REVIEW OF THE EVIDENCE

HEALTH PROMOTION STRATEGIES FOR RETAIL FOOD SHOPPING VENUES

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Health Promotion Strategies for Retail Food Shopping Venues

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Executive Summary

For decades, public health professionals have targeted the food and beverage retail sector as a venue for improving nutrition and, in recent years, preventing chronic disease and obesity. Some initiatives have been evaluated empirically and published in the peer-review literature.

A comprehensive review of programs that targeted the food and beverage retail sector as a way to improve nutrition, prevent obesity, and improve health status has illuminated:

- the value and effectiveness of ***price interventions*** that provide consumers with incentives for healthful purchases;
- the apparent ineffectiveness of ***access interventions*** that increase consumers' geographic access to new stores;
- the need for additional studies carefully designed to measure the effectiveness of a variety of ***in-store interventions***.

As part of a larger effort to inform evidence-based programming for SNAP-Ed across multiple settings, we examined the peer-reviewed literature on strategies for improving nutrition and/or preventing obesity in settings where people shop for food.[1] We found evidence from experimental studies[2] and/or natural experimental studies that address three main topics: 1) altering prices of healthy/unhealthy products (***price interventions***) 2) increasing physical access to healthy food (***access interventions***), and 3) modifying the store environment (***store-based interventions***).

We synthesized the existing evidence on each of these three intervention categories.

- Evidence on ***price interventions*** shows consistent effectiveness for all types of financial incentives for healthy purchases, and provides the most substantial support for vouchers/coupons and rebates. Incentive interventions help mitigate the economic burden of purchasing healthy foods and beverages on low-income families, who spend a greater proportion of their income on food (despite paying similar prices as their higher income counterparts for healthy items). The evidence on tax strategies is limited to natural experimental studies, but shows promise for their impact on sugar-sweetened beverage (SSB) purchase and consumption. Thus, the existing literature suggests that interventions that encourage the purchase of healthy foods and beverages via economic incentives are likely to favorably impact diet. Although there is substantial evidence that economic incentive strategies can increase the purchase and consumption of healthy products, there is little to indicate their

[1] This review corresponds to the Shop domain as defined by the California Department of Public Health NEOP Branch in the SNAP-Ed portfolios. It covers interventions for retail food stores and does *not* cover interventions for restaurants and other food retail outlets that sell only prepared foods, such as vending machines, food trucks, etc. The literature on interventions for prepared food-only settings will be covered in a future review of evidence relevant to the Eat domain.

[2] Experimental studies are considered to provide more reliable evidence of effectiveness than natural experiments and other observational studies. They are defined in this review as studies that include an assigned intervention (an exposure assigned by investigator), measurement of outcome(s) before and after the intervention occurred, and a control group not exposed to the intervention under investigation. Any available natural experimental studies were included to supplement the experimental studies when there were fewer than experimental studies.

efficacy for reducing purchases and consumption of unhealthy products or for improving weight status.

- Evidence on ***access interventions***, including opening new stores or delivering free produce in underserved areas, is limited. However, studies on opening new stores (5 interventions) offer minimal support to the efficacy of this strategy for improving diet. The evidence on delivering produce to low-income individuals in their homes or neighborhoods at no charge, via a truck or produce boxes, offers greater promise for affecting diet and weight, but is extremely limited (3 interventions). Thus, the literature suggests that opening new stores will not likely impact diet, and additional studies are needed to adequately inform the expected effect of free produce delivery interventions.

- Evidence on ***store-based interventions***, including print-based and audio-visual nutrition education/promotion, increased stocking of healthy foods, strategic product placement and/or support for store managers, is extensive (35 interventions), but shows mixed effectiveness for a range of intervention activities and outcomes. Most studies examined the impact on purchasing and did not assess dietary intake or weight status, so their potential for improving health status remains unclear. While there are examples of effective interventions within each category, it is not discernable why similar interventions were found to be effective in some studies and not others. The lack of clear trends precludes programmatic recommendations.

In sum, the existing evidence on food retail setting strategies supports the effectiveness of monetary incentives for increasing healthy purchases and consumption, and shows that opening new supermarkets in underserved areas is not a promising strategy. These findings are consistent with research showing that low-income households' shopping behaviors are most influenced by prices and, as a result, they shop at supermarkets, regardless of distance. The evidence on other interventions is too limited in terms of study quantity or design and/or findings are too variable to support conclusions. This review will be updated periodically to incorporate new evidence.

Based upon our review of the literature, we strongly recommend that new carefully designed research, with adequate participation numbers and comparable outcome evaluations, focus on assessment of strategies that have not yet been proven either effective or ineffective.

Definitions & Acronyms

Body Mass Index (BMI): a person's weight in kilograms divided by their height squared in meters.

DGA: Dietary Guidelines for Americans, the U.S. federal dietary guidance.

Duration: the length of time the intervention was implemented.

Experimental study: a study that includes an investigator-assigned intervention, outcome variable(s) measured before and after intervention implementation, and a control group not exposed to the intervention. Assignment of the intervention and control conditions could have been done randomly or non-randomly (quasi-experimental), but assignment was under the researcher's control.

Follow-up(s): length of time between the baseline and follow-up measurement(s).

Retail food store/outlet/venue/site: an establishment that sells unprepared foods, including grocery stores, supermarkets, convenience stores, corner stores, food pantries/banks, produce trucks and farmers' markets. Definitions of these outlet types vary in the literature. This definition excludes restaurants and other venues such as food carts and trucks that only sell prepared foods.

FPL: Federal poverty level

FVs: fruits and vegetables

Healthy Eating Index (HEI): a measure of diet quality that assesses conformance to the DGA.[1]

Intervention (Intx): a change in an exposure, either assigned by an investigator or naturally occurring.

Low-income low-access area (LILA): a census tract identified in the Food Access Research Atlas.[2] The tract is classified as **low access** if at least 500 people or 30% of residents live more than 1 mile from a supermarket in urban areas (10 miles in rural areas, and **low-income** if the poverty rate is above 20%, or the median family income is less than 80% of the statewide or metropolitan area median income.[3]

Natural experimental study: a study of a naturally occurring intervention with outcome measures taken before and after an intervention among those exposed to the intervention and a control group. Exposure to the intervention and control conditions is not controlled by the investigator. Longitudinal data (including cohort data) analyses are classified as natural experiments.

Sugar-sweetened beverages (SSBs): drinks with added sugar, including non-diet soft drinks/sodas, flavored juice drinks, sports drinks, sweetened tea and coffee, energy drinks and sweetened milks or milk alternatives.[4]

WC: waist circumference, a measure of abdominal adiposity.

Weight status: any body weight or body composition measure, including BMI, WC, skinfold, etc.

+: positive/desired/favorable result based on statistical significance.

Ø: null result based on statistical significance.

-: negative/undesired/unfavorable result based on statistical significance.

+/Ø: mix of positive and null results based on statistical significance.

Introduction

Public health professionals and policymakers have long been interested in the potential utility of the food and beverage retail environment for improving diet and health. A variety of intervention strategies have been implemented in the food retail setting, and some have been empirically evaluated. We conducted a review of the peer-reviewed published literature on retail-based strategies for nutrition promotion and obesity prevention with the intent of informing evidence-based practices for the California SNAP-Ed program. This report presents the findings, which will be combined with those from future reviews, including one focused on multi-setting interventions, to inform comprehensive SNAP-Ed programming across multiple settings. It begins with an overview of the food retail environment and shopping behaviors among low-income populations, then reviews the literature on each intervention category, and closes with conclusions and implications.

Methods

The literature review process included four phases: 1) Developing research questions and study inclusion/exclusion criteria, 2) Searching for evidence, 3) Screening studies for inclusion/exclusion, and 4) Organizing and summarizing the evidence.

We created and ran Boolean operator search strategies (Appendix 1) in PubMed. To maximize efficiency without sacrificing comprehensiveness, we searched for and identified relevant review papers published between January 1, 2005 and January 11, 2016 and extracted all relevant primary studies from them. We also searched for primary studies published between January 1, 2014 and April 20, 2016 to obtain the most recent publications. The PubMed searches yielded a total of 6,061 references. Key word searches were conducted in other relevant literature databases, including Health Systems Evidence, USDA's Nutrition Evidence Library, the Robert Wood Johnson Foundation's *What Works for Health*, Transtria, Academy of Nutrition and Dietetics' Evidence Analysis Library, and Center for Training and Research Translation for any relevant studies not indexed in PubMed.

Inclusion & Exclusion Criteria

All retrieved references were screened for relevance by applying inclusion/exclusion criteria. Specifically, studies had to satisfy the following conditions to be included in the review:

- **Setting:** Included interventions were implemented via retail food stores, defined as venues that sell *un*prepared foods and including grocery stores, corner stores, supermarkets, farmers' markets, food banks/pantries, and produce carts, among others. Studies were excluded if they were implemented in venues that only sell prepared foods, such as restaurants, food trucks and vending machines. Included studies could be conducted in upper-middle- or high-income countries, as defined by the World Bank.[5] Those done in developing countries were excluded due to their questionable generalizability. Multi-setting interventions in which food retail shopping venues were not the primary setting of implementation were excluded, but will be the subject of a future review of multi-setting interventions (e.g., interventions that included equally strong components in schools and worksites in addition to food retail venues).

- **Study Design:** Studies used experimental designs, defined as including an assigned intervention (an exposure assigned by the investigator), measurement of outcome(s) before and after the intervention occurred, and a control group not exposed to the intervention under investigation.
    - When few (≤5) studies met the experimental design criteria for a particular intervention category, all relevant natural experiments were included. Based on this criterion, natural experiments were included in the summaries of new supermarket, price reduction and tax interventions.
- **Intervention:** A change in a food retail-related exposure, either naturally occurring or assigned by an investigator was assessed.[3] Interventions were not excluded based on expected feasibility of implementation through SNAP-Ed. While some interventions could be deemed more or less practical for SNAP-Ed on account of program restrictions, we included any interventions that could reasonably be employed by leveraging partnerships or through other creative strategies.
- **Outcome Measures** (at least one measured and reported):
    - Purchases of target foods and beverages, such as fruits and vegetables and products containing added sugar
    - Consumption of target foods and beverages
    - Weight status measures, including body weight, BMI, skinfold, percent body fat, waist circumference, or other measures of body composition
    - Food security
- **Population:** Studies conducted among any population in upper-middle- or high-income countries were included. While the review was conducted to inform work among low-income populations, often only a limited number of studies were conducted among this specific population.

Ultimately, 82 primary studies published between 1978 and 2016 describing 75 interventions were included in our evidence synthesis. Sixty-one studies were identified from 26 review papers and an additional 19 studies were retrieved via the PubMed search for primary papers. Subject matter experts contributed 2 additional papers. Collectively, the studies represent 3 main categories of intervention: i) access, ii) price and iii) store-based. Effect sizes are reported in the result tables if they were interpretable. Natural experiments were incorporated into summaries of the literature on new store (access category) and tax and price reduction (price category) interventions, because there were no or few (≤5) experimental studies addressing these topics.

Methodological Limitations

While we applied a strict study design exclusion criterion, we did not conduct a systematic assessment of other study quality metrics, such as sampling methods, group assignment, sample size, statistical power, duration, and measurement method. Hence, the results presented in this report (whether an outcome was positive, null or negative) are based on the statistical significance ($p<0.05$) of reported outcomes. Statistical significance is limited as an indicator of effectiveness, since studies may not have had adequate power to detect an effect for one or more outcomes measured. A complete quality

[3] Food package label interventions were excluded from this review since they were considered outside the scope of the food retail sector.

assessment of all primary papers would provide additional rigor, though would not be expected to alter the conclusions substantially.

Moreover, we identified all relevant primary studies published prior to 2014 through review papers on retail setting interventions. We consulted primary studies to confirm key pieces of information, including intervention activities and duration, outcomes measured, and effect sizes, but relied upon abstractions published in review papers to obtain much of the data used in our analysis.

Background: Food Retail Environment & Shopping Patterns among Low-Income Populations

To provide context for retail setting interventions among the SNAP-Ed eligible population, this section provides key facts and figures about the food retail environment to which low-income populations are exposed and their shopping behaviors. The information presented in this section is based on national-level data, except where stated as California-specific.

I. Despite variations in geographical access to supermarkets and smaller stores, low-income[4] individuals travel to do most of their grocery shopping at supermarkets, where prices are lower.

Larger retailers provide greater access to healthier foods than smaller retailers.

- The nutritional quality of purchases (average HEI score) is lower at medium/small grocery stores (42) and convenience stores (36) than large grocery stores (52).[6]
- Households that shop mainly at supermarkets are more likely to purchase milk, vegetables, and non-canned fruit compared to households that shop mostly at other venues.[7]
- Shopping at supercenters is associated with less healthful purchases.[8]

There are disparities in access, but the overall percentage of low-income households with low access to supermarkets is low.

