Rural vs. Urban Texas WIC Children Food Choices and Intakes Before and After Changes in the Food Benefits

Ariun Ishdorj[1]

and

Oral Capps Jr.[1]

[1]Department of Agricultural Economics

Texas A&M University

January 2015

This research was funded through a Research Innovation and Development Grant in Economics (RIDGE) Center for Targeted Studies award from the U.S. Department of Agriculture's Economic Research Service, administered through the Southern Rural Development Center at Purdue University.

Introduction

Improving the nutritional well-being of the low-income population is one of the primary objectives of 15 U.S. food assistance programs. The third largest of these in terms of total expenditure is the Special Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC), which targets low-income pregnant, breastfeeding and postpartum women, infants and children up to age five. The WIC program provides supplemental foods, nutrition education, breastfeeding support and referrals to health and social services for it participants. To expand the selection of foods the program offered and help combat the problem of obesity WIC food packages were revised in 2009. The revised food packages were designed to contribute to an overall dietary pattern that is consistent with the Dietary Guidelines for Americans as well as to insure that foods are readily acceptable, widely available and commonly consumed by the target population (IOM 2006).

One of the main changes in the revised WIC food packages was the reduction in the total amount of milk and the removal of whole milk from food packages offered to women and children of ages two through five. Also 100% juices continued to be included in the food packages but were offered in reduced amounts. Although it is well known that some of the most commonly consumed beverages have a high caloric content and may contribute to the current obesity epidemic, relatively few studies have examined dietary patterns of children with regard to beverage consumption. It is critical to understand the descriptive patterns of beverage consumption in children in order to help design intervention strategies to promote healthier beverage consumption in specific higher risk subgroups.

The objective of this paper is to better understand the food preferences and consumption behaviors of children residing in low-income households. We center our attention on whole, 2%,

1% and skim milk, 100 % juices and other sugar- and artificially-sweetened beverages consumed by Texas WIC participating children of ages two through five. This study contributes to the existing literature by conducting the analysis of pre- and post- implementation of revised WIC food packages and exploring the differences across rural and urban areas. Specifically, using data from the Texas Food and Nutrition Survey for WIC (TEXFAN) we analyze the effect of the removal of whole milk and reduction in the total amount of milk provided by WIC on the type and on the amount of milk consumed by children. We also check if the changes in WIC food packages affected the consumption frequency of 100% juices, and sugar-sweetened and artificially-sweetened beverages consumed by WIC children.

Why Texas? Today, the WIC program serves a culturally diverse population with a wide range of traditional food preferences. In this regard, Texas is one of the most culturally, ethnically and racially diverse states in the United States. As the second largest state in the nation with a population of over 25 million, the size and scope of Texas poses unique challenges due to the rapidly changing demographics and cultural diversity. Hispanics are the fastest growing population in Texas. In 2011, 38.1 percent of Texans were Hispanic in contrast to 32.0 percent in 2000. Texas is one of the most urban states in the nation with three of the top ten largest cities in the Nation and majority of its people living in 20 of the 254 counties in the state. Texas still has the nation's largest rural population, with more than 20 percent of its population living in rural areas. About 10 percent of the Texas population resides within 62 miles of the U.S.-Mexico border of whom 84 percent were Hispanic. Hispanic households who reside near the U.S.-Mexico border are primarily poor and face greater vulnerability to food security, overweight/obesity and poor nutritional health.

In 2014, the Food & Nutrition Board convened a committee to review and assess the nutritional status and food and nutritional needs of the WIC-eligible population as well as the impact of the 2009 regulation and food packages revisions. The new visions to WIC food packages will be consistent with the 2015 Dietary Guidelines for Americans. The recommendations will take into account the health and cultural needs of the WIC participant population. The findings of this paper provide an unparalleled opportunity to examine patterns, associations and other relevant information related to food consumption choices of children participating in Texas WIC program. This paper addresses questions related to the interests of state of Texas, the Food & Nutrition Board committee, and government agencies as to how changes in specific food assistance and nutrition programs affect food choices by participants. By providing a careful analysis of overall food choices and consumption patterns of WIC participants, this paper supports improved program evaluation, design and policy analysis.

Background and Related Research on WIC

WIC began as a pilot program in 1972 and became permanent in 1974. Over the past few decades, WIC had influenced the lives of millions of its participants and became one of the key programs targeted toward the low-income population. Nutrition and health outcomes are tied together tightly. Additionally, there is an increasing demand for food assistance; consequently, the health and welfare effects associated with nutrition programs have become a question of interest to policy makers. There is a well-developed body of literature devoted to examining the efficacy of the nutrition programs some of which is specifically designed to influence child health.

