

**The Impact of Financial Incentives on Fruit and Vegetable Expenditure and Consumption  
in Healthy Food Retail Environments: A Literature Review and Recommendations**

By

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## **ABSTRACT**

### **Problem**

In 2011, on average, U.S. adults and adolescents consumed produce fewer than two times per day (CDC, 2013). This dietary behavior is concerning as adequate fruit and vegetable intake is essential to maintaining a healthy weight (USDA, n.d.b, n.d.c), improving physical health (HSPH, n.d.), and preventing nearly half of the 10 leading causes of death in the United States (CDC, 2014; HSPH, n.d.). In numerous urban and rural communities across the country, inadequate produce consumption is rooted in unequal access to fresh fruits and vegetables (USDA, 2012a). Residents of these predominately low-income geographic areas must travel outside of their immediate neighborhoods to purchase high-quality, nutrient-dense food (USDA, 2012b). A highly touted response to this inequity has been to introduce or expand healthy food retail in low-access areas. While improving the physical availability of nutritious food is necessary, this action fails to address the other essential dimension of access: the affordability of healthy food at the consumer retail level.

### **Background**

A promising example of healthy food retail development is underway in New Orleans. In late 2014, Jake and Jake's will open a fresh food market in Central City—a neighborhood that has been characterized as a limited supermarket access area (TRF's LSA Mapping Tool, 2014) and food desert (Rose et al., 2009). To examine the health effects of the retailer's proposed programming, the City of New Orleans Health Department led a pilot health impact assessment referred to as the Myrtle Banks Redevelopment HIA. During my tenure as an MBR HIA data committee member, I commenced a literature review to assess the impact of financial incentives on consumer FV purchasing, FV consumption and venue patronage.

### **Methods**

Electronic literature searches in PubMed, Web of Science and the Cochrane Library, and supplementary hand searches were conducted to identify peer-reviewed, original research articles that evaluated the

effectiveness of economic-incentive interventions in supermarket, grocery store or farmers' market settings. Google was used to identify pertinent grey literature. Sixteen original articles (on 15 studies) and one USDA interim research report, published between 1994 and 2014, were selected for critical review.

## **Results**

The majority of the financial-incentive investigations were conducted in chain supermarkets in France, New Zealand, the Netherlands, South Africa and the United States. The others occurred at U.S. farmers' markets. Low-SES individuals were the priority population in all but three investigations. The study incentives spanned discounts, rebates, matched funds, vouchers and coupons of different monetary values.

***FV expenditure and consumption:*** In a high percentage of studies, there was a statistically significant increase in FV purchases and consumption among subsidy recipients. ***Venue patronage:*** Produce subsidies seemed to induce first and repeat visits to a new food retailer among a substantial proportion of participants. However, only a small number of studies reported this data.

## **Conclusion**

Targeted financial subsidies increased fruit and vegetable purchasing and consumption among low-income grocery shoppers. This finding has important implications for healthy food retailers such as Jack and Jake's, policymakers, researchers and public health leaders. In communities with insufficient access to FVs, public health practitioners should catalyze or support formal efforts to assess the underlying issues and community readiness for change; and, where appropriate, contribute to the design, implementation and evaluation of intersectoral food-access campaigns.

DEDICATION

TO THE LATE

*Fannie Mae Brown*

MY ROCK STAR AND MATERNAL GRANDMOTHER

On an otherwise ordinary day, with that inherent glimmer in your eyes,  
you told me you wanted to go back to school to earn your high-school diploma.

My heart leapt. And, stomach fell.

Taken aback, I feigned excitement; then scurried out of the room  
before the tears became too heavy for my eyes to bear.

Your beautiful mind continued to dream.

However, I knew the monster, Early-onset Alzheimer's, would not allow this one to be.  
After many moons, I decided to return to university. This achievement is dedicated to you.

You were and continue to be my light.

## ACKNOWLEDGEMENTS

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Some people genuinely have your best interest in mind, without thought of personal gain. Early on, Ms. Lori Evarts and Ms. Sue Robeson were allies to me. Thank you for informing me of significant opportunities that I might have overlooked.

I would be remiss if I did not extend appreciation to Ms. Katherine Cain and Ms. Nina Johnson. Thank you for opening the City of New Orleans’ first health impact assessment project to me. I hope the most vulnerable Central City residents will soon enjoy true access to healthy food.

I would not have reached this point without the unconditional support bestowed by my mother, Loretta, and younger sister, Johna. Mom, you finally had an opportunity to tease someone else about all of their papers. Thankfully, you will reclaim the crown in due course. Dearest Johna, not only are you an awesome buddy, Play-Doh artist, and all-around cool nine-year-old – you are also the most loving person I know. Thank you for the daily hugs. One day, you too will represent the Carolina Blue.

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## **LIST OF ABBREVIATIONS**

|        |                                                                         |
|--------|-------------------------------------------------------------------------|
| EBT    | Electronic benefit transfer                                             |
| FV     | Fruit(s) and vegetable(s)                                               |
| HIA    | Health impact assessment                                                |
| LSA    | Limited supermarket access                                              |
| MBR    | Myrtle Banks Redevelopment                                              |
| NACCHO | National Association of County and City Health Officials                |
| SNAP   | Supplemental Nutrition Assistance Program                               |
| SSI    | Supplemental Security Income                                            |
| WIC    | Special Supplemental Nutrition Program for Women, Infants, and Children |
| USDA   | United States Department of Agriculture                                 |



## GLOSSARY OF TERMS

- Food Desert:** A geographic area in which at least 500 persons or 33% of the population resides more than one mile or 10 miles from a supermarket in urban or rural census tracts, respectively (USDA, 2009).
- Food Swamp:** A food environment that has a higher concentration of retail outlets selling energy-dense food and beverages than venues selling more healthful options (Fielding & Simon, 2011).
- Healthy Food Retail:** Food venues that stock a combination of fresh fruits and vegetables, whole grains, legumes, lean meats or seafood. The outlet may offer products with reduced sodium, saturated and trans fats, and sugar as well as dairy alternatives such as lactose-free products. In addition, water and 100% juice are more prominent than (or as prominent as) unhealthy beverages (CDC, 2014a).
- Examples include: grocery stores and supermarkets, food hubs, co-ops, farmers' markets, community-supported agriculture, farm stands, mobile-produce units, and small stores and restaurants that offer healthful options.
- Limited Supermarket Access (LSA) area:** A geographic location in which the nearest supermarket is situated significantly farther than the "comparatively acceptable" distance found in better resourced communities (The Reinvestment Fund, 2012).
- Myrtle Banks Redevelopment:** A redevelopment project centering on the adaptive reuse of the historic Myrtle Banks Elementary School building in Central City, New Orleans. The rehabilitated building will house a 23,000-square-foot fresh food market and office spaces. Activities proposed by the supermarket proprietor were the foci of the first HIA conducted by the City of New Orleans Health Department (Alembic Community Development, 2014; New Orleans Redevelopment Authority, 2013).

## BACKGROUND

Throughout the last decade, the introduction or expansion of healthy food retail in underserved communities has been championed by influential policymakers and implemented through various partnership models across the country (HFAP, n.d.a; TRF, 2011; WHTFCO, 2010). In 2011, the City of New Orleans, in cooperation with HOPE Enterprise Corporation and The Food Trust, established the Fresh Food Retailer Initiative (FFRI) (Ulmer, Rathert, & Rose, 2012). A primary goal of the program is to improve the food landscape of low-to-moderate income areas that possess a low density of food outlets selling nutritious fare (HOPE Enterprise Corporation, 2011).

Currently, a promising example of healthy food retail development is underway in one of the city's limited-supermarket-access areas (see Figure 1). Later this year, FFRI-awardee Jack & Jake's, Inc. will open a fresh food market at the former Myrtle Banks Elementary School. The adaptive reuse of the historic building is part of an ongoing revitalization effort in Central City (OCHMBA, n.d.; White, J., 2014). Certainly, the new market will increase the physical availability of healthy food, but how might the proprietor's programming affect the health of residents in its immediate catchment area?

