An Urban Food Store Intervention Positively Affects Food-Related Psychosocial Variables and Food Behaviors

Joel Gittelsohn, Hee-Jung Song, Sonali Suratkar, Mohan B. Kumar, Elizabeth G. Henry, Sangita Sharma, Megan Mattingly and Jean A. Anliker

Health Educ Behav 2010 37: 390 originally published online 3 November 2009
DOI: 10.1177/1090198109343886

An Urban Food Store Intervention Positively Affects Food-Related Psychosocial Variables and Food Behaviors

Joel Gittelsohn, PhD
Hee-Jung Song, PhD
Sonali Suratkar, MHS
Mohan B. Kumar, MPH
Elizabeth G. Henry, MHS
Sangita Sharma, PhD
Megan Mattingly, MPH
Jean A. Anliker, PhD, RD

Obesity and other diet-related chronic diseases are more prevalent in low-income urban areas, which commonly have limited access to healthy foods. The authors implemented an intervention trial in nine food stores, including two supermarkets and seven corner stores, in a low-income, predominantly African American area of Baltimore City, with a comparison group of eight stores in another low-income area of the city. The intervention (Baltimore Healthy Stores; BHS) included an environmental component to increase stocks of more nutritious foods and provided point-of-purchase promotions including signage for healthy choices and interactive nutrition education sessions. Using pre- and postassessments, the authors evaluated the impact of the program on 84 respondents sampled from the intervention and comparison areas. Exposure to intervention materials was modest in the intervention area, and overall healthy food purchasing scores, food knowledge, and self-efficacy did not show significant improvements associated with intervention status. However, based on adjusted multivariate regression results, the BHS program had a positive impact on healthfulness of food preparation methods and showed a trend toward improved intentions to make healthy food choices. Respondents in the intervention areas were significantly more likely to report purchasing promoted foods because of the presence of a BHS shelf label. This is the first food store intervention trial in low-income urban communities to show positive impacts at the consumer level.

Keywords: *urban; food store program; African American*

Joel Gittelsohn, Hee-Jung Song, Sonali Suratkar, and Mohan B. Kumar, Johns Hopkins University, Baltimore, Maryland. Elizabeth G. Henry, Boston University, Boston, Massachusetts. Sangita Sharma, Nutrition Research Institute, University of North Carolina, Chapel Hill. Megan Mattingly, National Institute of Health, Bethesda, Maryland. Jean A. Anliker, University of Massachusetts, Amherst.

Address correspondence to Joel Gittelsohn, Johns Hopkins University, Bloomberg School of Public Health, Department of International Health, 615 N. Wolfe St., Baltimore, MD 21205; phone: (410) 955-3297; e-mail: jgittels@jhsph.edu.

This research was supported by grants from the Center for a Livable Future, Johns Hopkins University, and the U.S. Department of Agriculture Food Assistance and Nutrition Research Program.

Health Education & Behavior, Vol. 37(3): 390-402 (June 2010)
DOI: 10.1177/1090198109343886

Minority populations in the United States have disproportionately high levels of obesity and diet-related chronic diseases (Flegal, Carroll, Kuczmarski, & Johnson, 1998; Melanson, McInnis, Rippe, Blackburn, & Wilson, 2001). African Americans, in particular, have some of the highest obesity rates in the United States, with National Health and Nutrition Examination Survey 2003-2004 data showing that 45.0% of African American adults are obese and 10.5% are extremely obese (body mass index >40kg/m^2; Ogden et al., 2006). African American adults are also 1.6 to 1.8 times as likely to have diabetes as non-Hispanic Whites (Centers for Disease Control and Prevention, 2005; Marshall, 2005).

Some of the risk associated with these disorders among ethnic minority populations can be associated with place of residence, specifically living in low-income or urban neighborhoods. In these areas, environmental factors increase the availability of and accessibility to high-energy and high-fat foods, apparently at the expense of affordable and acceptable healthier alternatives (French, Story, & Jeffery, 2001). Inner-city areas such as Baltimore City, Maryland, are notable for the relative absence of large grocery stores and the overall low availability of healthy food choices (Franco, Diez Roux, Glass, Caballero, & Brancati, 2008), a situation common in many low-income urban areas in the United States (Powell, Slater, Mirtcheva, Bao, & Chaloupka, 2007). Many residents lack personal transportation and heavily rely on small- and medium-sized food stores in their neighborhoods. Also, there are many carry-out and fast-food restaurants in the city that offer high-fat fried foods and high-calorie foods at cheaper prices (Gittelsohn et al., 2007). Studies have shown that these same environmental factors are associated with diet-related chronic diseases and their risk factors (Diez Roux et al., 2001; McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006; Morland, Diez Roux, & Wing, 2006).