- Density of supermarkets in low-income[5] neighborhoods is 25% lower than in middle-income neighborhoods.[9]
- However, nationally, a greater share of low-income[6] individuals (62%) have high or medium access to supermarkets than those with higher income (56%).[7]

[4] The term "low-income" as used in summary statements encompasses all definitions used by authors of the reports from which supporting evidence was drawn.
[5] Defined by median household income quintile: low-income households fall into the bottom quintile, middle-income households into the middle three quintiles, and high-income household into the top quintile.
[6] An individual living in a household with income less than or equal to 200 percent of the federal poverty thresholds for family size.

- Only 3.6% of low-income[7] households live >1 mile from a supermarket and do not have access to a car.[7]
- Low-income[8] neighborhoods in California have 20% fewer healthy food sources than higher income neighborhoods.[10]
- In California, about 1 million people (~2.5% of the population) live more than 1 mile away in an urban area or more than 10 miles away in a rural area from a large grocery store or supermarket; just under half (45%) of those people are low-income[9].[11]

Residents of low-income areas have greater access than residents of higher income areas to small retail outlets that have less healthy foods and higher prices.

- Low-income neighborhoods are more likely to have more access to smaller grocery stores, convenience stores and specialty stores than higher income neighborhoods. [9]
- Many low-income[10], urban areas have a higher density of corner stores than higher income areas.[12]
- Prices at smaller stores tend to be higher; for example, prices at convenience stores are 11% higher than those in grocery stores.[13]
- Prices in larger stores tend to be lower; prices in supermarkets and supercenters are 10% lower than those in grocery stores.[13]

Low-income consumers primarily buy groceries at supermarkets and supercenters despite variations in geographic access.

- In 2014, 42.6% of CalFresh benefits were redeemed at supermarkets, 41.5% at supercenters, 4.7% at grocery stores, 5% at convenience stores, 5% at drugstores or dollar stores, 1.1% at specialty stores, and 0.05% at farmers' markets.[14]
- Few households in LILA neighborhoods limit their food purchases to those areas; in fact, there are negligible differences in the types of retail channels where LILA and non-LILA consumers shop for groceries.[8]
- Low-income[11] households spend only a marginally higher proportion of their food expenditures at convenience stores (2-3%) compared to the highest-income households (0.7%).[13]

Low-income consumers travel in order to shop at supermarkets, regardless of transportation mode.

- Almost all LILA area residents travel to stores more than 1 mile from their home, regardless of the transportation mode they use.[8]
- SNAP recipients travel an average 3.8 miles to the store they primarily use for grocery shopping, even though the nearest SNAP-authorized store is, on average, 2 miles from their home.[15]
- People living in LILA areas spend significantly more time traveling to a grocery store than the national average (19.5 versus 15 minutes, respectively).[7]

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[7] Household with income less than or equal to 200 percent of the Federal poverty thresholds for family size.
[8] Census tracts where more than 30% of households had incomes below 200% of the federal poverty level.
[9] Annual household income less than or equal to 200 percent of the federal poverty level.
[10] Communities with household incomes below the state average.
[11] Annual income between $5,000 and $11,999.

- Most (93%) LILA area residents travel to the grocery store in a vehicle they or another household member drive.[7]
- Fewer SNAP participants and low-income non-SNAP participants (101-185% FPL) use their own cars for food shopping than higher income individuals (>185% FPL)—68%, 83% and 95% respectively.[15]
- SNAP households are more likely to use other people's cars (19%), walk, bike, or take public transit or a shuttle (13%) to the store.[15]

II. Low-income consumers purchase less healthy food compared to their higher income counterparts, but socioeconomic disparities rather than supermarket accessibility appear to be the driving factors.

On average, low-income households pay similar prices for groceries compared to their higher income counterparts, but the costs represent a much higher proportion of their income.

- Households in the lowest income quintile spend a higher proportion of their total disposable income on food (34%) than those in the highest quintile (7%).[16]
- There is no evidence that LILA consumers pay more for healthful foods.
- The extremely poor (<$8,000 per household) pay 0.5 to 1.3 % higher prices for identical goods.[13]
- Other low-income households ($8-30,000 per household) pay the lowest prices for groceries.[13]

Low-income consumers purchase less healthy food in almost all retail channels relative to higher income consumers.

- Households living in LILA areas consume fewer fruits (-4.3%), vegetables (-2.4%) and low-fat milk products (-10.4%), and more red meats (+8.5%) and non-diet drinks (+10%).[8]
- The average HEI score of foods acquired by households in LILA areas is about 15 points lower than of those acquired by higher income households, even when the outlets where they shop have healthy options.[6]
- LILA consumers purchase less healthful foods in supermarkets and club stores than higher income consumers.[8]

Income and food prices appear to be more important factors influencing food purchase decisions than geographical access.

- SNAP participants with very difficult access to a supermarket purchase smaller amounts of perishable foods than shoppers with easy access. However, the prices of different food groups are more salient determinants of purchases than access to them.[17]
- Living in a low-income area is more strongly associated with the purchases of unhealthful food than is living in an area with limited access to supermarkets. [8]

III. Summary

Evidence suggests that disparities in access to food retail outlets do not dictate food shopping behaviors among low-income households. Despite lower proximity to supermarkets, LILA area residents manage to shop at them by spending more time traveling longer distances, borrowing vehicles and/or using alternative modes of transportation. Low-income households are more price-

sensitive and maximize their food budget by shopping where prices are lower, even if it means overcoming transportation barriers. And, despite greater physical access to convenience stores, low-income consumers spend only slightly more of their food budget at them.

Hence, the lower nutritional quality of purchases made by low-income households cannot be explained by the apparent lack of geographical access to retail outlets that sell healthy food. The effects of other factors, particularly income, are more salient than those of living in a LILA area on the healthfulness of purchases. However, less healthy purchases should not be attributed to a lack of knowledge or good intentions; evidence suggests that low-income consumers choose less healthy items because they cost less.

These findings are consistent with a 2016 USDA publication which concluded that food store access, as measured by proximity, has a limited impact on food choices.[3]

Results

I. Healthy Food Access Interventions

In response to observational data linking diet and weight status to geographical access to full-service grocery stores, ameliorative efforts have been made in the U.S. and abroad. Interventions aiming to improve access to healthy food in underserved neighborhoods have included adding new supermarkets, farmers' markets, and produce delivery systems, among others. Several projects have been evaluated for their impacts on diet and BMI via experimental and natural experimental studies. Included in this review are 8 experimental and 2 natural experimental studies that cover new supermarkets and free home or community produce delivery. Evidence from 4 interventions involving opening new supermarkets indicates they are unlikely to impact diet.

There is no evidence from experimental or natural experimental studies by which to evaluate the impact of other strategies aimed at increasing access to healthy food. While some studies have investigated the effectiveness of increasing stocking of healthy foods and beverages as part of multicomponent store interventions (see Store-based Interventions), none have evaluated whether increasing stocking in isolation changes purchasing or consumption. There is also no experimental evidence on the effects of other interventions, such as new farmers' markets and food co-ops. Summaries of the literature on these and other strategies have been produced by the Robert Wood Johnson Foundation (appendix 2).

1. New Supermarkets

THE EXISTING EVIDENCE DOES NOT DEMONSTRATE EFFECTIVENESS OF OPENING NEW SUPERMARKETS IN LOW-INCOME, LOW-ACCESS AREAS FOR IMPROVING NUTRITION OR WEIGHT STATUS.

Five experimental studies of 4 interventions have investigated the impact of opening new supermarkets in underserved areas—all 4 targeted low-income populations and 3 had samples with high proportions of racial/ethnic minority individuals.[18-22] All 5 studies reported no impact on community residents' fruit and vegetable consumption after 6 to 12 months, and the only study to examine a weight status outcome found no impact on self-reported BMI after 6 months. High baseline prevalence of supermarket shopping may help explain these null effects. The only positive outcomes reported in the experimental literature come from one intervention that resulted in a reduction in SSB consumption among adults and pastry consumption among children.[21, 22] One natural experiment assessed the relationship between supermarket density within 1-3 kilometers (km) of individuals' residence and the likelihood of meeting the daily fruit and vegetable recommendation, and found no association overall, but a positive association among men living in an area with greater supermarket access.[23]

Table 1. Summary of new supermarket interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results (effect size)
Elbel et al., 2015 a,b[21, 22]	Predominately Hispanic and Black low-income adults and children	Opened a new supermarket in a LILA area Follow-up: ~1 year	FV intake FV purchase SSB intake	Ø Ø + Adults only (-0.3

	New York City, NY USA			servings/day, or -20%)
			Pastry intake	+ Children only (-0.26 servings/day)
Cummins et al., 2014[20]	Predominately Black, low-income Philadelphia, PA USA	Opened a new supermarket in a LILA area Follow-up: 6 months	FV intake BMI	Ø Ø
Sadler et al., 2013[19]	Predominately Black, low-income Flint, MI USA	Opened a new supermarket in a LILA area Follow-up: 1 year	FV intake	Ø
Boone-Heinonen et al., 2011[23]*	Cohort study participants Birmingham, AL Chicago, IL Minneapolis, MN Oakland, CA USA	Used fixed effect models to analyze 15 years of longitudinal dietary data from the Coronary Artery Risk Development in Young Adults (CARDIA) cohort and linked time-varying GIS-derived supermarket and grocery store access data	FV intake (adherence to DGA) Overall diet quality (compliance with DGA)	Ø Overall + Males only Ø
Cummins et al., 2005[18]*	Supermarket shoppers Glasgow, Scotland	Opened a new supermarket in a LILA area Follow-up: 10 months	FV intake	Ø

*Natural experiment

2. Free Produce Delivery

EVIDENCE ON THE IMPACT OF FREE PRODUCE DELIVERY ON BOTH DIET AND WEIGHT STATUS IS LIMITED.

Three experimental studies have investigated the impacts of delivering free produce to low-income individuals at their homes or to a neighborhood location weekly or biweekly over 4-6 months. Two interventions showed positive impacts and 1 did not show an effect. One study that evaluated a home delivery model reported an increase in fruit and vegetable consumption among homebound seniors[24] and another, of a mobile store model, reported an increase in fruit and vegetable consumption and reductions in weight and BMI among Black women.[25] Neither study investigated whether the intervention effect was sustained after produce delivery ceased. One study that evaluated a community-supported agriculture (CSA) delivery program reported no impact on fruit and vegetable consumption among women in urban North Carolina.[26]

The impact of providing nutrition education in addition to free produce is unclear from the current literature. Of the 2 interventions that included both components, 1 reported positive results and the other reported null results.[25, 26] Both of these studies were feasibility trials with fewer than 50 participants, which possibly contributed to the null finding reported by Quandt et al., 2013.

Table 2. Summary of free produce delivery interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results (effect size)
Quandt et al., 2013[26]	Low-income women with children in an urban community	Delivered free boxes of produce via a CSA program for pick up from a community location	FV Intake	Ø

	Forsyth County, NC USA	Offered nutrition education and cooking classes and farm and grocery store tours Duration: 4 months		
Kennedy et al., 2009[25]	Black women East Baton Rouge Parish, LA USA	Delivered free fruits and vegetables via a "Rolling Store" weekly and provided nutrition education Duration: 6 months	FV Intake Weight BMI	+ + +
Johnson et al., 2004[24]	Low-income, homebound seniors Seattle, WA USA	The Seattle Senior Farmers' Market Nutrition Pilot Program: delivered free produce baskets biweekly Duration: 5 months	FV Intake	+ (1.31 servings/day)

II. Price Interventions

Applying principles of price elasticity, researchers have investigated whether price change interventions can promote healthy dietary behaviors and healthy weight status. Since low-income populations spend a relatively greater proportion of their income on food compared to higher-income populations, reducing the cost of healthy foods and beverages could promote greater purchase of healthier products which are generally more expensive than unhealthy products.

Strategies have included offering price incentives such as vouchers or coupons (with or without nutrition education), rebates, and price reductions for healthy products, alone or combined with store-based activities. The impact of taxes on unhealthy purchases has also been evaluated via natural experiments. Overall, price interventions tend to demonstrate effectiveness for modifying dietary behaviors. However, evidence for their impact on weight status outcomes is limited.

Thirty-three price interventions were included in this review, including 17 experiments and 16 natural experiments. Most studies measured food intake and/or purchases. The majority of the experimental studies found a significant positive effect on at least 1 dietary behavior outcome. Of the studies conducted among low-income populations, the majority were effective. Fruit and vegetable consumption was the most commonly measured outcome, and most interventions demonstrated positive effects.

Monetary incentives provided in a range of formats and values and distributed at a range of intervals have shown effectiveness for increasing FV purchase, FV intake and/or healthy food purchases (Appendix 3). Vouchers and coupons have been effective when provided weekly in the amounts of $3, $7.50, $10, and $30; biweekly as a 50% discount coupon; monthly in amounts of $15-60; and a one-time $6 coupon. Reimbursements and rebates in the amounts of 10- 50% and up to $50 over 3 weeks have also had positive effects. Discounts shown to be effective ranged from 12.5%-50%. A buy 3 get 1 free promotion also had a positive impact on healthy food purchases.

