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A Supermarket Double-Dollar Incentive Program Increases Purchases of Fresh Fruits and Vegetables among Low Income Families with Children: The Healthy Double Study

Michele Polacsek, PhD MHS¹, Alyssa Moran, MPH RD², Anne N Thorndike, MD MPH³, Rebecca Boulos, PhD MPH⁴, Rebecca L Franckle, ScD MPH², Julie C Greene, BS⁵, Dan J Blue, BS⁵, Jason Block, MD MPH³, and Eric B Rimm, ScD²

¹University of New England ²Harvard T.H. Chan School of Public Health ³Harvard Medical School ⁴University of Southern Maine ⁵Hannaford Supermarkets

Abstract

Objective: To carry out a pilot study to determine if a supermarket double-dollar fruit and vegetable (F&V) incentive increases F&V purchases among low-income families

Design: Randomized controlled design. Purchases were tracked using a loyalty card that provided participants with a 5% discount on all purchases during a 3-month baseline period followed by the 4-month intervention.

Setting: A supermarket in a low-income rural Maine community Participants: 401 low-income and SNAP supermarket customers Intervention: Same day coupon at checkout for half-off eligible fresh, frozen or canned F&V over 4 months Main Outcome Measure: Weekly spending in dollars on eligible F&V

Analysis: A linear model with random intercepts accounted for repeated transactions by individuals to estimate change in F&V spending per week from baseline to intervention. Secondary analyses examined changes among SNAP-eligible participants.

Results: Coupons were redeemed among 53% of eligible baskets. Total weekly F&V spending increased in the intervention arm compared to control (\$1.83, 95% CI=\$0.29, 3.88). The largest increase was for fresh F&V (\$1.97, 95% CI=\$0.49, 3.44). Secondary analyses revealed greater increases in F&V spending among SNAP-eligible participants who redeemed coupons (\$5.14, 95% CI =\$1.93, 8.34) than among non-SNAP-eligible participants who redeemed coupons (\$3.88, 95% CI =\$1.67, 6.08).

Conclusions and Implications: A double-dollar pricing incentive increased F&V spending in a low-income community despite the moderate uptake of the coupon redemption. SNAP-eligible customers saw the greatest F&V spending increases. Financial incentives for F&V are an effective strategy for food assistance programs to increase healthy purchases and improve dietary intake in low income families.

Keywords

Financial incentives for fruit and vegetable purchase promotion; SNAP; SNAP Policy; Randomized controlled trial; Behavioral economics; Food policy; Nutrition policy; Public health nutrition

INTRODUCTION

Consuming more fruits and vegetables (F&V) is associated with lower rates of obesity, diabetes, cardiovascular disease, and some cancers.¹ Children who consume a diet rich in F&V are less likely to be overweight or obese than peers who consume nutrient-poor foods.¹ Several factors have been linked to higher consumption of F&V among children, including greater availability of F&V in the home² and higher maternal intake of F&V.³ Furthermore, higher maternal F&V intake is inversely associated with child weight status.^{3,4} Efforts to increase F&V purchases and intake by adults in the household should positively impact children's F&V consumption and weight status.^{5,6}

Low-income populations, such as those who participate in the Supplemental Nutrition Assistance Program (SNAP), spend less per person on F&V than higher-income populations.⁷ Although the goal of SNAP is to eliminate food insecurity and improve nutrition,⁸ some studies have found that people who participate in SNAP are more likely to have obesity and other metabolic health risks than lower income non-participants.^{9–13} These findings could be explained by poorer dietary quality of SNAP participants. Compared to non-participants, SNAP participants consume more refined grains, processed meats, and sugar-sweetened beverages (SSBs) and fewer F&V.^{13–15} An analysis of recent sales data from a large supermarket chain demonstrated that over two years (2012–2014) in 188 northeast store locations, 13% of SNAP spending, and 19% of non-SNAP spending, was for F&V.¹⁶ Additionally, transactions made with SNAP benefits included greater spending on less healthful food categories, including SSBs (5.5% vs. 3.7%) and red meat (16.9% vs. 11.5%), than those made with non-SNAP dollars.¹⁶

