Research Article

Eat Right–Live Well! Supermarket Intervention Impact on Sales of Healthy Foods in a Low-Income Neighborhood

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ABSTRACT

Objective: To evaluate a multifaceted supermarket intervention promoting healthier alternatives to commonly purchased foods.

Design: Sales of 385 foods promoted between July and October, 2012 in the *Eat Right–Live Well!* intervention supermarket were compared with sales in a control supermarket.

Setting: Two supermarkets in geographically separate, low-income, urban neighborhoods.

Participants: One control and 1 intervention supermarket.

Intervention: Product labeling, employee training, community outreach, and in-store promotions, including taste tests.

Main Outcome Measures: Number of items sold; absolute and percent differences in sales.

Analysis: Difference-in-difference analyses compared absolute and percent changes between stores and over time within stores. Sub-analyses examined taste-tested items and specific food categories, and promoted items labeled with high fidelity.

Results: Comparing pre- and postintervention periods, within-store difference-in-differences for promoted products in the intervention store (25,776 items; 23.1%) was more favorable than the control (9,429 items; 6.6%). The decrease in taste-tested items' sales was smaller in the intervention store (946 items; 5.5%) than the control store (14,666 items; 26.6%). Increased sales of foods labeled with high fidelity were greater in the intervention store (25,414 items; 28.0%) than the control store (7,306 items; 6.3%).

Conclusions and Implications: Store-based interventions, particularly high-fidelity labeling, can increase promoted food sales.

Key Words: nutrition, food preferences, health promotion, food economics, healthy food (*J Nutr Educ Behav*. 2015;■:1-10.)

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INTRODUCTION

The role of food environments (at both the neighborhood and store level) in low-income consumers' purchasing and consumption of food has been studied over the past 15 years, with mixed results.[1-3] Low-income neighborhoods often have few options for purchasing healthier foods whereas they have an abundance of opportunities to purchase energy-dense foods[4] that are implicated in poor health outcomes including obesity.[1,5] Supermarkets are often used as a proxy for healthy food access because of the variety and healthfulness of food available, although there are recognized limitations of that assumption.[3] The dearth of grocery options in urban poor communities may contribute to racial and socioeconomic health disparities in which the largest gaps exist between ideal and attained goals for fruit and vegetable consumption in low-income and ethnic minority populations of color.[6,7] Even, and especially, when numbers of supermarkets are limited, their preponderance in the US and their critical role in food purchasing[8,9] lead to their being viewed as promising venues through which healthy food purchasing can be encouraged.[10]

A social ecological framework delineating the influences on what people eat spans from the individual

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to the macro-level environment and highlights the role of supermarkets as an important component in the complex interplay of factors affecting eating behaviors.[11] Using this framework, the intervention *Eat Right–Live Well!* (ERLW) was based on nutritional education by emphasizing knowledge transfer, eg, at the level of the individual (through recipe cards, healthy eating tours, staff training, etc); at the store level (through signage, advertising the intervention's promotions and the labeling of healthy products, etc); and at the level of the neighborhood (through community educational events, etc). Through this multifaceted approach, ERLW combined health education strategies with structural changes such as pricing and stocking of healthier foods.[12] To date, relatively little research has evaluated the impact of such supermarket interventions on food sales in large stores after comprehensive implementation and combination of these approaches.[13]

The study aim was to fill this gap by evaluating the effects of ERLW, a multifaceted supermarket intervention, on sales of promoted items in a supermarket located within in a primarily African American low-income neighborhood of Baltimore.

METHODS

The researchers compared food sales for promoted healthy foods or foods that were deemed to be healthier alternative products (eg, a low-sodium version) between an intervention and control supermarket. ERLW was implemented between April and December, 2012, after which sales of promoted foods were evaluated. Hereafter, these are referred to as promoted foods or promoted healthy foods, although technically some substitutions were more healthy alternatives (eg, baked chips in place of regular chips or diet soda in place of regular soda). The intervention supermarket was located in Southwest Baltimore, where residents are 76% African American, 33% are single-parent households, 70% of adults are aged > 25 years with a high school degree or less, 20% of residents are unemployed, and the average life expectancy is 65 years. In the intervention store during 2012, approximately 62% of all purchases were made using the US Government Supplemental Nutrition Assistance Program. Residents in the control supermarket in the Northeast Baltimore neighborhood were demographically similar (87% African American, 32% single-parent households, 63% of adults aged > 25 years with a high school degree or less, life expectancy of 71 years, and 14% unemployed).[14] At the control store in 2012, approximately 56% of all purchases were made using the Supplemental Nutrition Assistance Program. The 2 stores were selected because they are both full-service supermarkets, are under the same ownership and management, and stock similar inventory. This allowed the researchers to implement intervention components in the intervention store and withhold them in the control store while other similarities between the stores were held constant, which made these stores ideal for comparison. The Johns Hopkins Bloomberg School of Public Health Institutional Review Board reviewed and approved the intervention.