Health educators have long viewed food stores as a promising venue for providing health information and promoting healthy foods (Seymour, Yaroch, Serdula, Blanck, & Khan, 2004). First, store type and foods available within stores are associated with better diets and health. Morland et al. (2006) found that the presence of urban supermarkets, which tend to have a wider variety of healthy foods, was associated with lower rates of obesity, whereas convenience stores were associated with higher rates. Bodor, Rose, Farley, Swalm, and Scott (2008) showed that even for small neighborhood food stores, in-store availability of fruits and vegetables was associated with higher intakes for nearby residents. Second, programs in food stores have the potential to affect point-of-purchase decision making regarding household food choices. Supermarket intervention trials have shown success in increasing the purchase of healthy foods and improving consumer knowledge (Seymour et al., 2004). Our previous work in rural settings provided evidence of effectiveness of working in food stores. On two Apache reservations, our food store intervention had significant impacts on knowledge, healthy food purchasing frequency, and gram consumption of promoted foods (Gittelsohn et al., 2005). Among First Nations people, we were able to see impacts on knowledge and healthy food purchasing frequency (Ho et al., 2008). Although success has been shown in rural food stores, work in small- to medium-sized food stores in low-income urban settings is in its infancy, with a number of small pilot trials showing limited success in corner stores, bodegas, and small supermarkets (Cummins, Petticrew, Higgins, Findlay, & Sparks, 2005; Reger, Wootan, & Booth-Butterfield, 1999).

BALTIMORE HEALTHY STORES INTERVENTION

The first round of the Baltimore Healthy Stores (BHS) food store intervention was conducted from February to November 2006 in nine East Baltimore stores. The BHS

trial used a conceptual framework derived from social cognitive theory, which combines environmental, individual, and behavioral components (Bandura, 1986). The BHS program focused on changing the local food environment by directly influencing the availability of healthier food options in stores and increasing awareness of and skills for selecting and preparing these foods through point-of-purchase promotions. Exposure to the intervention was anticipated to lead to increases in knowledge and self-efficacy and to improved behavioral intentions to select, prepare, and consume healthier foods. BHS was conducted in two supermarkets (both owned by a local supermarket chain) and seven Korean American (KA) independently owned corner stores and was run in five themed phases, each lasting 2 months.

These five phases included the themes of (a) healthy breakfast, where behavioral objectives focused on increasing low-sugar, high-fiber cereals and low-fat milk; (b) healthy cooking at home, which promoted the use of cooking spray for eggs, pancakes, and vegetables; (c) healthy snacks, encouraging the consumption of low-fat snack alternatives, including fresh fruits; (d) carry-out purchasing, which concentrated on choosing whole wheat bread and the use of low-fat or fat-free mayonnaise; and (e) healthy beverage, in which water and diet soda were promoted over regular soda.

KA merchants are the predominant owners of corner stores in Baltimore City, and so the decision was made to focus on this subgroup. Store owners were requested to stock minimum quantities of healthy food options, specific to each of the phases. The two supermarkets carried most of the promoted foods prior to the beginning of the program. The selection of foods for promotion was based on extensive dietary recalls from community members to identify the foods that contributed the most fat, sugar, and total calories to the diet (Sharma et al., 2009) and on community workshops to identify affordable and acceptable alternatives.

There were several intervention components, including the use of phase-specific communication tools and interactive nutrition education sessions. Within the stores, a variety of print materials promoted phase-specific foods. These materials included shelf labels (identifying foods as “lower in fat,” “lower in sugar,” “higher in fiber,” and “healthy choice”) and informational posters and fliers bearing the BHS logo. During selected phases, limited numbers of incentive cards (e.g., “buy 3 get 1 free”) and coupons for discounts on promoted food items were given to store customers to increase initial demand. Interventionists conducted short interactive nutrition education sessions at stores approximately twice per month. During these sessions, the interventionists conducted promotions by interacting with visitors and disseminating phase-specific nutrition information through the use of educational displays and by conducting taste tests, distributing food samples, and promoting product giveaways. Interventionists also conducted nutrition education sessions at local community centers, expanding on the in-store sessions by including cooking demonstrations.

Educational materials and a nutrition education session were provided by a native Korean-speaking nutrition doctoral student (H.-J. S.) in Korean to corner store owners to enable them to identify nutritious foods and include them in their own diets as well in their stores for their customers. General guidelines to encourage and support the stocking of healthier food options and cultural guidelines to encourage positive interactions between store owners and their customers were also provided as posters in Korean. Small store owners were incentivized to initiate the stocking of healthier foods promoted in each phase through the use of wholesaler gift cards and/or the provision of small amounts of the target foods for promotion. The intervention was implemented with moderate reach, dose, and fidelity (Gittelsohn et al., 2009).

