

# Federal Nutrition Program Changes and Healthy Food Availability

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**Background:** Literature on food environments is expanding rapidly, yet a gap exists regarding the role of the U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) on healthy food availability. In October 2009, the U.S. Department of Agriculture revised the WIC food package, requiring certified stores to stock fresh produce, whole grains, and lower-fat milk.

**Purpose:** The goal of this study is to compare availability of foods in stores that are versus those that are not WIC-certified before and after the policy change.

**Methods:** Store inventories were collected in 45 corner stores in Hartford CT with four inventories each (180 total inventories) from January 2009 to January 2010. Data on availability and variety of fresh fruits, fresh vegetables, whole grains, and lower-fat milk were recorded. Analyses were completed in 2012 using Fisher's exact test, chi-square, and *t*-tests for descriptive analyses and multilevel models to measure food availability longitudinally (significance at  $p < 0.05$ ).

**Results:** Controlling for covariates, WIC-certified vendors carried more varieties of fresh fruit ( $p < 0.01$ ); a greater proportion of lower-fat milk ( $p < 0.01$ ); and had greater availability of whole grain bread ( $p < 0.01$ ) and brown rice ( $p < 0.05$ ) than vendors without WIC authorization after the policy change. Conversely, for all outcomes, stores without WIC authorization did not significantly increase healthy food availability.

**Conclusions:** The 2009 WIC revisions increased availability of healthy foods among WIC-certified vendors compared to those without WIC authorization in Hartford CT. For many residents without a car, these changes can create a convenient shopping location for healthy foods when a larger supermarket is not nearby.

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## Background

Lack of healthy, affordable food in low-income urban neighborhoods may contribute to health disparities.<sup>1–5</sup> Corner stores are widely available in low-income neighborhoods, yet they often provide limited supplies of healthy food<sup>6–14</sup> and a wide variety of energy-dense foods.<sup>15,16</sup> Literature on food environ-

ments is expanding rapidly, yet a gap exists regarding the role of the U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) on healthy food availability. WIC provides supplemental nutritious foods and nutrition education for low-income women, infants, and children aged  $\leq 5$  years.<sup>17</sup>

The 2005 IOM report "WIC Packages: Time for a Change" recommended changes to the WIC food package to align with national dietary recommendations.<sup>18</sup> In October 2009, the U.S. Department of Agriculture (USDA) implemented a revised food package to include fruits, vegetables, whole grains, and switching from whole milk to low-fat milk for children aged  $> 2$  years. The current study examines the impact of this federal policy change on availability of recommended foods in corner stores, comparing a sample of vendors with versus without WIC authorization in Hartford CT.

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## Methods

Data were collected for a broader study to evaluate the Healthy Food Retailer Initiative (HFRI), a project to encourage corner store owners in Hartford CT to stock healthier food. A list of grocery stores in Hartford was compiled by merging data from the commercial firm Dun & Bradstreet ([www.dnb.com](http://www.dnb.com)) with WIC-certified vendor lists obtained from the Connecticut Department of Public Health. Stores exceeding \$500,000 in sales were not considered corner stores and were excluded. From the sampling frame of 123 grocery stores, 26 stores participating in the HFRI were matched with 26 control stores based on ZIP code, average sales, and WIC authorization. Seven stores were dropped from this analysis because their WIC certification changed during data collection. The final sample included 45 stores with four observations each ( $n=180$ ), 19 with WIC authorization and 26 without.

Pairs of researchers completed four market inventories, two before the policy change (Winter 2009 and Summer 2009) and two after the policy change (Fall 2009 and Winter 2010), for each store. The inventory instrument was a revised version of the Nutrition Environment Measurement Survey in Stores (NEMS-S), a validated tool for measuring healthy food availability.<sup>19</sup> The instrument measured varieties of quality, fresh fruit and fresh vegetables, in counts of 0–15 or more; whether a store carried brown rice and whole wheat bread (dichotomous); and the proportion of all milk gallons that were lower in fat ( $\leq 2\%$  fat).

Store square footage was measured with a laser distance measurer (Stanley FatMax Tru Laser); two measurements were averaged to calculate store size. Store inventories were supplemented with U.S. Census data (2000, block group data) on neighborhood demographics, including ethnicity/race, poverty level, and car ownership. The University of Connecticut IRB approved this study.