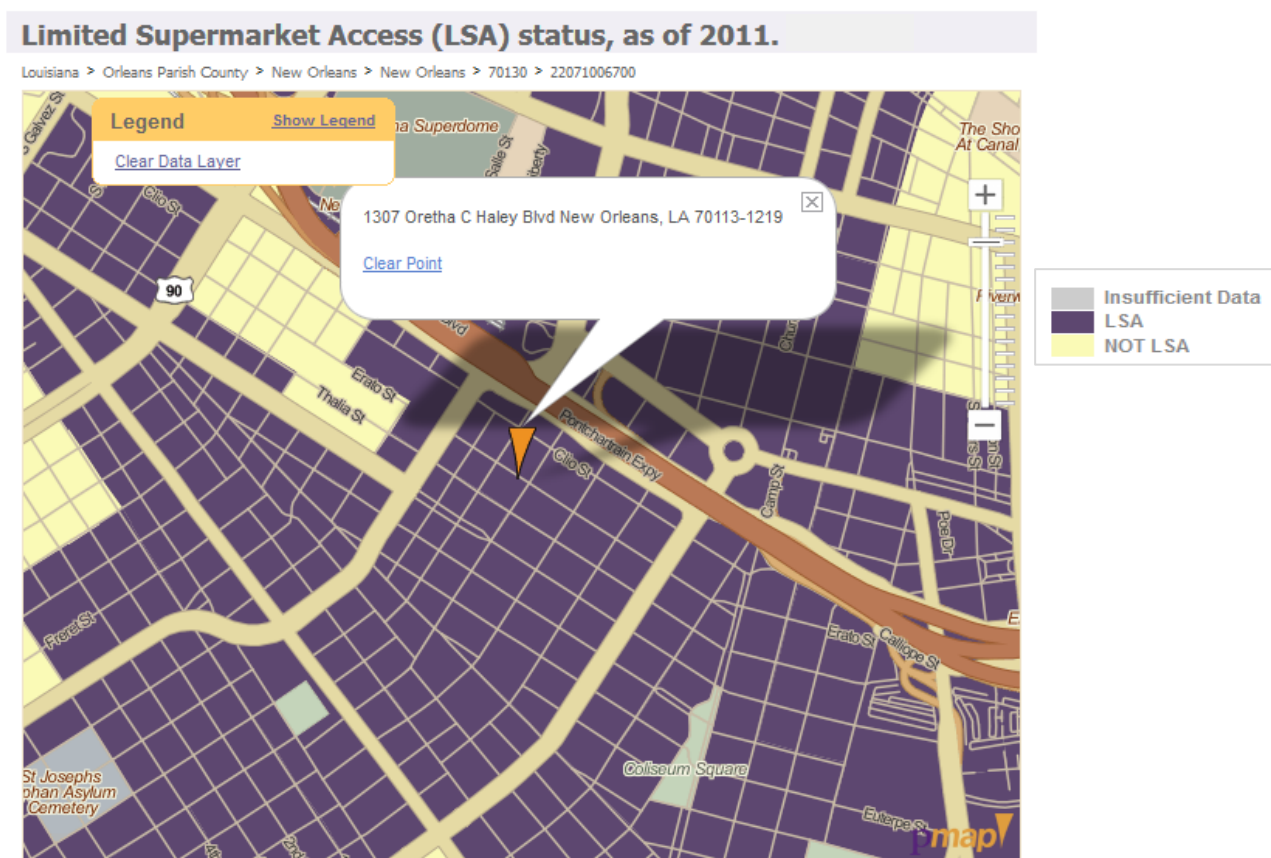
As a 2013-2014 NACCHO Health Impact Assessment (HIA) Project mentee, the City of New Orleans Health Department was charged with coordinating a pilot HIA to answer the foregoing question while testing a health-in-all-policies approach to multi-sectoral decision-making (NACCHO, 2013). To undertake the project, the health department partnered with the Livable Claiborne Communities Initiative, the New Orleans Redevelopment Authority, Alembic Community Development, and several stakeholders who constituted three project committees. Throughout a collaborative process that emphasized community engagement, the Myrtle Banks Redevelopment (MBR) HIA team examined the five activities proposed by Jack and Jake's. They included: financial incentives, food demonstrations, outdoor programming / green-space usage, community outreach, and hiring locally.

Health impact assessment is undertaken to assist decision makers with understanding the health effects of a prospective policy, program or project that typically originates outside of the health sector.

Relevant public health data, empirical research and stakeholder input are analyzed to elucidate unintended consequences of proposals, and to objectively formulate alternatives that mitigate risks and bolster benefits to a population's health (Human Impact Partners, 2013). The systematic, time-sensitive approach varies in length and complexity yet encompasses six phases: screening, scoping, assessment, recommendations, reporting, and monitoring and evaluation (National Research Council, 2011).

Initiated to help inform the third and fourth phases of the MBR assessment, this paper comprises a critical review of empirical research that investigated the impact of financial incentives on consumer purchasing, consumption and venue patronage. During my tenure on the project, I aimed to contribute to the evidence scrutinized by the HIA's steering, advisory, and data-resource committees in order to recommend actions that promote the well-being of Central City's most vulnerable residents.

**FIGURE 1.** SUPERMARKET ACCESS STATUS OF 1307 ORETHA CASTLE HALEY BOULEVARD—SITE OF JACK AND JAKE'S FORTHCOMING FRESH FOOD MARKET—IN CENTRAL CITY, NEW ORLEANS, 2011



SOURCE: THE ABOVE GRAPHIC WAS GENERATED USING THE REINVESTMENT FUND'S LIMITED SUPERMARKET ACCESS (LSA) ANALYSIS MAPPING TOOL ON APRIL 10, 2014.

## INTRODUCTION

Americans are urged to “make half [their] plate fruits and vegetables” (PBHF, n.d.; USDA, n.d.a) however insufficient produce consumption remains a population health challenge (USDA & HHS, 2010). In 2011, on average, U.S. adults and adolescents ate produce fewer than two times per day (CDC, 2013). This dietary behavior is concerning as adequate fruit and vegetable intake is essential to maintaining a healthy weight (USDA, n.d.b, n.d.c), improving physical health (HSPH, n.d.), and preventing nearly half of the 10 leading causes of death in the United States (CDC, 2014; HSPH, n.d.).

Although the foregoing advice is catchy and seemingly straightforward, food choice is affected by numerous determinants ranging from governmental policies to individual preferences (Contendo, 2011; Story, Kaphingst, Robinson-O’Brien, & Glanz, 2008). At the neighborhood level, eating behavior has been linked to modifiable conditions (IOM, 2009; Story et al, 2008) such as a lack of high-quality, affordable produce in food deserts (Walker, Keane, & Burke, 2010), and an abundance of energy-dense, inexpensive foods in food swamps (Fielding & Simon, 2011). In these non-mutually exclusive environments, cost is a key factor in food selection (Contento, 2011; FMI, 2012; Marketline, 2013; Neff, Palmer, McKenzie, & Lawrence, 2009). Recently, Zachary et al. (2013) reported that low-income, urban shoppers perceive healthy food as being more expensive than highly processed alternatives. This common sentiment (Catalina Marketing Corporation & FMI, 2010) raises the question of whether monetary interventions at the point-of-purchase would help increase the daily consumption of produce among price-sensitive individuals.

As part of a strategy to improve food access in the Central City neighborhood of New Orleans, Jack & Jake’s Public Market may employ targeted retail promotions when it opens later this year. The market’s proposed programming has been the focus of a yearlong HIA conducted by the City of New Orleans Health Department in partnership with prominent local entities (NACCHO, 2013). An example of a pricing-related activity that may be carried out by the new operation is offering “fresh food discounts to [its] Central City neighbors” (Jack & Jake’s, n.d., p. 1).

Increasingly, scholars from public health and other disciplines are augmenting a small body of research on how healthy food can be priced, placed and promoted to encourage increased uptake. Three relevant systematic appraisals include: An's (2013) review of field experiments using monetary subsidies to promote healthier food purchases and consumption among adults and adolescents; Glanz, Bader, & Iyer's (2012) integrative review of food marketing in supermarkets; and Seymour, Yaroch, Serdula, Blanck, & Khan's (2004) review of environmental and nutrition policy interventions. Altogether, a small number of pricing interventions in grocery stores and farmers' markets were evaluated in these important studies. Additional attention to these settings is warranted because supermarkets are the primary connector of food to people—consumers averaged 2.2 trips weekly to this venue in 2012 (FMI, 2012)—and U.S. farmers' markets have grown by 371% since 1994 (USDA, 2014).

This literature review synthesizes empirical research pertaining to the effectiveness of financial subsidies in healthy food venues. My effort contributes to the literature by focusing exclusively on produce-incentive interventions conducted in supermarket, grocery store or farmers' market environments. Specifically, I aim to address the following questions:

- Will the provision of a financial incentive increase fruit and vegetable purchasing among supermarket, grocery store or farmers' market customers?
- Will the provision of a financial incentive increase fruit and vegetable consumption among supermarket, grocery store or farmers' market customers?
- Will the provision of a financial incentive for use at a supermarket, grocery store or farmers' market affect recipients' willingness to patronize the venue?

In this paper, I present relevant research findings for the foregoing topics, discuss implications and future research directions, and recommend actions for key stakeholder groups.

## METHODS

Adhering to the framework presented in *A Guide to Reviewing Published Evidence for Use in Health Impact Assessment* (Mindell et al., 2006), I conducted a brief literature review for the financial-incentive decision option featured in the Myrtle Banks Redevelopment HIA.

### Search Strategy

Between February and May 2014, I performed electronic literature searches in PubMed, Web of Science and the Cochrane Library. One print journal was searched by hand for an article not available electronically. Additionally, I used Google to search the USDA, Healthy Food Access Portal, What Works for Health, The Community Guide, and food-retail trade websites for pertinent grey literature.

To identify studies that assessed the relationship between financial subsidies and consumer food expenditure, food consumption or venue patronage, initially, I conducted separate searches using *supermarket intervention*, *grocery store intervention*, and *farmer\* market intervention* as keywords. Next, I combined each venue type with the following terms: *financial incentive*, *coupon*, *subsidy*, *voucher*, *price reduction*, *discount*, *sales promotion*, *purchas\**, and *consumption*.

Subsequently, I read the title and abstract of articles populated in search results. Papers suggested by the aforementioned databases, professors and others were screened in a similar manner. The reference lists of some papers were searched to acquire cited articles that seemed relevant. Articles that satisfied the study selection criteria were retrieved and read in their entirety.

### Inclusion and Exclusion Criteria

Articles eligible for full-text review: (1) were primary research, i.e. a field experiment or a program evaluation; (2) reported the effect of a price-reduction intervention on fruit and vegetable purchasing, fruit and vegetable intake, or venue patronage; (3) were based in a supermarket, grocery store or farmers' market; (4) were English language; and (5) were published in the last 20 years.

The health impact assessment team sought information that shed light on the effectiveness of monetary-incentive interventions in real-world conditions. Accordingly, two papers on experiments in simulated supermarkets (Epstein, Dearing, Roba, & Finkelstein, 2010; Waterlander, Steenhuis, de Vet, Shuit, & Seidell, 2012) were rejected. Interventions based solely in small stores, restaurants and other food venues were beyond the scope of this literature review, and therefore excluded. Lastly, due to the small quantity of pricing interventions that have been conducted in the healthy food retail settings of interest, articles were not filtered using a quality-assessment framework.

### Data Extraction and Synthesis

Ultimately, 17 articles were selected for inclusion in this literature review. The following data were extracted from each study and input into a spreadsheet: intervention location, setting and design; population characteristics and sample size; targeted behaviors; outcome measures; type of financial incentive; discount-eligible foods or products; and results. The heterogeneity of the studies—in research design, subsidy characteristics and dissemination, units of measurement, group comparison methods, etc.—necessitated the use of narrative synthesis to summarize and interpret their findings.