1. Vouchers/Coupons

VOUCHER OR COUPON PROVISION IS GENERALLY EFFECTIVE FOR INCREASING FRUIT AND VEGETABLE CONSUMPTION, PARTICULARLY WHEN THE VALUE IS SUFFICIENT.

Providing vouchers exchangeable for a designated monetary value worth of healthy foods or coupons that give a discount on healthy foods are two strategies that have been studied for their efficacy in incentivizing healthy dietary behaviors. Four studies have evaluated the impact of giving vouchers, including 3 among low-income WIC program participants and 1 among the general population. In the 3 studies conducted in the U.S., at least one-third of participants were racial/ethnic minorities, and 2 showed positive effects on fruit and vegetable intake.

Voucher redemption occurred either at supermarkets[27, 28] or farmers' markets.[28-30] All 4 studies evaluated the effect on fruit and vegetable intake, and 1 also measured fruit and vegetable purchases.[27] Three of the 4 studies found a positive effect on fruit and vegetable consumption,[27-29] of which 1 also reported a positive impact on purchases.[27] One study reported only null results for fruit and vegetable intake, which might be because the amount of the coupon was very low ($10/year compared to $20-40/week in studies that found an impact).[30] The distribution frequency required to have an effect is not clear, but the evidence does suggest that the effect of vouchers disappears after provision ceases.

Table 1. Summary of voucher/coupon interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results (effect size)
Waterlander et al., 2013[27]	Supermarket shoppers Netherlands	50% discount coupons for FVs at supermarkets Received biweekly Duration: 6 months	FV purchase % participants consuming recommended amount of FVs	+ (0.3 kg per household/day) + (18.8% increase)
Herman et al., 2008[28]	WIC participants* at 3 sites 89% Hispanic Los Angeles, CA USA	$10 vouchers for produce at supermarkets or farmers' markets Received weekly Duration: 6 months	FV intake	+ (Farmers' market participants: +0.8 servings/1000 kcal; Supermarket participants: +1.4 servings/1000kcal)
Anderson et al., 2001[29]	WIC-eligible women 45% Black MI USA	$20 coupons for redemption at farmers' markets Received monthly Duration: 4 months	FV intake	+
Anliker et al., 1992[30]	WIC participants* 39% White, 36% Black CT USA	$10 coupons for redemption at farmers' markets Received annually Duration: 2 months	FV intake	Ø

* WIC participants in these studies may have been exposed to nutrition education before or during the intervention period; however, the exact specifications of the nutrition education are unknown.

2. Vouchers/Coupons + Nutrition Education

EVIDENCE ON INTERVENTIONS THAT COMBINE VOUCHER PROVISION WITH NUTRITION EDUCATION SHOWS CONSISTENT EFFECTIVENESS FOR INCREASING FRUIT AND VEGETABLE PURCHASES AND CONSUMPTION.

Five studies evaluated the combination of vouchers and nutrition education. Of the 4 studies among low-income populations and 3 among racial/ethnic minorities, all found positive effects on fruit and vegetable intake. Four evaluated fruit and vegetable intake and 3 found significant increases. One study measured healthy food purchases and found a positive impact.[31] However, the effect of these interventions on weight status is not clear; 2 interventions that measured BMI found a null effect,[32, 33] 1 of which may have been too short in duration to impact weight.[32] Providing fruit and vegetable vouchers and nutrition education together may have an additive or synergistic positive effect on consumption, but research is inadequate to determine whether education has an added effect.

Table 2. Summary of voucher/coupon plus nutrition education interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results (effect size)
Miller et al., 2016[34]	Low-income Black population with hypertension Baltimore, MD USA	$30 weekly voucher for high-potassium foods at an online supermarket, coach-directed dietary advice, and shopping assistance Duration: 2 months	FV intake	+ (2.1 servings/day)
Weinstein et al., 2014[32]	Mainly Latino, female and low-income overweight patients with type II diabetes The Bronx, NY USA	A single $6 coupon redeemable at farmers' markets; A single 1hr group education session focused on health benefits of FVs Duration: 3 months	FV intake BMI	+ (0.2 servings/day) Ø
Bihan et al., 2012[33]	Low-income adults France	~$15-60 monthly (depending on household composition) FV vouchers during 1 year with dietary advice Duration: 12 months	% of people consuming <1 FV per/day FV intake BMI	+ (% of low-consumers was 5 times less in the intx group) Ø Ø
Anderson et al., 2001[29]	WIC participants 45% Black MI USA	$20/month coupons to be redeemed at farmers' markets; Nutrition education and recipes	FV intake	+
Anderson et al., 1997[35]	Predominately white female primary household shoppers Rural Southern VA, USA	$3 coupons to be redeemed in a variety of high-fiber, low-fat foods and FV; 10 weekly education sessions through a multimedia in-grocery store kiosk	FV purchase Fiber purchase Total fat purchase	+ (0.71 servings/day per person) +(4 grams/day) +

3. Rebates

THE MAJORITY OF STUDIES OF OFFERING REBATES TO INCENTIVIZE HEALTHY DIETARY BEHAVIORS DEMONSTRATE EFFECTIVENESS FOR INCREASING HEALTHY PURCHASES.

Five studies evaluated the impact of rebates (partial refunds given for healthy food purchases), including 4 on fruit and vegetable purchasing and 3 on intake. Two of the studies targeted low-income populations and 1 had a predominately minority (black) sample; all of these studies found positive effects. All 4 studies that measured FV *purchases* found positive effects.[36-39] One study also found a positive effect on "healthy purchases."[36] Evidence for the effect on FV *intake* is more limited and less consistently positive than that for purchases, as just 1 of 3 studies of rebates that measured intake found an effect.[39] This study found a positive impact on FV intake of offering SNAP participants $0.30 (added to their EBT card) for every $1 they spent on fruits and vegetables. One study analyzed the intervention effect on BMI and WC and found null results, possibly due to the small sample (n<60 participants) and short duration (3 months).[40] The null results may in part be attributable to the burdensome rebate redemption process, which might have deterred participation.[40]

Table 3. Summary of rebate interventions.

First Author, Yr.	Population	Intervention Description	Outcomes Measured	Results (effect size)
Smith-Drelich et al., 2016[38]	Residents of Palo Alto, CA USA	Cash reimbursement up to $50 over 3 weeks on purchases of raw vegetables Duration: 3 weeks	Vegetable purchases Vegetable intake	+ ($1.14 /day) Ø
Kral et al., 2016[40]	Adults aged 40-70 years Philadelphia, PA USA	$1 rebate for every purchased healthy food or and beverage. Participants were required to send via mail their annotated receipts and nutrition facts labels from packaged products Duration: 3 months	Daily energy intake Fruit intake Vegetable intake Weight WC BMI	Ø Ø Ø Ø Ø Ø
Phipps et al., 2015[37]	Low-income, mainly black families Philadelphia, PA USA	50% rebate on supermarket FV purchases; newsletters with nutritional information and recipes Duration: 2 months	FV purchases Vegetable purchases Fruit purchases	+ (1.5 servings/day per household) + (1.14 servings/day per household) + (0.34 servings/day per household)
Bartlett et al., 2014[39] & An, 2015	SNAP participants Eastern MA USA	$0.30 incentive, added to their SNAP EBT card for every $1 of SNAP benefits redeemed at participating retailers on targeted FVs Duration:14 months	FV intake FV purchase	+ (0.48 servings/day) + ($6.15 increase in spending or 8.5% increase)
Sturm et al., 2013[36]	Individuals insured by the largest health insurer 400 supermarkets South Africa	Cash-back rebate of 10-25% for healthy food purchases in over 400 supermarkets in South Africa. Eligible healthy food items were selected by a panel of nutritionists and physicians Duration: 28 months	% of expenditures on healthy food % of purchases on FV	+ (6% for the 10% rebate and 9.3% for the 25% rebate) + (5.7% for the 10% rebate and 8.5% for the 25% rebate)

4. Price Reductions

EVIDENCE SUGGESTS THAT REDUCING THE PRICE OF HEALTHY FOOD, PARTICULARLY FRUITS AND VEGETABLES, HAS A POSITIVE EFFECT ON PURCHASES AND INTAKE.

Three experimental studies have measured the effect of reducing prices of healthy products, and all reported at least 1 positive dietary outcome. The 1 study that had a large low-income population found mostly positive effects on fruit and vegetable purchases and consumption, and mixed results for beverage purchases and intake. All found a positive effect of discounts on fruit and/or vegetable purchases, and 2 on produce intake.[41, 42] The impact of changing beverage prices on SSB intake or purchase is limited to 3 studies; 1 reported a null effect on SSB intake and 1 on purchases,[43] while 1 found an unexpected intervention effect of an increase in SSB purchases.[42] The only study that measured weight status found null results for body weight and body fat; however, anthropometric changes would not be expected to manifest within the 8 week study duration.[41]

Evidence from 7 natural experimental studies of data representative of the US population suggests an inverse relationship between fruit and vegetable prices and weight status and a positive relationship between SSB prices and weight status.

In all the studies, increases in healthy food consumption or purchases were not maintained a few months after the withdrawal of the discount. It should also be noted that the interventions that discount the prices of fruits and vegetables do not seem to reduce purchasing or intake of less healthy items, and 1 study showed that individuals may spend the money they save on unhealthy products.[42]

Table 4a. Summary of experimental studies of price reduction interventions.

First Author, Yr.	Population	Intervention Description	Outcomes Measured	Results (effect size)
Geliebter et al., 2013[41]	Overweight and obese shoppers recruited from within the store and via study advertisements 2 supermarkets Manhattan, New York City, NY USA	50% discount on FVs and low-calorie beverages Duration: 8 weeks	FV purchases FV intake Non-caloric beverage purchases Non-caloric beverage intake SSB intake Total daily energy intake Body weight Body fat	+ ($0.5/day increase) + (1.4 servings/day) Ø Ø Ø Ø Ø Ø
Ni Mhurchu et al., 2010[43]	8 supermarkets New Zealand	12.5% discount on select healthy foods including healthier cereals, meat, milk, fats and FVs Duration: 6 months Follow-ups: 6 and 12 months	Healthier product purchases FV purchases Less healthy food purchases SSB purchases	+ (112g/day at 6 months and 54 g/day at 12 months) + (69 g/day at 6 months and 40 g/day at 12 months) Ø Ø

Ball et al., 2015[42]	Female primary household shoppers (44% low-SES) Supermarkets Melbourne, Australia	20% price reduction on all FVs, low-cal carbonated drinks, and water applied at checkout using store loyalty card Duration: 3 months Follow-ups: 3, 6 and 9 months	Total vegetable purchases Total fruit purchases Bottled water purchases SSB purchase Vegetable intake Fruit intake SSB intake	+ (33 g/day increase) + (52 g/day increase) Ø Ø Ø + (35 g/day increase) - (10 ml/day increase)

Table 4b. Summary of natural experimental studies of the relationship between price and weight.

First Author, Yr.	Population	Analysis	Outcomes Measured	Results (effect size)
Han, et al., 2012[44]	Representative sample of US population USA	Longitudinal individual fixed effects model using the Panel Study of Income Dynamics (PSID) including three waves of data in 1999, 2001, and 2003. A simulated 20% reduction in the price of FVs	BMI Probability of obesity	+ (20% reduction in the price of FV would decrease BMI more for SNAP participants than non-participants) + Increased probability of obesity among male SNAP participants
Han & Powell, 2011[45]	Young adults aged 12-32 USA	Longitudinal individual random effect and fixed effect models were estimated using a retrospective cohort study to determine whether food prices had an effect on obesity prevalence	Prevalence of obesity	Ø (prices of fast food, FV and soft drinks did not affect prevalence of obesity after controlling for individual characteristics and year fixed effects)
Powell & Han, 2011[46]	Representative sample of US population USA	Individual-level fixed effect (FE) models to examine the relationship between adult BMI and food prices using data from the PSID	BMI	+ (higher FV prices are significantly related to higher BMI only among women: $1 increase in price results in a 0.62 unit increase in BMI)
Wendt & Todd, 2011[47]	Nationally representative sample of children USA	Estimated the effect of food prices on children's BMI using variation in food prices across time and geographic areas using the Early Childhood Longitudinal Study (ECLS-K) of kindergarten students during the 1998-99 school year followed until the 2006-07 school year	BMI BMI	+ (lower prices for healthier food such as low-fat milk and green vegetables were associated with decreases in child BMI) + (lower prices for soda, 100% juice, starchy vegetables and sweet snacks were associated with increases in child BMI)
Powell & Bao, 2009[48]	Nationally representative sample of young adults and their children USA	Random effects estimation models using the 1998, 2000 and 2002 waves of the 1979 cohort of the National Longitudinal Survey of Youth combined with FV price data obtained from the American Chamber of Commerce Researchers Association	BMI	+ (10% increase in the price of FVs was associated with a 0.7% increase in child BMI)
Powell &	Children aged	Cross-sectional and individual-	BMI z-score	+ (higher fruit and

Caloupka, 2009[48]	6-19 USA	level fixed effects (FE) models to examine the relationship between child weight and fast food and FV prices. Using the Child Development Supplement of the Panel Study of Income Dynamics		vegetable prices are statistically significantly related to a higher BMI percentile among children, with greater effects among low-income children)
Sturm & Datar, 2008 [49]	Longitudinal, nationally representative sample of kindergarten students USA	Estimated the effect of the price index for FVs on the change in BMI of children via an analysis of ECLS-K data	BMI	+ (areas where FV prices are 1 standard deviation higher, the BMI of children are greater by an additional 0.11 units by 3rd grade and 0.20 units by 5th grade)

5. Monetary Incentives + Store-based Educational or Promotional Activities

THE MAJORITY OF INTERVENTIONS THAT COMBINED MONETARY INCENTIVES WITH STORE-BASED ACTIVITIES SHOWED POSITIVE EFFECTS, PRIMARILY ON PURCHASES. THE DISPARATE NATURE OF THE ACTIVITIES PREVENTS DRAWING CONCLUSIONS ABOUT THE POTENTIAL OF ENHANCING THE IMPACT OF DIFFERENT STORE-BASED ACTIVITIES.