Low-income and SNAP populations often cite cost and preparation time as major barriers to purchasing and preparing F&V.^{4,7,17} Efforts to prevent obesity at the population level will require changes that address these key barriers. Diffusion Theory¹⁸ was used to help guide our intervention design. Diffusion Theory posits that the speed of adoption of new behaviors within any population is based on four factors: *observability*; *trialability*; *compatibility*, and *relative advantage*. Maximizing these factors will speed the adoption of a desired behavior.¹⁸ The intervention impacts “*perceived relative advantage*” by making F&V more affordable for low-income shoppers; greater affordability means greater “*compatibility*” with lower income needs. To a lesser extent *observability* and *trialability* of the study loyalty card system (described later) is impacted through a demonstration of how to use the study loyalty card system at enrollment and through the observation of savings at checkout. Financial incentives and price changes, such as decreasing the cost of healthy foods or increasing the cost of unhealthy foods, have been successful at promoting healthy food purchases.^{19–21} For example, farmers’ market pricing incentives for fresh produce have been shown to have a positive impact on F&V purchases among SNAP users.^{22, 23} However, inconvenience,

seasonality, and the perception of the lack of racial/ethnic diversity at farmers' markets may discourage use among others.²⁴ A recent review of the effect of food pricing on diet demonstrates the effectiveness of pricing strategies to increase the consumption of healthy food while concurrently decreasing the consumption of unhealthy food.²⁵ For example, the Healthy Incentives Pilot Study (HIPS) in Hampden County, MA, tested the use of financial incentives (\$0.30 per \$1.00 SNAP benefit) to encourage the purchase of fresh, frozen and canned F&V in retail food stores.²⁶ The study found that participants consumed 26% (1/4 cup per day) more F&V than non-participants, spent 11% more on F&V using SNAP dollars, and spent over \$6 per month more on F&V.²⁶ However, existing evidence is limited due to small convenience samples and short intervention and follow-up timeframes; furthermore, few studies have explored the use of supermarket point-of-purchase incentives applied in real time.²⁷

The large chain supermarket setting is ideal to test effective strategies to promote healthy purchases because of the broader array of available fresh, frozen and canned F&V. Supermarkets reach more people, and account for a larger share of the SNAP food budget than do other retail venues, such as farmers' markets or corner stores. Ninety percent of both SNAP and food-insecure households do their usual grocery shopping at either a supermarket or a supercenter—the same as higher income consumers.²⁸ Moreover, 64% of weekly SNAP food budgets are spent in large supermarkets compared to only 2% in specialty stores.²⁹ Supermarket chains also have the potential to affect large segments of the population by targeting promotions in low-income and rural locations, and may be eager to promote sales of higher priced perishable items (e.g. produce), thus reducing potential financial losses, and, in turn helping to sustain financial incentives. Incentives could also be sustained through programs such as SNAP or a sugary beverage tax.

To date, there are limited data available to evaluate the effectiveness of pricing interventions from randomized controlled studies in large supermarkets.^{25,30} Therefore, this pilot study uses a randomized controlled design to test the effectiveness of financial incentives for increasing purchases of fresh, frozen and canned F&V in a supermarket that serves a low-income, rural population, and is part of a large regional supermarket chain.

METHODS

SETTING AND PARTICIPANTS

The setting for our Healthy Double study was a supermarket located in a rural suburb of Portland, Maine. The study store was chosen for its high SNAP customer base. Transactional store data demonstrated approximately 10% of store purchases were made with an Electronic Benefit Transfer (EBT) card. In 2015, 19% of the Maine population participated in SNAP, compared to the national average of 15%.³¹ Sixty five percent of Maine adults are classified as overweight or obese,³² and Maine ranks 13th in the nation for prevalence of childhood obesity.³³ Maine's rural geography limits access to supermarkets, and long winters mean a shorter growing season, further limiting access to fresh affordable local produce, placing low income rural Mainers at greater risk for poor nutrition and its consequences.^{34–36}