## **RESULTS**

Relevant findings are presented in two major sections: a description of study characteristics, and a summary of intervention effects. In the latter section, results are organized by the three research topics of interest in this review: produce expenditure, produce consumption, and healthy food retailer patronage.

### **General Descriptive Characteristics**

#### Study Characteristics

Twelve original research articles, four program evaluations, and one USDA-commissioned preliminary research report were identified for inclusion in this literature review. Summarized in **Table 1**, (see Appendix) the majority of papers were published after 2009. The most common study design was

randomized control trial (RCT) (articles 2, 6, 7, 9, 10, 13, 14, 16) followed by time series (5, 8, 11, 12, 15); posttest-only (1, 4, 15); and pretest-posttest (3). Two papers reported findings of different analyses on data collected from the same cohort study (12a, 12b).

Eleven studies were conducted in the Northeastern, Midwestern, Southeastern and Western regions of the United States (1, 2, 3, 4, 5, 8, 10, 11, 13, 15, 16); the other interventions were based in New Zealand (6, 9), France (7), the Netherlands (16), and South Africa (12). Three of seven RCTs were performed domestically (2, 10, 13). Chain supermarkets served as the setting for eight studies (2, 6, 7, 9, 10, 12, 14, 16), six occurred in farmers' markets (1, 3, 4, 8, 11, 15), and one had research arms based at a supermarket and a farmers' market (5). In addition to these food venues, the Healthy Incentives Pilot study included superstore, grocery store and corner store sites (USDA, 2013).

The length of the experimental and observational studies ranged from eight weeks to one year. The time frame of one investigation, the Massachusetts Farmers' Market Coupon Program survey, was not reported. Study data were collected several times from subjects during the intervention phase of four investigations (7, 11, 12, 13). Additionally, in six studies (2, 5, 6, 10, 14, 16), post-intervention data were collected at least once at a follow-up that occurred three months to one year after the intervention ended.

### Outcome Characteristics

Primary outcomes of interests were the purchasing (1, 5, 6, 8, 9, 12a, 16) and consumption (4, 5, 7, 11, 12b, 15) of produce. Five studies measured both behaviors (2, 3, 10, 13, 14). Transaction data was acquired from electronic scanner systems, electronic and manual receipts, and a food purchase form. The assessments used to identify changes in consumption were modified food frequency questionnaires (2, 3, 7, 14), a 24-hour dietary recall interview (5, 10, 13), customer surveys (4, 11, 15), and a health risk assessment questionnaire (12b). In some farmers' market studies, venue patronage-related (1, 4, 8, 11, 15) and EBT sales data (8, 11, 15) were reported.



### Population Characteristics

Analyzed sample sizes ranged from 47 to 1,998 individuals. An outlier, the South Africa-based study (12) had two analyses with study populations totaling 169,485 and 351,319. The sample sizes are reasonable as eligible participants were members of the country's largest health insurance provider. In 10 studies, more than 70% of the participants were female. With the exception of three studies (2, 11, 13), low-income individuals, and SNAP and WIC recipients were the investigations' target populations. Additionally, a few studies focused primarily on seniors (1, 4, 12), and one included youth (8).

### Subsidy Characteristics

Vouchers were the most common financial subsidy offered to intervention-group participants, followed by coupon, rebate, automatic price discount, and matched funds. Specifically, the incentives included: a biweekly 50-cent coupon (2); one-time \$5 and \$20 vouchers (1, 3); up to four \$5 vouchers (8); five \$10 vouchers (4); monthly vouchers totaling \$40 (5); a \$2 voucher for every \$5 in SNAP benefits spent (15); a \$0.30 rebate for every \$1 in SNAP benefits spent (13); up to \$20 monthly in matched farmers' market tokens (11); rebates of 10%, 25% and 50% (12,16); automatic price discounts of 12.5% and 50% (6, 10, 14); and vouchers with monetary values based on household size (7, 9). For some incentives, a household cap was established (11, 12, 13). The majority of supermarket-based interventions offered price reductions through a coupon, discount or rebate however vouchers were used more often in the farmers' market investigations.

### Eligible Products

Fresh fruits and vegetables were the targets of most financial incentives. However, in nearly half of the interventions, an economic supplement was also redeemable for other healthy foods (2, 6, 10, 11, 12, 13, 14). A few examples include frozen and canned fruits and vegetables; wheat cereals and breads; low-sodium, -sugar and -fat items; diet soda; and water. Conversely, one of the New Zealand-based studies (9) did not restrict its incentive to pre-determined foods. In fact, the voucher funds could be used toward the purchase of any food or non-food item sold at a study venue.

## Intervention Effectiveness

**Table 2** (see Appendix) details the targets, activities and results of each financial-incentive study. Several research teams used statistical significance to estimate intervention effect size, while others published descriptive data about their primary outcomes of interest. In the next three sections, relevant empirical findings are presented for the outcomes germane to this literature review: produce spending, produce intake, and venue patronage.

## Expenditure on Fruits and Vegetables

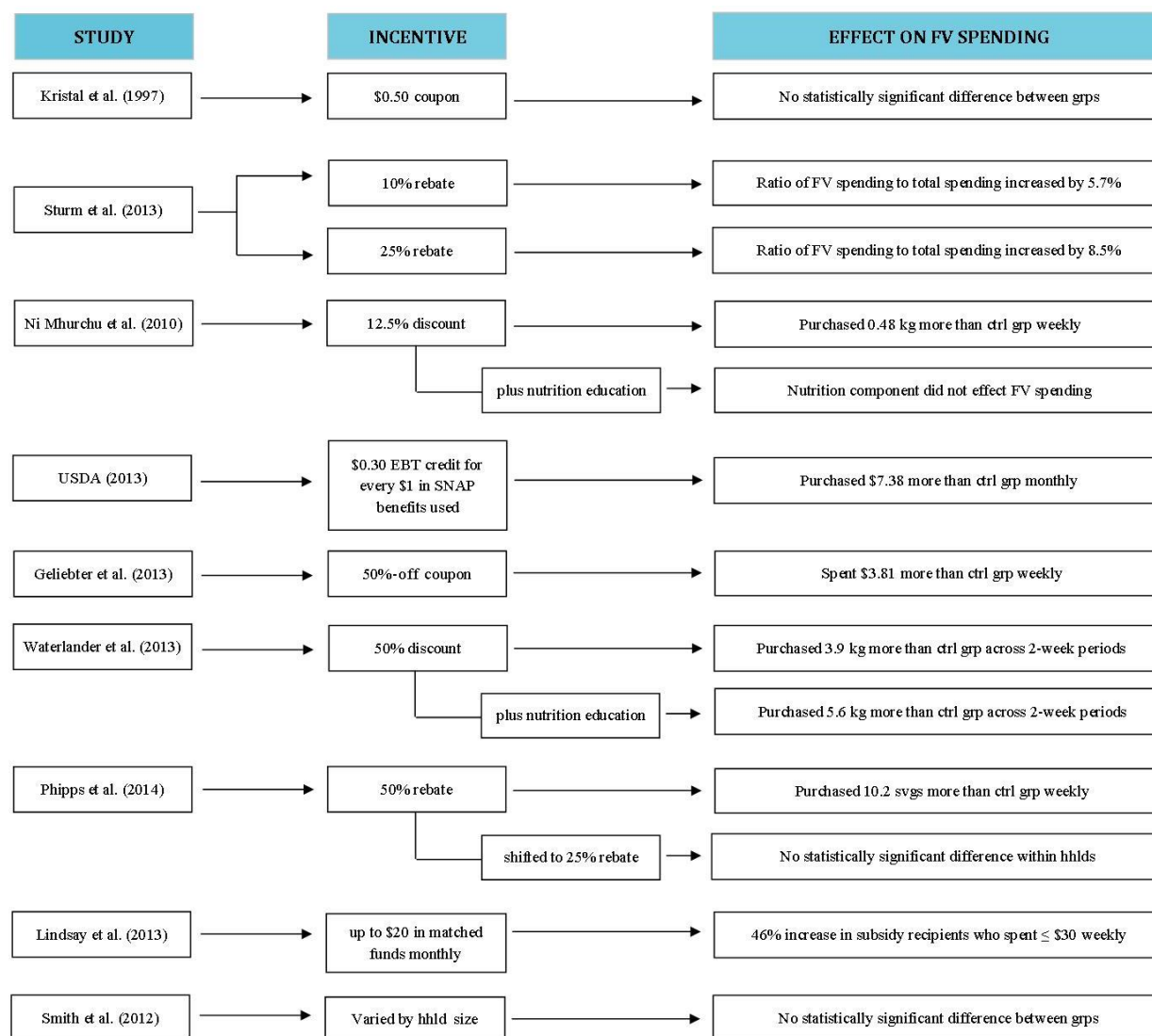
Food purchase was a key outcome in nine studies.<sup>1</sup> Seventy-eight percent (n=7) reported increased FV expenditure among intervention-group participants. All of the investigations were based in a supermarket. **Figure 2** depicts the documented effects of the financial incentives on produce expenditure. Change in fruit and vegetable purchasing was reported in dollars, percentages and kilograms. Select findings are expounded upon below.

In Geliebter et al. (2013), the 50% discount group spent an average of \$3.81 more on fruits and vegetables weekly compared to the control arm. A smaller yet significant spending differential was also present in the Healthy Incentives Pilot. Participants who received a 30% rebate on eligible produce spent \$7.38 more on FVs than non-rebate group members each month (USDA, 2013). Similarly, Waterlander and colleagues (2013) documented greater FV purchasing in their two discount conditions. The 50% discount and the discount-plus-nutrition education groups bought an average of 3.9 kg and 5.6 kg more fruits and vegetables, respectively, than the control group across two-week periods. Moreover, the participants did not purchase additional items at the study supermarkets with the money they saved (Waterlander et al., 2013). Rebate-eligible shoppers in Sturm, An, Segal, & Patel's (2013) study not only increased the ratio of their FV spending to total spending by 5.7% (in the 10% rebate group) and 8.5% (in the 25% rebate group), they also decreased spending on food categorized as less desirable.