This article presents the results of the first round of implementation of the BHS program and addresses the following questions:

1. Was there a difference in the impacts of the program between respondents living in the intervention versus comparison areas?
2. What was the effect of level of exposure to the intervention on study outcomes?

MATERIALS AND METHOD

The BHS program was evaluated through a quasiexperimental design, where East Baltimore was considered the intervention area and West Baltimore was considered the comparison area. East Baltimore, comprising 23 of Baltimore City's 200 census tracts, is 96.0% African American, with 57.0% of the households headed by females. The median household income by neighborhood ranged from $11,000 to $13,000, and 22.0% to 36.0% of households with children have incomes below the poverty line (see http://www.bnia.org). West Baltimore, comprising 24 census tracts, is 91.8% African American, with 27.8% of the households headed by females. The median household income of West Baltimore ranged from $10,000 to $15,000, and 21.3% of households with children have incomes below the poverty line (see http://www.bnia.org). Both East and West Baltimore have many food sources with a limited range of available foods but an abundance of energy-dense foods high in fat and sugar. Food sources include several supermarkets, full-service and fast-food restaurants, corner stores, and convenience stores. East and West Baltimore are geographically distinct areas of the city, roughly 2 miles apart, and are separated by a highway.

Store recruitment for the intervention trial focused on involving a range of different store sizes and types to reach different types of consumers and to explore intervention strategies that might vary based on store size. Corner stores were recruited by first establishing a collaborative relationship with the Korean American Grocers Association (KAGRO) chapter in Baltimore City. A letter of support from KAGRO was sent to Korean corner store owners in East and West Baltimore, along with sample program materials. A Korean doctoral student next met with small store owners to provide them with further detailed explanation. Because of limited resources and time frame, the number of stores included in the study was limited up to 8 to 10 in each area. In East Baltimore, 9 stores (2 supermarkets and 7 corner stores, out of several hundred) were recruited to receive the program, whereas 8 similar stores (2 supermarkets, 6 corner stores) in West Baltimore were selected as a comparison group and did not receive the intervention. Stores ranged greatly in size, from one to seven aisles, with gradations in between. Baseline data were gathered from June to December 2005. Postintervention data were collected from January to July 2007.

Data Collection Instruments

Two questionnaires were developed to collect pre- and postdata to demonstrate program impact on consumers: the Customer Impact Questionnaire (CIQ) and a Quantitative Food Frequency Questionnaire. The development of these two instruments has been described in detail in other articles (Gittelsohn et al., 2009; Sharma et al., 2009; Suratkar et al., in press). Food frequency data will be presented in a later article. In addition, an exposure instrument was conducted postintervention to assess the level of exposure to specific intervention components.

The 106-item CIQ has been described in detail elsewhere (Suratkar et al., in press). The recall period was the past 30 days. Information on sociodemographic characteristics and Material Style of Life Scale (MSL) questions, which were used as a proxy for socioeconomic status, was collected at baseline. We gathered information on the respondents' frequency of "food getting," which includes not just purchasing foods but also procuring foods through church, food stamps, friends or family members, and all sources where the respondents obtained food. Respondents reported how they commonly prepared certain foods using different cooking methods. A section on healthy eating self-efficacy captured the confidence and the ease with which the respondents could perform certain healthy eating and cooking behaviors on a regular basis. In the healthy eating intentions questions, the respondents were given different options on food choices, cooking methods, and food-related behaviors and were asked to report what they would really choose, not necessarily what they thought was healthiest. Respondents were also tested on their knowledge of nutrition and on their ability to comprehend a nutrition facts label.

At postintervention, an Intervention Exposure Evaluation (IEE) instrument was used to assess exposure to different elements of the intervention. To aid in recollection, this instrument was supplemented with an intervention materials packet that had pictures of all the materials used. To determine the level of exposure to store-based interventions, respondents were asked whether they had seen the BHS logo, shelf labels, in-store posters, and educational displays used in conjunction with the taste tests and cooking demonstrations; whether they had participated in the cooking demonstrations and taste tests; and whether or not they had seen or received any of the flyers, giveaways, coupons, or incentive cards. Respondents were also asked whether they had purchased foods, specifically promoted healthy foods, because of exposure to the shelf labels. To assess the possibility of acquiescence bias, materials that were not actually used in the intervention were included in some sections of the IEE.

