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Impact of the Revised Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Food Package Policy on Fruit and Vegetable Prices

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Abstract

Obesity is generally inversely related to income among women in the United States. Less access to healthy foods is one way lower income can influence dietary behaviors and body weight. Federal food assistance programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), are an important source of healthy food for low-income populations. In 2009, as part of a nationwide policy revision, WIC added a fruit and vegetable (F/V) voucher to WIC food packages. This quasi-experimental study determined whether F/V prices at stores authorized to accept WIC (ie, WIC vendors) decreased after the policy revision in seven Illinois counties. It also examined cross-sectional F/V price variations by store type and neighborhood characteristics. Two pre-policy observations were conducted in 2008 and 2009; one post-policy observation was conducted in 2010. Small pre- to post-policy reductions in some F/V prices were found, particularly for canned fruit and frozen vegetables at small stores. Compared with chain supermarkets, mass merchandise stores had lower prices for fresh F/V and frozen F/V and small

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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stores and non-chain supermarkets had higher canned and frozen F/V prices, but lower fresh F/V prices. Limited price differences were found across neighborhoods, although canned vegetables were more expensive in neighborhoods with higher concentrations of either Hispanics or blacks and fresh F/V prices were lower in neighborhoods with more Hispanics. Results suggest the WIC policy revision contributed to modest reductions in F/V prices. WIC participants' purchasing power can differ depending on the type and neighborhood of the WIC vendor used.

Keywords

Special Supplemental Nutrition Program for Women; Infants; and Children (WIC); Food policy; Food environment; Food prices; Food assistance

The dramatic increase in overweight and obesity in the United States over the past several decades has challenged the scientific community and health professionals to develop effective population-level obesity-prevention strategies.¹ Although the development of obesity is influenced by multiple factors, unhealthy dietary behaviors are integrally involved.² Recently, obesity-prevention efforts in the United States have focused on revising nutrition policies to ensure that at-risk populations, particularly low-income and minority populations, have access to healthy foods.³ One of the largest food-assistance programs, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), was recently modified to address, in part, the high prevalence of obesity among WIC participants. Revisions in the WIC food package policy included the addition of whole-grain options and a reduction in the fat content of milk. One of the most substantial revisions was a monthly fruit and vegetable (F/V) cash-value voucher (\$6 to \$10 monthly per participant). The policy changes went into effect nationwide in October 2009.

Although a variety of factors affect food choices, price is also influential, especially among low-income consumers.⁴⁻⁷ Research suggests that a 10% reduction in F/V prices is associated with an approximate 5% to 7% increase in consumption.^{4,7} Lower F/V prices are also associated with healthier body weights, with the strongest associations found among low-income families.⁷ Consequently, prices at food stores frequented by low-income families, specifically stores that accept WIC and other federal food-assistance benefits, can have important implications for dietary behaviors and weight outcomes.

Approximately 49,000 retailers nationwide are authorized to redeem WIC food packages (WIC vendors). Some research suggests that food prices might be lower at larger stores and in economically advantaged and white neighborhoods⁸⁻¹²; however, little is known about food price variations among WIC vendors.

The 2009 WIC food package revisions were put into place primarily to align the WIC food packages with the 2005 Dietary Guidelines for Americans and reflect recommendations made by the Institute of Medicine's report, "WIC Food Packages: Time for a Change."¹³⁻¹⁵ However, new minimum stocking requirements for WIC vendors to carry F/V and other healthy foods were also viewed as a way to improve community retail food environments. Studies have documented improvements in F/V and other healthy food availability at WIC vendors after the 2009 WIC revisions.¹⁶⁻¹⁹ In addition, increased F/V sales could have led

to lower retail F/V prices, particularly at smaller vendors. However, little is known about any changes in F/V prices in relation to the WIC food package revisions. Lower F/V prices at WIC vendors could enable WIC participants to maximize their benefits, which would have health benefits not only for WIC participants, but also the broader US population who shop at the more than 49,000 WIC vendors.