## Data Analyses

Data were analyzed in 2012 using Stata LP 11.1 and R 2.14.2. Bivariate analyses by WIC status were compared using chi-square tests and independent *t*-tests. The effect of WIC status and the WIC policy change on outcomes were analyzed with multilevel models. The generalized linear mixed model used was:

$$g[E(HealthyFood_{it})] = \beta_{00} + \beta_{01} * WIC_i + \beta_{02} * cStoreSize_i + \beta_{03} * cPovertyRate_i + \beta_{10} * Time_{it} + \beta_{20} * PolicyChange_{it} + \beta_{21} * WIC_i * PolicyChange_{it} + r_{0i} \tag{1}$$

*HealthyFood<sub>it</sub>* represents the outcome variables (i.e., fresh fruit variety) of store *i* at time *t*. The intercept  $\beta_{00}$  represents the predicted mean outcome for *HealthyFood* in vendors without WIC authorization in Winter 2009. *WIC<sub>i</sub>* captures the difference in *HealthyFood* between stores with and without WIC authorization in Winter 2009. Store-level control variables included *cStoreSize<sub>i</sub>*, and *cPovertyRate<sub>i</sub>*. *Time<sub>it</sub>* is the difference in outcome at each data collection time point.  $\beta_{20} * PolicyChange_{it}$  is the change in *HealthyFood* availability in vendors without authorization after implementation of the revised WIC food package. The primary variable of interest is  $\beta_{21} * PolicyChange_{it} * WIC_i$ ,

**Table 1.** Neighborhood and store characteristics for all stores, *n* (%) unless otherwise noted

Characteristic	All stores
<b>Total number of stores</b>	45 (100.0)
<b>Neighborhood</b>	
Average poverty rate, % (M [SD])	37.3 (12.2)
Average households with no car, % (M [SD])	41.6 (11.2)
<b>Racial/ethnic composition</b>	
Predominantly ( $\geq 60\%$ ) Latino	18 (40.0)
Predominantly ( $\geq 60\%$ ) black	12 (26.7)
Racially diverse <sup>a</sup>	15 (33.3)
<b>Store</b>	
WIC-certified	19 (42.2)
Member of the Healthy Food Retailer Initiative	23 (51.1)
Years owned (M [SD])	7.3 (5.3)
Store size, square footage (M [SD])	623 (437)

<sup>a</sup>Neighborhoods without a predominant racial/ethnic group but where the majority of residents are either Latino or black  
WIC, U.S. Department of Agriculture’s Special Supplemental Nutrition Program for Women, Infants, and Children

See related Commentary by Laraia in this issue.

which measures the average difference in *HealthyFood* in WIC-certified vendors after policy implementation.

The Akaike information criterion was used to compare model fit.<sup>20</sup> Initial models tested participation in the HFRI, the interaction of HFRI by *Time*, and Winter 2010. None of these variables was significant in the models, and they were therefore removed to improve model fit.

## Results

Neighborhood demographics and store characteristics are shown in Table 1. No significant differences were detected based on WIC authorization or HFRI intervention (results not shown). Average store size was 623 square feet. On average, 37.3% of households were living below the poverty level, and 41.6% did not own a car in store neighborhoods.

The multilevel models control for store size, neighborhood poverty prevalence, and healthy food availability over time (Table 2). Before the policy change, food availability by WIC authorization only differed for lower-fat milk. WIC-certified vendors carried on average 13.8% more lower-fat milk compared to stores without WIC authorization ( $p < 0.01$ ). After the policy change, controlling for covariates, WIC-certified vendors carried more varieties of fresh fruit ( $p < 0.01$ ); a greater proportion of