Supermarket partner and Guiding Stars.—The Hannaford supermarket chain, with a loyal customer base, has 194 stores located in New York and northern New England, including 62 stores in Maine. In 2006, Hannaford introduced the Guiding Stars nutrition labeling system, the first storewide nutritional navigation program in a supermarket setting. The nutrient profiles of all edible products in the store are rated from zero to three stars, and item ratings are displayed to customers using shelf tags. An analysis of the program in 2011 demonstrated that of 27,466 grocery items, 24% earned at least one-star rating.^{37,38} One star indicates good nutritional quality, two stars is better and three stars is best. Products with one, two, or three star ratings have lower levels of added sodium, saturated fat, *trans* fat, and added sugar, and more fiber, whole grains, vitamins, and minerals per calorie compared to items that do not earn a star rating.

Study design and participants.—This was a randomized controlled pilot study that included a 3 month baseline data collection period, followed by a 4 month intervention period. This study was reviewed and classified as exempt from the University of New England's Institutional Review Board as defined by 45 CFR 46.101 (b)(2) on July 22, 2015.

Study subjects were supermarket customers who shopped in the study supermarket regularly (at least 50% of the time). Because our goal was to enroll as many SNAP participants as possible, enrollment occurred in October 2015 during eight sequential days (October 10–17), which overlapped with the dates that Maine SNAP users' monthly benefit is loaded to their EBT card (the 10th-14th of each month). To maximize participation from a diversity of shoppers, study staff enrolled shoppers as they entered the store at varying times of the day. Inclusion criteria were English language fluency, being 18 years or older, living with a child 18 years of age or younger, and using the study store regularly as their primary food shopping location.

Enrollment and randomization.—At the time of study enrollment, the research team assisted participants with joining the store's loyalty card program, which provided a unique ID that was used to track store purchases. Loyalty cards were presorted randomly by study arm (intervention and control) and provided to newly enrolled participants in order of enrollment. While the store did offer an existing loyalty program, it was not widely used (and only for storing shopping lists); therefore, very few customers already had a loyalty card. If participants did have an account, their existing card number was used for the study to track their purchases. The loyalty card was printed with the name of the participant (one card per household) and their unique study ID number. Loyalty cards looked identical for intervention and control group participants. For those receiving F&V discounts, codes were embedded in a Universal Product Code (UPC) on the back of the card. Cashiers received information about the goals of the study but were not able to distinguish between control and intervention participants based on the loyalty card. Participants were given instructions for how to use the study loyalty card at checkout, and about Guiding Stars. To incentivize participation in the study and use of the card during the study, all intervention and control participants received a 5% discount on all purchases (excluding alcohol, tobacco, lottery, and pharmacy) when using the loyalty card throughout the 7 month study period. Participants could use the card and the discount on the day of enrollment.

Intervention arm.—After the 3 month baseline period, study participants assigned to the intervention arm received an additional 2 for 1 discount on all fresh F&V (including qualified legumes), and any frozen or canned F&V receiving at least two Guiding Stars for the duration of the 4 month intervention period, with a limit of \$10 benefit per household per shopping day. The 2 for 1 discount was based on F&V cost, not weight. Intervention arm participants continued to receive the 5% discount on all purchases. Monthly messages (text or email) were sent to intervention arm participants reminding them about the 5% discount, as well as the additional 2 for 1 F&V discount.

When the transaction was subtotaled, a coupon printed at the cash register, which provided the 2 for 1 discount for eligible F&V in the basket. With our retail partner, this was accomplished using a Catalina coupon system (www.catalina.com). The cashier was asked to scan this coupon for the current transaction to provide the intervention arm participant with the same day discount for the eligible F&V. Because the cashier process did not always work the way it was intended, some participants were handed the coupon to redeem in the future, rather than receiving the discount immediately. This may have been, in part, because Catalina coupons are usually handed to shoppers by cashiers for future redemption. The study was thus provided the opportunity to explore the future redemption of these incorrectly processed coupons.