Six studies have investigated the impact of offering coupons, vouchers or price reductions combined with store-based activities. Most of the interventions focused on fruits and vegetables. The evidence of effectiveness is generally positive for a range of store types and sizes: 4 studies reported at least 1 positive outcome and 2 reported null effects. All of the studies measured healthy food purchases and 4 found a positive intervention effect for at least 1 food item.[42, 50-53] Two studies found all null results.[54, 55] Neither of the 2 studies that evaluated fruit and vegetable intake found an effect.[42, 55] Of the 2 studies with substantial proportions of low-income individuals, one was effective for healthy food purchases, and one reported mixed impacts on fruit and vegetable purchase and consumption and a null effect on SSB intake. There is no evidence on the effect of the combined interventions on weight status outcomes.

Table 5. Summary of monetary + store-based component interventions.

First Author, Yr.	Population	Intervention Description	Outcomes Measured	Results (effect size)
Ball et al., 2015[42]	Female primary household shoppers (44% low-SES) 2 supermarkets Melbourne, Australia	20% price reduction on all FVs, low-cal carbonated drinks, and water; tailored skill-building newsletters with recipes, activities such as budgeting worksheets, goal-setting and self-monitoring activities, and access to an online forum to interact with other women and a dietitian Duration: 3 months Follow-ups: 3, 6 and 9 months	Vegetable purchase Fruit purchase FV intake SSB consumption	Ø + (39 grams/day) Ø Ø

Gittelsohn et al., 2010[52]	Mainly Black, low-income adults 17 food stores Baltimore, MD USA	Financial incentive card (buy 3 get 1 free) and coupons; cooking demonstrations and taste-tests; print materials; support for store managers (nutrition education and wholesaler gift cards and/or small amounts of the target foods) Duration: 18 months	Healthy food purchase	+
Van Assema et al., 2006[54]	Butcher shop customers 18 butcher shops Netherlands	20% price reductions for lean meat products; print materials in butcher shops; TV, radio, and newspaper advertisements; and employee training Duration: 2 months	Lean meat purchase	Ø
Bamberg et al., 2002[50]	University students 1 bio-shop Germany	$7.50 voucher for FVs and a promotional message Duration: 1 week	Organic FV purchase	+
Kristal et al., 1997[55]	8 supermarkets Rural IA USA	50-cent discount coupon for any FV purchase; shelf labels, food demonstrations and distribution of flyers that advertised and promoted the purchase of on-sale produce items and offered recipes. Duration: 8 months	FV purchase FV intake	Ø Ø
Paine-Andrews et al., 1996[51]	1 supermarket Middle-income area KS USA	20-25% discount coupons, verbal encouragements and taste-tests Duration: 1 day	Purchase of healthy food (shopping cart observations)	+

6. Taxes

EVIDENCE IS LIMITED BUT PROMISING FOR THE IMPACT OF TAXES ON SSB PURCHASE AND CONSUMPTION AND INCONCLUSIVE FOR WEIGHT STATUS.

Nine natural experimental studies have evaluated the effect of taxing SSBs or snacks, including 4 on SSB intake, [56-59] 2 on SSB purchases,[58, 60] 6 on BMI,[57, 58, 61-63] and 2 on overweight and/or obesity prevalence.[57, 61] Half of the studies found a positive effect on at least 1 outcome. One study found that although an increase in the SSB tax rate was associated with decreased SSB consumption, the tax also increased the caloric intake of whole milk in children, potentially reducing the effect of the tax on total calorie intake.[57]

The Berkeley SSB tax was found to be effective among residents of low-income high-minority neighborhoods. Three other studies conducted analyses by income status—1 found a significant effect only on low-income families, and 2 found a greater effect among lower-income populations. One study also found a stronger effect among black children compared to the entire study sample.

The evidence suggests taxes might be effective, but additional evidence is needed to draw a conclusion. It should be noted that taxes have the added benefit of generating revenue that could be used to fund health-promoting initiatives.

Table 6. Summary of tax interventions.

First Author, Yr.	Population	Analysis/Intervention	Outcomes Measured	Results (effect size)
Falbe et al., 2016[56]*	Low-income neighborhoods with high proportions of Black and Hispanic residents Berkeley (intx); San Francisco and Oakland (controls) CA USA	A $0.01-per-ounce tax on distribution of SSBs, including soda; energy, sports, and fruit-flavored drinks; sweetened water, coffee, and tea; and syrups used to make SSBs (non-SSBs such as diet soda were not taxed).	SSB intake (intercept surveys)	+ (21%reduction in Berkeley and 4%increase in the control cities)
			Soda intake	+ (26% reduction in Berkeley and 10% increase in control cities)
			Water intake	+ (63% increase in Berkeley vs 19% increase in control cities)
			Sport and energy drink intake	Ø
			Fruit drink intake	Ø

Colchero et al., 2016[60]	Mexican households Mexico	National 10% tax on non-dairy and non-alcoholic beverages with added sugar Compared the predicted volumes (mL/capita/day) of taxed and untaxed beverages purchased in 2014—the observed post-tax period—with the estimated amounts that would have been bought if the tax had not been implemented (counterfactual) based on pretax trends	SSB purchases	+ (6% reduction on taxed SSB purchases; the effect was greatest among low-income households:-9.1%)
Fletcher et al., 2010a[57]	Children and adolescents aged 3-18 years USA	Combined soft drink tax data between 1989 and 2006 with the restricted-access version of the nationally representative National Health Examination and Nutrition Survey (NHANES) to examine the effects of soft drink taxes on child and adolescent consumption, substitution patterns, and weight outcomes	SSB intake	+ (1% increase in the SSB tax rate reduced the amount of kcals consumed by SSB by nearly 6 kcal/day)
			Whole milk intake	- (1% increase in SSB tax rate increases caloric intake from whole milk by almost 8 kcal per day)
			BMI z-score	Ø
			% overweight	Ø
			% obese	Ø
Fletcher et al., 2010b *[61]	Population USA	Analyzed the impact of changes in states' soft drink taxation rates from 1990 to 2006 on BMI and obesity status using repeated cross-sections of the Behavioral Risk Factor Surveillance System (BRFSS)	BMI % overweight % obese	+ + + (1% increase in the state soft drink tax rate led to a decrease in BMI of 0.003 points and a decrease in obesity and overweight of 0.01% and 0.002% respectively. The effect was larger in the lowest category of income: <$10,000, and for Hispanics)
Sturm et al., 2010[58]	Children USA	Combined individual-level national data from the Early Childhood Longitudinal Study—Kindergarten Cohort (ECLS-K) with data on state-level soda tax rates in effect during the year in which the longitudinal study data were collecte.	SSB intake	Ø
			SSB purchase at schools	+ (Only for low-income families: an increase in the soda tax by 1% led to a 0.039 reduction in school purchase; and Black students: 1% increase led to a 0.103 reduction)
			BMI	+ (an increase in the soda tax by 1% is associated with a 0.013 reduction in BMI)

Powell et al., 2009[63]	Adolescents aged 12-19 years USA	Associations between state-level grocery store and vending machine soda taxes and adolescent BMI based on Monitoring the Future surveys 1997-2006	BMI	Ø
Kim et al., 2006[64]	Adults USA	Associations between state-level soft drink or snack food taxes between and relative increases in obesity prevalence between 1991 and 1998	BMI	Ø
Oaks et al., 2005[62]	Adults ME USA	Assess the impact of snack taxes on obesity rates using BRFSS data	BMI	Ø
Bahl et al., 2003[59]	Adults Ireland	Reduction of an existing national SSB tax by 22%	SSB intake	+ (the decrease of the tax resulted in a 6.8% increase in consumption)

III. Store-Based Interventions

Experimental studies of store-based interventions have included print-based educational/promotional materials with or without media campaigns (16 studies); audiovisual nutrition education (9 studies); multicomponent strategies that include activities aimed at improving healthy food availability and/or placement (10 studies); and product placement manipulations (2 studies).

1. Print Materials

THE IMPACT OF PRINT EDUCATIONAL/PROMOTIONAL MATERIALS, WITH OR WITHOUT A MEDIA CAMPAIGN, ON PURCHASES AND CONSUMPTION IS NOT DISCERNABLE FROM THE EXISTING EVIDENCE BECAUSE STUDIES REPORT A MIX OF POSITIVE AND NULL EFFECTS.

Fifteen studies of 14 interventions have evaluated the impact of in-store print-based educational/promotional materials including shelf tags, posters, brochures, recipe cards and/or cart placards—4 with and 10 without a media campaign—on purchases (n=13) or consumption (n=1) of targeted products. Thirteen interventions took place in supermarkets and 1 in a grocery store.

Four interventions demonstrated positive results only.[65-68] Four other interventions demonstrated at least one positive outcome,[69-72] of which 3 had at least one null outcome[70-73] and 1 had at least one negative outcome.[69] Six interventions demonstrated only null results.[68, 69, 74-78]

In sum, print-based nutrition education/promotion interventions can be, but are not consistently, effective in improving food and beverage purchases. The nature of the interventions varied widely, and it is not possible to determine why some demonstrated effectiveness while others did not. Moreover, since none of the studies specifically targeted low-income populations, the potential impact on SNAP-Ed participants is uncertain. One study with a predominately Hispanic population did demonstrate a positive impact on fruit and vegetable purchases.

Table 1. Summary of print-based nutrition education/promotion with or without media campaign interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results
Payne et al., 2014[65]	Predominately Hispanic grocery store shoppers 2 grocery stores El Paso, TX USA	Placards on shopping carts with social norms messages about FV purchasing Duration: 2 weeks	FV purchases (store sales data)	+
Ogawa et al., 2011 [66]	Supermarket shoppers 2 supermarkets Niigata Prefecture, Japan	Posters with health information about vegetables in the produce section and at checkout counters Duration: 3 months	Vegetable purchases (store sales data)	+
Steenhuis et al., 2004 [74]	Supermarket shoppers 13 supermarkets Netherlands	Shelf labels identifying low-fat products, posters, a brochure, a self-help manual, and recipe cards Duration: 6 months Follow-ups: 2 and 6 months	Total fat intake	Ø
Reger et al., 1998[67]	Supermarket shoppers 14 supermarkets Clarksburg and Bridgeport (intx); Wheeling (control), WV USA	Taste-tests and dairy case signage at supermarkets Newspaper, radio and television ads, public relations efforts, school-based educational events, and activities, and worksite presentations Duration: 3 months Follow-ups at 3 and 6 months	Purchases of low-fat milk (stores sales data)	+
Teisl et al., 1997[69]	Supermarket shoppers 25 supermarkets Connecticut Rhode Island New Hampshire Massachusetts USA	Shelf tags highlighting products reduced in fat, cholesterol, sodium, or calories within 6 product categories Duration: 4 years	Purchases of targeted products, including: milk, peanut butter, refried beans, cream cheese, mayonnaise and salad dressing (store sales data)	+ milk, peanut butter, refried beans and cream cheese - mayonnaise and salad dressing
Rodgers et al., 1994 [70]; **Patterson et al., 1992**[73]	Supermarket shoppers 40 supermarkets Washington, DC (intx) and Baltimore, MD (control) USA	Eat for Health + Special Diet Alert Program Shelf labels; a food guide containing calorie, fat, cholesterol, sodium, and fiber values for all items carrying the shelf labels; a monthly bulletin containing nutrition information and recipes; signs in the produce department; and a multimedia advertising campaign	Purchases (self-reported) of recommended higher-fiber, low-fat foods, including whole milk, high-fat foods, low-fat milk, poultry and fish, fruits and vegetables, whole grains, potatoes, bakery/snacks and beans	Ø, except + for beans and bakery/snack items