The idea for this healthy purchasing intervention emerged from planning meetings with the storeowner and formative research, which consisted of a literature review of food marketing for healthy eating as well as qualitative research including 37 in-depth interviews, 3 focus group discussions, and 20 hours of participant observation in the intervention store to learn about purchasing decisions.[15] Respondents reported wanting to purchase healthier foods, but perishability, costs, and needing to provide filling calories influenced their purchases. They also described uncertainty about being able to find healthy foods and difficulty in getting this type of information from store employees.[15] In-store sampling was suggested as an important way to reduce consumer risk and mitigate the cost of food waste. In addition, participants noted that most store sales focused on processed foods that were high in sugar, salt, and fat.[15] Based on the literature review, the authors adopted health education best practices shown to be effective in driving the purchase of healthy foods, which were related to food labeling[16,17] and visual displays of healthful foods.[18,19] In this phase, organizations in which outreach and educational events could be held in the community were also identified. The intervention sought to increase the purchasing of healthy food through 6 intervention components: increased stocking of healthy foods; shelf labels and signage to enable shoppers to identify promoted foods (low fat, low sodium, healthier sugar level, 100% juice, and better choice); taste tests; advertisements for price reductions in the store circular; store staff training; and community outreach events (see Lee et al[12] for details).

A registered dietitian from the intervention team selected 475 foods based on Food and Drug Administration and Institute of Medicine guidelines for increased stocking, labeling, and promotion through in-store advertising.[20,21] Although 475 items were promoted through labeling, 385 were included in this analysis because sales data were not available from either the intervention or prior comparison years for the remaining items.

Taste tests, sometimes using simple recipes, promoted healthy items and were held only in the intervention store, which provided an opportunity to evaluate the impact of taste test activities on healthy food sales. Other reinforcing intervention activities included the distribution of recipe cards and in-store healthy shopping tours. Some of the 475 promoted items were also discounted in the weekly store circular; however, the independent impact of the discount could not be evaluated because the circular, and therefore discounts advertised, was common to both stores. Staff trainings sought to provide an orientation to the intervention; improve knowledge on general nutrition; highlight customer service tips to encourage healthy purchasing; review food safety practices; and discuss food marketing/messaging of ERLW. About 65% of employees resided in the surrounding neighborhoods. Ten training sessions with all store employees were conducted during work hours before and at the beginning of the intervention period. Each lasted approximately 2 hours with a format that combined group

interactive activities and a presentation by ERLW staff. The researchers used simple feedback forms to evaluate the sessions. The nutrition education session was ranked the most popular, and several employees requested additional training on reading nutrition fact labels. Based on interest in the project, several employees also participated in an advisory role to the project during the intervention period.

Community outreach activities that heavily promoted the ERLW campaign were held in the surrounding community, sometimes in conjunction with community events and activities (eg, a church community fair, a 5K run fitness festival, a back-to-school night at a local elementary school). Events with community partners included adults and children from the area surrounding the intervention supermarket. According to community partners, because of the dearth of supermarkets in the area, the intervention supermarket was typically the most commonly used food store among event participants. Activities, typically in the form of discussion groups or workshops, typically included an overview of ERLW, a demonstration of the shelf labeling system, and at least 1 additional activity (eg, how to incorporate ERLW-promoted items into popular meals, an explanation of nutrition facts labels, tips for purchasing seasonal products to decrease costs and improve food quality). Workshops were interactive, used visual aids or demonstrations, and elicited opinions from participants regarding barriers and facilitators to eating healthfully. Activities were frequently co-led by the research team's registered dietitian, who was available to answer questions and talk to participants about strategies to improve healthy eating.

Store management tracked the quantity of sales for promoted food items from both the intervention and control stores in the Retail Boss Program (BRdata, http://brdata.com/) and SVHarbor (SUPERVALU INC, www.svharbor.com) systems. A series of exploratory statistics were estimated to suggest where data quality checks were needed for low-selling items and outliers. Store management helped review questionable data for accuracy prior to final analyses.