Sampling

At baseline, respondents were sampled from study supermarkets and corner stores and from community action centers that service East and West Baltimore. Community action centers provide city and state services to low-income residents, including assistance with utilities payments, food stamp distribution, and other services, and were used as a recruitment locale to maximize the selection of low-income residents of these two inner-city areas. Eligibility requirements included current resident of Baltimore and anticipated continuing residence in the city for the next 12 to 18 months, role as the main food preparer and shopper of the household, and not pregnant. Interviews were conducted at different times of the day and different days of the week. Respondents were given a $20 gift card to a local food store for participating in the 60- to 70-minute baseline survey. At postintervention, we attempted to interview as many of the 175 baseline respondents as possible. Respondents were contacted by letter and phone, and then interviews were scheduled at local stores or in the participants' home. We were able to reinterview 84 (48% of the original baseline sample) at postintervention. The main reasons for inability to reinterview were phone disconnected (59%), declined or multiple messages left but no response (29%), and moved leaving no forwarding address or number (8%). Baseline respondents who did not participate in the postintervention evaluation did not significantly differ from the respondents who did participate by sex, education, employment status, household size, number of children in household, MSL score, and

food assistance participation. However, they were significantly younger (respondents M = 51.8 years vs. nonrespondents M = 45.9 years, p value for t test = .004) and more were single (respondents = 47.6% vs. nonrespondents = 62.6%, p value for χ^2 = .046).

Data Analysis

Scale Construction. A series of scores and scales was developed to assess the main psychosocial factors on the baseline sample of 175 respondents (Suratkar et al., in press). All scales were assessed for internal consistency reliability using Cronbach's alpha. An alpha equal to or greater than .7 implies there was good internal consistency and that the scale has good reliability. Knowledge (α = .65) was an additive score created from responses to 14 questions on nutrition-related knowledge, and a label reading score (α = .58) was based on a subset of 4 questions on reading a nutrition facts label. A healthy eating self-efficacy score (α = .75) was created using responses to 15 questions on how easy or difficult the respondent thought it would be for him or her to do certain healthy behaviors. A Likert-type scale was used, where the highest points were assigned to the response *very easy to do* and the lowest points were assigned to *impossible to do*. Responses to 8 questions on healthy eating intentions were scored based on the healthfulness of the options (i.e., lower in fat and sugar and/or higher in fiber than commonly consumed alternatives) and were summed together to create the healthy eating intention score (α = .57). A healthy food getting score was generated by adding the consumption frequencies for a list of 26 healthy foods (e.g., low-fat milk, diet soda, fruits and vegetables, whole wheat bread, high-fiber and low-sugar cereals, low-sodium pretzels, and cooking spray) in the past 30 days (α = .77). For the healthy food preparation score, the cooking methods reported for different foods were assigned negative, zero, and positive points depending on whether or not the method added fat to, made no change to, or removed fat from the food (α = .58). MSL was an additive scale where ownership of 14 material items was assessed at baseline (α = .85).

Intervention Exposure Scores. Two intervention exposure scores were developed. The first exposure score was called the materials exposure score and included one point for each intervention component the respondent reported seeing or participating in—logo, shelf labels, posters, educational displays, taste tests, cooking demonstrations, giveaways, coupons, and incentive cards. The second exposure score included these same indicators but also added the number of visits to intervention stores reported by the respondent and was called the overall exposure score. The former score ranged from 0 to 30, with a mean of 3.25 (SD = 4.8). The latter score ranged from 0 to 60, with a mean of 8.23 (SD = 12.2) and was used in regression models for outcome variables. We divided the overall exposure score into quartiles; the first quartile included scores from 0 to 0.5, the second quartile included scores from 1 to 3.5, the third quartile included scores from 4 to 10, and the last quartile included scores from 11 to 60. No respondents demonstrated substantial acquiescence bias (i.e., reporting they saw two or more of the false items), so all were used for the analysis.

Analysis of Intervention Impact

To assess impact of the BHS program, we looked at change in key outcomes pre to post comparing intervention and comparison samples but also looked at the

independent effects of level of exposure to the intervention. Differences in the baseline sociodemographic characteristics between intervention and comparison respondents and between respondents and nonrespondents were analyzed using a *t* test for normally distributed continuous variables, a χ^2 test for binary variables, a Wilcoxon Mann–Whitney test for skewed data, and Fisher's exact test for those variables where one or more of the cells had an expected frequency less than 5. A *p* value of < .05 was used as the level of significance for all analyses.

Multiple linear regressions were conducted to assess program impact. Postintervention scores for food knowledge, label reading, healthy eating self-efficacy, healthy eating intentions, and behavioral outcomes of healthy food getting and preparation were regressed on a series of independent variables, including intervention assignment, baseline score of the dependent variable, age, sex, high school education (>12 years of schooling), and log of MSL score. The baseline and postintervention healthy food getting scores were log transformed. We conducted additional analyses by including overall level of exposure to the intervention by quartiles irrespective of the intervention assignment. The first quartile of exposure was used as reference group. Data were analyzed using SAS 9.1.