The literature devoted to the WIC program has focused primarily on the impact on food and nutrient consumption as well as the impact on the health of targeted groups (Burstein, et al. 2000; Oliveira and Gundersen, 2000; Ponza, et al. 2004; Rose, et al. 1998; Siega-Riz, et al. 2004;

Oliveira and Chandran, 2005; Ishdorj, et al., 2008; Yen 2010). Considerable work also has been done to evaluate the effect of WIC participation on pregnant women and birth outcomes (Kowaleski-Jones and Duncan, 2002, Lazariu-Bauer, et al., 2004; Bitler and Currie, 2005). The findings of these studies are mixed, although the weight of the evidence points to the program having a positive effect on birth outcomes and on intake of some targeted nutrients and foods. A handful of these studies have explored these issues using large national surveys such as the National Health and Nutrition Examination Survey (NHANES) (Cole, 2001; Lin, 2005; Ver Ploeg, et al., 2009), and the Continuing Survey of Food Intakes by Individuals (CSFII) (Rose et al., 1998; Oliveira and Gundersen, 2000; Ishdorj, et al., 2008, Siega-Riz, et al., 2004; Oliveira and Chandran, 2005; Yen, 2010).

The majority of work focusing on nutrient intake of children has, with few exceptions, found that the WIC program performs as desired and that the children receiving targeted food assistance are consuming more WIC approved foods than non-participants. Oliveira and Chandran (2005) found that participation in the WIC program increased the consumption of at least some types of WIC-approved foods for children participating in the WIC program compared to eligible non-participating children living in non-WIC households, eligible non-participating children living in WIC households, and children living in households with income too high to be eligible for WIC (income greater than 185% of the poverty threshold). Their findings suggested that some WIC foods replace non-WIC foods in the diets of children participating in the WIC program rather than adding to their diets.

Rush et al. (1988) studied the effect WIC participation had on a child's diet and found that the WIC program improved dietary quality, with the largest impact associated with the intake of iron, vitamin A, and vitamin C. They also found that this effect is more pronounced for children

who were poor, black, living in single parent families, or living in very large families. Other research had shown that WIC had a positive impact on a participant's diet as participants tended to consume less fat and sugar than their non-participating counterparts (Siega-Riz et al., 2004 and Wilde et al., 2000). Further, WIC participants had a higher intake of several important vitamins and minerals (Oliveira and Gunderson, 2000 and Rose et al., 1999) than their non-participating counterparts.

Among the studies that considered the WIC program, there were several that looked at the food consumption of WIC participants using regional or state-level data (Dennison, et al., 2000; Herman, et al., 2008; Anliker, et al., 1992; Black, et al., 2009). Dennison et al. (2000) examined the types of milk that were consumed by children participating in the New York State WIC program and found that 75% of WIC participating children consumed whole milk, while only 6.9% consumed exclusively 1% and/or skim milk. They also found that children tended to drink the same type of milk as other family members. Herman et al., (2008) looked at the effect of intervention on fruits and vegetables consumption of WIC women in surrounding areas of Los Angeles and found that intervention participants increased their consumption of fruits and vegetables and sustained the increase six months after the intervention was terminated.

Although WIC is one of the well-studied food assistance programs, to our knowledge there are only a handful of studies that have looked at the effect of the revised WIC food packages on food choices and consumption patterns of participants (Ishdorj and Capps 2013; Andreyeva 2012; Andreyeva, Luedicke, Middleton and et al. 2012; Whaley, Ritchie, Spector and et al. 2012; Black, K.M. Hurley, Oberlander and et al. 2009). Results of the existing literature on the WIC program highlight the importance of how the inclusion of specific foods in the WIC food packages may influence the change in the dietary patterns of program participants. Our paper contributes to this

literature by conducting the analysis of pre- and post- implementation of revised WIC food packages.

Data and Method

We make use of two similar cross-sectional datasets of children before the programmatic changes, the Texas Food and Nutrition Questionnaire (TEXFAN), 2008-2009 survey, and the other after the programmatic changes, the Texas Food and Nutrition Questionnaire (TEXFAN), 2010-2011, more than six months after the changes. The TEXFAN data were collected under the auspices of the Institute for Obesity Research and Program Evaluation at Texas A&M University in collaboration with Texas WIC and USDA. Texas WIC programs administered surveys using samples of WIC participants who attended WIC clinics during the data collection periods. Our variables of interest in our study were the amount of milk, the type of milk most often consumed, and the frequency of 100% juices and sugar-sweetened and artificially- sweetened beverages consumed. Here 100% juices include orange, apple, or tomato varieties; sugar-sweetened drinks include Kool-Aid, soda, cola, sports drinks, or sugar-sweetened tea; and artificially-sweetened drinks include diet soda, diet cola, or Crystal Light.