The analytic period was restricted to July 1 through October 17, 2012 (and the same dates for comparison in 2011 and 2010) because product labeling was one of the main components of the intervention. Product labeling occurred with high fidelity (defined as > 75% of products being identified with the shelf label that conveyed that item's healthy characteristic) only during this period.[12] (Therefore, hereafter, although the years 2010, 2011, and 2012 are used to streamline the text, the actual analytic period included only July 1 to October 17 of these 3 years).

Descriptive analyses included frequencies of items sold and percent differences in sales (quantity sold) for all promoted food, by store and by year. To assess the impact of the intervention, the authors used a difference-in-difference approach. First, the absolute difference in sales between 2010 and 2011 (both pre-intervention years) was calculated. Next, the absolute difference in sales between 2011 and 2012 (a pre-intervention and the intervention year) was calculated. Finally, the difference between these differences was calculated, expecting the second difference to be bigger than the first. A between-store comparison was also made, with the hypothesis that the difference between 2011 and 2012 was more positive for the intervention store than for the control store. In addition to making comparisons based on absolute differences, similar comparisons over time and between stores were made using percent change with the base year of the calculation as the denominator. Finally, a difference-in-difference-in-difference comparison was used. This addresses the question of whether the difference in growth (absolute or percentage) between the intervention and control store varies when comparing years before and after the intervention relative to the comparison of 2 pre-intervention years. The hypothesis is that the difference between intervention and control when comparing pre- and post-intervention years is larger than when comparing only pre-intervention years. Because the analysis included the whole population of goods and sales across all days, statistical comparisons using P were not performed.

Second, similar analyses were conducted on subsets of taste-tested and non–taste-tested food sale items. Descriptive analyses were also conducted for overall promoted food sales by store and by year for 6 food item categories, including (1) fruit and vegetable products; (2) soda, snacks, and desserts; (3) grains; (4) dairy; (5) condiments and spreads; and (6) other. Comparisons were also made for high labeling fidelity and low labeling fidelity items. By this criterion, high-fidelity food categories (with > 75% items correctly labeled with labels in place) included fruit and vegetable products, soda, snacks, and desserts, condiments and spreads, and other. Low-fidelity categories included grains and dairy. Other time periods included in the analysis were July 1, 2010 through October 17, 2010 (year 2010) and July 1, 2011 through October 17, 2011 (year 2011), designated as pre-intervention years.

RESULTS

Table 1 shows the frequency of healthy items sold, differences in sales of these items, and percent difference in the quantity overall of healthy foods sold, by store and by year. During the pre-intervention period (years 2010–2011), the intervention store had a decrease in sales of healthy promoted items between 2010 and 2011 with –14,555 fewer items sold in 2011, but sales of these food increased between 2011 and the 2012 intervention period by 11,221 sales. When comparing stores, the intervention store had a smaller percent decrease in sales of healthy items in the pre-intervention period, 2010 to 2011, compared with the control store (decreases of 12.3% and15.9%, respectively). During the pre- to post-intervention period, years 2011–2012, the intervention store had a 10.8% increase in sales of promoted products compared with the control store's 9.3% decrease. The difference-in-difference analyses indicate that the growth in the intervention store was increased during the intervention year, contrasting with a decline between the 2 pre-intervention years. In addition, the growth in intervention store sales in the postintervention

Table 1. Quantity of Promoted Healthy Items, Difference in Number of Items Sold, and Percent Growth in Sales, by Intervention and Control Store and Year

All Items	Year			Difference in Sales		Within-Store Difference-in-Difference (2012–2011)	Growth in Sales (%)		Difference-in-Difference Within-Store
Store	**2010**	**2011**	**2012**	**2011–2010**	**2012–2011**	**to (2011–2010)**	**2011–2010**	**2012–2011**	**(% Growth)**
Intervention	118,289	103,734	114,955	−14,555	11,221	25,776	−12.3	10.8	23.1
Control	117,323	98,705	89,516	−18,618	−9,189	9,429	−15.9	−9.3	6.6
Between-store difference-in-difference (intervention – control)				4,063	20,410	16,347[a]	3.6	20.1	16.5[a]