The primary purpose of this quasi-experimental study was to compare F/V prices at WIC vendors pre- and post-2009 WIC policy revision. The central hypothesis was that F/V prices will decrease after the WIC policy revision, particularly at small stores and non-chain supermarkets and in neighborhoods that are lower income and have greater concentrations of blacks and Hispanics (hypothesis 1). To identify whether F/V prices differ depending on the type and location of the store where WIC participants redeem their food package, two additional hypotheses were tested. F/V prices are higher at small stores and non-chain supermarkets than at chain supermarkets and mass merchandise stores (hypothesis 2). F/V prices are higher in lower income, black, and Hispanic neighborhoods (hypothesis 3).

METHODS

Sample and Design

This study involved 3 years of data (2008–2010) from all WIC vendors in seven northern Illinois counties (DeKalb, DuPage, Kane, Lee, Ogle, Winnebago, west suburban Cook).¹⁹ Although located in Cook County, the city of Chicago was not included because most WIC participants in Chicago are served by WIC food-distribution centers. These counties were chosen based on proximity to the research team, as well as contiguity and demographic diversity (race/ethnicity, socioeconomics, urbanicity). Under the WIC policy, states have discretion to specify eligible food forms (eg, canned) and brands and to set minimum stocking requirements at WIC vendors. Beginning in 2009, Illinois WIC vendors outside of Chicago were required to stock \$20 worth of F/V, with fresh, frozen, and canned forms eligible. Based on state guidelines, small vendors (less than five cash registers) and pharmacies were required to carry a minimum of two frozen/canned vegetable varieties and two frozen/canned fruit varieties. Large vendors (five or more registers) were required to carry at least two fresh vegetable varieties, two fresh fruit varieties, two frozen/canned fruit varieties, and two frozen/canned vegetable varieties.

The Illinois Department of Human Services provided a complete list of WIC vendors in 2008, 2009, and 2010. Data were collected annually from each vendor. The analysis includes all WIC vendors that were authorized in 2008 and those that joined the program in 2009 and 2010. Data from stores that subsequently lost WIC authorization were not used for that year.

To address hypothesis 1, the study used a quasi-experimental, one-group design with two pre-policy observations in 2008 and 2009 and one post-policy observation in 2010. It is possible to evaluate the post-policy difference relative to pre-policy “background noise.” To address hypotheses 2 and 3, the study used a cross-sectional, observational design, drawing on data pooled across 3 years. This study was deemed exempt by the University of Illinois at Chicago Institutional Review Board under federal regulation 45 CFR §46.101(b).

Procedure

Undergraduate or graduate students trained on the instrument and data-collection protocol collected annual data at each WIC vendor. Adapted from earlier work,^{20,21} the WIC Northern Illinois Vendor Project instrument included items on the availability and prices of fresh, frozen, and canned F/V. The 2008 data collection was completed April through October, with 38% of vendors observed in June and July and another 47% in August and September. The 2009 and 2010 data collections were both completed in June and July. To evaluate inter-rater reliability, a 10% sample of vendors was visited and independently rated by two observers. All items included in the analysis had inter-rater agreement in excess of 80%.

Observers recorded the price of several varieties of fresh F/V, frozen and canned vegetables with no added fat, such as cream or cheese sauces, and frozen and canned fruit with no added sugar. Items represented those most commonly consumed in the general US population.²² For each assessed fresh F/V, observers recorded the lowest price per pound or lowest price per item as appropriate. For each assessed canned and frozen F/V, observers recorded the lowest price of a preselected package size, typically a 14- to 16-oz can or package. There were no brand restrictions.

Measures

F/V Prices—Fresh F/V prices were changed to a common unit (per pound or per item) across the vendors, using product weights from the US Department of Agriculture.²³ All prices were converted to 2010 real dollars. Five price indices were developed: fresh fruit (six varieties), fresh vegetables (four varieties), canned vegetables (five varieties), canned fruit (five varieties), frozen vegetables (five varieties), and frozen fruit (five varieties). To account for differences in F/V varieties comprising the price indices across stores (due primarily to differences in product availability), *z* scores (number of standard deviations [SDs] from the mean of the sample) were derived for each item by year and then the mean of those items' *z* scores were calculated by year. The price measures used in the analyses reflect the distance in SD units from the overall sample mean for a given year.