Detailed socio-demographic information on ethnicity/race, gender, age of a child, language spoken at home, age and education level of caregivers and the zip code of residence were available for the data. We collected neighborhood characteristic information by zip code from the American Community Survey, U.S. Census. Rural and urban classifications using the self-reported zip code were created with specific attention paid to those children who lived in households close to the U.S.-Mexico border.

The econometric analysis, based on the use of the TEXFAN data allowed us to identify and assess the factors associated with the choices of milk types and the frequency of beverages consumed. The dependent variable equals one if WIC participating child consumed whole milk most often, two if 2% fat milk is mostly chosen, and three if 1% fat or skim is mostly chosen (1=whole milk; 2=2% milk; and 3=1% or skim milk).

The data provide information on the frequency of 100% juice, sugar-sweetened and artificially-sweetened beverage consumption per day and per week (never or less than once per week; 1 to 3 times per week; 4 to 6 times per week; 1 time per day; 2 times per day; 3 times per day; and 4 or more times per day). Therefore, the dependent variables for beverages were measured on a scale that is discrete and ordinal. As a result, an ordered probit model was used in the analysis.

To discern whether or not statistically significant differences exist in milk choices made by WIC participants before and after programmatic changes, we pooled the data and estimated the ordered probit model. However, with the pooled dataset, the set of explanatory variables include a dummy variable equal to one corresponding to observations after the change in the WIC program and equal to zero corresponding to observations before the change in the WIC program. Consequently, based on the significance of the estimated coefficient associated with this dummy variable, we were in position to identify and assess differences in milk and beverage choices made by WIC participants.

Results

Our final sample consists of 2,782 observations, with 1,339 before the WIC revisions and 1,443 observations after the WIC revisions, respectively. The sample size of rural WIC children was smaller than the sample size of urban WIC children.

Tables 1 and 2 provide descriptive statistics of dependent variables by rural and urban areas before and after the changes in WIC foods. As shown in Table 1, after the implementation of the new food packages, there was a significant shift away from whole milk and towards reduced fat milk. The percentage of children consuming whole milk decreased from 61.4% to 8.7% whereas percentage of children consuming reduced fat milk increased from 32.6% to 81.5%. There was a significant increase in the percentage of children consuming low fat/skim milk (5.6% to 9.8%). The amount of milk consumed per day decreased from 2.63 cups to 2.33 cups. No significant differences were observed for rural and urban areas with respect to the amount of milk consumed per day. A slightly higher percentage of children consumed whole milk in rural areas compared to those located in urban areas after WIC revisions.

With respect to WIC households in our sample, roughly 50% of respondents reported having one infant/child currently receiving WIC benefits and 40% reported having two infants/children receiving WIC benefits. Of all the households which have a child over 1 year on WIC, 75% reported having an infant who received WIC foods in the past 30 days. Almost 100% of the respondents in our sample were primary caregivers of WIC children. About 85% of caregivers reported receiving WIC foods themselves in the past 30 days, and 60% reported receiving food benefits through Supplemental Nutrition Assistance Program (SNAP). This set of descriptive statistics is consistent with current statistics on Texas. In 2010 Texas was the state with highest birth rate in the country behind Utah and Alaska and Texas kids account for one of

every 11 kids in the U.S. However, 27.6% of Texas kids are food insecure and food assistance programs are the primary ways many Texas families access food.

About 70% of children in out sample were Hispanic (Table 3). The 2007 National Youth Risk Behavior Survey found that 61% of Hispanic youth were more likely to consume one or more cans of soda per day, and their milk consumption has been decreasing. Lower fluid milk consumption can partially be explained by the fact that sugar- and artificially-sweetened beverages may be displacing fluid milk consumption in addition to other dairy products such as cheeses and yogurts. Table 2 presents the frequency of 100% juices and sugar-sweetened and artificially sweetened beverage consumption. We found that 100% juices were consumed more frequently per day compared to other beverages. Compared to artificially-sweetened beverages, sugar-sweetened beverages were more popular and were consumed more frequently per day and per week both before and after the changes in WIC. Our results also indicate an increase in the percentage of children consuming 100% juices, sugar- and artificially-sweetened beverages after the changes in WIC program, although we cannot make any definitive conclusions about the amount of those beverages consumed.

The distributions for before and after samples of explanatory variables used in the analysis were very similar (Table 3). The average caregiver's age was 29. Little over 20% of caregivers in our sample were employed full time and over 60% were not employed. More than a third of caregivers had less than a high-school education, and about 3% had some college education. Consequently, roughly 60% of caregivers had a high-school degree. About 28% of caregivers reported speaking Spanish most often at home and the same percentage reported speaking both Spanish and English most often at home. The only significant difference we

observed for border and non-border regions in comparison with total sample was the percentage of Hispanic respondents.