[a]This is a difference-in-difference-in-difference. The difference in the change in sales between stores (intervention's difference compared with control's difference) is compared over time. This addresses the question of whether the difference in the difference (absolute or percentage) was more favorable for the intervention store compared with the control store when comparing the intervention and pre-intervention years than when comparing the 2 pre-intervention years.
Note: The table shows 2 difference-in-difference analyses. One compares the change in sales (absolute or percent) from 2011 to 2012 with the change in sales from 2010 to 2011. The other compares the changes (absolute or percent) between stores in the same 2-year period (ie, intervention change from 2011 to 2012 minus control change). Although for shorthand the years 2010, 2011, and 2012 are written in the table, the analysis includes data for only the period when the intervention was fully implemented between July 1 and October 17, 2012, and for the corresponding dates in the prior 2 years.

year compared with the pre-intervention year contrasted with a decline in the control store in the same period. Whereas the intervention store had a more favorable change in promoted items in both 2-year periods, the degree of difference was larger in the intervention year. All of this suggests that the intervention had an impact on sales in the intervention store that was different from any environmental effects in the intervention store in the pre-intervention years or in the control store at any time from 2010 to 2012.

Table 2 shows the frequency of promoted items sold, differences in sales of these items, and percent difference

Table 2. Quantity of Promoted Healthy Items, Difference in Number of Items Sold, and Percent Growth in Sales, by Store and Year for Taste-Test and Non–Taste-Test Items

	Year			Difference in Sales		Within-Store Difference-in-Difference (2012–2011)	Growth in Sales (%)		Difference-in-Difference Within Store
Store	**2010**	**2011**	**2012**	**2011–2010**	**2012–2011**	**to (2011–2010)**	**2011–2010**	**2012–2011**	**(% Growth)**
Taste-test items									
Intervention	16,965	15,763	15,507	−1,202	−256	946	−7.1	−1.6	5.5
Control	37,654	18,490	13,992	−19,164	−4,498	14,666	−50.9	−24.3	26.6
Between-store difference-in-difference (intervention – control)				17,962	4,242	−13,720[a]	43.8	22.7	−21.1[a]
Non–taste-test items									
Intervention	101,324	87,971	99,448	−13,353	11,477	24,830	−13.2	13.1	26.2
Control	79,669	80,215	75,524	546	−4,691	−5,237	0.7	−5.9	−6.5
Between-store difference-in-difference (intervention – control)				−13,899	16,168	30,067[a]	−13.9	19.0	32.8[a]

[a]This is a difference-in-difference-in-difference. The difference in the change in sales between stores (intervention's difference compared with control's difference) is compared over time. This addresses the question of whether the difference in the difference (absolute or percentage) was more favorable for the intervention store compared with the control store when comparing the intervention and pre-intervention years than when comparing the 2 pre-intervention years.
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in sales for the overall quantity of promoted foods sold by store and by year, by selected taste-tested and non–taste-tested items. Taste test activities to promote healthy items were held only in the intervention store, which provided an opportunity to evaluate the impact of taste test activities on healthy food sales. Across the 3-year period, the intervention and control stores both had decreasing sales of taste-tested healthy foods over time, but the intervention store had smaller absolute and percent decreases in taste test item sales compared with the control store. Among items promoted with taste tests, the reduction in sales in the intervention store went down by 1,202 (from 2011 to 2012) to 256 (from 2011 to 2012), with a similar downward trend in absolute sales of promoted items observed in the control store. The overall difference in sales and in the growth rate in sales between 2012 and 2011 compared with 2011 and 2010 for taste test items for the intervention store (increasing by 946 [5.5%]) was lower than the control store (increasing by 14,666 [26.6%]). Meanwhile, the pattern was distinct, with a rise in promoted food items among non–taste-tested items for the intervention store in 2012 compared with 2011, whereas the trend in sales of promoted foods continued downward in the control store in 2012 from fairly stable higher number of sales in 2010 and 2011 (with only a 546-item increase between these years [0.7% change]). The difference-in-differences analyses suggests that although there was a decrease in sales of taste test items in the intervention store, it was a smaller decrease than in the control store (the difference-in-difference between store result for 2011–2012). However, the pattern for the non–taste test–promoted items was distinct in both the comparison of pre-intervention years (decrease in intervention and small increase in control) and in the comparison of the pre-intervention and intervention years. In the intervention store, however, there was an increase in sales between the year before the intervention and the intervention year, compared with a decrease in sales of these items in the 2 pre-intervention years.

