that affected food intake were indeed correlated within families and across pyramid food groups.

Age

Table 1 and figure 2 illustrate how the baseline expected level of food intake for the seven food measures varies with age and compare these levels to the recommendations.¹ Baseline intake of meats and vegetables is highest at age 30. Intake of grains, added sugars, and total fats is highest at age 16, and intake of fruits and dairy is highest at age 7. For fruits and dairy, baseline intake for all ages falls short of even the lower end of the recommended range. By contrast, for added sugars and total fats, baseline intake is quite high relative even to the recommended maximums.

Additional Income

Because of the way income and age variables are specified in the model, the effects of higher income are

shown separately for several age groups (table 1, fig. 3). In this simulation, the “very low income” in the baseline case is chosen such that only one-quarter of the low-income sample is poorer (approximately \$162 per person per month). “Higher income” is chosen such that only one-quarter of the low-income sample has more income (approximately \$375 per person per month). For meats, added sugars, and total fats, the effect of higher income is uniformly positive and in most cases statistically significant. The greatest increases with income, relative to the baseline case, are for intake of added sugar by young people (ages 7 and 16). For the remaining pyramid categories, the income effect varies in sign and is less consistently significant, but positive effects still predominate.

Program Effects

As with income, FSP participation has a significant positive effect on meats, added sugars, and total fats (table 1, fig. 4). The corresponding effect of FSP participation for the remaining food groups varies in sign and is not statistically significant. WIC participation appears to have a positive effect on intake of fruits and dairy. However, these parameter estimates are not statistically significant. Thus, these positive results could be due to random sampling variation. The one statistically significant effect for the WIC participation variable is a negative effect on intake of added sugars.

Correlations Within Families

Finally, consider some patterns in the “random error” that the statistical model cannot explain. With regard to correlations in food intake for members of the same family, the key results may be seen in the variances of the household error component and the individual error component for each equation.² If there were no correlations within households — that is, if the random factors affecting food intake for two people in the same household were no more related than the factors for two people in different households — then the variance of the household error component would be near zero and the variance of the individual error component would constitute the total variance. Instead, however, the variance of the household error component is at least a third as large as the variance of the

¹The recommended maximum for total fats in the Dietary Guidelines is expressed in terms of a proportion of total calories — 30 percent — not in terms of grams. In table 1, this recommendation is converted into a range of recommended grams of intake of total fats, using the same range of benchmark caloric intake that is used in the Food Guide Pyramid to construct the recommended ranges for the five main pyramid food categories: 1,600 calories to 2,800 calories.

²Not all households report food intake observations for multiple “sample persons.” Some households have only one person. For other households, only one person was randomly chosen to receive the full food intake survey instrument. The statistical model is estimated using the full sample, but these results for intrahousehold correlations are fully determined by food intake patterns in just those households with more than one sample person.