Over 90% of caregivers living in the U.S.-Mexico border regions of Texas were Hispanic and about 50% reported speaking both Spanish and English, with 37% speaking Spanish most often at home. Distributions of other explanatory and dependent variables for border and non-border regions were similar to the whole sample. To conform to space limitations, these results were not reported in this paper. But these results are available from the authors by request.

Table 4 shows the marginal effects of the estimated ordered probit model for milk types. We estimated this model for the entire sample since no significant differences were observed for explanatory variables dealing with the amount of milk and the type of milk consumed between rural and urban areas and for border and non-border regions from the descriptive analysis. The probability of consuming whole milk decreased by 45% and probability of consuming reduced fat milk increased by 33% for the post-survey compared to pre-survey. We expected to observe whole milk consumption in the data set corresponding to post-WIC changes since our variables measure total milk consumption not only provided by the WIC program but also purchased by the household.

Compared to two-year olds, three- and four-year olds were less likely to consume whole milk and were more likely to consume reduced fat and low fat/skim milk. Since WIC allows whole milk for infants and children up to two years of age, these findings are consistent with WIC regulations. Two-year olds in our sample were more likely to be transitioning from whole milk to lower fat milk. Caregivers' education level had a significant effect on the type of milk most often consumed by children. Compared to caregivers with less than a high school degree, caregivers with some college education were less likely to provide whole milk (9%) and more

likely to provide lower fat milk (13%) to their children. Children with older caregivers were significantly less likely to consume whole milk and more likely to consume lower fat milk.

Tables 5, 6 and 7 show the marginal effects for frequency of 100% juices, sugar- and artificially-sweetened beverages consumed by Texas WIC children. Caregivers' education level, employment status, race, language spoken at home and age had significant effects on the frequency of consumption of 100% juices as well as on sugar- and artificially-sweetened beverages. The probability of consuming 100% juices more frequently slightly decreased but the probability of consuming sugar-sweetened beverages more frequently increased after the changes in WIC compared to the situation before the changes.

Conclusions

The WIC program has the potential to positively influence health and nutrition related issues of low-income households because almost half of all infants in the United States, roughly quarter of children under age of five along with many women who are pregnant, breastfeeding or postpartum are enrolled in the program. The WIC program is the most targeted federal nutrition program that provides specific food packages to supplement the diet of its participants. In 2009, WIC food packages were revised in order to reflect new dietary recommendations and changing WIC population, promote healthy food choices and consumption and address the problem of overweight/obesity of program participants. This study analyzed the effect of WIC food changes on the amount and the type of fluid milk and other beverages chosen and consumed by Texas WIC children.

Our findings suggest that the new food packages that restrict purchases of whole milk and reduce the amount of milk provided by WIC had an impact on participants type of milk

consumed in the intended direction. The amount of milk consumed per day by WIC children after the changes in WIC food packages slightly decreased (2.33 cups/day after) compared to the amount before consumed before the changes (2.63 cups/day for before), suggesting that the decrease in the amount of whole milk was replaced by the increase in the amount of reduced and low-fat/skim milk consumed by WIC children.

We did not find significant differences in the types of milk and the amount of milk consumed by WIC participants in rural and urban areas and in border and non-border regions. Significantly more children consumed 100% juices two or more times per day compared to sugar- and artificially-sweetened beverages both before and after WIC revisions. Although there was a reduction in the total amount of juices offered by WIC, significantly more children consumed 100% juices two or more times/day after the revisions in both rural and urban areas.

There are several limitations to this study. The TEXFAN data contain information on only WIC participants, hence we are in no position todiscuss the effectiveness of the program and compare the results to eligible non-participants. Also, we cannot those dropping out of the program since our data only deal with those enrolled in the WIC program. We cannot tell if individuals dropped out of the program because they didn't like the new food packages or simply because they no longer qualified to receive WIC benefits. Nonetheless, in this study we were able to address the effect of changes in WIC food packages, conditional on individuals being WIC participants.

The findings of this research need to be interpreted with caution since our sample is limited to only Texas WIC children. WIC food packages vary by state and some states, for example, limit purchases to only 1% or skim milk excluding both whole and reduced fat milk. Nonetheless, Texas provide services to over 10% of all WIC participants, the second largest WIC

program with respect to participants after California (USDA 2012) with majority of its participants being Hispanic. The findings of this study will add to the knowledge of understanding the effect of revisions in WIC at the national WIC program level. The Texas child poverty rate is growing faster than the child population with 22.5% in 2008 to 26.6 % in 2011; yet enrollment of children in WIC declined from 2010 to 2011. The current study addressed questions related to the interests of state of Texas and government agencies as to how changes in specific food assistance and nutrition programs affect food choices made by participants.