		Duration: 2 years Follow-ups at 1 and 2 years	Purchases of recommended foods (store sales data)	+/Ø by product category
Schucker et al., 1992[71]	Supermarket shoppers 19 supermarkets Baltimore, MD (intx) and Washington DC (control)	Eat for Health + Special Diet Alert Program (same as above) Replicated the intervention described above but included labels on additional packaged food categories for products low in sodium, calories, fat and cholesterol, or having a 2: 1 or greater ratio of polyunsaturated to saturated fat. Duration: 2 years	Purchases of shelf-tagged healthy products (store sales data)	+/Ø
Achabal et al., 1987[75]	Supermarket shoppers 372 supermarkets in the metropolitan areas of Dallas, TX; San Francisco, CA; and Washington, DC USA	Signs displaying a produce item along with selection advice, calorie content, and key nutrients; similar signs that contained no information on calories or key nutrients; or neither type of sign. Duration: 4 weeks for each condition	Purchases of broccoli, cabbage, carrots, cauliflower, tomatoes, and kiwifruit (store sales data)	Ø
Ernst et al., 1986[76]	Supermarket shoppers 20 supermarkets Washington, D.C., area (intx) and Baltimore, Maryland (control) USA	Series of 4-page brochures, on the importance of reducing dietary fat, cholesterol and calories; shelf signs near targeted food items and advertisements in newspapers and on radios; window signs, banners and posters Duration: 1 year	Purchases of low-fat milk, oils low in saturated fat, margarine, low-fat cottage cheese, lean beef yogurt, chicken, eggs, salt (store sales data)	Ø
Russo et al., 1986 A[68]	Supermarket shoppers 14 supermarkets Chicago, IL USA	Displayed posters with nutrition information for vitamins, minerals, calories and protein and offered take-home informational handouts Duration: 8 months	Nutritional quality of food purchases in 6 categories: breakfast cereals, frozen vegetables, canned soup, canned and bottled fruit and vegetable juice, and frozen TV dinners (store sales data)	Ø
Russo et al., 1986 B[68]	Supermarket shoppers 2 supermarkets	Displayed posters listing added sugar content in breakfast cereals Offered take-home copies with additional information	Purchases of sugary cereal (store sales data)	+

	Chicago, IL USA	about how and why to reduce sugar intake Signs and arrows posted around the store to alert customers to the nutrition posters Duration: 8 months		
Levy et al., 1985[72]	Supermarket shoppers 20 supermarkets Washington DC (intx) and Baltimore, MD (control) USA	Special Diet Alert Program consisting of: Shelf labels flagging specific brand-name products as low or reduced in calories, fat, cholesterol and sodium; 25-page information guide booklet explaining the SDA program Multi-media campaign with radio and TV ads Duration: 2 years	Purchases of products targeted for their fat, calorie, cholesterol content: canned fruit, butter/margarine, canned fish, fresh milk, cottage cheese, mayonnaise, fruit juice, soft drinks and cheese (store sales data)	+ butter margarine, canned fish, cottage cheese, mayonnaise, fruit juice, frozen vegetables, soft drinks and tomato sauce Ø canned fruit, fresh milk, soft drinks and cheese
Jeffery et al., 1982[77]	Supermarket shoppers 8 supermarkets Twin Cities Metropolitan area, MN USA	Posters, recipes and brochures designed to inform shoppers of the fat content of foods, placed in the dairy section during a 6-month period Duration: 9 months	Purchases of 25 dairy section items including eggs, cottage cheese, milk and cream, yogurt and frozen desserts (store sales data)	Ø
Soriano et al., 1978[78]*	Supermarket shoppers 3 supermarkets Fresno, CA USA	Index card brochures distributed in stores designed for home use Duration: 4 months	Purchases of targeted items	Ø

*Paper not available, so the information presented is based on the abstract and information provided in review papers.

2. In-Store Audio-Visual Nutrition Education

Store-based audio-visual nutrition education, provided with or without print educational materials, demonstrates mixed effectiveness for changing dietary behaviors.

Nine studies have investigated the impact of store-based audio-visual nutrition education including store tours, interactive computer kiosks, in-person nutrition education, taste-tests and cooking demonstrations, and audiotapes, with or without print-based educational materials. Seven took place in supermarkets, 1 in large and small food stores, and 1 in an online supermarket.

Three studies reported only positive results for consumption and/or purchases,[79-81] 3 a mix of positive, null and/or null outcomes,[82-84] and 3 only null and/or negative results.[42, 85, 86] Seven studies reported purchase outcomes, of which 5 found a positive effect on at least one targeted product and 5 found at least one null effect. Two studies measured fruit and vegetable intake;[42, 80] 1 found a positive effect and 1 found a null effect. The latter study also reported a null finding for water intake and an adverse effect

for SSB intake.[42] The only study that measured overall dietary quality (HEI) and calorie intake reported null effects; however, it was a pilot with a small sample.[85, 86] Only one study had a low-income sample and only one was among a minority population, so the impact on underserved communities is not discernable.

In the case of interventions that required a large time investment, participants might have been particularly motivated to participate which could introduce selection bias; thus, the results might not be replicable in the general population. [79, 80, 85]

Table 2. Summary of audio-visual nutrition education +/- print material interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results (effect)
Lewis et al., 2015[85]	Predominantly Black individuals with obesity trying to lose weight (recruited via healthcare provider) 1 supermarket grocery store Atlanta metro area, GA USA	Three 1-hour in-person nutrition education sessions with a nutritionist covering MyPlate, food groups, portion control, label and nutrition facts reading, food preparation, etc. The dietician used the store to facilitate learning. Control group received standard nutrition education in the clinical setting Duration: 3 months	HEI score Calorie intake	Ø Ø
Ball et al., 2015[42]	Female primary household shoppers (44% low-SES) 2 supermarkets Melbourne, Australia	Tailored skill-building behavior change intervention including newsletters with recipes, activities such as budgeting worksheets, goal setting and self-monitoring activities, and access to an online forum to interact with other women and a dietitian. Duration: 3 months Follow-up at 3, 6 and 9 months	FV purchases (loyalty card-based electronic sales data) FV intake SSB purchases SSB intake Bottled water purchase and intake	Ø Ø - (37 ml/day increase) - (11 ml/day increase) Ø
Milliron et al., 2012[82]	Supermarket shoppers 1 supermarket Socioeconomically diverse region of Phoenix, AZ USA	In-person nutrition education sessions Shelf tags, and distribution of healthy shopping lists, monthly newsletters, and recipes Control group was exposed to shelf tags only Duration: 4 months	Fruit purchases (receipt and nutrition label data) Vegetable purchases Fat content (total, saturated and trans) of purchases	+ Ø Ø

Gittelsohn et al., 2007[84]	Grocery shoppers 23 stores (9 large and 3 small food stores (intx) and 11 control stores) Republic of the Marshall Islands	In-store cooking demonstrations, taste tests, shelf labels Mass media campaign including radio announcements, newspaper ads, and video Follow-up at 2.5 months	Purchases of healthy foods (self-reported frequency during past month)	+ oatmeal, turkey chili, fish, canned fruit and local vegetables Ø low-fat powdered milk, 100% juice, equal, pretzels, noodles, imported FVs, local fruit, frozen FVs - low-fat and evaporated milk, diet soda, low-fat cereal, low-fat ramen, cooking spray, canned vegetables
Huang et al., 2006[81]	Online supermarket service Sydney, Australia	Participants received automated purchase-specific recommendations for specific switches from products higher in saturated fat to alternate similar products lower in saturated fat. Participants assigned to control received general advice about how to eat a diet lower in saturated fat. Duration: 6 shopping episodes	Saturated fat purchases (grams per 100 grams of food in shopping baskets)	+
Connell et al., 2001[80]	Regular supermarket shoppers 6 supermarkets Eastern MA USA	The intx group was given two 1-hour audiotapes and asked to listen to them within the next 4 weeks. They were also exposed to in-store public service announcements (PSAs) with information about fruits and vegetables were rotated every 30 minutes for four weeks. The control group was given audiotapes on stress reduction	FV intake (self-reported)	+
Silzer et al., 1994[79]	Grocery shoppers 1 supermarket Hamilton, Ontario Canada	One 2-hour supermarket tour about food label interpretation, food purchasing and meal preparation, and dietary fat, salt, fiber Follow-up at 1 month	Healthy food purchases (self-reported)	+
Winett et al., 1991[83]	1 supermarket Rural southwestern VA	A multi-media computer kiosk, watching 6 weekly video segments and receiving feedback on intended purchase	Purchases of select high-fat/low-fat and high-fiber	+ high-fat meat, high-fiber grains/cereals, hat-fat dairy,

	USA	and guidance on goal-setting Duration: 7-8 weeks Follow-up: 10-11 weeks	items (sales receipt data)	low-fat dairy Ø low-fat meat, fruits/vegetables, low-fat fish/poultry
Dougherty et al., 1990[86]	Grocery shoppers 3 supermarkets Suburban northern NJ USA	Print materials, videocassettes shown in-store, live nutrition education demonstrations, all targeting protein-rich foods, fats and oils, dairy products and convenience foods Duration: 6 months	Purchases of low-fat foods (store sales data)	Ø

3. Multicomponent Store Interventions: Product or Placement +/- Promotion

EVIDENCE ON MULTICOMPONENT IN-STORE INTERVENTIONS SHOWS INCONSISTENT EFFECTIVENESS. THE DISPARATE NATURE OF STRATEGIES USED MAKES IT DIFFICULT TO DRAW CONCLUSIONS ABOUT INDIVIDUAL COMPONENTS.

Ten studies have evaluated the effect of a combination of in-store strategies, including improving availability, visibility and/or placement of healthy products in combination with other activities. All of the interventions used marketing strategies to promote healthy food purchases, 8 improved the stocking of healthy food items, 7 provided training to the store owners and/or staff on intervention strategies, and 6 used taste-tests to promote healthy foods. Interventions were implemented in corner stores, other small stores and/or supermarkets. All studies, except one, targeted disadvantaged populations characterized by low SES and high prevalence of racial/ethnic minorities.

Nine studies measured a variety of food/beverage purchases [87-96] and reported a mix of positive and null results. Only 1 study reported *only* a positive purchase outcome. [97] Three studies assessed dietary intake [52, 87, 98] and reported mostly null results, except for 1 study that detected a positive impact on HEI and water consumption among children. [52] Of the 3 studies that measured a weight status outcome,[89, 92, 97] 1 found a positive impact, but only among participants with the highest level of exposure to the intervention.[89]

Table 3. Summary of store conversion interventions.

First Author, Yr.	Population	Intervention Description	Outcomes Measured	Results
Ortega et al., 2016[87]	Latino adults living in 2 urban communities with a high prevalence of overweight and obesity 8 corner stores Less affluent communities Los Angeles, CA USA	Increased stocking of FV (added ≥12 new FVs to the inventory), new signage, paint, security upgrades, store layout alterations, product placement, social marketing promotions for healthful eating, training for store owners and refrigeration equipment for fresh FVs Duration: 2 years Follow-up: 12 and 24 months	FV purchase FV intake	Ø Ø