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<sup>1</sup> Balsam et al. (1994) and Freedman (2011) are not reflected in this number because the researchers did not specify whether their respective subsidy had an impact on participants' usual FV spending.

**FIGURE 2. MEAN EFFECTS OF FINANCIAL INCENTIVES ON PRODUCE EXPENDITURE AT SUPERMARKET SITES**



The effect of a monetary subsidy was mixed in two investigations. Phipps et al.'s (2014) study included a full-intervention phase featuring a 50% rebate and a tapering phase featuring a 25% rebate. During the full intervention, the rebate group purchased 10.2 more servings of FVs weekly than the control group however a statistically significant difference in FV spending was absent in the tapering phase. The other investigation, Ni Mhurchu et al. (2010), did not observe a significant change in their primary outcome of interest (percentage of saturated fat in total food purchases) albeit a 10% increase in produce purchases was observed among subsidy group members during follow-up.

Contrary to the foregoing findings, two research teams did not observe an association between the provision of a financial subsidy and healthy food purchasing. In Smith et al.'s (2012) study, intervention-group members were allowed to apply their funds toward any food or non-food item at the participant's primary supermarket. As a result, the subsidy group increased its total food spending, but did not purchase more fruits or vegetables than the control group. Additionally, the biweekly 50-cent produce coupon that Kristal, Goldenhar, Muldoon, & Morton (1997) offered midway through their intervention period did not affect the quantity of fruits and vegetables purchased by supermarket shoppers.

### **Consumption of Fruits and Vegetables**

Dietary intake was a key outcome in 10 studies.<sup>2</sup> Eighty percent (n=8) reported greater fruit and vegetable consumption among participants who received a financial subsidy. **Figures 3 and 4** illustrate the documented effects of study incentives by intervention setting. Change in FV intake was reported in servings and percentages primarily. A few findings are discussed below.

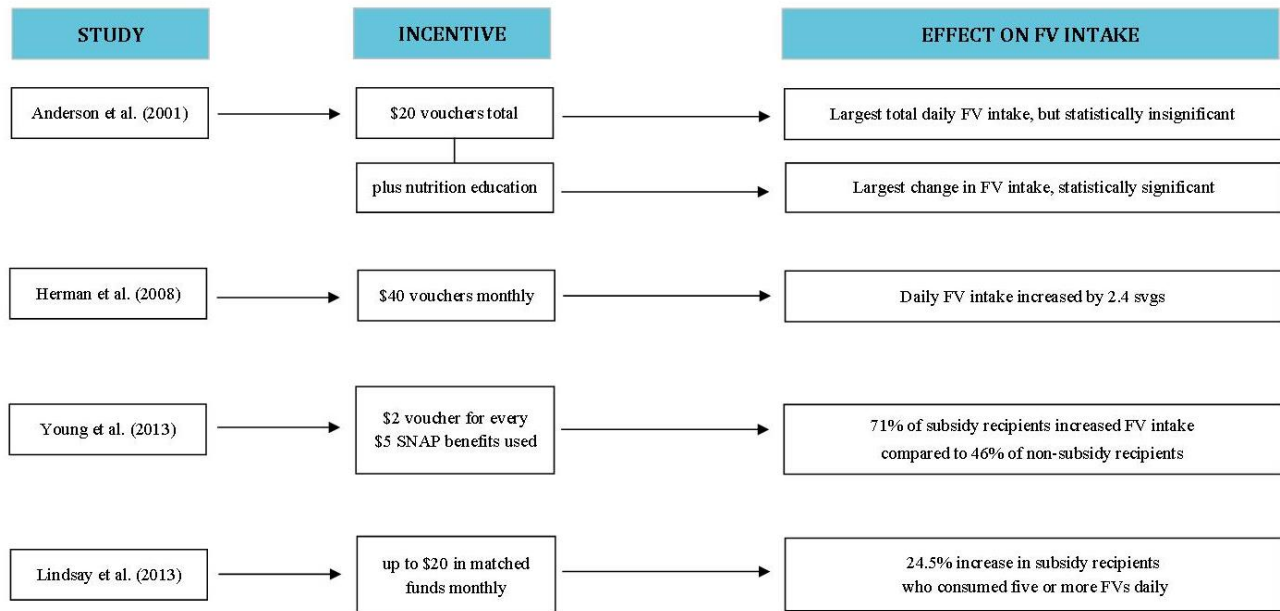
In Herman, Harrison, Afifi, & Jenks (2008), the recipients of \$40 in monthly farmers' market and supermarket vouchers increased their average daily FV intake by 2.4 and 0.9 servings, respectively. Although their daily produce intake was lower than the WIC enrollees in the foregoing study, the supermarket shoppers who received a 50% discount in Geliebter et al. (2013) increased their average daily intake by 88% from baseline to follow-up. A smaller yet statistically significant difference was reported in the Healthy Incentives Pilot rebate group whose members consumed 25% more targeted fruits and vegetables daily than the control group (USDA, 2013). Additionally, Lindsay et al. (2013) and Waterlander et al. (2013) documented increases of 25% and 19%, respectively, in subsidy participants who reported consuming the recommended quantities of FVs daily.

As in the previous section, some findings must be qualified. First, the subsidy-plus-nutrition education arms in Anderson et al. (2001) and Waterlander et al. (2013) reported the largest improvement

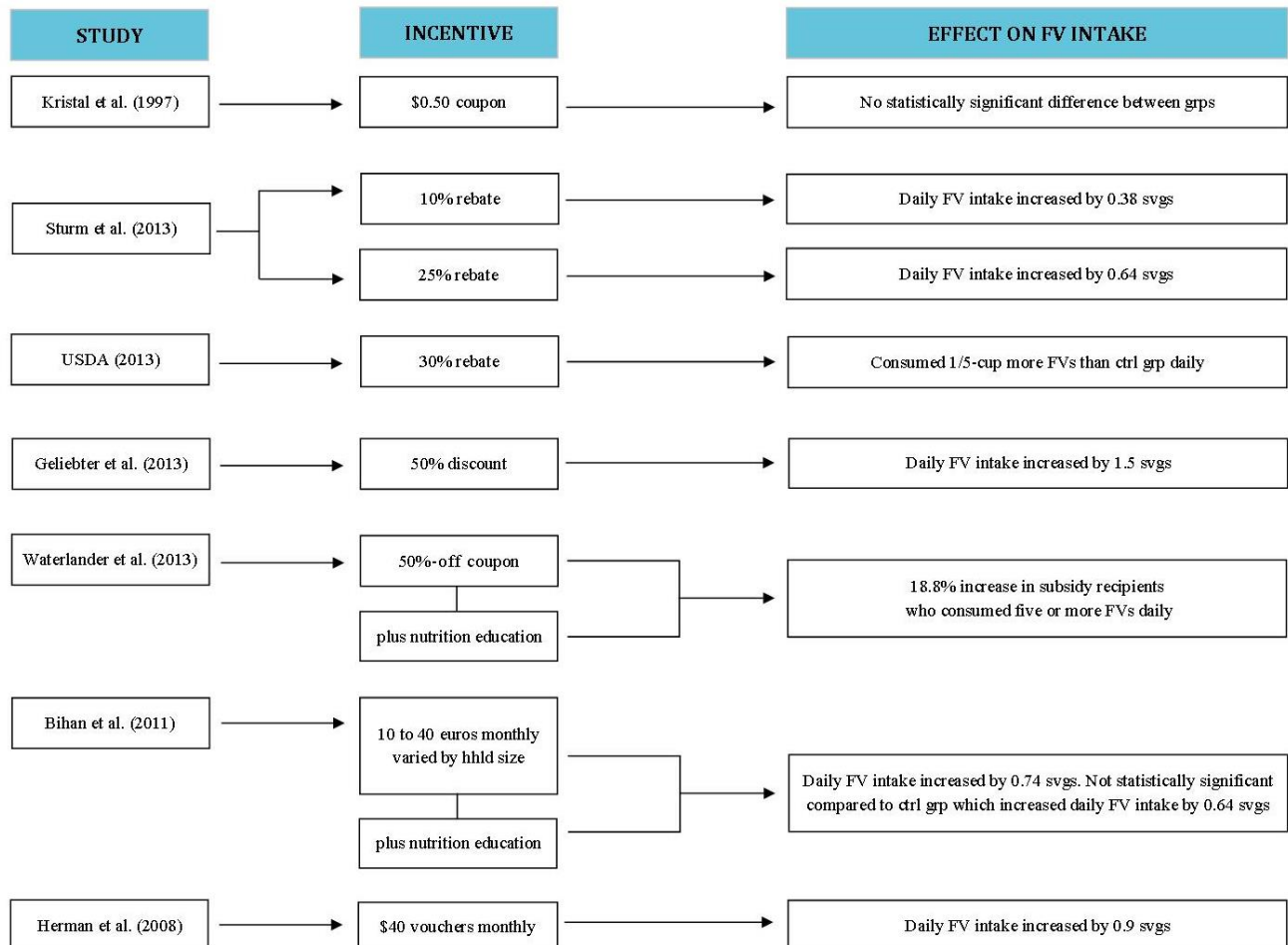
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<sup>2</sup> Kunkel et al. (2003) is not reflected in this number because the researchers did not specify whether the voucher had an impact on participants' usual FV consumption.

**FIGURE 3. MEAN EFFECTS OF FINANCIAL INCENTIVES ON PRODUCE INTAKE AT FARMERS' MARKET SITES**



**FIGURE 4. MEAN EFFECTS OF FINANCIAL INCENTIVES ON PRODUCE INTAKE AT SUPERMARKET SITES**



in FV intake. Second, a nutrition-education activity was offered at the farmers' market locations visited by survey respondents in Young and colleagues' (2013) evaluation. The investigators noted an association between using Philly Food Buck vouchers and eating more fruits and vegetables. However, there was also a positive association between receipt of nutrition education and participants' consumption behaviors. Third, when fruit and vegetable intake data were analyzed separately by Herman et al. (2008), a significant difference remained only for vegetables between the intervention and control groups.