This study considers the types and amount of food consumed by WIC participants, and does not address the supply side, specifically food availability and selection options. Not all Texans have access and can afford to purchase healthy foods like fruits and vegetables, but a far greater percentage has access to high caloric, empty nutrient foods and drinks. Since we only considered milk and other beverages, the availability and ease of access to those foods might not be an issue and might not affect the findings of this study.

The results of this study provide useful information on how policy changes impacted food choices and consumption decisions of program participants. With changes in demographics of WIC participants along with changes in dietary guidelines and food packages, sound information on food choices for program eligible and low-income households is crucial to better understand the impact of WIC and the effectiveness of WIC in improving the foods available to program participants. By providing a careful analysis of overall food choices and consumption patterns of WIC children, the research supports improved program impacts, design and policy analysis.

References

Andreyeva, T. 2012."Effects of the Revised Food Packages for Women, Infant, and Children (WIC) in Connecticut." *Choices*, 27(3).

Andreyeva T, Luedicke J, Middleton AE, Long MW, Schwartz MB. 2012. "Positive influence of the revised Special Supplemental Nutrition Program for Women, Infants, and Children food packages on access to healthy foods." *Journal of the Academy of Nutrition and Dietetics.* Jun;112(6):850-858.

Andreyeva, T., J. Luedicke, A. Tripp, and K. Henderson. 2013 "The Effect of Reduced Juice Allowances in Food Packages for Women, Infant, and Children Program." *Pediatrics*, 131(5)1-9.

Bitler P. M. and J. Currie. 2005. "Does WIC Work? The Effect of WIC on Pregnancy and Birth Outcomes" *Journal of Policy Analysis and Management*, 24 (1): 73-91

Black, M.M., K.M. Hurley, S.E. Oberlander, E.R. Hager, A.E. McGrill, N.T. White, and A.M. Quigg. 2009. "Participants' Comments on Changes in the Revised Special Supplemental Nutrition Program for Women, Infants, and Children Food Packages: The Maryland Food Preference Study." *Journal of American Diet Association* 109:116-123.

Burstein, N.R., M.K. Fox, J.B. Hiller, R. Kornfeld, K. Lam, C. Price and D.T. Rodda. 2000. "Profile of WIC Children." U.S. Department of Agriculture, Food and Nutrition Service. March.

Capps, O., H.A. Love, G.W. Williams, and W.L. Adams. 1999. "Examining Packer Choice of Slaughter Cattle Procurement and Pricing Methods", *Agricultural and Resource Economics Review*, April, vol. 28, issue 1.

Cole, N. 2001. "The Prevalence of Overweight among WIC Children." U.S. Department of Agriculture, Food and Nutrition Service, Special Nutrition Programs. Report No. WIC-01-PCM, July.

Dennison, B.A., T.A. Erb, and P.L. Jenkins. 2001. "Predictors of Dietary Milk Fat Intake by Preschool Children." *Preventive Medicine*. 33:536-542.

Herman, D. R., G.G. Harrison, A.A. Afifi, and E. Jenks. 2008. " Effect of a Targeted Subsidy in Intake of Fruits and Vegetables Among Low-Income Women in the Special Supplemental Nutrition Program for Women, Infants, and Children."*American Journal of Public Health.* 98(1), 98-105.

Institute of Medicine, Food and Nutrition Board. 2006. "WIC Food Packages: Time for a Change." Report of the Committee to Review the WIC Food Packages." Washington, D.C.: National Academy Press, Washington, DC.

Ishdorj, A., and O. Capps, Jr. 2013. "The Effect of Revised WIC Food Packages on Native American Children." *American Journal of Agricultural Economics, forthcoming*.

Ishdorj, A., H. H. Jensen, and J. Tobias. 2008. "Intra-household Allocation and Consumption of WIC Approved Foods: A Bayesian Approach." *Advances in Econometrics*, Volume 23: Bayesian Microeconomics (Chib, Griffiths, Koop, and Terrell, eds.), 157-182.

Kowaleski-Jones, L., and G.J. Duncan. 2002. "Effects of Participating in the WIC Program on Birthweight: Evidence from the National Longitudinal Survey of Youth." *American Journal of Public Health*, 95(5): 799-804.

Lazariu-Bauer, V., H. Stratton, R. Pruzek and M.L. Woelfel. 2004. "A Comparative Analysis of Effects of Early Versus Late Prenatal WIC Participation on Birth Weight: NYS, 1995." 2004. *Maternal and Child Health Journal*, 8(2), 77-86.