WIC Vendor Type—Vendors were classified by type according to criteria from the Illinois Department of Human Services and store name. Pharmacies were distinguished from other retailers, typically grocery stores or supermarkets. Stores other than pharmacies were categorized by size using number of cash registers as a proxy: small (less than five cash registers) and large (five or more cash registers). Based on store name, large vendors were further categorized as chain supermarkets (stores with locations in multiple states, eg, Jewel-Osco), mass merchandise stores (chain supercenters, eg, Walmart Supercenter and other general merchandise stores, eg, Kmart), and non-chain supermarkets (stores not affiliated with a national or regional chain).

Neighborhood Characteristics—Stores were geocoded to their 2000 Census block group, which was used as a proxy for neighborhood, and characterized using 2005–2009 American Community Survey data based on median household income, racial/ethnic

composition (percentage of residents who were non-Hispanic white, non-Hispanic black, Hispanic, and other race/ethnicity), and population density (residents per square area).²⁴

Seasonality—To adjust for seasonal or within-season variations in F/V prices, observations were indexed to the number of days from the date of data collection to July 1 of the data collection year.

Analysis

Analyses were conducted in Stata (version 11.0, 2011, Stata-Corp). Testing hypothesis 1, which involves price changes over time, required mixed model regression with a random effect for vendor. Time effects were evaluated by regressing each F/V outcome on vendor type, neighborhood characteristics, data collection year, and the seasonality control variable. Follow-up contrasts of model coefficients determined whether the post-policy change in the outcome was significantly greater than the change in the pre-policy years. The comparison of interest was 2010 to 2009 with 2009 to 2008. A negative value for this contrast shows that post-policy price change from 2009 to 2010 was less than the pre-policy price change from 2008 to 2009; that is, annual changes in prices either decreased or increased at a lower rate post-policy compared with pre-policy. Interactions between vendor type and year tested whether change differed by vendor type. Finally, to test whether change differed by neighborhood characteristics, the preceding model was re-estimated, including multiplicative interactions between year and each neighborhood characteristic.

To address hypotheses 2 and 3, data were pooled across the 3 years and analyzed using ordinary least squares regression with standard errors adjusted for multiple observations of vendors.²⁵ Each F/V outcome was regressed on vendor type, neighborhood characteristics, data-collection year, and the seasonality control variable. Pharmacies were excluded from all models except canned vegetables, and small vendors were excluded from frozen-fruit models because of limited sample size (ie, small number of vendors carrying that F/V form).

RESULTS

A total of 329 vendors were observed in 2008, 346 in 2009, and 364 in 2010. Across the 3 years, 27% were chain supermarkets, 8% were mass merchandise stores, 13% were non-chain supermarkets, 16% were small stores, and 37% were pharmacies.

Hypothesis 1: Change in F/V Prices Pre- to Post-WIC Food Package Revision

Overall, canned vegetable prices ($P<0.001$) and frozen vegetable prices ($P<0.001$) fell post-policy change (Table 1), increasing in 2008–2009 and declining in 2009–2010. Fresh vegetable prices fell at chain supermarkets ($P=0.005$) and canned fruit prices fell at mass merchandise stores ($P=0.01$). At non-chain supermarkets, canned and frozen vegetable prices fell ($P=0.04$; $P<0.001$, respectively), but fresh vegetable and frozen fruit prices increased ($P<0.001$; $P=0.006$, respectively). Price changes at small stores for canned fruit ($P=0.04$) and frozen vegetables ($P<0.001$) were among the largest: canned fruit prices stabilized post-policy after increasing pre-policy (Figure, top panel); frozen vegetable prices

were steady from pre-policy, then declined post-policy (Figure, bottom panel). At pharmacies, prices of canned vegetables fell modestly post-policy change ($P<0.001$).

Significant interactions between year and neighborhood characteristics and subsequent significant follow-up tests were found for canned vegetables only. Canned vegetable prices increased pre- to post-policy to a greater extent in neighborhoods with proportionately more Hispanics ($P<0.05$; not shown).