Neither Kristal et al. (1997) nor Bihan et al. (2011) reported a statistically significant change in consumption between intervention- and control-group participants. Compared to the other investigations, Kristal et al.'s (1997) 50-cent subsidy was very small, and nearly 75% of their survey respondents reported high or very high FV intake at baseline.

Bihan et al.'s (2011) study was comprised of two intervention arms: nutrition-advice and voucher-plus-nutrition-advice. At follow-up, the latter group experienced an average increase of 0.74 daily servings in their FV intake. This change was not statistically significant in comparison to the control group, which reported a mean increase of 0.62 daily FV servings. Interestingly, the researchers observed that the entire study population experienced a significant increase in produce consumption. Similar to Waterlander and others' (2013) findings, it is difficult, if not impossible, to disaggregate the effect of the financial subsidy from the effect of the dietary advice on self-reported consumption.

Of the six studies that collected baseline and follow-up data after an intervention concluded, five reported a statistically significant increase in FV expenditure or consumption. In three studies, the improvements were almost completely (5, 6, 10) or partially sustained (10) at follow-up. Conversely, the increases documented in the other two investigations reverted toward baseline (14, 16).

### **Patronage of a Healthy Food Retailer**

Willingness to shop at a supermarket, grocery store or farmers' market was not a dependent variable in any investigation. However, two activities related to study participants' shopping patterns can serve as proxies for this latent variable. They are: (1) first visit to the study-specific healthy food venue

and (2) repeat visits to the retailer. Data were derived from farmers' market-based studies because participants in the supermarket-based investigations were current patrons of the retail sites.

#### First Visit to the Healthy Food Venue

Three research teams asked study participants if they had shopped at a farmers' market before the study ensued. In the evaluations, farmers' markets were an untapped food retail setting for a substantial number of participants. Specifically, 36% and 68% of survey respondents in Kunkel et al. (2003) and Balsam et al. (1994), respectively, shared that they had never shopped at a farmers' market. The voucher recipients had participated in an incentive program for low-income seniors.

The proportion of new farmers' market patrons was the highest in Lindsay and colleagues' (2013) assessment of a matched-funds program for SNAP, WIC and SSI recipients. Of all program enrollees, 82% had never visited a farmers' market. Further, among participants who completed the final customer survey, 93% stated that the incentive program influenced their decision to shop in a new food retail environment (Lindsay et al., 2013).

#### Repeat visits to the Healthy Food Venue

Returning to the evaluations discussed above, voucher recipients were also asked if they visited or would visit a farmers' market more than once. Thirty-five percent of survey respondents in Balsam et al. (1994) continued to shop at a farmers' market after exhausting their coupons, and 49% indicated it was likely that they would continue shopping at the venue. Of equal importance, 29% of the respondents expressed that they would not shop at a farmers' market again without a financial inducement.

Repeat visits were more common in three other studies. Specifically, 46% of Lindsay et al.'s (2013), 71% of Freedman et al.'s (2011), and 94% of Kunkel et al.'s (2013) adult survey respondents, and 77% of the youth in Freedman et al. (2011) visited a farmers' market at least twice. Moreover, the proportion of program enrollees who would continue shopping at the venue without a subsidy was 55% in Lindsay et al. (2013) and 89% in Kunkel et al. (2013). Granted, the extent to which the repeat visits data reflect the feedback of individuals who were new farmers' market patrons is unclear.

In summary, findings from 16 domestic and international studies that evaluated the effectiveness of financial incentives for nutritious foods are reflected in this section. Across the studies, a variety of methodologies were used to investigate consumer response to a produce subsidy in healthy food retail outlets. More data is needed to assess the impact of economic incentives on venue patronage however the literature suggests that produce subsidies exert a positive effect on consumer FV spending and intake.

## **DISCUSSION**

A low-produce diet increases individual risk for chronic disease, disability and premature death (ACS, 2012; ADA, n.d.; AHA, 2014). Despite a succession of national produce campaigns in the United States—including 5 A Day, Choose Your Plate, and Fruit & Veggies Matter More—Americans’ average daily fruit and vegetable consumption falls short of the levels recommended by health authorities (CDC, 2013). Although individuals of disparate socioeconomic positions regularly cite price as a barrier to adequate FV consumption (Catalina Marketing & FMI, 2010; PBHF, 2014; Zachary et al. 2013), this modifiable factor is a greater deterrent for consumers with restricted food dollars. When unreasonable, the cost of produce precludes vulnerable groups from acquiring foods essential to good health.

In this critical literature review, I evaluated the impact of 16 economic-incentive interventions on FV expenditure, FV consumption, and venue patronage in healthy food outlets. Altogether, the evidence suggests that healthy food retail patrons buy and eat more produce in response to a financial incentive. Specifically, in 11 of 14 studies (79%), there was a statistically significant increase in FV expenditure and consumption among incentive recipients compared to control-group shoppers. The effect of a produce incentive on venue patronage—examined herein by focusing on participants’ first and subsequent venue visits—could not be determined as the quantity of convincing evidence was limited for this outcome.

Key findings of this appraisal support the use of financial subsidies to encourage healthy dietary behaviors among low-income consumers. A range of economic incentives were investigated, and the only



subsidy that failed to affect produce spending or intake was a biweekly 50-cent coupon (2). A few notable strengths that may have enhanced the effectiveness of the other incentives are discussed below.

The supermarket investigations had strong research designs. Most used randomization to assign participants to research conditions, acquired electronic sales data to analyze purchasing, and reminded intervention subjects of eligible items by highlighting the foods on print and online lists, newsletters, receipts, or in-store signage. In the studies that investigated FV consumption, 24-hour recall interviews or modified versions of a food frequency questionnaire were used.

Collaboration was essential to the farmers' market interventions. For example, nearly all of the incentive programs in this setting were designed to connect individuals at nutritional risk to an alternative source of healthy food. Program staff worked with a number of community organizations to reach these populations successfully (1, 8, 11, 15). Effective outreach and the prospect of social interaction (5) may have motivated some incentive recipients to patronize this healthy food venue.

Nutrition education was offered in three supermarket studies (6, 7, 14). Two investigations (6, 14) had four arms—subsidy only; subsidy-plus-nutrition education; nutrition education only; and control—and the other (7) had a total of two conditions, which both featured nutrition education. Surprisingly, the subsidy-plus-nutrition education group did not exhibit greater produce spending in the only study that provided culturally tailored information (6) however in another study (14) this arm documented the largest change in FV purchasing. Further, in the two-arm intervention, a statistically significant increase in produce intake was observed in the entire study population, but not between groups. This finding seems to elucidate the influence of the educational component received by all participants.

Most of the farmers' market studies targeted recipients of WIC or SNAP—two programs that avail nutrition education to enrollees. In the four investigations that featured this component, two (3, 15) indicated that the activity had a significant effect on consumption, while the other studies (4, 8) did not report impact data. Overall, the foregoing information conveys that price-reduction strategies should include complementary actions, such as community engagement and education, to foster dietary change.

## **Intervention Limitations**

A few limitations temper the documented effects of a produce subsidy in healthy food retail settings. With the exception of the USDA investigation that randomized all of one county's SNAP enrollees into its Healthy Incentives Pilot, research subjects self-selected into all of the financial-incentive experiments or programs. In addition, some outcome effects may be overestimated. For example, self-reported consumption could reflect social desirability bias or inaccurate recollection, especially when the 24-hour recall method was not used.

With the exception of two studies, the research designs of the farmers' market-based interventions were weak. Specifically, most of the farmers' market evaluations used nonprobability sampling to recruit survey respondents. The majority of studies lacked baseline data, a control group, and moderate-to-high response rates. Further, several investigations did not quantify changes in subjects' FV purchasing or intake. Since within-group or between-group differences could not be determined, most farmers' market-based studies could only inform venue patronage.

External validity is an important concern. In addition to the shortcomings of several farmers' market studies, the majority of the supermarket-based RCTs were performed outside of the United States. The unique social, cultural and geographic contexts that influence food-related decision making hinder the generalizability of reported effects. Even so, the produce-incentive interventions in supermarkets were largely effective in increasing FV expenditure and consumption among low-income people of diverse backgrounds in four countries.

## **Literature Review Strengths and Limitations**

To my knowledge, this is the first critical review of produce-incentive interventions based exclusively in supermarket, grocery store or farmers' market environments. During the article acquisition stage, I consulted public health, nutrition and business experts in order to conduct a robust search. My thorough critique of the literature resulted in the identification of useful findings not emphasized in some

papers. For example, Ni Mhurchu et al.'s (2010) findings for their secondary outcomes are not highlighted in some articles however this data was germane to one of my research questions.

This literature review is not without limitations. First, the heterogeneity of the research designs did not allow for direct comparisons. Even attempting to isolate the treatment variable was impractical because the subsidies varied substantially by type; monetary value; and distribution mode, frequency and duration. Second, studies based solely in small food outlets such as corner stores were not eligible for review. If the Healthy Corner Store Network has published reports about the effectiveness of financial incentives in participating stores, this review may overlook important data. Third, due to the dearth of research undertaken in the food venues of interest, I did not use a quality assessment tool to exclude literature during the article acquisition stage. This may have introduced bias into my results section.

However, to determine if the results for FV purchasing or consumption would change, I analyzed the studies with the strongest design. Specifically, the investigations had randomized conditions; objective sales or 24-hour dietary recall data; a post-intervention, follow-up period; and response rates of 60% or higher. In this small subset of studies, Geliebter et al. (2013), Ni Mhurchu et al. (2010) and Phipps et al. (2014) reported increases in purchasing; and, Herman et al. (2008) and Geliebter et al. (2013) documented increases in consumption. Although the quantity was greatly reduced, the best evidence herein maintains that financial incentives stimulate produce expenditure and consumption.