Lin, B-H. 2005. “Nutrition and Health Characteristics of Low-Income Populations: Body Weight Status, Agriculture Information.” U.S. Department of Agriculture, Economic Research Service, Bulletin No. 796-3, February.

Oliveira, V., and R. Chandran. 2005. “Children’s Consumption of WIC-Approved Foods, Food Assistance and Nutrition.” Washington, DC: U.S. Department of Agriculture, Economic Research Service, Research Report No. 44, February.

Oliveira, V., Gundersen, C. 2000. “WIC and the Nutrient Intake of Children. Food Assistance and Nutrition.” Washington, DC: US Department of Agriculture, Research Report No.5, March.

Ponza, M., B. Devaney, P. Ziegler, K. Reidy, and C. Squatrito. 2004. “Nutrient Intakes and Food Choices of Infants and Toddlers Participating in WIC,” *Journal of the American Dietetic Association*, Volume 104(1), January 2004 supplement, S71-S79.

Rose, D., Habicht, J.P., Devaney, B. 1998. “Household participation in the Food Stamp and WIC programs increases the nutrition intakes of preschool children.” *Journal of Nutrition.* 128(3):548–555.

Rush, D., J. Leighton, N. Sloan, J. Alvir, D. Horvitz, W. Seaver, G. Garbrowski, S. Johnson, R. Kulka, and J. Devore. 1988. “The National WIC Evaluation: Evaluation of the Special Supplemental Food Program for Women, Infants, and Children. VI. Study of Infants and Children.” *The American Journal of Clinical Nutrition*, 48:484-511.

Siega-Riz, A.M., S. Kranz, D. Blanchette, P.S. Haines, D.K. Guilkey, and B.M. Popkin. 2004. “The effect of participation in the WIC Program on preschoolers’ diets.” *The Journal of Pediatrics.*144(2): 229-234.

U.S. Department of Agriculture, Food and Nutrition Service. 2011. *Program Data: National Level Annual Summary, FY 1974-2010.*Available at http://www.fns.usda.gov/pd/wicmain.htm. (Last modified: 01/ 31/2011).

Ver Ploeg, M. 2009. “*WIC and the Battle against Childhood Overweight.”* Washington, DC: U.S. Department of Agriculture, Economic Research Service, Economic Brief Number 13, April.

Whaley, S.E., Ritchie, L.D., Spector, P. and Gomez, J. 2012. "Revised WIC Food Package Improves Diets of WIC Families." *Journal of Nutrition Education and Behavior*. 44(3):204-209.

Wilde, P., P. McNamara, and C. Ranney. 2000. “The Effect on Dietary Quality of Participation in the Food Stamp and WIC Programs.” Food Assistance and Nutrition Research Reports No 33837, U.S. Department of Agriculture, Economic Research Service.

Yen, S. T. 2010. “The effects of SNAP and WIC programs on nutrient intake of children.” *Food Policy*. 35: 576-583.

Table 1. Dependent variables and sample mean values

	Urban		Rural		Total	
	Before	After	Before	After	Before	After
Dependent variables						
Drinks whole milk	0.611	0.083	0.626	0.099	0.614	0.087
Drinks reduced fat milk	0.329	0.815	0.317	0.814	0.326	0.815
Drinks low fat/skim milk	0.056	0.101	0.057	0.087	0.056	0.098
Cups of milk per day	2.616	2.333	2.681	2.321	2.630	2.330
N	1058	1131	281	312	1339	1443

Table 2. Frequency of beverage consumption (in %)

	Never		1-3 times/week		4-6 times/week		1 time/day		2 or more times/day	
	Before	After	Before	After	Before	After	Before	After	Before	After
100% juices	2.39	2.01	22.33	18.09	16.58	15.11	17.92	19.75	40.78	45.05
Urban	2.17	2.12	22.4	18.21	16.35	14.94	17.77	20.07	41.30	44.65
Rural	3.2	1.60	22.06	19.63	17.44	15.71	18.51	18.59	38.79	46.47
Sugar-sweetened drinks	28.94	26.32	34.65	34.14	8.68	8.5	9.08	11.65	18.65	19.40
Urban	30.54	27.91	33.57	33.88	8.19	8.08	9.30	11.16	18.40	18.96
Rural	22.75	20.62	38.82	35.05	10.59	9.97	8.24	13.4	19.61	20.96
Artificially-sweetened drinks	48.35	51.85	22.78	18.28	4.81	3.21	4.14	6.28	19.92	20.38
Urban	48.72	52.45	33.57	17.81	8.19	3.29	9.30	6.23	18.40	20.21
Rural	46.95	49.68	25.81	20.00	5.02	2.90	2.51	6.45	19.71	20.97