Additional analyses were broken down by 6 categories of promoted foods (Table 3). By these food categories, as would be expected if the intervention were effective, there was a large and positive percent increase in the change of sales from 2011 to 2012 for soda/snacks/desserts and the other food category in the intervention store relative to the control store (Table 4). This resulted in overall greater change in sales of promoted items from 2011 to 2012 (with an increase of 4,872 items), compared with between 2010 and 2011 (with an increase of only 1,951 items). This parallels 13.5% and 6.8% percent increases in the change of sales for soda/snacks/desserts in the intervention and control stores, respectively (subtracting the 2011 to 2012 change in sales from the pre-intervention change between 2010 to 2011). This pattern was similar for the other category, with the difference between changes of sales between the pre- and postintervention periods showing an increase of 8,027 sales of promoted items from 2011 to 2012 in the intervention store, whereas there was a decrease in sales of promoted items in the control store during this period (−7,021 items). Likewise, there was a 41.0% larger increase of sales (22,877 items) of promoted items in the intervention store over the second 2-year period, whereas in the control store, the other items declined in the intervention year but the decline was 12.8% smaller than in the pre-intervention years (10,925 items). For fruits and vegetables, although there was a similarly sized percent decrease in sales between 2011 and 2012 for both stores, when examining the overall change in differences between the pre-intervention and intervention period, the magnitude of the overall percent decrease in sales was much smaller in the intervention store (−0.4%) than in the control store (−57.6%).

Food categories with trends in unexpected directions included dairy, grains, and condiments/spreads. Promoted dairy products showed a similarly sized increase in the percentage of sales between 2011 and 2012 in the intervention and control stores. Contrary to expectations, when taking into account the change over time compared with the pre-intervention period, the absolute change in sales of promoted dairy product items increased by much more in the control store (from a decrease in sales of −2,934 between 2010 and 2011 to an increase of 221 sales from 2011 to 2012) vs the intervention store (with a decrease in sales of −1,043 between 2010 and 2011 to an increase of 186 sales from 2011 to 2012). The overall percent increase in sales of promoted dairy products was larger in the control

Table 3. Promoted Healthy Food Item Categories

Fruit and Vegetable Products (n = 70)	**Soda, Snacks, and Desserts (n = 123)**
Frozen fruit	Snacks
Beans	Rice cakes
Canned fruit	Sweetened gelatin
Canned vegetables	Pudding
Juice	Frozen novelties
Applesauce	Soda/beverages
Grains (n = 63)	**Dairy (n = 48)**
Pasta	Cheese
Rice	Eggs
Bread	Milk
Cereal	Butter
Condiments and spreads (n = 35)	**Other (n = 46)**
Condiments	Soup
Cooking spray	Tuna
Dressings	Frozen dinners
Spices	
Jams and jellies	
Sauces	

Table 4. Quantity of Food Items, Difference in Number of Items Sold, and Percent Growth in Sales, by Store and Year, by Food Category

	Year			Difference in Sales		Within-Store Difference-in-Difference (2012–2011) to (2011–2010)	Growth in Sales (%)		Difference-in-Difference Within Store (% Growth)
Store	**2010**	**2011**	**2012**	**2011–2010**	**2012–2011**		**2011–2010**	**2012–2011**	
Fruit and vegetable products									
Intervention	15,722	14,538	13,380	−1,184	−1,158	26	−7.5	−8.0	−0.4
Control	7,430	11,119	10,236	3,689	−883	−4,572	49.7	−7.9	−57.6
Between-store difference-in-difference (intervention – control)				−4,873	−275	4,598[a]	−57.2	−0.1	57.2[a]
Soda, snacks, and dessert									
Intervention	18,080	20,031	24,903	1,951	4,872	2,921	10.8	24.3	13.5
Control	19,048	18,029	18,287	−1,019	258	1,277	−5.4	1.4	6.8
Between-store difference-in-difference (intervention – control)				2,970	4,614	1,644[a]	16.1	22.9	6.8[a]
Grains									
Intervention	10,706	11,125	10,677	419	−448	−867	3.9	−4.0	−7.9
Control	12,754	12,143	10,500	−611	−1,643	−1,032	−4.8	−13.5	−8.7
Between-store difference-in-difference (intervention – control)				1,030	1,195	165[a]	8.7	9.5	0.8[a]
Dairy									
Intervention	10,026	8,983	9,169	−1,043	186	1,229	−10.4	2.1	12.5
Control	12,322	9,388	9,609	−2,934	221	3,155	−23.8	2.4	26.2
Between-store difference-in-difference (intervention – control)				1,891	−35	−1,926[a]	13.4	−0.3	−13.7[a]
Condiments and spreads									
Intervention	1,847	1,999	1,741	152	−258	−410	8.2	−12.9	−21.1
Control	1,605	1,808	1,687	203	−121	−324	12.7	−6.7	−19.3
Between-store difference-in-difference (intervention – control)				−51	−137	−86[a]	−4.4	−6.2	−1.8[a]
Other Store									
Intervention	61,908	47,058	55,085	−14,850	8,027	22,877	−24.0	17.1	41.0
Control	64,164	46,218	39,197	−17,946	−7,021	10,925	−28.0	−15.2	12.8
Between-store difference-in-difference (intervention – control)				3,096	15,048	11,952[a]	4.0	32.3	28.3[a]