Control arm.—Control arm participants received the 5% discount on all purchases throughout the study period, but they did not receive the 2 for 1 F&V discount. Monthly messages (text or email) were sent to control arm participants reminding them to use their loyalty card and about the 5% discount.

Purchase data.—Item-level scanner data were obtained for all transactions at the study store during the 7 month study period (3 month baseline, 4 month intervention). For this study, items purchased as part of a single shopping trip were grouped via a transaction identification number, and transactions were linked to study participants through their unique loyalty card ID number. Discount-eligible F&V were identified by matching each item's UPC or Price Look-Up code (PLU) to product descriptions with a list of frozen and canned items given two or three Guiding Stars, provided by the retail partner. There were 604 eligible frozen and canned products (41.8% of eligible F&V items) and 842 eligible fresh products (58.2% of all eligible F&V items). All fresh produce items were eligible for the discount. However, some canned and frozen F&V with added sugars, and other additives such as sodium, were excluded through the Guiding Stars.

Eligible items were first coded as either fruits or vegetables (including eligible legumes), and then categorized as fresh, frozen, or canned/dried based on product descriptions provided by the retailer. Alcohol and non-food items (n=18,818; 7.9%), as well as items missing a product description (30,943; 13.0%) were excluded. To account for irregular spending patterns during the holiday season, all items purchased during the calendar weeks of Thanksgiving (n=8,531; 4.4%) and Christmas (n=7,404; 3.8%) were also removed. Analyses were performed with and without these weeks removed.

Survey Data.—A short survey was administered at baseline to collect information about participants' demographics (age, gender, household size, income, race, ethnicity), percent of total shopping done at the study store, preferred method for communication (e.g. text, email, US mail), participation in federal food assistance programs (e.g. SNAP, WIC), and food purchasing and preparation behavior. Food purchasing and preparation questions included: 1) how often (past week) I purchased already prepared or 'ready to eat' foods; how often I or someone in my household prepared meals from scratch, and; how often I use Hannaford's Guiding Stars when shopping.

Statistical Analysis.—The primary outcome was weekly spending in dollars on eligible F&V. Spending was calculated by summing dollars spent by each participant on eligible items before transaction-level discounts were applied for each calendar week (7 days) during the 10-week baseline period and the 16-week intervention period. In the primary analysis, a linear model with random intercepts was used to account for repeated transactions by individuals within study arms to estimate the average change in F&V spending per week from baseline to intervention in both study arms. All data available from the transaction records were included. Independent variables included time-period (baseline, intervention), study arm (intervention, control), and a time \times intervention interaction to capture differences-in-differences change over time. All analyses are unadjusted due to the randomized nature of the design.

To estimate the change in F&V spending among participants who redeemed the F&V coupon, secondary analyses were conducted, which excluded participants in the intervention arm who did not redeem a F&V coupon at any time during the intervention period. To rule out the possibility of participants purchasing more expensive, but not greater quantities of F&V due to the intervention, a second set of analyses were conducted. These models were identical to those described above, except with quantity (number of items purchased for items sold by quantity) and weight (pounds of items purchased for items sold by weight) of eligible fresh F&V purchased per week as the primary outcomes. All analyses were then stratified by SNAP-participation, defined as those who self-reported SNAP use at enrollment, or used an EBT card anytime throughout the study period. All analyses were conducted using SAS 9.4 (Cary, NC).

RESULTS

Four-hundred-and-one participants were enrolled and randomized, 382 (95%) used the card at least once during the study period, and 253 (63%) used the discount card at least once during the last month of the intervention (April, 2016). The final analysis is based on 9,060 transactions containing approximately 177,000 items and 24,000 unique UPCs and PLUs. Of the 382 participants who used their card at least once, 28 participants did not purchase food items during the study. The primary analysis included 354 individuals (183 intervention and 171 control participants). The secondary analytical sample used the same control arm, but excluded 60 participants in the intervention arm who did not redeem any coupons during the intervention period (n=123 "intervention/redeemed coupon") (Figure 1). Participants who did not redeem coupons (n=60) had more children in the household (2.0 vs. 1.7), had higher BMIs (28.9 vs. 26.2) and were more likely to participate in SNAP (35% vs. 20%)

than intervention participants who did redeem coupons (n=123). SNAP intervention participants who did not redeem coupons (n=21) had higher BMIs (30.6 vs 27.3) and were less likely to report income at all or reported weekly (instead of monthly) income (71.4% vs 41.7%) than SNAP intervention participants who redeemed coupons (n=24).