### **Alignment to Existing Research**

In An's (2013) systematic review of 20 economic-incentive experiments, only one did not document an effect on its primary outcomes of interest. The findings reported in An's (2013) study and this review diverge from earlier research by Seymour et al. (2004). In their comprehensive review, the scholars concluded that nutritional interventions in supermarkets were the least effective. At least two factors contribute to this differing assessment. First, of the 10 supermarket-based studies reviewed by Seymour and colleagues (2004), only two used pricing as an intervention: Curhan (1974) and Kristal et al. (1997). The latter was the "no-effect" study in An (2013), which is also discussed in the intervention

effectiveness section of this paper. Second, the majority of the supermarket-based studies in this appraisal were conducted after Seymour et al.'s (2004) study was published.

### **Future Research Directions**

During the last decade, a plethora of projects received federal, state, local or private foundation funding to establish or rehabilitate food retail outlets in underserved communities (HFAP, n.d.b). Only a small number of behavioral-incentive studies have been conducted in these outlets. Public health researchers should attempt to partner with more of these proprietors to build upon the promising findings presented in this review. To strengthen generalizability, the price-reduction interventions with strong research designs and evidence of positive effects should be replicated in other places.

In addition to the price manipulations covered in this review, researchers should investigate how other types of retail promotions, e.g. buy-one-get-one-free offers, affect consumer spending and consumption. Several scholars have expressed the importance of considering total energy intake. Fruits and vegetables represent only two-fifths of the food groups recommended for a balanced diet. Therefore, the cost of healthful versions of dairy, grains and proteins should also be considered to increase access to all components of a nutritive diet. Finally, the sustainability of financial-subsidy interventions must be addressed. Total cost varied substantially across the investigations in this review. Additional research is needed to determine incentive thresholds, and their effects on retailer profitability.

### **RECOMMENDATIONS**

Undoubtedly, the introduction of healthy food retail into low-access communities increases the physical availability of nutritious food. However, the realization of equitable food access requires an essential next step: increasing the affordability of healthful food. Four important stakeholder groups—healthy food retailers, policymakers, research institutions, and public health leaders—can act to attenuate economic barriers that prevent low-income individuals from accessing new sources of fresh produce. The recommendations that follow were informed by the findings in this review and grey literature.

## Healthy Food Retailers

Healthy food outlets should offer price incentives on fresh fruits and vegetables. To avoid widening the gap in produce consumption between high- and low-SES groups, supermarkets and grocery stores should follow the lead of farmers' markets by offering special discounts to qualifying low-income patrons. Although the following program design, funding and sustainability recommendations were generated with Jack & Jake's in mind, the suggestions are equally useful to other grocery venues.

- Establish a FV discount program that offers a point-of-purchase price reduction or rebate. If financially feasible, the use an electronic service (such as the e-VIC program offered by Harris Teeter) is encouraged to make the customer benefit automatic rather than something that must be pursued, e.g. by remembering to bring a print coupon. Moreover, an electronic format can help diminish the stigma that some individuals associate with needs-based or charity programs. Consider piloting the incentive program with a specific group, such as senior citizens, in order to acquire data that helps strengthen the initiative prior its expansion to a larger audience.
- Apply for a Specialty Crop Block Grant. Funded by the USDA, each state has money earmarked to promote its specialty crops, which include fresh fruits and vegetables. Louisiana awards up to \$100,000 in grant funding for projects that last up to 2 years and 11 months (NASDA, 2014). In 2015, Jack & Jake's should apply for this grant, and propose using the funding to implement a produce discount program for disadvantaged Central City residents, or to conduct educational or marketing activities that would enhance said initiative.
- Use in-store fundraising. As part of a corporate social responsibility or similar program, allocate a percentage of sales from a set retail period, e.g. one week, one month, etc., to fund the produce incentive initiative. Whole Foods Market employs this tactic for a variety of causes regularly.
- Partner with local universities or colleges and other pertinent stakeholders to apply for grant funding. As an example, the Produce for Better Health Foundation awards a training grant to

collegiate-level nutrition and dietetic students who are interested in leading educational grocery store tours as part of a semester-long internship (PBHF, 2014b).

- Determine a profitable produce mix. Learn the FV preferences of program participants through brief surveys. Subsequently, use sales data to assess price elasticity. A product is price elastic when change in demand exceeds change in price (Andreyeva, Long, & Brownell, 2010). Attempt to balance the promotion of produce that are highly preferred with those that are highly elastic to satisfy customer preferences and operational needs. The *Retail Fruit & Vegetable Marketing Guide* created by the Network for a Healthy California has several useful tips for this area.
- Apply to become authorized to accept SNAP benefits. Acquiring this designation would attract patrons as most SNAP benefits are redeemed in grocery stores (USDA, 2013, p. 47). Further, this group would be ideal for a FV discount program. Research has documented significant increases in EBT sales at farmers' markets subsequent to the implementation of rebate and matched-funds programs (Baronberg et al., 2013; Lindsay et al., 2013; Young et al., 2013).
- Apply to become authorized to accept WIC benefits. After the federal moratorium on new vendor applications in Louisiana is lifted, submit an application to partner with this important program.

### **Policymakers**

- Require healthy food financing applicants to submit a preliminary plan that specifies how the retailer aims to make healthy food more accessible to vulnerable community members. Establish the plan as a criterion upon which the merit and feasibility of proposals are evaluated.
- Encourage awardees to collaborate with public health researchers and evaluators to help expand the evidence base on the health effects of healthy food financing initiatives.

### **Research Institutions**

- Partner with recipients of healthy food financing and other appropriate food-retail proprietors to

develop innovative research proposals, apply for grant funding, evaluate in-store programs, and disseminate findings.

- Replicate the well-designed and promising investigations reflected in this literature review to improve their external validity. New Orleans researchers should look to Phipps et al.'s (2014) work as the population, setting and context are quite similar to Central City.
- Build upon recently completed supermarket-based studies by Foster et al. (2014) and Johnston et al. (2014), and monitor RAND's ongoing, five-year PHRESH (Pittsburgh Hill/Homewood Research on Eating, Shopping & Health) investigation.

### **Public Health Leaders**

Public health leaders are integral to realizing the vision of equitable food access in every community. At local, regional and national levels, collaborative leadership is needed to mobilize the stakeholders essential to improving population health and well-being. In communities with insufficient access to healthy food, public health practitioners should catalyze or support formal efforts to assess the underlying issues and their community's readiness for change. Several coordinated strategies can be employed to meaningfully engage the groups discussed above—a few instrumental actions follow.

- Organize a diverse coalition of community members to devise a comprehensive healthy food access campaign that reflects adequate attention to the social ecological model of health. Invite healthy food retail proprietors to contribute their unique perspectives to the multi-sector team.
- Stay abreast of the food-access knowledge generated by public health researchers and scholars from other fields. Consult with thought leaders to translate this knowledge into evidence that can be used to influence key policy and environmental decisions.
- Encourage policymakers to consider the best available evidence, which includes the lived experiences of disadvantaged groups, as well as the public's health in all decision-making. Use

message framing techniques to describe how neighborhood food environments facilitate or hinder community well-being and viability. Urge decision makers to create policies and to engage in practices that reduce physical and economic barriers to fresh, healthy food.

## **SUMMARY**

A new fresh food market will open soon in a New Orleans neighborhood that has limited access to fresh produce. The forthcoming proprietor proposed offering financial incentives to increase residents' access to healthful foods. This research effort commenced as part of a pilot HIA project, which was undertaken to examine the health effects of the food retailer's proposed activities.

In this literature review, I acquired and critiqued 17 empirical research and evaluation studies that investigated financial-incentive experiments and programs in supermarket, grocery store and farmers' market settings. Primary outcomes of interest were change in subsidy recipients' produce expenditure and intake. The majority of studies documented significant increases in the purchase and consumption of produce. Despite important limitations, to date, the best available evidence supports using price-reduction tactics in healthy food stores to help improve the dietary intake of low-income patrons.

This finding has implications for several stakeholder groups including healthy food retailers, policymakers, research institutions, and public health practitioners. The latter group plays an essential role in advocating for policy and environmental changes that improve population health and lessen socially driven disparities. While it is important for public health to help translate knowledge into action, the sector cannot facilitate community-level change efforts alone.

Rather, public health workers must participant in, if not convene, a collective of diverse and resourceful stakeholders who are committed to addressing the economic dimension of food access. Ideally, incentivized produce in food retail venues would reflect one of several activities featured in a multi-pronged, cross-sector campaign that aims to improve the nutritional health of food-desert dwellers.