The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board.

RESULTS

Exposure to the Intervention

Exposure to specific intervention components was modest. Only exposure to the educational displays was significantly higher among intervention respondents (intervention group = 0.42 vs. comparison group = 0.12, *p* value for Wilcoxon Mann–Whitney test = .02), although exposure to posters (intervention group = 0.82 vs. comparison group = 0.45, *p* value for Wilcoxon Mann–Whitney test = .1) and giveaways (intervention group = 0.41 vs. comparison group = 0.13, *p* value for Wilcoxon Mann–Whitney test = .07) neared significance. The materials exposure score did not significantly differentiate between intervention and comparison respondents (intervention group = 3.9 vs. comparison group = 2.5, *p* value for Wilcoxon Mann–Whitney two-sample test = .13). On the other hand, respondents living in the intervention areas were significantly more likely to visit intervention stores far more frequently than were respondents living in the comparison areas (intervention group = 9.1 vs. comparison group = 0.4, *p* value for Wilcoxon Mann–Whitney two-sample test < .0001). The overall exposure score was significantly higher among intervention area respondents than among comparison area respondents (intervention group = 12.8 vs. comparison group = 2.8, *p* value for Wilcoxon Mann–Whitney two-sample test < .0001).

Impact on Food-Related Psychosocial Factors

Although there were positive changes in most psychosocial factors from baseline to follow-up, and although greater changes were seen in the intervention versus the comparison group, the differences were not statistically significant (see Table 1). After adjustment for baseline value and other factors, no impact of the intervention was

Table 1. Change in Psychosocial Factors and Outcomes of Interest by Intervention Assignment (Mean and Standard Deviation)

Variable	Intervention Pre (n = 45)		Comparison Pre (n = 39)		Intervention Post (n = 45)		Comparison Post (n = 39)		Change[a]	p Value[b]
Food knowledge score	8.44	2.5	8.56	2.1	9.87	2.7	9.28	2.3	0.7	.21
Label reading score	1.84	1.2	1.97	1.1	2.38	1.2	2.28	1.1	0.23	.38
Healthy eating self-efficacy score	49.58	6.1	52.28	5.0	49.31	6.5	51.49	4.7	0.53	.68
Healthy eating intention score	14.93	3.3	15.95	3.3	15.36	3.3	16.23	3.3	0.14	.83
Healthy food getting score	33.84	28.2	26	15.7	25.37	18.5	26.72	13.8	–9.19	.11[c]
Healthy food preparation score	–4.01	1.8	–3.65	3.2	–3.21	2.1	–3.82	2.4	0.97	.08

NOTE: N = 84 intervention and comparison respondents. $p < .05$ was used as the level of significance.

a. (intervention post – intervention pre) – (comparison post – comparison pre).

b. A t test was performed.

c. A Wilcoxon Mann–Whitney test was performed.

observed by treatment group on any of the psychosocial factors assessed, including knowledge, self-efficacy, and intentions (see Table 2). When we examined exposure to the intervention, those respondents in the most exposed quartile showed a positive trend in healthy food intentions as compared to those in the least exposed quartile (p = .0663; see Table 3).

Impact on Food-Related Behaviors

After adjustment for other factors in the regression models, healthy food preparation scores significantly improved in the intervention group as compared to the comparison group (see Table 4). Although the healthy food getting score decreased in the intervention group (see Table 1), intervention status was not a significant contributor after controlling for other factors in the regression models (see Table 4). Exposure did not make a significant change in the regression models of these food-related behaviors. Importantly, healthy eating intention was a significant predictor in both of these behavioral outcomes.

Purchasing a promoted food because of a shelf label was more likely among intervention than among comparison participants (Fisher's exact test, p = .02).

Table 2. Impact of the Baltimore Healthy Stores Program on Psychosocial Factors, by Treatment Group

	Food Knowledge Score		Label Reading Score		Healthy Eating Self-Efficacy Score		Healthy Eating Intention Score	
Psychosocial Factors	Std *b*	*p*	Std *b*	*p*	Std *b*	*p*	Std *b*	*p*
Intervention vs comparison	.15	.12	.07	.46	–.06	.57	.01	.90
Baseline score	.34	.0004	.34	.001	.51	<.0001	.58	<.0001
Age, years	–.06	.49	–.06	.59	.17	.11	.22	.03
Sex (*female* = 1 vs. *male* = 0)	.28	.0029	.24	.0177	–.10	.34	.03	.73
Education > 12 years vs. those </= 12 years	.13	.16	.16	.11	.04	.70	–.02	.80
Material Style of Life (log)[a]	.23	.0197	.19	.0692	.04	.70	.05	.57
N	84		84		84		84	
R^2	.45		.36		.3		.43	

NOTE: Std *b* = standardized beta. $p < .05$ was used as the level of significance. Multiple linear regressions were conducted. R^2 is the variance in the outcome that is explained by the variables in the model.

a. Material Style of Life score is the measure we used as a proxy for socioeconomic status and was log transformed.