There were 2,100 transactions with eligible F&V; yet, only 1,117 coupons were redeemed by participants in the intervention arm during the study period, representing 53% of coupons that should, theoretically, have been issued for baskets with eligible F&V. Thirty-six percent of coupons were redeemed by SNAP participants, while 57% were redeemed by non-SNAP participants. Many of the coupons that should have been issued were not redeemed either because they did not print or because they were handed to participants for redemption at a future shopping trip, but were never redeemed. In the intervention arm, 123 participants (67%) redeemed a coupon at least once during the intervention period (Figure 1). When a F&V coupon was redeemed, the average discount was \$6.08 (14% of discounts were for the maximum \$10). Forty-seven percent of SNAP participants redeemed at least one coupon compared to 72% of non-SNAP participants.

Baseline characteristics were similar in intervention and control arms (Table 1). However, by chance, there were more SNAP (27% vs. 17%) participants in the control arm. Participants made a food purchase approximately one (0.98) time per week and spent, on average, \$67.49 (+/- \$97.92) per week on food using the loyalty card. No significant differences were found between results that did and did not exclude the holiday weeks of Thanksgiving and Christmas.

As measured by the time \times intervention interaction, participants in the intervention arm increased weekly spending on total F&V by 15% during the intervention period, compared to the control arm (\$1.83, 95% CI=\$0.29, 3.88) (Table 2). When stratified by type of produce, spending on vegetables increased by 20% (\$1.06, 95% CI=\$0.23, 1.89), but fruit spending did not increase significantly (\$0.77, 95% CI=\$-0.19, 1.73). At baseline, participants spent most of their produce budget on fresh F&V. The intervention increased spending on fresh F&V by 18% (\$1.97, 95% CI=\$0.49, 3.44), but had little or even a slightly negative effect on canned and frozen F&V purchases, respectively.

When analyses were limited to include only participants in the intervention arm who ever redeemed a F&V coupon during the intervention period (intervention/redeemed coupon; n=123, control n=171), the intervention arm had an even greater increase in weekly F&V spending (28%; \$4.23, 95% CI=\$2.39, 6.06) (Table 2). Spending on fruits increased by 25% (\$2.04, 95% CI=\$0.90, 3.17), vegetable spending increased by 32% (\$2.19, 95% CI=\$1.20, 3.18), and fresh F&V spending increased by 31% (\$4.25, 95% CI=\$2.51, 6.00).

When analyses were stratified for SNAP-use, participants in the intervention arm spent more on F&V compared to those in the control arm. SNAP participants in the intervention arm increased F&V spending by 45% (\$2.37, 95% CI=\$-0.14, 4.75) compared to only 11% among non-SNAP participants (\$1.57, 95% CI=\$-0.35, 3.49), and significantly increased fresh F&V spending by 53% (\$2.55, 95% CI=\$0.63, 4.84) compared to 13% among non-SNAP participants (\$1.68, 95% CI=\$-0.14, 3.51). Comparing SNAP participants who

redeemed coupons to non-SNAP participants who redeemed coupons, SNAP participants in the intervention arm increased F&V spending by 66% (\$5.14, 95% CI=\$1.93, 8.34) compared to 23% (\$3.88, 95% CI=\$1.67, 6.08) in the non-SNAP group, and increased fresh F&V spending by 75% (\$5.34, 95% CI=\$2.26, 8.41) compared to 25% (\$3.86, 95% CI=\$1.75, 5.95) (Table 3).