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**Table A.1:** Summary of Literature Included in the Review of Financial-Incentive Studies in Grocery Store and Farmers' Market Settings

| Study ID | First Author, Year                  | Intervention Location        | Intervention Setting                                              | Study Design                                             | Intervention Duration                        | Follow-up | Economic Incentive | Eligible Item                                                                                                                        |
|----------|-------------------------------------|------------------------------|-------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------|-----------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 1        | Balsam A, 1994                      | United States Massachusetts  | Farmers' market                                                   | One-group posttest                                       | Not reported                                 | No        | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 2        | Kristal AR, 1997                    | United States Iowa           | Supermarket                                                       | Randomized ctrl                                          | 8 mos                                        | Yes       | Coupon             | Any fruit or vegetable                                                                                                               |
| 3        | Anderson JV, 2001                   | United States Michigan       | Farmers' market                                                   | Pre-post ctrl group                                      | 2 mos                                        | Yes       | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 4        | Kunkel ME, 2003                     | United States South Carolina | Farmers' market                                                   | One-group posttest                                       | 5 mos                                        | No        | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 5        | Herman DR, 2008                     | United States California     | Farmers' market                                                   | Ctrl-grp interrupted time series                         | 6 mos                                        | Yes       | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 6        | Ni Mhurchu C, 2010                  | New Zealand                  | Supermarket                                                       | Randomized ctrl                                          | 6 mos                                        | Yes       | Discount           | Variety of healthy foods, including fruits and vegetables                                                                            |
| 7        | Bihan H, 2011                       | France                       | Supermarket                                                       | Randomized ctrl                                          | Not reported                                 | No        | Voucher            | Fresh fruits and vegetables; potatoes excluded                                                                                       |
| 8        | Freedman DA, 2011                   | United States Tennessee      | Farmers' market                                                   | One-grp interrupted time series                          | 3 mos (sales data)                           | No        | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 9        | Smith C, 2012                       | New Zealand                  | Supermarket                                                       | Randomized ctrl                                          | 4 wks                                        | No        | Voucher            | All food and non-food items                                                                                                          |
| 10       | Geliebter A, 2013                   | United States New York       | Supermarket                                                       | Randomized ctrl                                          | 2 mos                                        | Yes       | Discount           | Fruits, vegetables and non-caloric beverages                                                                                         |
| 11       | Lindsay S, 2013                     | United States California     | Farmers' market                                                   | Ctrl-grp interrupted time series; pre-post ctrl grp      | 1 yr, 8 mos                                  | No        | Matched Funds      | Fresh fruits and vegetables, healthy packaged foods                                                                                  |
| 12       | (a) Sturm R, 2013<br>(b) An R, 2013 | South Africa                 | Supermarket                                                       | Ctrl-grp interrupted time series                         | (a) 2 yrs, 4 mos<br>(b) 2 yrs, 9mos          | No        | Rebate             | Variety of healthy foods, including fruits and vegetables                                                                            |
| 13       | USDA, 2013                          | United States Massachusetts  | Supermarket, grocery store, convenience store and farmers' market | Randomized ctrl                                          | 1 yr                                         | No        | Rebate             | Fresh, canned, frozen and dried fruits and vegetables w/o added sugars, fats, oils, or salt; white potatoes and fruit juice excluded |
| 14       | Waterlander WE, 2013                | Netherlands                  | Supermarket                                                       | Randomized ctrl                                          | 6 mos                                        | Yes       | Coupon             | Fresh, canned and frozen fruits and vegetables; potatoes excluded                                                                    |
| 15       | Young CR, 2013                      | United States Pennsylvania   | Farmers' market                                                   | Ctrl-grp interrupted time series; posttest with ctrl grp | 3 mos (survey); 3 yrs and 5 yrs (sales data) | No        | Voucher            | Fresh fruits and vegetables                                                                                                          |
| 16       | Phipps EJ, 2014                     | United States Pennsylvania   | Supermarket                                                       | Randomized ctrl                                          | 3 mos                                        | Yes       | Rebate             | Fresh or frozen fruits and vegetables                                                                                                |

A paper unit that exceeded the value of a standard U.S. food coupon is categorized as a voucher herein. In 2013, the average value of a food coupon was \$1.03 (Inmar, 2014).

**Table A.2:** Summary of Interventions Included in the Review of Financial-Incentive Studies in Grocery Store and Farmers' Market Settings

| ID | First Author, Year | Targeted Population                                                                                                                     | Targeted Behavior                                        | Sample Size | Outcome Measure                                                  | Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Results                                                                                                                                                                                                                                      |
|----|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Balsam A, 1994     | Seniors in the Massachusetts Farmers' Market Coupon Program (MFMCPC)                                                                    | Farmers' market food purchase                            | 124 elders  | Self-report food purchases                                       | As part of MFMCPC, low-income seniors given \$5 voucher to use at a farmers' market during 1992 season                                                                                                                                                                                                                                                                                                                                                                                                            | Survey respondents purchased vegetables and fruits most frequently with the vouchers                                                                                                                                                         |
| 2  | Kristal AR, 1997   | Supermarket shoppers in rural Iowa                                                                                                      | Fruit/vegetable consumption<br>Supermarket food purchase | 958 adults  | Self-report food purchases<br>Self-report fruit/vegetable intake | Eight supermarkets randomized into two arms: four intv and four ctrl sites. Intv components included: (1) Flyers featuring on-sale FVs and a motivational health message on one side, and suggested recipes and menus on the other. Initially, flyers distributed weekly; changed to biweekly and included a 50-cent FV coupon. (2) Store signage portrayed shelf location of on-sale FVs. (3) Awareness activities, such as study personnel dressing as large vegetables and food demos, conducted twice monthly | Neither FV purchases nor intake increased significantly among intv-store shoppers at 12-month follow-up                                                                                                                                      |
| 3  | Anderson JV, 2001  | WIC and Community Action Agency Commodity Supplemental Food Program (CSFP) recipients in the Michigan Farmers' Market Nutrition Program | Fruit/vegetable consumption                              | 455 women   | Self-report fruit/vegetable intake                               | WIC participants randomized into two arms: subsidy-plus-nutrition education or nutrition education. Education groups attended 20-minute nutrition session. CSFP participants assigned to two arms: subsidy or ctrl. Subsidy groups given \$20 in vouchers after pretest and cash for posttest. The education-only and ctrl participants received cash after pretest and vouchers for posttest. The cash incentive given to WIC and CSFP participants was \$5 and \$10, respectively                               | Coupons had a positive, direct effect on FV consumption<br><br>Coupon-plus-education group had largest change in FV intake<br><br>Education had an indirect effect on FV consumption through its impact on participants' attitudes about FVs |
| 4  | Kunkel ME, 2003    | Seniors in the South Carolina Farmers' Market Nutrition Education Program (SCFMNEP)                                                     | Fruit/vegetable consumption                              | 658 elders  | Self-report fruit/vegetable intake                               | As part of SCFMNEP, low-income seniors given \$50 in vouchers to use at a farmers' market during the 2001 season. The incentive was disseminated in \$10 units                                                                                                                                                                                                                                                                                                                                                    | 64.2% of survey respondents indicated that having the [vouchers] changed the way they ate<br><br>88.5% of survey respondents indicated they would eat more fresh FV all year round due to their participation in the incentive program       |



| ID | First Author, Year | Targeted Population                                                                                        | Targeted Behavior                                                                                             | Sample Size  | Outcome Measure                                                                                                    | Intervention                                                                                                                                                                                                                                                                                                                                                                  | Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|--------------------|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | Herman DR, 2008    | Post-partum WIC recipients in suburbs of Los Angeles, California                                           | Fruit/vegetable consumption                                                                                   | 451 women    | Self-report fruit/vegetable intake                                                                                 | Three WIC centers assigned to three arms: farmers' market subsidy, supermarket subsidy or ctrl. Intv groups instructed on proper voucher use at food retail sites and issued \$40 in vouchers monthly; they could be used during ensuing two-month period. Vouchers disbursed in \$1 or \$2 units according to site. Ctrl group given \$13 in coupons for disposable diapers  | <p>Significant increase in avg daily FV intake from baseline to end of intv:</p> <ul style="list-style-type: none"> <li>Farmers' market: 5.4 to 7.8 svgs</li> <li>Supermarket: 6.9 to 7.8 svgs</li> </ul> <p>Increase mostly maintained at 6-month follow-up:</p> <ul style="list-style-type: none"> <li>Farmers' market: 7.5 svgs</li> <li>Supermarket: 7.4 svgs</li> </ul> <p>Significant difference in avg vegetable intake alone btwn intv and ctrl groups at intv end and 6-month follow-up</p> <p>No significant difference in avg fruit intake alone btwn intv and ctrl groups at intv end or 6-month follow-up</p> |
| 6  | Ni Mhurchu C, 2010 | Maori, Pacific and low-income supermarket shoppers in Lower North Island, New Zealand                      | Supermarket food purchase<br>(focus: percentage of energy from saturated fat and quantity of healthier foods) | 1,028 adults | Electronic sales data                                                                                              | Participants randomized into four groups: 12.5% discount, nutrition education, discount-plus-nutrition education or ctrl. Subsidy groups mailed list of eligible foods regularly and rcvd automatic 12.5% discount on these items when shopper card was scanned at point of purchase. Education groups mailed culturally specific nutrition materials monthly                 | <p>Saturated fat purchases did not decrease significantly</p> <p>Compared to ctrl group, discount groups purchased 0.79kg (11%) more healthier foods overall and 0.48kg (10%) more FVs at 6-month follow-up</p> <p>Nutrition education did not have an effect on food purchasing</p>                                                                                                                                                                                                                                                                                                                                       |
| 7  | Bihan H, 2011      | Low-income patients at health center affiliated with the French National Insurance System in Paris, France | Fruit/vegetable consumption                                                                                   | 73 adults    | Self-report fruit/vegetable intake<br><br>Biochemical tests for vitamin C, beta carotene and other nutrient levels | Subsequent to receipt of nutrition advice and print materials from a dietitian, participants randomized into two arms: voucher-plus-dietary advice or dietary advice. The advice group was not offered additional intvs. Each month, the subsidy group rcvd a voucher; the amount, based on hldd size, ranged from 10 to 40 euros per month (see Bihan et al., 2011, p. 371). | <p>Mean daily FV consumption in voucher group did not increase significantly in comparison to advice-only group</p> <p>At 3-month follow-up, daily FV consumption increased significantly in both groups: voucher by 0.74 svgs and advice by 0.62 svgs</p> <p>In both groups, nutrient levels did not change significantly</p>                                                                                                                                                                                                                                                                                             |