[a]This is a difference-in-difference-in-difference. The difference in the change in sales between stores (intervention's difference compared with control's difference) is compared over time. This addresses the question of whether the difference in the difference (absolute or percentage) was more favorable for the intervention store compared with the control store when comparing the intervention and pre-intervention years than when comparing the 2 pre-intervention years.

Note: The table shows 2 difference-in-difference analyses. One compares the change in sales (absolute or percent) from 2011 to 2012 with the change in sales from 2010 to 2011. The other compares the changes (absolute or percent) between stores in the same 2-year period (ie, intervention change from 2011 to 2012 minus control change). Although for shorthand the years 2010, 2011, and 2012 are written in the table, the analysis includes data for only the period when the intervention was fully implemented between July 1 and October 17, 2012, and for the corresponding dates in the prior 2 years.

store (26.2%) than the intervention store (12.5%). For grains and condiments/spreads there was an absolute decrease in change in sales of promoted items from the years 2010 to 2011 to the years 2011 to 2012. The overall percentage point difference in sales subtracting the pre-intervention (2010–2011) from the change including the period of the intervention (2011–2012) remained almost the same (for grain items: a 7.9% decrease in the intervention store and an 8.7% decrease in the control store of the earlier year sales; for condiments and spreads: a 21.1% decrease in the intervention store and a 19.3% decrease in the control store). Overall, enough categories met expectations or stayed the same to conclude that the intervention was moderately although not uniformly successful across food categories.

Table 5 shows the frequency of items sold and percent difference in sales for overall food quantity of sales by store and by year, comparing

Table 5. Quantity of Food Items, Difference in Number of Items Sold, and Percent Growth in Sales, by Store and Year for Items Labeled With High and Low Fidelity

	Year			Difference in Sales		Within-Store Difference-in-Difference (2012–2011) to (2011–2010)	Growth in Sales (%)		Difference-in-Difference Within Store (% Growth)
Store	**2010**	**2011**	**2012**	**2011–2010**	**2012–2011**		**2011–2010**	**2012–2011**	
High fidelity									
Intervention	97,557	83,626	95,109	−13,931	11,483	25,414	−14.3%	13.7	28.0
Control	92,247	77,174	69,407	−15,073	−7,767	7,306	−16.3	−10.1	6.3
Between-store difference-in-difference (intervention – control)				1,142	19,250	18,108[a]	2.1	23.8	21.7[a]
Low fidelity									
Intervention	20,732	20,108	19,846	−624	−262	362	−3.0	−1.3	1.7
Control	25,076	21,531	20,109	−3,545	−1,422	2,123	−14.1	−6.6	7.5
Between-store difference-in-difference (intervention – control)				2,921	1,160	−1,761[a]	11.1	5.3	5.8[a]

[a]This is a difference-in-difference-in-difference. The difference in the change in sales between stores (intervention's difference compared with control's difference) is compared over time. This addresses the question of whether the difference in the difference (absolute or percentage) was more favorable for the intervention store compared with the control store when comparing the intervention and pre-intervention years than when comparing the 2 pre-intervention years.

Note: High-fidelity items were categorized as: (1) fruit and vegetable products; (2) soda, snacks, and desserts; (3) condiments and spreads; and (4) other. Low-fidelity items were: (1) grains and (2) dairy. The table shows 2 difference-in-difference analyses. One compares the change in sales (absolute or percent) from 2011 to 2012 with the change in sales from 2010 to 2011. The other compares the changes (absolute or percent) between stores in the same 2-year period (ie, intervention change from 2011 to 2012 minus control change). Although for shorthand the years 2010, 2011, and 2012 are written in the table, the analysis includes data for only the period when the intervention was fully implemented between July 1 and October 17, 2012, and for the corresponding dates in the prior 2 years.

low-fidelity and high-fidelity items. For high-fidelity items, although the intervention store had a decrease in sales from 2010 to 2011 of 13,931 items, there was an increase in sales of 11,483 items from 2011 to 2012, the year the intervention was implemented. The control store had a decreasing trend in sales for high-fidelity items across the 3-year period. Thus, the overall absolute and percentage point differences in change of sales for high-fidelity items for the intervention store (increasing by 25,414 items [28.0%]) was higher than the control store (increasing by 7,306 items [6.3%]). Overall, the difference-in-difference results were in the expected direction and much more strongly suggestive that the intervention had an impact for high- vs low-fidelity items.