Table 3. Explanatory variables and sample means values

	Urban		Rural		Total	
	Before	After	Before	After	Before	After
Child						
Female	0.472	0.481	0.470	0.513	0.471	0.488
Two--year old	0.409	0.390	0.370	0.397	0.401	0.392
Three--year old	0.361	0.364	0.367	0.388	0.362	0.369
Four--year old	0.230	0.246	0.263	0.215	0.237	0.239
Caregiver						
Less than high school	0.391	0.361	0.281	0.321	0.368	0.352
High school or GED	0.329	0.347	0.377	0.349	0.339	0.348
Some college	0.252	0.263	0.324	0.301	0.267	0.272
College or Graduate	0.027	0.028	0.018	0.029	0.025	0.028
Employed full--time	0.222	0.208	0.295	0.250	0.237	0.217
Employed part--time	0.140	0.154	0.160	0.179	0.144	0.159
Not employed	0.638	0.638	0.544	0.571	0.618	0.624
Hispanic	0.709	0.711	0.552	0.622	0.676	0.692
White	0.152	0.135	0.331	0.263	0.190	0.163
Black	0.082	0.110	0.057	0.093	0.077	0.106
Other race	0.057	0.044	0.060	0.022	0.058	0.040
English	0.417	0.405	0.612	0.554	0.458	0.437
Spanish	0.270	0.280	0.302	0.272	0.277	0.279
Spanish and English	0.308	0.308	0.082	0.157	0.261	0.275
Other languages	0.005	0.007	0.004	0.016	0.004	0.009
Caregiver's age	28.922	29.015	28.808	29.452	28.898	29.109
N	1058	1131	281	312	1339	1443

Table 4. Marginal effects of ordered probit model for milk types most often consumed

	Whole			Reduced fat			Low fat/skim		
	ME		Std.	ME		Std.	ME		Std.
Female	0.013		0.016	-0.009		0.012	-0.004		0.005
Three-year old	-0.059	***	0.019	0.043	***	0.014	0.016	***	0.005
Four-year old	-0.102	***	0.021	0.073	***	0.016	0.028	***	0.006
High school or GED	-0.011		0.020	0.008		0.015	0.003		0.006
Some college	-0.091	***	0.023	0.066	***	0.016	0.025	***	0.006
College or Graduate	-0.131	***	0.052	0.094	***	0.037	0.036	***	0.014
Employed full time	-0.004		0.021	0.003		0.015	0.001		0.006
Employed part time	0.009		0.024	-0.007		0.017	-0.003		0.007
Hispanic	-0.025		0.026	0.018		0.019	0.007		0.007
Black	0.135	***	0.034	-0.098	***	0.025	-0.038	***	0.010
Other race	-0.050		0.044	0.036		0.032	0.014		0.012
English	0.008		0.023	-0.006		0.017	-0.002		0.007
Spanish	-0.043	*	0.023	0.031	*	0.016	0.012	*	0.006
Other languages	0.196	*	0.106	-0.142	*	0.077	-0.055	*	0.030
Caregiver's age	-0.002	**	0.001	0.002	**	0.001	0.001	**	0.000
After WIC change in WIC	-0.454	***	0.018	0.328	***	0.018	0.127	***	0.008

ME—marginal effect

Std.—standard deviation associated with the marginal effect

Table 5. Marginal effects of ordered probit model for 100% juices consumed by WIC children

	Never			1-2 times/week			4-6 times/week			1 or more times/day		
	ME		Std.	ME		Std.	ME		Std.	ME		Std.
Female	0.001		0.002	0.003		0.010	0.001		0.004	0.000		0.000
Three-year old	0.004	*	0.002	0.022	*	0.012	0.007	*	0.004	0.001		0.001
Four-year old	0.001		0.003	0.005		0.013	0.002		0.005	0.000		0.001
High school or GED	0.004		0.003	0.019		0.013	0.006		0.004	0.001		0.001
Some college	0.002		0.003	0.007		0.014	0.003		0.005	0.000		0.001
College or Graduate	0.017	***	0.007	0.083	***	0.033	0.028	***	0.011	0.004	**	0.002
Employed full-time	0.005	**	0.003	0.026	**	0.013	0.009	**	0.004	0.001	*	0.001
Employed part-time	-0.003		0.003	-0.015		0.015	-0.005		0.005	-0.001		0.001
Hispanic	0.004		0.003	0.017		0.016	0.006		0.006	0.001		0.001
Black	-0.007	*	0.003	-0.032		0.021	-0.011		0.007	-0.002		0.001
Other race	-0.006		0.006	-0.028		0.028	-0.010		0.010	-0.001		0.001
English	0.002		0.003	0.009		0.015	0.003		0.005	0.000		0.001
Spanish	0.001		0.003	0.003		0.014	0.001		0.005	0.000		0.001
Other languages	0.043	***	0.014	0.210	***	0.064	0.071	***	0.022	0.010	**	0.005
Caregiver's age	0.000		0.000	-0.001		0.001	0.000		0.000	0.000		0.000
After WIC change	-0.007	***	0.002	-0.032	*	0.010	-0.011	***	0.004	-0.002	**	0.001