DISCUSSION AND CONCLUSIONS

This article reports on consumer impact data of one of the first carefully evaluated low-income urban food store intervention trials. We saw positive impacts of the intervention on food preparation methods and purchasing of foods because of exposure to shelf labels and a positive trend toward impact of the intervention, using quartile levels of exposure, on behavioral intentions for healthy food choices. We did not see significant impacts of the program on other psychosocial factors or on healthy food getting frequency. Respondents with the highest exposure to the intervention had higher healthy eating intentions, indicating greater potential for making a positive change in eating, shopping, and preparation habits.

These findings from an urban store intervention trial parallel results from other programs that our team have implemented in food stores servicing small rural communities, including American Indians (Gittelsohn et al., 2005) and First Nations (Ho et al., 2008). In both of these rural settings, we worked in small communities and were able to have a much greater intensity of intervention delivery by working in the majority of food stores, and the programs had broad, far-reaching media components.

Although the BHS program was implemented well in terms of process indicators, exposure to intervention materials by local consumers was low to moderate and probably accounted for the modest impacts observed. In addition, process evaluation indicated that the intervention materials were implemented with moderate dose and fidelity

Table 3. Impact of the Baltimore Healthy Stores Program on Psychosocial Factors, by Level of Overall Exposure to Intervention

	Food Knowledge Score		Label Reading Score		Healthy Eating Self-Efficacy Score		Healthy Eating Intention Score	
Psychosocial Factors	Std *b*	*p*	Std *b*	*p*	Std *b*	*p*	Std *b*	*p*
Overall exposure (Quartile 2 vs. Quartile 1)	–.05	.68	–.20	.09	.06	.61	.06	.59
Overall exposure (Quartile 3 vs. Quartile 1)	.05	.65	.07	.58	.00	.97	.05	.64
Overall exposure (Quartile 4 vs. Quartile 1)	.06	.61	.05	.65	–.19	.12	.20	.0663
Baseline score	.34	.0008	.30	.0032	.50	<.0001	.59	<.0001
Age, years	–.09	.37	–.05	.63	.17	.11	.23	.02
Sex (*female* = 1 vs. *male* = 0)	.26	.0057	.26	.0066	–.10	.3115	.05	.584
Education > 12 years vs. those < /= 12 years	.15	.0977	.19	.0513	.00	.976	—[a]	—
Material Style of Life (log)[b]	.24	.0182	.21	.0379	.03	.7986	.06	.4857
N	84		84		84		84	
R^2	.44		.42		.34		.46	

NOTE: Std *b* = standardized beta. $p < .05$ was used as the level of significance. Multiple linear regressions were conducted. R^2 is the variance in the outcome that is explained by the variables in the model.

a. Not included in the model.

b. Material Style of Life score is the measure we used as a proxy for socioeconomic status and was log transformed.

(Gittelsohn et al., 2009), which likely contributed to reduced exposure. Increasing the frequency and location of interventionist activities such as taste tests and cooking demonstrations and improving fidelity of interventionists in conducting planned activities would likely improve intervention exposure.

A limitation of the study was the low retention rate (48%) of respondents. We interviewed low-income respondents in urban Baltimore at preintervention and then about 18 months later at postintervention. A very high proportion of the baseline respondents had moved or could not be contacted (largely because of changed or cancelled phone numbers) despite our best efforts. A comparison of basic demographic characteristics of those respondents lost to follow-up revealed that they were somewhat younger and more likely to be single, but they did not differ in other ways from those respondents we were able to reinterview. Our results therefore may be said to better represent the impact of the program on store customers who were stable area residents and more likely to be exposed to the intervention as opposed to those who were more transient. Future studies in low-income urban settings should identify better ways to track respondents.