DISCUSSION

The overall sales of all promoted items showed a downward trend before the intervention that slowed in the control store but was completely reversed in the ERLW store. Specifically, sales of healthy promoted items in the ERLW intervention supermarket showed an overall greater higher increase in sales compared with the control supermarket during the intervention period. An additional analysis demonstrated that the difference in the change from 2010 to 2011 up to 2011 to 2012 was more favorable for the ERLW store than for the control store.

The taste-test stratified analysis suggested that there was also a downward trend in sales in both stores over the 3 years for taste-tested foods, although there was a greater percent decrease in promoted sales in the control store. The intervention store improved less for taste test items compared with the control store, which suggests that taste tests were ineffective or that there were other unobserved factors. Among non–taste test–promoted items, sales of healthy foods decreased in the years before the intervention and then rose in the year the program was implemented, a pattern that was opposite in the control store. This contrasted with the sales of non–taste test–promoted items in the control store, in which sales were similar in 2010 and 2011 and continued to decrease in the year of the intervention.

Of the food store interventions that have used taste tests to promote healthy foods,[22-25] few have collected sales data.[22,23] In a corner store intervention, in which taste tests were used in combination with other promotional activities, sales of healthier snack items and breads increased, although not significantly.[23] In a nutrition campaign focusing on promoting low-fat milk, the market share of high-fat milk decreased by 23% and was sustained at follow-up when taste tests were implemented along with paid advertisements and community education programs.[22]

Results broken down by food categories were also mixed with some trends in the direction that would be expected from a successful health promotion intervention (fruits/vegetables, soda/snacks/desserts, and other), whereas others were in the unexpected direction (dairy, grains,

and condiments/spreads). Without more detailed information, it is difficult to pinpoint a cause. Nonetheless, a possible explanation could have to do with how many staple items were in a given category (ie, the intervention's impact may depend on the perceived need to buy certain kinds of products). Another factor that could alter how much the intervention affected the purchase of particular types of foods may have to do with the proportion of low-cost or high-cost items in that category. Finally, the strength of preferences for some goods relative to others may vary substantially. For example, substituting diet soda for regular may take more effort to overcome than substituting lower-fat milk for whole milk.

As would be expected for a successful program, labeling promoted items correctly and consistently > 75% of the time was associated with higher sales and larger increases in sales of these items. This suggests that the better the labeling component of the intervention was implemented, the stronger the effect was on the promotion and sales of the promoted healthy items. This was similar to results from a study in Japan, in which point of purchase health information appeared to increase vegetable purchasing,[26] and in a US study in which labeling of healthy foods led to greater sales in crackers, soup, and cereal.[27]

Interventions to promote healthy food purchasing at grocery stores and in other community settings have shown varied success, depending on the type and duration of intervention.[28] Whereas some studies have focused on changing purchasing by using multifaceted intervention strategies similar to those in ERLW,[23,29-31] few have evaluated sales data.[23,30] Studies using 1 or some of the interventions components in ERLW that have reported sales data have shown mixed results.[23,27,32-34]

There were relatively stable levels of fruit and vegetable purchasing in the pre- to postintervention periods in the intervention supermarket, whereas sales of fruits and vegetables declined over time in the control store. Interventions aimed at increasing sales in a wide variety of food categories often have not shown a significant influence on fruit and vegetable and low-fat milk purchasing.[23,33,35] However, interventions that have specifically targeted fruits and vegetables or low-fat milk have resulted in significant increases in the purchasing of these items.[22,36] Although the analysis did not separate out milk specifically, lower gains were observed from the pre- to postintervention dairy product sales in the intervention vs the control store. This may have been because of imperfect implementation of the ERLW intervention, as dairy products were not labeled with high fidelity. Nonetheless, ERLW appears to have positively affected overall sales, especially for the food categories promoted most heavily.