Table 6. Marginal effects of ordered probit model for sugar-sweetened beverages consumed by WIC children

	Never			1-2 times/week			4-6 times/week			1 or more/day		
	ME		Std.	ME		Std.	ME		Std.	ME		Std.
Female	-0.006		0.014	-0.001		0.002	0.001		0.002	0.005		0.011
Three-year old	-0.002		0.016	0.000		0.002	0.000		0.002	0.002		0.013
Four-year old	-0.016		0.018	-0.002		0.003	0.002		0.002	0.013		0.015
High school or GED	0.022		0.017	0.003		0.003	-0.002		0.002	-0.018		0.014
Some college	0.064	***	0.019	0.009	***	0.003	-0.007	***	0.002	-0.052	***	0.016
College or Graduate	0.168	***	0.046	0.024	***	0.008	-0.019	***	0.005	-0.136	***	0.037
Employed full-time	-0.021		0.018	-0.003		0.003	0.002		0.002	0.017		0.015
Employed part time	-0.037	*	0.020	-0.005	*	0.003	0.004	*	0.002	0.030	*	0.016
Hispanic	0.059	***	0.022	0.008	***	0.003	-0.007	***	0.003	-0.048	***	0.018
Black	-0.057	**	0.029	-0.008	**	0.004	0.006	**	0.003	0.046	**	0.024
Other race	0.005		0.038	0.001		0.006	-0.001		0.004	-0.004		0.031
English	0.018		0.020	0.003		0.003	-0.002		0.002	-0.014		0.016
Spanish	0.059	***	0.020	0.008	***	0.003	-0.007	***	0.002	-0.048	***	0.016
Other languages	0.234	***	0.094	0.033	**	0.014	-0.026	**	0.011	-0.188	**	0.076
Caregiver's age	0.004	***	0.001	0.001	***	0.000	0.000	***	0.000	-0.003	***	0.001
After WIC change	-0.027	**	0.014	-0.004	*	0.002	0.003	*	0.002	0.022	**	0.011

Table 7. Marginal effects of ordered probit model for artificially-sweetened beverages consumed by WIC children

	Never			1-2 times/week			4-6 times/week			1 or more/day		
	ME		Std.	ME		Std.	ME		Std.	ME		Std.
Female	0.006		0.017	-0.001		0.002	0.000		0.001	-0.004		0.012
Three-year old	0.004		0.020	-0.001		0.003	0.000		0.001	-0.003		0.014
Four-year old	-0.020		0.023	0.003		0.003	0.001		0.001	0.014		0.016
High school/GED	0.039	**	0.021	-0.005	*	0.003	-0.002	*	0.001	-0.027	**	0.015
Some college	0.074	***	0.024	-0.010	***	0.003	-0.005	***	0.002	-0.052	***	0.017
College or Graduate	0.169	***	0.060	-0.024	***	0.009	-0.010	***	0.004	-0.119	***	0.042
Employed full time	-0.007		0.022	0.001		0.003	0.000		0.001	0.005		0.016
Employed part time	-0.052	**	0.025	0.007	**	0.004	0.003	**	0.002	0.037	**	0.017
Hispanic	0.037		0.027	-0.005		0.004	-0.002		0.002	-0.026		0.019
Black	-0.076	**	0.036	0.011	**	0.005	0.005	**	0.002	0.054	**	0.025
Other race	0.002		0.048	0.000		0.007	0.000		0.003	-0.002		0.033
English	0.053	**	0.025	-0.007	**	0.004	-0.003	**	0.002	-0.037	**	0.017
Spanish	0.058	***	0.024	-0.008	***	0.003	-0.004	***	0.002	-0.040	***	0.017
Other languages	0.226	**	0.118	-0.032	***	0.017	-0.014	**	0.007	-0.158	**	0.083
Caregiver's age	0.002		0.001	0.000		0.000	0.000		0.000	-0.001		0.001
After WIC change	0.014		0.017	-0.002		0.002	-0.001		0.001	-0.010		0.012