An additional limitation of the study was that our program intervened in only 9 food stores in a setting with more than 100 food stores. We enhanced our opportunity to see

Table 4. Impact of the Baltimore Healthy Stores Program on Food-Related Behavioral Outcomes, by Treatment Group

	Healthy Food Preparation Score		Healthy Food Getting Score	
Behavioral Outcomes	Std *b*	*p*	Std *b*	*p*
Intervention vs. comparison	.21	.0460	–.09	.40
Baseline score	.14	.19	.18	.0816
Age, years	.14	.22	–.08	.46
Sex (*female* = 1 vs. *male* = 0)	–.11	.29	.38	.0003
Employed (*employed* = 1 vs. *not employed* = 0)	—[a]	—	.18	.0848
Education > 12 years vs. those </= 12 years	—	—	–.12	.25
Material Style of Life (log)[b]	–.14	.19	—	—
Postintervention healthy eating intention score	.35	.0016	.21	.0438
N	84		83	
R^2	.29		.31	

NOTE: Std *b* = standardized beta. $p < .05$ was used as the level of significance. Multiple linear regressions were conducted. R^2 is the variance in the outcome that is explained by the variables in the model.

a. Not included in the model.

b. Material Style of Life score is the measure we used as a proxy for socioeconomic status and was log transformed.

program impacts by sampling respondents either within or near the study stores. Nevertheless, future food store intervention trials in urban settings should increase their reach to a greater proportion of local food sources to see stronger effects and should expand their efforts to include community settings outside of stores.

Being female and having a higher material style of life contributed to higher food knowledge and label reading scores, results we have found in studies in other minority populations (Gittelsohn et al., 2006; Ho et al., 2008). These findings suggest that we might direct our interventions more specifically to women, who might be more likely to change their behaviors as a result of the intervention. Women may be more receptive and responsive to these types of store-based interventions.

The BHS trial was the first pilot round of our work in Baltimore City stores and was primarily oriented to demonstrate feasibility (Gittelsohn et al., 2009). We are completing a second round (BHS2) with other types of small stores where we have improved and standardized intervention procedures. Future rounds are planned to expand the program to a larger number of food stores in Baltimore City to increase reach and to have more pronounced intervention effects. We hope that this approach can serve as a model for interventions in food stores in low-income urban areas throughout the United States.

IMPLICATIONS FOR PRACTICE

The literature strongly suggests that there is a great need for interventions to improve the food environment, particularly in low-income ethnic minority neighborhoods. Intervention trials focusing on urban food stores have been recently conducted in low-income settings, but this is the first article to report positive impacts on consumers. The

results of the BHS study presented in this article and others (Gittelsohn et al., 2009; Song et al., 2009) suggest that urban food stores may be a viable venue for intervention and that stores of different sizes (from supermarkets to small corner stores) can be included as intervention venues.

Investigators should consider the types and sizes of food stores to be the focus of the interventions and develop intervention components specific to these store types. It was essential to our early work with KA corner stores to initiate the recruitment process with the local KAGRO chapter, to have a Korean doctoral student as a liaison, and to provide the owners with small incentives. Future efforts to work with small stores may need to incorporate these tactics. The implementation of programs in a higher proportion of retail food sources in urban food environments will likely lead to a greater chance for successful outcomes.

In Baltimore, food suppliers for small corner stores include vendors, supermarkets, and wholesale stores. A lack of availability of specific healthier foods at corner stores was sometimes linked to lack of these foods at wholesale stores or large chain supermarkets. The availability of healthy foods at these higher levels should be explored first to ensure sustainable healthy food stocking in corner stores.

Certain intervention activities were found to be quite effective in reaching our target population and promoting the behavioral objectives (Gittelsohn et al., 2009). Taste tests showed high attendance and participation. Increasing the frequency of these activities in participating stores would likely improve intervention exposure. In addition, the use of shelf labels for the promotion of target foods is a relatively simple way to encourage purchasing of healthy foods. In summary, a range of different approaches (signage, interactive approaches, increasing the availability of healthy food options) is needed when working in small food stores to reinforce key messages and optimize the potential for success.

References

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Upper Saddle River, NJ: Prentice Hall.

Bodor, J. N., Rose, D., Farley, T. A., Swalm, C., & Scott, S. K. (2008). Neighbourhood fruit and vegetable availability and consumption: The role of small food stores in an urban environment. *Public Health Nutrition, 11*, 413-420.

Centers for Disease Control and Prevention. (2005). *National diabetes fact sheet: General information and national estimates on diabetes in the United States, 2005*. Atlanta, GA: Author. Retrieved April 2, 2007, from http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2005.pdf

Cummins, S., Petticrew, M., Higgins, C., Findlay, A., & Sparks, L. (2005). Large scale food retailing as an intervention for diet and health: Quasi-experimental evaluation of a natural experiment. *Journal of Epidemiology and Community Health, 59*(12), 1035-1040.

Diez Roux, A. V., Merkin, S. S., Arnett, D., Chambless, L., Massing, M., Nieto, F. J., et al. (2001). Neighborhood of residence and incidence of coronary heart disease. *New England Journal of Medicine, 345*(2), 99-106.