Hypotheses 2 and 3: F/V Price Variations at WIC Vendors by Store Type and Neighborhood Characteristics

Table 2 shows pooled cross-sectional results of each price outcome regressed on store type, neighborhood characteristics, seasonality, and data-collection year. Compared with chain supermarkets, prices at mass merchandise stores were 0.44 SD lower for fresh vegetables ($P<0.001$), 0.21 SD lower for fresh fruit ($P=0.03$), 0.54 SD lower for frozen vegetables ($P<0.001$), and 1.02 SD lower for frozen fruit ($P<0.001$). Price comparisons for chain supermarkets and non-chain supermarkets were mixed. Compared with chain supermarkets, canned fruit prices were 0.59 SD higher at non-chain supermarkets ($P<0.001$), and prices were 0.85 SD lower for fresh vegetables ($P<0.001$), 0.49 SD lower for fresh fruit ($P<0.001$), and 0.19 SD lower for canned vegetables ($P=0.004$) at non-chain supermarkets. Compared with chain supermarkets, prices at small stores were 0.46 SD higher for canned vegetables ($P<0.001$), 1.20 SD higher for canned fruit ($P<0.001$), and 0.39 SD higher for frozen vegetables ($P<0.001$). Fresh vegetable and fresh fruit prices were 0.49 ($P<0.001$) and 0.36 SD lower ($P<0.001$), respectively, at small stores relative to chain supermarkets. Canned vegetable prices at pharmacies were 1.39 SDs higher than chain supermarkets ($P<0.001$).

Neighborhoods with proportionately more Hispanic residents had significantly lower fresh vegetable prices ($P<0.001$) and fresh fruit prices ($P<0.001$), but higher canned vegetable prices ($P=0.02$). Neighborhoods with proportionately more black residents also had significantly higher canned vegetable prices ($P=0.03$). Median household income was positively associated with canned vegetable prices ($P=0.002$). Results for neighborhood racial/ethnic composition and median household income were generally consistent in models in which they were tested separately and that did not adjust for vendor type (not shown).

DISCUSSION

Implemented in 2009, the WIC policy revision is one of the most significant efforts to modify the nutrition guidelines in a federal food and nutrition assistance program. These revisions provide an important opportunity to evaluate how revised policies in food and nutrition assistance impact food prices and dietary choices. WIC and authorized vendors serve approximately 8.9 million infants, children, and pregnant/postpartum women each month with estimated expenditures of \$6.8 billion annually.²⁶ This study sought to examine the impact of the 2009 WIC policy revision on F/V prices. Our findings suggest the WIC policy change might have led to some improvements in canned and frozen F/V prices at small stores and non-chain supermarkets. Greater volumes of stocked F/V and resultant economies of scale might have contributed to these price reductions.^{17,19} Given prior research showing small grocery stores and non-chain supermarkets are more prevalent in

low-income and racial/ethnic minority neighborhoods,^{27–29} these price reductions might have indirect benefits for those living in low-income and racial/ethnic minority neighborhoods.

This study also compared F/V prices at WIC vendors by store type and neighborhood characteristics (ie, income, racial/ethnic composition). Our findings for WIC vendors suggest that chain supermarkets and mass merchandise stores had lower canned and frozen F/V prices, but higher fresh F/V prices compared with small stores and non-chain supermarkets. These findings are consistent with a Minnesota study that found—with the exception of a few fresh F/V varieties—prices were lower at chain than non-chain supermarkets.⁹ They are also similar to a Chicago study that found lower prices for packaged items, but higher prices for fresh food, including F/V, at chain than non-chain supermarkets.³⁰ This implies that chain supermarkets can be valuable resources to cultivate for lower-priced canned and frozen F/V, but not necessarily for lower-priced fresh F/V. Some studies have found that fresh F/V selection and quality, although not examined here, are higher at chain supermarkets.^{20,31,32} It is important that ongoing efforts aimed at increasing F/V access in low-income and minority neighborhoods through new store developments and existing store improvements, such as the Healthy Food Financing Initiative,³³ to consider fresh, frozen, and canned F/V prices, selection, and quality.

Findings to date regarding retail food price variations by neighborhood characteristics are mixed.^{8,11} We found little evidence that F/V cost more at WIC vendors in economically disadvantaged neighborhoods or in neighborhoods with proportionately more black or Hispanic residents. In fact, although canned vegetables were more expensive in neighborhoods with greater proportions of either Hispanic or Black neighborhoods, fresh F/V prices were lower in neighborhoods with higher concentrations of Hispanics. However, prior research suggests that fresh F/V might be of lower quality, even after accounting for differences in the types of stores present, and less consistent with cultural food preferences in black neighborhoods.^{20,30,34} This warrants attention in store interventions in order to ensure equity in F/V access for all WIC participants, regardless of race/ethnicity.