To rule out alternative explanations for increased F&V spending, outcomes examined were defined by weight or quantity purchased (some produce items are sold by weight while others are sold by quantity). Similar results were found using either outcome (Table 4). Among fresh F&V sold by weight (43% of items), there was a 14% increase in the weekly weight of F&V purchased by those in the intervention arm compared to those in control (0.34 lbs., 95% CI=0.06, 0.62 lbs.), and among fresh F&V sold by quantity (57% of items) there was a 19% increase in the number of F&V items purchased (0.41 items, 95% CI=0.10, 0.71 items) in the intervention compared to the control arm. Among SNAP participants in the intervention arm, there was a 55% increase in the number of F&V items purchased (0.48 items, 95% CI= -0.01, 0.97 items), which did not meet statistical significance.

DISCUSSION

The pricing incentive of 2 for 1 F&V led to higher F&V spending overall, particularly for fresh produce. The system used was not utilized fully by the lowest income participants, which provides important considerations for designing future programs to incentivize F&V purchases. An immediate discount at check-out may be more impactful than a coupon redeemed in the future. Contrary to our expectation, the incentive did not increase spending on frozen or canned F&V. Participants spent most of their F&V budget on fresh produce at baseline, and used the incentive to increase spending on these same items, while reducing spending on frozen items. This is especially pertinent as the intervention took place over the winter months (January-April) when one might normally expect to see greater frozen F&V spending due to the lack of inexpensive varieties of fresh produce. Both primary and secondary analyses demonstrated stronger intervention effects for SNAP participants than for non-SNAP participants.

Secondary analyses restricted to purchases where a F&V coupon was redeemed demonstrated significantly greater overall F&V spending among participants in the intervention arm compared to the control arm (28% increase), as well as for fruit (25% increase), vegetables (32% increase), and fresh F&V (31% increase). Among SNAP participants, F&V spending was even higher overall (45% increase), and for fresh F&V (53% increase) among intervention arm participants compared to controls. This is particularly important because lower income participants were less likely to utilize the F&V incentive, but when the incentive was used, it had a greater impact on spending (i.e. the subset of SNAP participants in the intervention arm who did redeem coupons spent even more on F&V than their non-SNAP counterparts).

Our results raise the question of whether a 'same day' coupon is more impactful than a coupon that is redeemable in the future, especially among SNAP participants, who redeemed future coupons at a lower rate overall than participants not eligible for SNAP. Some of the

difference in coupon redemption could be explained by SNAP participants shopping less often than non-SNAP participants. The median number of transactions during the intervention period was 9 (range: 1–96) in the SNAP group compared to 13 (range: 1–70) in the non-SNAP group. Our results suggest that, ideally, a larger scaled program among SNAP users should make a same-day incentive automatic without the use of a loyalty card or coupon. This approach would provide more compatibility with the shopping habits of customers using SNAP, as predicted by Diffusion of Innovations.¹⁸ Because expected increases in frozen or canned F&V spending were not found, adding point of purchase interventions (e.g. prompts, education, promotional messages, marketing) to the pricing incentive that address aspects of Diffusion Theory (e.g. product compatibility, trialability, relative advantage, observability) may have further enhanced the effectiveness for customers using SNAP, who redeemed fewer coupons in this study than SNAP non-participants. In our study, participants used discounts to purchase fresh fruit (e.g. berries), which is typically perceived too costly,⁴ especially in the winter when cost may be even higher.³⁵ The grocery retail setting provides the opportunity to test interventions addressing other barriers at the point of purchase^{28, 29}.

The HIPS trial, which used a same-day credit to EBT cards at farmers' markets, found that a 30% F&V discount resulted in \$6 per month more spending on F&V in participating SNAP households.²⁵ In the current study, SNAP households in the intervention arm spent \$5.34 more per week (or \$23 more per month) on F&V overall. While a variety of F&V discount types have been studied at farmers' markets (e.g. 100% match with limit, partial match, and for various periods of time), most previous studies used coupons, vouchers, or rebates to discount F&V.²³ More studies on same day discounts, versus other types of redemption programs, are needed to better understand differences in their effectiveness.^{26,27}

Other promising recent studies in the supermarket setting include marketing social norms using placards displaying the number of produce items purchased in a store, and arrows on the floor directing customers to the produce section.^{39,40} However, the ability of these programs to influence behavior change over time has not been well-studied. Participation in our 4-month intervention dropped modestly over time; however, the coupon redemption amounts did not substantially change over the same period. A recent review of supermarket and grocery interventions suggests that interventions that combine demand (e.g. point of purchase marketing) and supply-side (e.g. pricing incentives) strategies are most promising for promoting purchase and consumption of F&V in this setting.⁴¹ Because not all shoppers respond to the same types of promotions, studies testing multicomponent interventions are needed.