A study limitation was that there was only 1 intervention and 1 comparison store, which were located in neighborhoods that were demographically similar but not identical. Because the 2 neighborhoods were relatively distant (about 5.6 miles), the likelihood of contamination effects of the intervention on the control supermarket may be low. Another limitation was the short time period because it would have been ideal if all components had been fully implemented for at least 6 months (a massive store renovation led to an interruption in implementing the intervention). This may have led to less intervention exposure, especially for low-income shoppers who limit their shopping to 1 visit/mo. Because the 2 supermarkets stocked almost identical merchandise, discounts advertised for sales through the circular were common to both stores, which made it impossible to assess the effect of price reductions on sales of promoted items. Despite this, the co-occurrence of discounts with the other reinforcing health promotion activities may have had synergistic effects beyond the impact of price reduction alone, possibly resulting in increased purchasing of healthy items in the intervention store. Although missing data cut across all promoted food categories, there was a smaller proportion of missing data from sodas/snacks/desserts and from the other category than from the other 4 categories. An important caveat is that there was no way to evaluate whether the changes in purchasing in these stores truly reflect changes in consumption of healthier foods or whether they reflect a substitution effect of buyers purchasing at other venues. This kind of substitution could also possibly explain the downward trend in healthy sales overall in the control store from 2010 to 2012. Nonetheless, because healthy items sales in the control store did not change at all from the pre-intervention period to the intervention period (remaining at 2.8%), whereas in the intervention store this increased from 2.7% to 3.3%, this suggested a real increase in purchasing of healthier items.

A study strength was the assessment not only of the overall percent change in healthy food sales between the 2 stores but also of the separate assessment of foods that were promoted with taste tests. Another advantage is that sales data were obtained from supermarket records, which avoided the possibility of self-reporting errors and enabled comparisons with changes in sales from the past year during the same period and took into account potential seasonal differences in purchasing. Sales data were obtained over a 3-year period, which allowed for a comparison both across stores and over time periods. Finally, the pattern of sales in the control store may indicate only the effects of price changes as advertised in the circular, which were common to the 2 stores.

The study findings suggest potential benefits of multifaceted strategies to influence sales of healthy items in a supermarket primarily serving low-income African American urban residents. Replication and scale-up of these precise intervention components may pose challenges. This particular health promotion intervention benefited from being community driven (conceived of by the store owner), which resulted in strong store support, including financial (eg, purchasing of intervention T-shirts, hats) and in-kind resources (eg, donating food for taste tests, paying for staff time during trainings). In addition, the fact that the same supermarket owner was also the wholesaler and supplied most of his own products allowed for flexibility in terms of introducing new healthy items in the store, having control over store displays, and so forth. In future studies, it would be useful to gather supplementary information on sociodemographic characteristics of shoppers to understand

who may have increased healthy purchasing. Qualitative research could also inform such studies to elucidate which aspects of the intervention were most influential.

IMPLICATIONS FOR FUTURE RESEARCH AND PRACTICE

Findings suggest that educational interventions such as ERLW may have the potential to affect the purchasing practices of shoppers in low-income, inner-city neighborhoods. Because the intervention had multiple components implemented simultaneously, apart from taste tests, the analysis was not able to tease out the effects of different components. Nonetheless, its emphasis on labeling reinforces to health educators, who have been initiating many such initiatives globally,[37,38] that making consumers aware of what constitutes a healthy diet and helping them identify which products are healthiest are important in this context. Cities or districts could provide incentives to food retail operators who adopt health education initiatives such as labeling healthy foods, followed by promotional campaigns to further incentivize stores that adopt complementary educational practices. This change might make it more attractive for store owners who are considering opening a market in an underserved area. Municipal health departments could provide classification guidelines if stores do not have access to industry promotion programs. Incentives could be provided to stores for sufficient periods to generate demand so that they would benefit, and not fear losing money from promoting healthy items. To support other health educational efforts, some supermarkets employ dietitians to assist customers with information about nutrition, shopping, and cooking ideas and offer taste tests. After the intervention, the supermarket owner hired a part-time dietitian to serve in this role. She provides health education advice to customers, uses the existing labeling system to help them identify healthier foods, and conducts taste tests. It would be useful to replicate this study with a longer intervention period to see whether results were similar. Data collection at the level of individual shoppers could also be helpful to assess changes to diet and differences between sociodemographic groups, to understand how health educational efforts may best target specific consumer subgroups. In addition, stores in low-income neighborhoods do not always benefit from health-promoting amenities such as shelf labeling and taste tests, although residents in low-income areas have higher levels of diet-related disease. Another potential role for health educators in designing healthy purchasing initiatives would be to elicit customer suggestions for the best food retail experience based on affordability, shelf labeling, and other health-promoting behaviors.

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.