Surkan et al., 2016[96]	2 supermarkets Low-income, urban and predominantly African American neighborhoods in Baltimore, MD USA	Increased stocking of healthy foods; shelf labels and signage for promoted foods (low-fat, low-sodium, healthier sugar level, 100% juice, and better choice); taste tests; advertisements for price reductions; store staff training; and community outreach events. Reinforcement activities: recipe cards and store tours Duration: 4 months	Purchase of 385 healthy foods items Purchase of FVs Purchase of SSBs, snacks and dessert purchase Purchase of dairy products Purchase of grain products (sales data)	+ + + - Ø
Martinez-Donate et al., 2015[93]	4 supermarkets 2 rural Midwestern communities USA	Labeling, promoting and increasing the availability of healthy foods, through activities including store signage, healthy recipes, store displays, promotional activities and staff training. Duration: 10 months	Purchase of healthy foods promoted by the intx Healthfulness of overall food purchase	Ø +
Foster et al., 2014[88]	8 supermarkets Urban low-income, high-minority neighborhoods in Philadelphia, PA, and Wilmington, DE USA	Marketing strategies to promote the visibility of and access to healthier food items including: prime placement of healthy foods, signage, cross promotion, taste-tests, and increased number of facings of recommended products Duration: 6 months	Purchase (sales data) of healthy food items targeted by the intx Purchase of SSBs Purchases of skim and 1% milk Purchase of whole and 2% milk Purchase of cereals Purchase of water	Ø Ø + Ø Ø +
Lent et al., 2014[92]	4th-6th grade low-income youth in 10 schools (82% of students qualified for free or reduced-price meals) <10% white 24 corner stores Low-income neighborhoods in Philadelphia, PA USA	3 main components: i) corner-store level initiatives: increased stocking of healthier items, owner training, adding signage identifying healthy items, water and whole fruit priced competitively, refrigeration provided to stock fruit; ii) classroom-based nutrition education lessons on the identification of healthy snacks, label reading, energy intake; iii) branded social marketing campaign: printed giveaways, banners, web site, comic book and video Duration: 2 years Follow-ups: 1 and 2 years	Total energy purchase (kcal) Fat, sodium, carbohydrate, sugar, protein or fiber content of purchases BMI BMI z-score % overweight % obese	Ø Ø Ø Ø Ø Ø
Ayala et al., 2013[98]	Mainly Latino low-income grocery shoppers 4 tiendas NC USA	3 components: (i) employee and manager trainings; (ii) 8-week food marketing campaign that included a point-of-purchase component, food demonstrations and an audio-based media campaign; and (iii) equipment for structural changes	FV intake	Ø

		and improve placement of FV and healthy items Duration: 4 months		
Gittelsohn et al., 2013[89]	10 designated store regions spanning the Navajo Nation New Mexico, Arizona and Utah USA	Encouraging stores to stock healthier foods, point of purchase promotions (shelf labels, posters, giveaway items) interactive sessions (cooking demonstrations, taste-testing), and media (radio and newspaper) Duration: 14 months	Healthy food purchases Unhealthy food purchases BMI	+(only among participants with the highest level of intx exposure) Ø + (only among participants with the highest level of intx exposure)
Gittelsohn et al., 2010[90]	Predominately Native Hawaiian or other Pacific Islander caregivers and their children 5 food stores Low-income multi-ethnic communities Oahu and Big Island, HI USA	Increasing stocking of healthy foods and using shelf labels, food demonstrations and taste tests to target healthier beverages, snacks, condiments and meals; also involved local producers/distributors training and had a nutrition education component with in-store displays and posters and take-home printed materials (brochures and recipes) Duration: 9-11 months	Healthy food purchasing score Unhealthy food purchasing score Healthy food intake score Consumption of targeted foods HEI score Water intake	Ø Ø Ø Ø + only among children + only among children
Song et al., 2009[95]	7 corner stores and 2 supermarkets Low-income, predominately Black urban communities Baltimore, MD USA	Encouraged supermarket and corner store owners to stock and promote 10 healthy foods (low-sugar or high fiber cereals) using shelf labels, taste tests, incentives and giveaways, educational displays, posters and flyers. Store owners received a small monetary incentive for initial stocking costs, a nutrition education session, guidelines for purchasing, stocking and placing healthy foods and strategies for building better relationships with the community Duration: 10 months	Purchase of healthy foods (sales data translated into an overall score) Low-sugar cereals High-fiber cereals Low-fat milk Cooking spray Baked/low-fat chips Low-salt crackers Whole wheat bread Diet soda/diet drinks 100% fruit juice Water	+ Ø Ø Ø + Ø Ø Ø Ø Ø Ø
Ho et al.,	4 First Nation	Increased stocking and promotion of	Purchases of	+

2008[97]	sites Northwestern Ontario Canada	healthy foods (produce, low-fat dairy, water, whole grain, and snacks), displaying shelf labels and signage, print materials, cooking demonstrations, taste tests, and advertising through radio, TV, newsletters, and bulletin boards Included a school component: revised curriculum to promote healthy eating Duration: 10 months	healthy foods BMI % Body Fat	 Ø Ø

4. Product Placement Interventions

Evidence on in-store product placement strategies (in the absence of other intervention components) is limited and variable.

Two studies have evaluated the efficacy of strategic product placement aimed at making healthier product options more convenient and accessible. One study took place in a supermarket and did not impact bread purchases.[99] The other was implemented in a food pantry and had a positive effect on clients' dessert selection.[100] There is insufficient evidence to determine the impact of interventions that only change product placement.

Table 4. Summary of product placement interventions.

First Author, Yr.	Sample Population	Intervention Description	Outcomes Measured	Results
De Wijk et al., 2016[99]	Supermarket shoppers 2 supermarkets Veenendaal Netherlands	Modified the shelf position of bread so that healthier options were encountered first in the aisle (whole grain bread was placed at the entrance of the aisle, followed by dark wheat bread, wheat bread, light wheat bread, and white bread) Duration: 6 weeks	Healthier bread purchases (sales data)	Ø
Wilson et al., 2016[100]	Clients at 1 food pantry NY USA	Offering healthier options at the beginning versus end of the table of desserts Duration: 4 days	Selection of healthier dessert options (granola bars vs. brownies, cookies, pies, cakes, and pastries, etc.)	+

Conclusion

This review presents the current evidence on the effectiveness of retail food store-related strategies for nutrition promotion and obesity prevention. We reached the following conclusions based on our synthesis of the literature on this specific setting:

1. Offering **monetary incentives** for healthy food purchases is the most promising strategy for increasing healthy food purchases and consumption, particularly for fruits and vegetables. Monetary incentives, including coupons, vouchers, rebates and price reductions, have demonstrated effectiveness in a variety of retail settings. This finding is consistent with evidence indicating that low-income consumers are especially price-sensitive. However, there is no evidence to date to show a positive impact of monetary incentives on weight status.
2. **Taxing unhealthy products** has been inadequately studied to assess the effect; however, evidence on SSB taxes suggests it may be a promising approach for impacting purchases and consumption of SSBs, particularly for low-income populations.
3. Improving access to healthy food by opening **new supermarkets** in underserved areas does not show promise for improving healthy food purchases, consumption or BMI. This finding is consistent with data showing that low-income populations primarily shop at supermarkets even when geographical access is limited.
4. Increasing access to healthy food, through **free produce delivery** to neighborhoods or individual households, shows promise for increasing fruit and vegetable consumption, but more evidence is needed to draw a firm conclusion.
5. Offering **nutrition education and promotion** through retail outlets, via print materials or audio-visual mediums, is not consistently effective. The existing literature does not inform the components critical to the effectiveness of these interventions, thereby limiting our ability to make specific recommendations.
6. Improving existing food retail outlets to promote healthy purchases (**multicomponent store interventions**), by increasing the availability of healthy products, making infrastructure changes, training store managers, and/or providing nutrition education/promotion has not been found consistently to have a positive impact on purchases or consumption.
7. There is no experimental evidence regarding other strategies, such as developing **farmers' markets, gardens, food hubs, or food co-ops**.

Taken together, the existing evidence on retail food shopping strategies supports the effectiveness of monetary incentives for promoting healthy food purchases and improving diet, and the ineffectiveness of opening new supermarkets in underserved areas. These findings are consistent with research showing that low-income households' shopping behaviors are most influenced by prices and, as a result, people shop at supermarkets, regardless of having to travel distances to do so.

Evidence on the other retail food shopping intervention strategies is inconclusive. For some interventions, the paucity of evidence provides inadequate insight to draw conclusions and for others, the studies are too dissimilar with respect to the intervention activities studied, outcomes targeted and/or measured, and results observed to determine which intervention activities are likely to be effective and for which outcomes. For some interventions, such as increasing EBT acceptance at farmers' markets, we found no experimental or natural experimental evidence.

For most intervention strategies, there are examples of both effective and ineffective interventions in the literature. Moreover, the evidence is inadequate to determine the extent to which the effects of successful interventions are reproducible or generalizable. In sum, this review found a general dearth of high-quality evidence to inform the impact of retail food shopping-based interventions for nutrition promotion and obesity prevention. Monetary incentive interventions are the only type for which there is sufficient positive evidence to infer a likely impact.

Additional research is needed to inform evidence-based retail shopping interventions and guide the investment of SNAP-Ed funds. Research on the determinants of food shopping, purchasing and consumption behaviors among low-income populations is also needed to illuminate the most promising targets for intervention. Devoting resources to interventions for which there is no evidence of effectiveness should be considered carefully and evaluated against other interventions for which there is more evidence. When retail interventions are implemented, particularly innovative interventions or those with little evidence base, rigorous evaluations should be conducted to measure impact.

Lastly, it is important to consider the retail food store literature in context of the broader literature on nutrition promotion and obesity prevention when developing multi-setting SNAP-Ed strategies.

The retail food store literature can be characterized generally by the following evidence classifications:

- **Promising evidence:** Price interventions (vouchers/coupons, rebates, price reductions, monetary incentives)
- **Inconsistent evidence:** Store-based interventions (in-store print materials, audio-visual education, multicomponent)
- **Insufficient evidence:** Access interventions (new supermarkets, free produce delivery)
- **No evidence:** farmers' markets, food hubs, food coops, food banks, healthy checkouts, in-store availability of healthy and/or unhealthy products, among others.

Recommendations

1. **Implement price interventions wherever possible, as they are effective for improving dietary intake.** The consistent effectiveness of price interventions for improving dietary intake in the studies reviewed suggests that pricing strategies can be pursued with the expectation that they will impact intake. Care should be taken to implement interventions consistent with those that have demonstrated effectiveness. While SNAP-Ed implementing agencies are unable to engage in price interventions directly, partnerships and creative means could be pursued to implement pricing strategies that encourage healthy and/or discourage unhealthy purchases. Since there is no evidence that the impact of price interventions is sustained after the intervention ends, these interventions would need to be financially self-sustaining or a dependable long-term source of funding would need to be identified in order to ensure sustained impact.

2. **Consider interventions in supermarkets, which are likely to have a greater reach than interventions in smaller stores, including corner stores.** While SNAP-Ed work currently emphasizes small stores, interventions to increase healthy foods in these venues may have limited effectiveness on dietary outcomes in most communities. Moreover, the reach of small store interventions is limited since low-income populations purchase the vast majority of their groceries at larger stores. Only a relatively small proportion of low-income communities lack access to larger markets and stand to benefit from interventions to expand the offerings in corner stores. However, given the large and variable distances that individuals travel to shop for groceries in larger stores, it may be difficult to target specific geographic population groups effectively.

3. **Gather more information to determine whether limiting access to unhealthy foods in corner stores and other retail venues would reduce consumption of unhealthy foods.** Corner stores could be a significant source of unhealthy foods, and data suggest that access to these stores is greater in low-income areas. Decreasing access to these stores, or targeting unhealthy foods at these stores, may be more effective for improving dietary intake than increasing access to healthy foods; however, no evidence meeting our review criteria was available to assess this strategy. Any corner store strategies should be implemented on a trial basis to evaluate effectiveness prior to broader dissemination.

4. **If in-store interventions are conducted, evaluate their impact on diet and weight-related outcomes.** Overall, there is a lack of evidence suggesting that any retail food store interventions are effective at improving weight-related outcomes. Given that all types of in-store interventions (with the exception of price interventions), including multi-component interventions, sometime called "store conversions," had mixed or inadequate results with regard to purchasing, intake and weight status, any of these interventions should only be implemented on a trial basis with strong outcome evaluation. Strategies that have demonstrated success should be selected from the literature, replicated and evaluated in order to determine whether the results are generalizable and merit wider dissemination.

5. **Apply more rigorous standards to evaluate the impact of various retail strategies.** Many retail strategies, such as farmers' market interventions and limits on the availability of unhealthy foods in retail stores, remain untested by study designs that met this review's criteria. As evidence for these strategies emerges, interventions should be designed drawing upon lessons learned from the literature regarding shopping patterns and intervention design. Issues of feasibility, replicability, sustainability, and community receptiveness should be carefully considered. Any new interventions should be implemented on a trial basis with strong evaluations to assess effectiveness. If feasibility is in question, field trials should be conducted to test feasibility prior to effectiveness testing.

6. Allocate **scarce resources to: a) strategies that have been proven effective and b) additional research that is carefully designed, with adequate participation numbers and comparable outcome evaluations, to assess the impact of strategies that have not yet been proven either effective or ineffective.** Further research, carefully designed to meet rigorous qualitative and quantitative standards, is needed to identify effective measures that impact dietary, weight, and health outcomes.

References

1. Guenther PM, Krebs-Smith SM, Reedy J, et al. Healthy eating index-2005. *Center for Nutrition Policy and Promotion factsheet.* 2006;1.