Our aim was to pilot test the feasibility and impact of a 2 for 1 discount on low-income shoppers' spending on fresh, frozen and canned F&V in the supermarket setting. Our results are promising, but larger studies are needed to determine the clinical significance of the F&V spending improvements found.

Strengths of our study include enrolling a high SNAP-use population, using data systems that allowed tracking individuals' purchases over time, high retention rate (95% used the study loyalty card at least once over the 7-month study period), and a randomized

intervention design. Despite logistical problems with the same day F&V coupon, this study was able to test the effectiveness of same day F&V incentives in the supermarket setting. Because the incentive program was directly linked to individual F&V UPC and PLU codes, the checkout system allowed matching F&V coupons with eligible healthy F&V through the Guiding Stars nutrition rating system. Also, testing the incentive in a supermarket setting increased the variety of fresh F&V, which are typically unavailable in smaller specialty stores or in seasonal farmers' markets. By chance, there was a larger number of SNAP participants in the control arm. However, if this impacted our results, it would likely bias effect estimates toward the null hypothesis of no effect because the intervention appeared to have a greater influence on changes in F&V spending among SNAP participants. Given that the primary analysis found significant intervention main effects and that the secondary analyses (among intervention participants who used the incentive) found even stronger effects, the intervention was likely effective in motivating desired behavior change.

One limitation of this study is that although cashiers were instructed to check participant ID's at checkout to prevent loyalty card sharing, it is unknown how effective this was in preventing the sharing of loyalty cards. Second, a smaller number of coupons were found used at the time of the transaction than anticipated. The F&V coupons only worked "same day" if the coupon was printed and scanned before totaling the transaction. This did not always happen and some participants were, instead, handed coupons to redeem at a future visit to the store; thus, many coupons were not redeemed. Because SNAP participants who didn't redeem coupons reported higher BMIs and did not report income as often as SNAP participants who redeemed coupons, those who redeemed coupons were not representative of all SNAP participants. Third, while the study was unable to measure the quantity of all F&V purchased, alternative explanations for increased spending on F&V (e.g. participants were buying more costly items versus greater quantities of less expensive produce) were examined. Minimal differences in the average unit price paid for F&V during the intervention period by the intervention and control arm participants were found. There were also minimal differences between arms in the most popular (by frequency) produce items purchased during the intervention period, suggesting the intervention increased the amount of produce purchased, but had little effect on the types of items selected.

While 13.0% of UPCs were missing product descriptions, these products only accounted for 7.1% of total sales. In the control group, these items accounted for 7.3% of sales during both baseline and intervention. In the treatment group, these items accounted for 7.2% of sales during baseline and 6.7% of sales during the intervention. Although this is a small difference, if this decline is from sales of eligible F&V, our effect estimate may be biased away from the null.

Another limitation is that measurement of spending on produce at other retailers was not feasible; therefore, spending on F&V may not represent the total spending per household. It is also unknown what was consumed; parents may be buying more produce because of the incentive but it may not be eaten. Finally, generalizability from this study is limited given our study was conducted in one store in rural Maine, which may have differences in socioeconomics and regional racial/ethnic composition compared to supermarkets in other parts of the country.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This pilot study tested an evidence-based F&V incentive program in a supermarket setting, emphasizing a shift in focus on food assistance from restrictions to incentives, and from fresh-only to fresh, canned, and frozen F&V. This study is timely given current discussions about modifying SNAP by adding dollars specifically for F&V purchases.^{21,30} It is important to create stronger evidence-base for the effects of subsidizing F&V among SNAP populations in settings where a large proportion of SNAP dollars are spent before national SNAP policy changes are considered. Retailers may be motivated to collaborate with researchers to promote sales of perishable items, while also promoting the health of their customers and communities.