Flegal, K. M., Carroll, M. D., Kuczmarski, R. J., & Johnson, C. L. (1998). Overweight and obesity in the United States: Prevalence and trends, 1960-1994. *International Journal of Obesity Related Metabolic Disorders, 22*(1), 39-47.

Franco, M., Diez Roux, A. V., Glass, T. A., Caballero, B., & Brancati, F. L. (2008). Neighborhood characteristics and availability of healthy foods in Baltimore. *American Journal of Preventive Medicine, 35*, 561-567.

French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. *Annual Review of Public Health, 22,* 309-335.

Gittelsohn, J., Anliker, J., Ethelbah, B., Sharma, S., Curran, S., Blake, K., et al. (2005). A food store intervention to reduce obesity in two American Indian communities: Impact on food choices and psychological indicators. *FASEB Journal, 19*(5), A594.7.

Gittelsohn, J., Anliker, J. A., Sharma, S., Vastine, A. E., Caballero, B., & Ethelbah, B. (2006). Psychosocial determinants of food purchasing and preparation in American Indian households. *Journal of Nutrition Education and Behavior, 38*(3), 163-168.

Gittelsohn, J., Franceschini, M. C., Rasooly, I., Ries, A. V., Ho, L. S., Pavlovich, W., et al. (2007). Understanding the food environment in a low income urban setting: Implications for food store interventions. *Journal of Hunger & Environmental Nutrition, 2*(2-3), 33-50.

Gittelsohn, J., Suratkar, S., Song, H.-J., Sacher, S., Rajan, R., Rasooly, I. R., et al. (2009). Process evaluation of Baltimore Healthy Stores: A pilot health intervention program with supermarkets and corner stores in Baltimore City. *Health Promotion Practice*. Epub ahead of print January 14. DOI: 10.1177/1524839908329118.

Ho, L. S., Gittelsohn, J., Rimal, R., Treuth, M., Sharma, S., Rosecrans, A., et al. (2008). An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in northwestern Ontario First Nations. *Health Education & Behavior, 35*, 561-573.

Marshall, M. C., Jr. (2005). Diabetes in African Americans. *Postgraduate Medical Journal, 81*(962), 734-740.

McNeill, L. H., Wyrwich, K. W., Brownson, R. C., Clark, E. M., & Kreuter, M. W. (2006). Individual, social environmental, and physical environmental influences on physical activity among Black and White adults: A structural equation analysis. *Annals of Behavioral Medicine, 31*(1), 36-44.

Melanson, K. J., McInnis, K. J., Rippe, J. M., Blackburn, G., & Wilson, P. F. (2001). Obesity and cardiovascular disease risk: Research update. *Cardiology in Review, 9*(4), 202-207.

Morland, K., Diez Roux, A. V., & Wing, S. (2006). Supermarkets, other food stores, and obesity: The atherosclerosis risk in communities study. *American Journal of Preventive Medicine, 30*(4), 333-339.

Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association, 295*(13), 1549-1555.

Powell, L. M., Slater, S., Mirtcheva, D., Bao, Y., & Chaloupka, F. J. (2007). Food store availability and neighborhood characteristics in the United States. *Preventive Medicine, 44*(3), 189-195.

Reger, B., Wootan, M. G., & Booth-Butterfield, S. (1999). Using mass media to promote healthy eating: A community-based demonstration project. *Preventive Medicine, 29*(5), 414-421.

Seymour, J. D., Yaroch, A. L., Serdula, M., Blanck, H. M., & Khan, L. K. (2004). Impact of nutrition environmental interventions on point-of-purchase behavior in adults: A review. *Preventive Medicine, 39*(Suppl. 2), S108-S136.

Sharma, S., Cao, X., Arcan, C., Mattingly, M., Jennings, S., Song, H.-J., et al. (2009). Assessment of dietary intake in an inner-city African American population and development of a quantitative food frequency questionnaire to highlight foods and nutrients for a nutritional invention. *International Journal of Food Sciences and Nutrition*. Epub ahead of print April 8. DOI: 10.1080/09637480902755061.

Song, H.-J., Gittelsohn, J., Kim, M., Suratkar, S., Sharma, S., & Anliker, J. A. (2009). A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. *Public Health Nutrition*. Epub ahead of print April 30. DOI: 10.1017/S1368980009005242.

Suratkar, S., Gittelsohn, J., Song, H.-J., Sharma, S., Anliker, J. A., & Mattingly, M. (in press). Food security is associated with food-related psychosocial factors and behaviors among low-income African Americans in Baltimore City. *Journal of Hunger and Environmental Nutrition.*