2. USDA. Food Access Research Atlas. 2016.

3. Ver Ploeg M, Rahkovsky I. Recent Evidence on the Effects of Food Store Access on Food Choice and Diet Quality. *Amber Waves.* 2016:1C.
4. CDC. *The CDC guide to strategies for reducing the consumption of sugar-sweetened beverages* 2010.
5. Bank TW. World Bank Country and Lending Groups. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519.
6. Mancino L, Ver Ploeg M, Lin B-H, Joanne G. How do SNAP participation, food access and food prices affect nutritional quality of food purchases? An analysis of FoodAPS data. Paper presented at: 2016 Annual Meeting, July 31-August 2, 2016, Boston, Massachusetts, 2016.
7. Ver Ploeg M. *Access to affordable and nutritious food: measuring and understanding food deserts and their consequences: report to Congress*: DIANE Publishing; 2010.
8. Rahkovsky I, Snyder S. Food Choices and Store Proximity. *ERR-195. US Department of Agriculture, Economic Research Service.* 2015.
9. Powell LM, Slater S, Mirtcheva D, Bao Y, Chaloupka FJ. Food store availability and neighborhood characteristics in the United States. *Preventive medicine.* 2007;44(3):189-195.
10. Babey SH, Diamant AL, Hastert TA, Harvey S. Designed for disease: the link between local food environments and obesity and diabetes. *UCLA Center for Health Policy Research.* 2008.
11. Yoshida S, Woelfel T. California FreshWorks: A Case Study Examining the Development and Implementation of FreshWorks. In: Endowment TC, ed; 2016.
12. Hendrickson D, Smith C, Eikenberry N. Fruit and vegetable access in four low-income food deserts communities in Minnesota. *Agriculture and Human Values.* 2006;23(3):371-383.
13. Broda C, Leibtag E, Weinstein DE. The role of prices in measuring the poor's living standards. *The Journal of Economic Perspectives.* 2009;23(2):77-97.
14. Castner L, Henke J. *Benefit Redemption Patterns in the Supplemental Nutrition Assistance Program*: Mathematica Policy Research; 2011.
15. Ver Ploeg M, Mancino L, Todd JE, Clay DM, Scharadin B. Where do Americans usually shop for food and how do they travel to get there? Initial findings from the national household food acquisition and purchase survey. *US Department of Agriculture, Economic Research Service, Washington, DC.* 2015.
16. USDA. Food spending as a share of income declines as income rises. Available at: http://www.ers.usda.gov/data-products/chart-gallery/detail.aspx?chartId=40096, 2016.
17. Lin B-H, Ver Ploeg M, Kasteridis P, Yen ST. The roles of food prices and food access in determining food purchases of low-income households. *Journal of Policy Modeling.* 2014;36(5):938-952.
18. Cummins S, Petticrew M, Higgins C, Findlay A, Sparks L. Large scale food retailing as an intervention for diet and health: quasi-experimental evaluation of a natural experiment. *J Epidemiol Community Health.* Dec 2005;59(12):1035-1040.
19. Sadler RC, Gilliland JA, Arku G. A food retail-based intervention on food security and consumption. *Int J Environ Res Public Health.* Aug 2013;10(8):3325-3346.
20. Cummins S, Flint E, Matthews SA. New neighborhood grocery store increased awareness of food access but did not alter dietary habits or obesity. *Health Aff (Millwood).* Feb 2014;33(2):283-291.
21. Elbel B, Mijanovich T, Kiszko K, Abrams C, Cantor J, Dixon LB. The Introduction of a Supermarket via Tax-Credits in a Low-Income Area: The Influence on Purchasing and Consumption. *Am J Health Promot.* Sep 2015.
22. Elbel B, Moran A, Dixon LB, et al. Assessment of a government-subsidized supermarket in a high-need area on household food availability and children's dietary intakes. *Public Health Nutr.* Oct 2015;18(15):2881-2890.

23. Boone-Heinonen J, Gordon-Larsen P, Kiefe CI, Shikany JM, Lewis CE, Popkin BM. Fast food restaurants and food stores: longitudinal associations with diet in young to middle-aged adults: the CARDIA study. *Arch Intern Med.* Jul 2011;171(13):1162-1170.

24. Johnson DB, Beaudoin S, Smith LT, Beresford SA, LoGerfo JP. Increasing fruit and vegetable intake in homebound elders: the Seattle Senior Farmers' Market Nutrition Pilot Program. *Prev Chronic Dis.* Jan 2004;1(1):A03.

25. Kennedy BM, Champagne CM, Ryan DH, et al. The "Rolling Store:" an economical and environmental approach to the prevention of weight gain in African American women. *Ethn Dis.* 2009;19(1):7-12.

26. Quandt SA, Dupuis J, Fish C, D'Agostino RB. Feasibility of using a community-supported agriculture program to improve fruit and vegetable inventories and consumption in an underresourced urban community. *Prev Chronic Dis.* 2013;10:E136.

27. Waterlander WE, de Boer MR, Schuit AJ, Seidell JC, Steenhuis IH. Price discounts significantly enhance fruit and vegetable purchases when combined with nutrition education: a randomized controlled supermarket trial. *The American journal of clinical nutrition.* 2013;97(4):886-895.

28. Herman DR, Harrison GG, Afifi AA, Jenks E. Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the Special Supplemental Nutrition Program for Women, Infants, and Children. *American Journal of Public Health.* 2008;98(1):98-105.

29. Anderson JV, Bybee DI, Brown RM, et al. 5 a day fruit and vegetable intervention improves consumption in a low income population. *J Am Diet Assoc.* Feb 2001;101(2):195-202.

30. Anliker JA, Winne M, Drake LT. An evaluation of the Connecticut Farmers' Market coupon program. *Journal of Nutrition Education.* 1992;24(4):185-191.

31. Anderson ES, Winett RA, Bickley PG, et al. The Effects of a Multimedia System in Supermarkets To Alter Shoppers' Food Purchases Nutritional Outcomes and Caveats. *Journal of Health Psychology.* 1997;2(2):209-223.

32. Weinstein E, Galindo RJ, Fried M, Rucker L, Davis NJ. Impact of a focused nutrition educational intervention coupled with improved access to fresh produce on purchasing behavior and consumption of fruits and vegetables in overweight patients with diabetes mellitus. *The Diabetes Educator.* 2014:0145721713508823.

33. Bihan H, Mejean C, Castetbon K, et al. Impact of fruit and vegetable vouchers and dietary advice on fruit and vegetable intake in a low-income population. *European Journal of Clinical Nutrition.* 2012;66(3):369-375.

34. Miller ER, Cooper LA, Carson KA, et al. A Dietary Intervention in Urban African Americans: Results of the “Five Plus Nuts and Beans” Randomized Trial. *American Journal of Preventive Medicine.* 2016;50(1):87-95.

35. Anderson ES, Winett RA, Bickley PG, et al. The effects of a multimedia system in supermarkets to alter shoppers' food purchases: nutritional outcomes and caveats. *J Health Psychol.* Apr 1997;2(2):209-223.

36. Sturm R, An R, Segal D, Patel D. A cash-back rebate program for healthy food purchases in South Africa: results from scanner data. *Am J Prev Med.* Jun 2013;44(6):567-572.

37. Phipps EJ, Braitman LE, Stites SD, et al. Impact of a Rewards-Based Incentive Program on Promoting Fruit and Vegetable Purchases. *Am J Public Health.* Jan 2015;105(1):166-172.

38. Smith-Drelich N. Buying health: assessing the impact of a consumer-side vegetable subsidy on purchasing, consumption and waste. *Public Health Nutr.* Feb 2016;19(3):520-529.

39. Bartlett S, Klerman J, Olsho L. Evaluation of the Healthy Incentives Pilot (HIP): Final Report. Prepared by Abt Associates for the US Department of Agriculture. *Food and Nutrition Service.* 2014.

40. Kral TV, Bannon AL, Moore RH. Effects of financial incentives for the purchase of healthy groceries on dietary intake and weight outcomes among older adults: A randomized pilot study. *Appetite.* May 2016;100:110-117.

41. Geliebter A, Ang IY, Bernales-Korins M, et al. Supermarket discounts of low-energy density foods: effects on purchasing, food intake, and body weight. *Obesity (Silver Spring).* Dec 2013;21(12):E542-548.

42. Ball K, McNaughton SA, Le HN, et al. Influence of price discounts and skill-building strategies on purchase and consumption of healthy food and beverages: outcomes of the Supermarket Healthy Eating for Life randomized controlled trial. *The American Journal of Clinical Nutrition.* 2015;101(5):1055-1064.

43. Mhurchu CN, Blakely T, Jiang Y, Eyles HC, Rodgers A. Effects of price discounts and tailored nutrition education on supermarket purchases: a randomized controlled trial. *The American Journal of Clinical Nutrition.* 2010;91(3):736-747.

44. Han E, Powell LM, Isgor Z. Supplemental nutrition assistance program and body weight outcomes: The role of economic contextual factors. *Social Science & Medicine.* 2012;74(12):1874-1881.

45. Han E, Powell L. Effect of food prices on the prevalence of obesity among young adults. *Public Health.* 2011;125(3):129-135.

46. Powell LM, Han E. Adult obesity and the price and availability of food in the United States. *American Journal of Agricultural Economics.* 2011:aaq106.

47. Wendt M, Todd J. The Effect of Food and Beverage Prices on Children's Weights. Washington: US Department of Agriculture. *Economic Research Service.* 2011.

48. Powell LM, Chaloupka FJ. *Economic contextual factors and child body mass index*: National Bureau of Economic Research; 2009.

49. Sturm R, Datar A. Food prices and weight gain during elementary school: 5-year update. *Public Health.* 2008;122(11):1140.

50. Bamberg S. Implementation intention versus monetary incentive comparing the effects of interventions to promote the purchase of organically produced food. *Journal of Economic Psychology.* 2002;23(5):573-587.

51. Paine-Andrews A, Francisco VT, Fawcett SB, Johnston J, Coen S. Health marketing in the supermarket: using prompting, product sampling, and price reduction to increase customer purchases of lower-fat items. *Health Mark Q.* 1996;14(2):85-99.

52. Gittelsohn J, Song HJ, Suratkar S, et al. An urban food store intervention positively affects food-related psychosocial variables and food behaviors. *Health Educ Behav.* Jun 2010;37(3):390-402.

53. Blamey A, Ayana M, Lawson L, Mackinnon J, Paterson I, Judge K. Final report: The independent evaluation of Have a Heart Paisley. *Public Health and Health Policy, University of Glasgow, June.* 2005;4.

54. van Assema P, Steenbakkers M, Stapel H, van Keulen H, Ronda G, Brug J. Evaluation of a Dutch public-private partnership to promote healthier diet. *Am J Health Promot.* 2006 May-Jun 2006;20(5):309-312.

55. Kristal AR, Goldenhar L, Muldoon J, Morton RF. Evaluation of a supermarket intervention to increase consumption of fruits and vegetables. *Am J Health Promot.* 1997 Jul-Aug 1997;11(6):422-425.

56. Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley Excise Tax on Sugar-Sweetened Beverage Consumption. *American Journal of Public Health.* 2016(0):e1-e7.

57. Fletcher JM, Frisvold DE, Tefft N. The effects of soft drink taxes on child and adolescent consumption and weight outcomes. *Journal of Public Economics.* 2010;94(11):967-974.

58. Sturm R, Powell LM, Chriqui JF, Chaloupka FJ. Soda taxes, soft drink consumption, and children's body mass index. *Health Affairs.* 2010:10.1377/hlthaff. 2009.0061.

59. Bahl R, Bird R, Walker MB. The uneasy case against discriminatory excise taxation: soft drink taxes in Ireland. *Public Finance Review.* 2003;31(5):510-533.

60. Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *bmj.* 2016;352:h6704.

61. Fletcher JM, Frisvold D, Tefft N. Can Soft Drink Taxes Reduce Population Weight? *Contemp Econ Policy.* Jan 2010;28(1):23-35.

62. Oaks B. *An evaluation of the snack tax on the obesity rate of Maine*, Texas State University; 2005.

63. Powell LM, Chriqui J, Chaloupka FJ. Associations between state-level soda taxes and adolescent body mass index. *J Adolesc Health.* Sep 2009;45(3 Suppl):S57-63.

64. Kim D, Kawachi I. Food taxation and pricing strategies to "thin out" the obesity epidemic. *American Journal of Preventive Medicine.* 2006;30(5):430-437.

65. Payne CR, Niculescu M, Just DR, Kelly MP. Shopper marketing nutrition interventions. *Physiology & behavior.* 2014;136:111-120.

66. Ogawa Y, Tanabe N, Honda A, et al. Point-of-purchase health information encourages customers to purchase vegetables: objective analysis by using a point-of-sales system. *Environ Health Prev Med.* Jul 2011;16(4):239-246.

67. Reger B, Wootan MG, Booth-Butterfield S, Smith H. 1% or less: a community-based nutrition campaign. *Public Health Rep.* 1998 Sep-Oct 1998;113(5):410-419.

68. Russo JE, Staelin R, Nolan CA, Russell GJ, Metcalf BL. Nutrition information in the supermarket. *Journal of Consumer Research.* 1986;13(1):48-70.

69. Teisl MF, Levy AS. Does nutrition labeling lead to healthier eating? *Journal of Food Distribution Research.* 1997;28:18-27.

70. Rodgers AB, Kessler LG, Portnoy B, et al. "Eat for Health": a supermarket intervention for nutrition and cancer risk reduction. *Am J Public Health.* Jan 1994;84(1):72-76.

71. Schucker RE, Levy AS, Tenney JE, Mathews O. Nutrition shelf-labeling and consumer purchase behavior. *Journal of Nutrition Education.* 1992;24(2):75-81.

72. Levy AS, Mathews O, Stephenson M, Tenney JE, Schucker RE. The impact of a nutrition information program on food purchases. *Journal of Public Policy & Marketing.* 1985:1-13.