Registered dietitian nutritionists working in low-income communities should understand foods included in WIC and other food and nutrition assistance programs, as well as their availability and prices within local neighborhoods. Increasing participants' skills in comparing prices will help to maximize their benefits. WIC participants might need assurance that canned and frozen options, without added salt, sugar, or fat, can be more economical and also as nutritious as fresh F/V. In addition, encouraging WIC participants to purchase F/V in season, as well as partnering with programs such as Cooking Matters,³⁵ can improve WIC participants' economic access to F/V.

Strengths and Limitations

Strengths of this study include the large sample of multiple types of WIC vendors in a demographically diverse area. Nonetheless, the study has limitations. First, the study did not examine other food products affected by the WIC policy change (eg, whole grains, low-fat dairy). Second, the 2009 economic recession and associated price trends might have impacted the attributed WIC policy effect for canned and frozen F/V. Third, non-chain

supermarkets in this study can include a small number of other stores (eg, large produce markets). Fourth, results might not apply to WIC vendors outside the seven-county area or non-WIC retailers. Finally, although a seasonality control variable was included, some residual seasonality confounding might remain.

CONCLUSIONS

In the United States, body weight is inversely related to income among women, with differences in association strength sometimes observed by race/ethnicity.^{36–38} Ensuring availability and economic accessibility of F/V is essential to promote positive health outcomes among low-income populations. Although a larger subsidy and greater retail stocking requirements could yield more substantial environmental change,¹⁹ this study suggests that the cost-neutral WIC initiative might have reduced the F/V prices, particularly at small stores. In addition, this study suggests that WIC participants' purchasing power for F/V can differ, depending on the type and location of the WIC vendor used. Additional research is needed to evaluate the potential of food and nutrition policy changes to improve retail food availability and prices as well as individual dietary behaviors and weight outcomes. Results of this study suggest that attempts to improve dietary behaviors should take economic disparities into account and that systematic efforts are needed to ensure that there is access to affordable healthy foods, particularly among low-income populations that are at great risk for diet-related chronic diseases.

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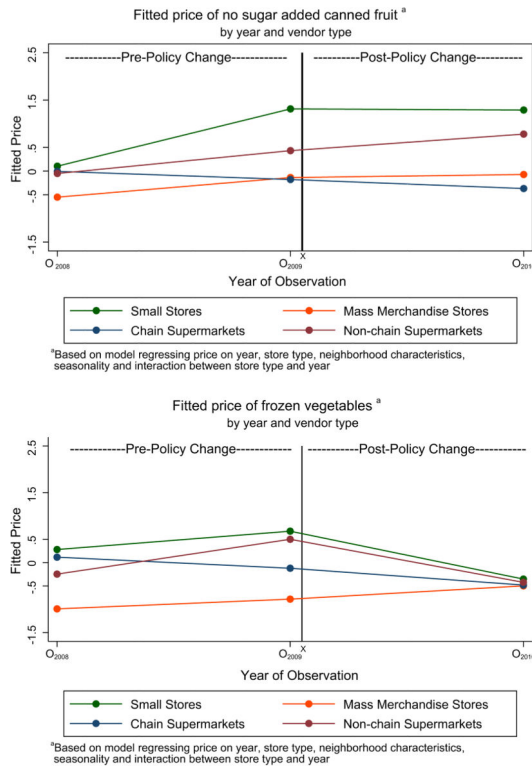


Figure. Estimated change in prices of canned fruits (top panel) and frozen vegetables (bottom panel) by year and store type.

Table 1

Changes in fruit and vegetable prices pre- to post-2009 Special Supplemental Nutrition Program for Women, Infants, and Children policy revision overall and by store type among authorized vendors in seven northern Illinois counties