| ID | First Author, Year | Targeted Population                                                                                                          | Targeted Behavior                                            | Sample Size            | Outcome Measure                                                 | Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Results                                                                                                                                                                                                                                                                                             |
|----|--------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8  | Freedman DA, 2011  | Adults and youth in low-income, minority, urban neighborhoods with low access to healthy food retail in Nashville, Tennessee | Farmers' market food purchase                                | 286 adults<br>65 youth | Manually created sales receipt data                             | Intervention included three components: farmers' markets, a Super Shopper program, and a Youth Leader Board (YLB). Under adult supervision, YLB members managed 34 farmers' markets held at four Boys & Girls Club sites. Two locations had eight markets and the others had nine each. Community members (including YLB participants) enrolled in the Super Shopper Program. Participants given up to \$20 in produce vouchers for use at the farmers' markets. For adults, the subsidy was connected to the completion of surveys and disbursed in \$5 units. The youth rcvd vouchers in exchange for volunteering at the markets | Super Shoppers purchased 66% of the total volume of produce sold at the farmers' markets<br><br>62% of adult voucher users made at least one sales transaction, and 71% were repeat customers<br><br>100% of youth voucher users made at least one sales transaction, and 77% were repeat customers |
| 9  | Smith C, 2012      | Low-income, food-insecure supermarket shoppers in Dunedin, New Zealand                                                       | Supermarket food and nonfood purchases                       | 151 adults             | Electronic sales receipt data<br><br>Self-report purchases      | Participants randomized into two arms: voucher or ctrl. Inv group rcvd a voucher or credit on a prepaid shopping card weekly; the amount varied by hld size and supermarket (see Smith et al., 2012, p. 1508-9). Weeks 1-3 vouchers had a two-week usage window; the final voucher had to be redeemed within one week. Forms given to inv group for recording unredeemed food purchases. Ctrl group rcvd vouchers at end of study                                                                                                                                                                                                   | Voucher users did not purchase more FVs (nor other food groups of interest) than ctrl group<br><br>Intv group's spending overall (on food and nonfood items) and on food specifically was significantly higher than the ctrl group                                                                  |
| 10 | Geliebter A, 2013  | Overweight and obese supermarket shoppers in Manhattan, New York                                                             | Fruit/vegetable consumption<br><br>Supermarket food purchase | 47 adults              | Electronic sales data<br><br>Self-report fruit/vegetable intake | At two locations of a chain supermarket, participants were randomized into two arms: 50% discount or ctrl. Inv participants given new shopping card and list of eligible foods; they rcvd an automatic discount on these items when shopper card was scanned at point of purchase. Ctrl group given identical document framed as a healthy food list                                                                                                                                                                                                                                                                                | Discount group daily FV intake increased from 1.7 svgs at baseline to 3.2 during follow-up<br><br>Discount group's avg weekly FV spending was \$5.50 compared to \$1.69 in the ctrl group                                                                                                           |

| ID | First Author, Year                  | Targeted Population                                                                                                | Targeted Behavior                                                                                                                  | Sample Size                                                                              | Outcome Measure                                             | Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----|-------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | Lindsay S, 2013                     | SNAP, WIC and SSI recipients at farmers' markets in low-income, primarily immigrant areas of San Diego, California | Farmers' market food purchase<br>Fruit/vegetable consumption                                                                       | 908 adults 3-to-6 month follow-up<br>252 adults 12-month follow-up<br>5 farmers' markets | Self-report fruit/vegetable intake<br>Electronic sales data | Government nutrition assistance recipients were eligible to enroll in the Fresh Fund program. Enrollees used EBT, WIC or SSI vouchers, or cash to buy "purchased" tokens that were matched by distinct incentive tokens. Each month, participants could receive up to \$20 in incentive tokens that were redeemable throughout the market season at vendors selling produce and healthful packaged foods. 2010 and 2011 sales and incentive data were acquired for five markets                                                     | At 12-month follow-up: <ul style="list-style-type: none"> <li>24.5% increase in enrollees' intake of five or more daily FV svgs</li> <li>46% increase in participants who spent ≥\$30 weekly on FVs</li> </ul> At 3-to-6-month follow-up: <ul style="list-style-type: none"> <li>24.1% increase in enrollees' intake of five or more daily FV svgs</li> <li>3.8% increase in participants who spent ≥\$30 weekly on FVs</li> </ul>                                                                          |
| 12 | (a) Sturm R, 2013<br>(b) An R, 2013 | Adult members of Discovery health insurance company in South Africa                                                | Supermarket food purchase                                                                                                          | (a) 169,485 adults<br>(b) 351,319 adults                                                 | (a) Electronic sales data<br>(b) Health Risk Assessment     | Health insurer offered an opt-in incentive program to its members. Enrollees received a 10% or 25% rebate on healthy food purchases in 432 study supermarkets. Each month, up to \$480 per hhld was eligible for the rebate. (The larger incentive required completion of an annual online health risk assessment.) Participants were informed of eligible foods via a webpage, brochure, in-store signage and store receipts                                                                                                       | In the 10% rebate grp, spending on: <ul style="list-style-type: none"> <li>healthy foods increased 6%</li> <li>FVs increased 5.7% (0.38 svgs)</li> <li>less desirable foods decreased 5.6%</li> </ul> In the 25% rebate grp, spending on: <ul style="list-style-type: none"> <li>healthy foods increased 9.3%</li> <li>FVs increased 8.5% (0.64 svgs)</li> <li>less desirable foods decreased 7.2%</li> </ul> In the 10% and 25% rebate grps, daily FV intake increased by 0.38 and 0.64 svgs, respectively |
| 13 | USDA, 2013                          | WIC recipients in Hampden County, Massachusetts                                                                    | Food purchase at convenience stores, farmers' markets, grocery stores, supermarkets and superstores<br>Fruit/vegetable consumption | 1,998 females (aged 16 and older)                                                        | Electronic sales data<br>Self-report fruit/vegetable intake | As part of the USDA's Healthy Incentives Pilot (HIP) program, WIC recipients were randomized into two conditions: 30-cent rebate (for every SNAP dollar spent on targeted FVs) or ctrl. The incentive arm had three waves. Each month, up to \$60 per hhld was eligible for the rebate. Intv group given EBT card sleeve that contained information on eligible foods; the holder could be used to verify participation in HIP. Throughout the intv, eligible retailer lists, a program brochure and updates mailed to rebate group | During first half of pilot program: <ul style="list-style-type: none"> <li>Incentive group purchased a larger quantity and greater variety of targeted FVs than ctrl group</li> <li>Two-thirds of HIP hhlds received a rebate; specifically, these hhlds purchased an avg of \$18.50 in targeted FVs and earned an avg of \$5.55 in rebates monthly</li> <li>HIP participants consumed 25% more targeted FVs daily than ctrl group (equivalent to 1/5 cup)</li> </ul>                                       |

| ID | First Author, Year   | Targeted Population                                                                       | Targeted Behavior                                         | Sample Size                                                                                                                               | Outcome Measure                                                                   | Intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Results                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----|----------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14 | Waterlander WE, 2013 | Supermarket shoppers in the Netherlands                                                   | Supermarket food purchase<br>Fruit/vegetable consumption  | 151 adults                                                                                                                                | Electronic sales data<br>Self-report fruit/vegetable intake                       | Participants randomized into four arms: 50% discount coupon, nutrition education, coupon-plus-education or ctrl. Every two weeks, discount groups mailed two coupons for each eligible vegetable and fruit. The discount-eligible produce selection changed biweekly however groups for apples were provided continuously during the inv. Education groups given two season-specific recipe books and offered nutrition counseling via four telephone calls with a dietitian                                                                                                                                                                     | At end of invt, the coupon-only grp purchased 3.9 kg, and the coupon-plus-education grp purchased 5.6 kg more FVs than the ctrl group across a two-week period<br><br>Intv participants who consumed recommended amounts of FVs increased 18.8% from baseline to end of invt<br><br>At 3-month follow-up, previous purchase and intake differences btwn groups were no longer significant                                                                                     |
| 15 | Young CR, 2013       | Farmers' market shoppers in low-income areas of Philadelphia, Pennsylvania                | Fruit/vegetable consumption<br>Farmers' market SNAP sales | 531 adult respondents to FV consumption survey question<br>538 adult respondents to trying new FVs survey question<br>22 farmers' markets | Self-report fruit/vegetable intake<br>Electronic sales and coupon redemption data | As part of the Philly Food Bucks (PFB) program, SNAP recipients received a \$2 produce voucher for every \$5 in EBT credits spent at participating farmers' markets. (The PFB initiative began in 2010.) EBT sales and PFB redemption data for 22 farmers' markets was acquired for the 2009 - 2011 market seasons. Also, pre- and post-PFB sales data, from 2005 - 2011, obtained for the largest and longest-running market in the study                                                                                                                                                                                                       | 71.1% of survey respondents increased their FV consumption, and 56.7% tried new FVs<br><br>Avg SNAP sales increased more than 300% from \$12,431 in 2009 to \$52,405 in 2011; avg SNAP sales per market were \$1,036 in 2009 and \$2,382 in 2011<br><br>Avg PFB redemptions per market were \$679 in 2010 and \$1,178 in 2011                                                                                                                                                 |
| 16 | Phipps EJ, 2014      | Supermarket shoppers in a low-income, minority neighborhood of Philadelphia, Pennsylvania | Supermarket food purchase                                 | 58 adults                                                                                                                                 | Electronic sales data                                                             | Participants randomized into two conditions: invt or wait-listed ctrl. (The ctrl group began receiving the incentive eight weeks after the invt group.) Zero-balance gift cards were mailed to invt group members at the study's outset. The treatment arm had two phases: full invt and tapering. During the full invt, participants' gift cards were credited 50 cents for every \$1 spent on eligible produce. During tapering, the 50-cent credit was applied for every \$2 of eligible purchases. Throughout the invt, four newsletters featuring nutrition info and produce selection and preparation tips were sent to study participants | During the intervention, on average: <ul style="list-style-type: none"> <li>Intv hhlds purchased 10.2 more svgs of fruits and vegetables combined than ctrl hhlds weekly</li> <li>Intv hhlds purchased 2.5 more svgs of fruit than ctrl hhlds weekly</li> <li>Intv hhlds purchased 8 more svgs of vegetables than ctrl hhlds weekly</li> </ul> <p>The 50% rebate had a significant effect on participants' fruit and vegetable spending however the 25% incentive did not</p> |