73. Patterson BH, Kessler LG, Wax Y, et al. Evaluation of a Supermarket Intervention The NCI-Giant Food Eat for Health Study. *Evaluation Review.* 1992;16(5):464-490.

74. Steenhuis I, van Assema P, van Breukelen G, Glanz K. The effectiveness of nutrition education and labeling in Dutch supermarkets. *Am J Health Promot.* 2004 Jan-Feb 2004;18(3):221-224.

75. Achabal DD, McIntyre SH, Bell CH, Tucker N. The effect of nutrition POP signs on consumer attitudes and behavior. *Journal of Retailing.* 1987.

76. Ernst ND, Wu M, Frommer P, et al. Nutrition education at the point of purchase: the foods for health project evaluated. *Prev Med.* Jan 1986;15(1):60-73.

77. Jeffery RW, Pirie PL, Rosenthal BS, Gerber WM, Murray DM. Nutrition education in supermarkets: an unsuccessful attempt to influence knowledge and product sales. *J Behav Med.* Jun 1982;5(2):189-200.

78. Soriano E, Dozier DM. Selling nutrition and heart-healthy diet behavior at the point-of-purchase. *Journal of Applied Nutrition.* 1978.

79. Silzer J, Sheeshka J, Tomasik H, Woolcott D. An evaluation of Supermarket Safari nutrition education tours. *Journal of the Canadian Dietetic Association (Canada).* 1994.

80. Connell D, Goldberg JP, Folta SC. An intervention to increase fruit and vegetable consumption using audio communications: in-store public service announcements and audiotapes. *J Health Commun.* 2001 Jan-Mar 2001;6(1):31-43.

81. Huang A, Barzi F, Huxley R, et al. The effects on saturated fat purchases of providing internet shoppers with purchase- specific dietary advice: a randomised trial. *PLoS Clin Trials.* 2006;1(5):e22.

82. Milliron BJ, Woolf K, Appelhans BM. A point-of-purchase intervention featuring in-person supermarket education affects healthful food purchases. *J Nutr Educ Behav.* 2012 May-Jun 2012;44(3):225-232.

83. Winett RA, Moore JF, Wagner JL, et al. Altering Shoppers' Supermarket Purchases to Fit Nutritional Guidelines: An Interactive Information System. *Journal of Applied Behavior Analysis.* 1991;24(1):95-105.

84. Gittelsohn J, Dyckman W, Frick KD, et al. A pilot food store intervention in the Republic of the Marshall Islands. *Pac Health Dialog.* Sep 2007;14(2):43-53.

85. Lewis K, Roblin D, Leo M, Block J. The personal shopper–a pilot randomized trial of grocery store‐based dietary advice. *Clinical obesity.* 2015;5(3):154-161.

86. Dougherty MF, Wittsten AB, Guarino MA. Promoting low-fat foods in the supermarket using various methods, including videocassettes. *J Am Diet Assoc.* Aug 1990;90(8):1106-1108.

87. Ortega AN, Albert SL, Chan-Golston AM, et al. Substantial improvements not seen in health behaviors following corner store conversions in two Latino food swamps. *BMC public health.* 2016;16(1):1.

88. Foster GD, Karpyn A, Wojtanowski AC, et al. Placement and promotion strategies to increase sales of healthier products in supermarkets in low-income, ethnically diverse neighborhoods: a randomized controlled trial. *The American journal of clinical nutrition.* 2014;99(6):1359-1368.

89. Gittelsohn J, Kim EM, He S, Pardilla M. A food store–based environmental intervention is associated with reduced BMI and improved psychosocial factors and food-related behaviors on the Navajo nation. *The Journal of nutrition.* 2013;143(9):1494-1500.

90. Gittelsohn J, Vijayadeva V, Davison N, et al. A food store intervention trial improves caregiver psychosocial factors and children's dietary intake in Hawaii. *Obesity.* 2010;18(S1):S84-S90.

91. Ho LS, Gittelsohn J, Rimal R, et al. An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in northwestern Ontario First Nations. *Health Education & Behavior.* 2008;35(4):561-573.

92. Lent MR, Vander Veur SS, McCoy TA, et al. A randomized controlled study of a healthy corner store initiative on the purchases of urban, low‐income youth. *Obesity.* 2014;22(12):2494-2500.

93. Martínez-Donate AP, Riggall AJ, Meinen AM, et al. Evaluation of a pilot healthy eating intervention in restaurants and food stores of a rural community: a randomized community trial. *BMC public health.* 2015;15(1):1.

94. Rosecrans A, Gittelsohn J, Ho L, Harris S, Naqshbandi M, Sharma S. Process evaluation of a multi-institutional community-based program for diabetes prevention among First Nations. *Health Education Research.* 2008;23(2):272-286.

95. Song H-J, Gittelsohn J, Kim M, Suratkar S, Sharma S, Anliker J. A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. *Public health nutrition.* 2009;12(11):2060-2067.

96. Surkan PJ, Tabrizi MJ, Lee RM, Palmer AM, Frick KD. Eat Right–Live Well! Supermarket Intervention Impact on Sales of Healthy Foods in a Low-Income Neighborhood. *Journal of Nutrition Education and Behavior.* 2016;48(2):112-121. e111.

97. Ho LS, Gittelsohn J, Rimal R, et al. An integrated multi-institutional diabetes prevention program improves knowledge and healthy food acquisition in northwestern Ontario First Nations. *Health Educ Behav.* Aug 2008;35(4):561-573.

98. Ayala GX, Baquero B, Laraia BA, Ji M, Linnan L. Efficacy of a store-based environmental change intervention compared with a delayed treatment control condition on store customers' intake of fruits and vegetables. *Public health nutrition.* 2013;16(11):1953-1960.

99. de Wijk RA, Maaskant AJ, Polet IA, Holthuysen NT, van Kleef E, Vingerhoeds MH. An In-Store Experiment on the Effect of Accessibility on Sales of Wholegrain and White Bread in Supermarkets. *PloS one.* 2016;11(3):e0151915.

100. Wilson NL, Just DR, Swigert J, Wansink B. Food pantry selection solutions: a randomized controlled trial in client-choice food pantries to nudge clients to targeted foods. *J Public Health (Oxf).* May 2016.

Appendix

1. PubMed Search Strategies

PubMed Search Strategy for Review Papers:

Settings:

grocery OR grocery-store OR corner-store OR food-store OR convenience-store OR market OR tienda OR bodega OR retail-outlet OR supermarket OR farmers-markets OR farm stand OR cart OR cooperative OR community-supported agriculture OR online-grocery OR co-op OR cooperative OR food-hub OR point-of-sale OR point-of-purchase OR outlet* OR vendor* OR pantry OR venue OR food-environment OR Supplemental-Nutrition-Assistance-Program OR SNAP OR food-stamp-program OR women-infants-children OR WIC

AND

Outcomes:

purchase* OR buy OR sale OR sell OR energy-intake OR consumption OR eat* OR calorie* OR diet OR nutrition OR dietary sugars OR sweetened OR sugar OR carbonated beverages OR soda pop OR sugar-sweetened-beverages OR junk-food OR candy OR snack OR meal Or breakfast OR lunch OR dinner OR food OR beverages OR fruits OR vegetables OR healthy-food OR body-weight OR body-weight-change OR body-mass-index OR BMI OR adiposity OR weight-gain OR weight-loss OR lose-weight OR overweight OR obesity OR waist-circumference OR food-security OR food-insecurity OR hunger

AND

Intervention:

access OR accessib* OR availab* OR distance OR proximity OR near* OR convenien* OR walkability OR food-desert OR neighborhood OR residence-characteristics OR transportation OR built-environment OR zoning OR density OR variety OR price OR pricing OR cost OR expense OR expensive OR inexpensive OR cheap* OR money OR fiscal OR incentive OR tax OR taxes OR taxation OR electronic-benefit-transfer OR price-reduction OR coupons OR vouchers OR affordab* OR unaffordab* OR economic* OR packag* OR label* OR prime OR priming OR placement OR locat* OR checkout OR promotion OR point-of-decision OR prompt OR display* OR shelf OR poster* OR flyer* OR advertis* OR signs OR signage OR conversion OR market* OR social-marketing OR public-service-announcements OR sampl* OR taste-test* OR nutrition-education OR teach* OR food demo* OR cooking demo* OR diet counseling OR nutritionist OR menu planning OR food budgeting OR resource management OR curriculum OR myplate OR traffic-light OR knowledge OR skill*

Yield on 1/11/16: 2,714

Applied date restriction 01/01/2015 to 12/31/2016, the Human filter and the Review filter

PubMed Search Strategy for Primary Papers:

Settings:

grocery OR grocery-store OR corner-store OR food-store OR convenience-store OR market OR tienda OR bodega OR retail-outlet OR supermarket OR farmers-markets OR farm stand OR cart OR cooperative OR community-supported agriculture OR online-grocery OR co-op OR cooperative OR food-hub OR point-of-sale OR point-of-purchase OR outlet* OR vendor* OR pantry OR venue OR food-environment OR Supplemental-Nutrition-Assistance-Program OR SNAP OR food-stamp-program OR women-infants-children OR WIC

AND

Outcomes:

purchase* OR buy OR sale OR sell OR energy-intake OR consumption OR eat* OR calorie* OR diet OR nutrition OR dietary sugars OR sweetened OR sugar OR carbonated beverages OR soda pop OR sugar-sweetened-beverages OR junk-food OR candy OR snack OR meal OR breakfast OR lunch OR dinner OR food OR beverages OR fruits OR vegetables OR healthy-food OR body-weight OR body-mass-index OR BMI OR adiposity OR weight-gain OR weight-loss OR overweight OR obesity OR waist-circumference OR food-security OR food-insecurity OR hunger

AND

Interventions:

access OR accessib* OR availab* OR distance OR proximity OR near* OR convenien* OR walkability OR food-desert OR neighborhood OR residence-characteristics OR transportation OR built-environment OR zoning OR density OR variety OR price OR pricing OR cost OR expense OR expensive OR inexpensive OR cheap* OR money OR fiscal OR incentive OR tax OR taxes OR taxation OR electronic-benefit-transfer OR price-reduction OR coupons OR vouchers OR affordab* OR unaffordab* OR economic* OR packag* OR label* OR placement OR locat* OR checkout OR promotion OR point-of-decision OR prompt OR display* OR shelf OR poster* OR flyer* OR advertis* OR signs OR signage OR conversion OR market* OR social-marketing OR public-service-announcements OR taste-test* OR nutrition-education OR teach* OR food demo* OR cooking demo* OR diet counseling OR nutritionist OR menu planning OR food budgeting OR resource management OR curriculum OR myplate OR traffic-light OR knowledge OR skill*

Yield on 4/20/16: 3,347

Words were required to appear in Titles and/or Abstracts

Applied date restriction 2014-01-01 and 2016-12-31

2. Robert Wood Johnson's Evidence Reviews

RWJF's *What Works for Health* evidence reviews, accessible via the following links:

- Farmers' Markets/Stands
- Electronic Benefit Transfer (EBT) Payment at Farmers' Markets
- Food Buying Clubs & Co-ops
- Food Hubs
- Mobile Markets
- Online Grocery Stores

- WIC and Senior Farmers' Market Nutrition Programs

3. Price Incentive Values

The following table summarizes the values of monetary incentives that demonstrative effectiveness.

Paper	Incentive Value	Inflation-Adjusted	Outcomes
Waterlander, et al 2013	50% biweekly discount coupons for FVs	NA	+FV purchase
Herman, 2008	$10 per week vouchers	$11.2	+FV intake
Anderson et al., 2001	$20 per month coupons	$27.3	+FV intake
Miller et al., 2016	$30 per week voucher	$30	+FV intake
Weinstein et al., 2014	$6 single coupon	$6.1	+FV intake
Bihan et al., 2012	~$15-60 per month FV vouchers	~15.8-63	+FV purchase
Anderson et al., 2001	$20 per month coupons	$27.3	+FV intake
Anderson, 1997	$3 per week coupons	$4.5	+FV purchase
Smith-Drelich et al., 2016	Up to $50 over 3 weeks reimbursement	Up to $50	+FV purchase
Phipps et al., 2015	50% rebate on FV purchases	NA	+FV purchase
Bartlett et al., 2014 & An, 2015	$0.30 for every $1 of SNAP benefits redeemed on targeted FVs	$0.30	+FV purchase and intake
Sturm et al., 2013	10-25% rebate for healthy food purchases	NA	+Healthy food purchases
Geliebter et al., 2013	50% discount on FVs and low-calorie beverages	NA	+FV purchases and intake
Ni Mhurchu et al., 2010	12.5% discount on select healthy foods	NA	+FV purchases
Ball et al., 2015	20% price reduction on FVs, low-cal carbonated drinks, and water	NA	+FV purchases
Gittelsohn et al., 2010	Buy 3 get 1 free	NA	+Healthy food purchase
Bamberg, 2002	$7.50 voucher for FVs	$10	+FV purchase
Paine-Andrews et al., 1996	20-25% discount coupons	NA	+Healthy food purchases