	Fresh Vegetables			Fresh Fruit			Canned Vegetables			Canned Fruit			Frozen Vegetables			Frozen Fruit		
	Est ^a	SE ^b	P value	Est	SE	P value	Est	SE	P value	Est	SE	P value	Est	SE	P value	Est	SE	P value
Overall change post-policy compared to pre-policy^c	0.10	0.08	0.23	-0.02	0.07	0.77	-0.15	0.04	<0.001	-0.15	0.11	0.18	-0.64	0.11	<0.001	-0.03	0.10	0.78
Change post-policy compared with pre-policy by store type^c																		
Chain supermarket	-0.29	0.11	0.005	-0.13	0.08	0.10	-0.09	0.08	0.22	-0.01	0.13	0.95	-0.11	0.14	0.41	-0.25	0.13	0.05
Mass merchandise store	-0.13	0.17	0.45	-0.07	0.19	0.73	<0.01	0.19	0.99	-0.46	0.19	0.01	0.06	0.13	0.65	0.01	0.15	0.93
Non-chain supermarket	0.68	0.13	<0.001	0.12	0.15	0.42	-0.21	0.10	0.04	-0.04	0.22	0.85	-1.66	0.19	<0.001	0.57	0.21	0.006
Small store	0.58	0.25	0.02	0.14	0.22	0.52	-0.09	0.15	0.55	-1.09	0.55	0.04	-1.44	0.25	<0.001	NA ^d		
Pharmacy ^e	NA			NA			-0.28	0.04	<0.001	NA			NA			NA		

^a Est=estimate.

^b SE=standard error.

^c Based on follow-up tests conducted on regression coefficients: 2010 to 2009 and 2009 to 2008. A negative value indicates that post-policy price change from 2009 to 2010 was less than the pre-policy price change from 2008 to 2009. That is, prices either decreased or increased at a lower rate post-policy compared with pre-policy. Estimates adjusted for neighborhood characteristics and seasonality.

^d NA=not available. Due to the small number of stores carrying frozen fruit, small stores were excluded from this model.

^e Due to the small number of stores carrying the fruit and vegetable form, pharmacies were excluded from all models except canned vegetables.

Table 2

Pooled cross-sectional regression results of relationships between of six types of fruit and vegetable prices and stores type and neighborhood characteristics among stores authorized to redeem food packages of the Special Supplemental Nutrition Program for Women, Infants, and Children in seven northern Illinois counties^a

	Fresh Vegetables			Fresh Fruit			Canned Vegetables			Canned Fruit			Frozen Vegetables			Frozen Fruit		
	Coeff ^b	SE ^c	P value	Coeff	SE	P value	Coeff	SE	P value	Coeff	SE	P value	Coeff	SE	P value	Coeff	SE	P value
Store type (Ref: chain supermarket)																		
Mass merchandise store	-0.44	0.11	<0.001	-0.21	0.09	0.03	-0.13	0.15	0.38	-0.03	0.15	0.86	-0.54	0.08	<0.001	-1.02	0.13	<0.001
Non-chain supermarket	-0.85	0.09	<0.001	-0.49	0.08	<0.001	-0.19	0.07	0.004	0.59	0.12	<0.001	0.12	0.07	0.07	0.07	0.06	0.23
Small store	-0.49	0.11	<0.001	-0.36	0.08	<0.001	0.46	0.10	<0.001	1.20	0.24	<0.001	0.39	0.10	<0.001	NA ^e		
Pharmacy ^f	NA			NA			1.39	0.33	<0.001	NA			NA			NA		
Neighborhood racial/ethnic composition (in 10s) (Ref: % white)																		
% non-Hispanic black	-0.04	0.03	0.15	<-0.01	0.02	0.85	0.04	0.02	0.03	0.03	0.06	0.62	0.02	0.03	0.41	-0.01	0.04	0.72
% Hispanic	-0.07	0.02	<0.001	-0.06	0.01	<0.001	0.03	0.01	0.02	0.04	0.03	0.11	0.01	0.02	0.69	-0.01	0.03	0.78
Neighborhood median household income (1,000s)	-0.02	0.01	0.19	<-0.01	0.02	0.96	0.03	0.01	0.002	0.01	0.02	0.36	0.02	0.01	0.14	0.02	0.02	0.17
Adjusted R ²	0.35			0.25			0.61			0.17			0.26			0.29		

^aEstimates adjusted for year of data collection, seasonality, population density, % other race/ethnicity.

^bCoeff=coefficient.

^cSE=standard error.

^dRef=reference category.

^eNA=not available. Due to the small number of stores carrying frozen fruit, small stores were excluded from this model.

^fDue to the small number of stores carrying the fruit and vegetable form, pharmacies were excluded from all models except canned vegetables.