**Table 2.** The WIC policy change: shifts in food availability by store WIC authorization<sup>a</sup>

	Linear mixed model; proportion of milk inventory as lower-fat (%)	Poisson mixed models		Bernoulli mixed models	
		Fresh vegetable varieties (count 0–15)	Fresh fruit varieties (count 0–15)	Whole wheat bread (yes, no)	Brown rice (yes, no)
Intercept, $\beta_{00}$ <sup>b</sup>	9.30 (2.87)	0.79 (0.16)**	0.69 (0.15)**	−4.35 (1.03)**	−3.07 (0.84)**
WIC, $\beta_{01}$ <sup>c</sup>	13.84 (4.25)**	0.36 (0.24)	0.29 (0.21)	0.48 (1.19)	1.04 (1.12)
cStoresize, $\beta_{02}$ <sup>d</sup>	4.32 (3.39)	0.76 (0.19)**	0.93 (0.17)**	2.26 (0.79)**	2.15 (0.89)*
cPovertyRate, $\beta_{03}$ <sup>e</sup>	−0.38 (0.15)**	−.00 (0.01)	0.02 (0.01)*	−0.11 (0.05)*	−0.06 (0.04)
Time, $\beta_{10}$ <sup>f</sup>	2.98 (1.92)**	0.06 (0.08)	0.02 (0.08)	0.92 (0.64)	0.48 (0.49)
PolicyChange, $\beta_{20}$ <sup>g</sup>	−2.32 (4.59)	−0.09 (0.19)	−0.18 (0.21)	−2.36 (1.74)	−0.44 (1.24)
PolicyChange*WIC, $\beta_{21}$ <sup>h</sup>	11.0 (3.88)**	0.22 (0.15)	0.50 (0.17)**	5.65 (1.58)**	2.36 (1.06)*

Note: Values are unstandardized  $\beta$  (SE).

<sup>a</sup>All models included random effects (results not shown).

<sup>b</sup>HealthyFood in vendors without WIC authorization at baseline

<sup>c</sup>HealthyFood in WIC-certified vendors at baseline

<sup>d</sup>Store square footage, log transformed, grand mean-centered

<sup>e</sup>Percentage of families in store neighborhood with incomes below the federal poverty level, grand mean-centered

<sup>f</sup>Average change in HealthyFood per time period: Winter 2009, Spring 2009, Fall 2009, Winter 2010

<sup>g</sup>Average difference in HealthyFood after the policy change for vendors without WIC authorization

<sup>h</sup>Average difference in HealthyFood after the policy change for WIC-certified vendors

\* $p < 0.05$ , \*\* $p < 0.01$

WIC, U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children

lower-fat milk ( $p < 0.01$ ); and had greater availability of whole grain bread ( $p < 0.01$ ) and brown rice ( $p < 0.05$ ), but not varieties of fresh vegetables than vendors without WIC authorization.

Conversely, for all outcomes, stores without WIC authorization did not increase healthy food availability. Store size was associated with increases in vegetables ( $p < 0.01$ ) and fruits ( $p < 0.05$ ) and a greater likelihood of carrying whole grain bread ( $p < 0.01$ ) and brown rice ( $p < 0.05$ ) but not with proportion of lower-fat milk. Higher poverty rates in a store's neighborhood decreased the proportion of lower-fat milk ( $p < 0.01$ ); increased fruit variety ( $p < 0.05$ ); and decreased the odds of carrying whole grain bread ( $p < 0.01$ ).

## Discussion

### Implications for Research and Practice

Federal and state-level changes to the WIC program increased availability of produce, whole grain foods, and lower-fat milk among WIC-certified vendors in Hartford CT. Larger grocery stores (regardless of WIC authorization) tend to carry a greater selection of healthy foods compared to smaller corner stores.<sup>12–14,21</sup> Yet even controlling for store size, WIC-certified vendors were more likely than vendors without WIC authorization to carry fruits, low-fat milk, and whole grains after the policy change. Smaller stores may need additional assistance to

increase their vegetable supplies. These findings are consistent with two recent studies showing increased availability of healthy food among WIC-certified vendors following the policy change in Philadelphia<sup>22</sup> and in five urban towns in Connecticut (not including Hartford).<sup>21</sup> Cost-neutral policies such as the WIC food package can create substantial improvements to the food environment and more-sustainable changes than short-term interventions.

### Limitations

The present study included a sample of corner stores in one medium-sized city, restricting generalizability of these results. The inventory did not measure price or affordability of food, which were beyond the scope of this project. Future research is needed to examine customer purchases of the new WIC foods, particularly redemption of the new fruit and vegetable vouchers that were introduced with the 2009 policy change. It is also important to measure the cost of healthy foods, especially because of the small dollar value of the new produce vouchers (e.g., \$6/month per child).<sup>23</sup>

Findings are particularly relevant to policymakers as they consider changes to food-assistance programs under the 2012 Farm Bill. Specifically, cost-neutral program changes to national food-assistance programs such as WIC and the Supplemental Nutrition Assistance Pro-

gram (SNAP) may improve substantially the nutrition environment, and ultimately food-consumption patterns and health for low-income households.

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