Enrolling, incentivizing, and tracking purchases among low-income shoppers in the grocery retail setting is feasible, and the same-day discount may be an important motivator to incentivize F&V purchases. A larger scaled program among SNAP users should support same-day, automatic incentives without the use of a loyalty card or coupon. More studies are needed to learn how best to reach the most nutritionally vulnerable populations in this setting. Financial incentives to promote healthy purchases could be considered as an effective modification to SNAP policy as part of an ecological approach to promote health among our nation's most vulnerable populations.

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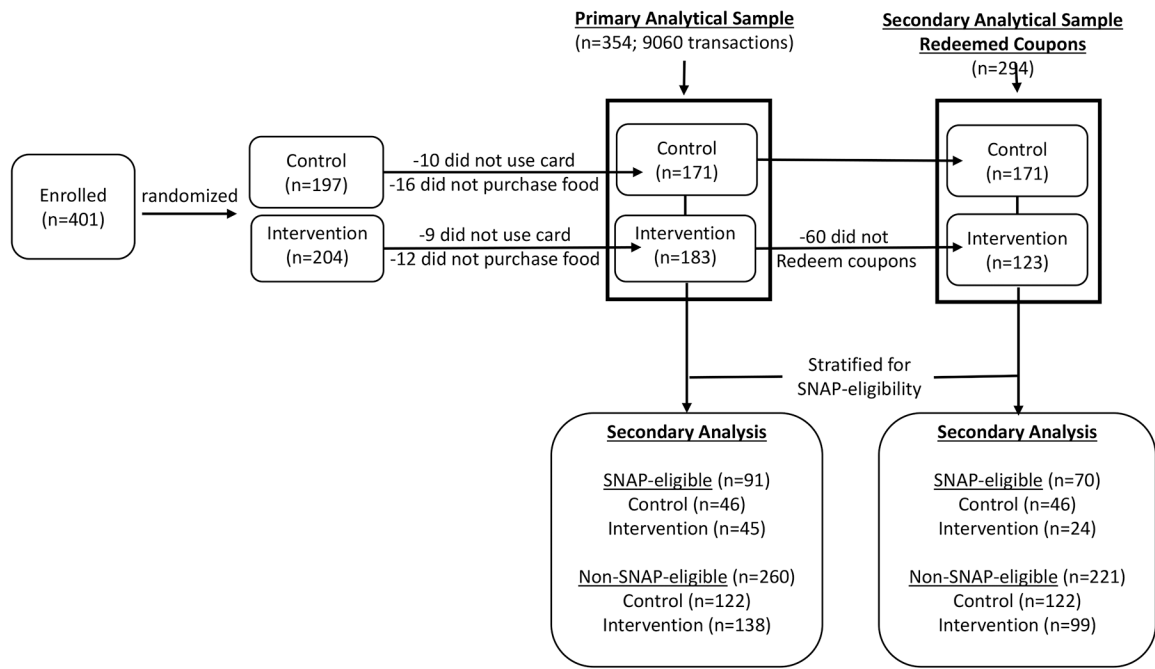


Figure :
Analytical Samples

Table 1.

Baseline characteristics of 401 shoppers enrolled in a randomized controlled trial of a double value incentive on fruits and vegetables in a Maine supermarket. Values are number (percentage) unless stated otherwise.

	Treatment (n=204)	Control (n=197)
Mean (SD) household size	3.9 (1.1)	4.0 (1.2)
Mean (SD) number of children	1.8 (0.9)	2.0 (1.1)
Mean (SD) body mass index (kg/m ²)	27.1 (6.4)	26.9 (5.7)
Age (years)		
18–29	29 (14.2)	27 (13.7)
30–39	91 (44.6)	75 (38.1)
40–49	64 (31.4)	75 (38.1)
50–59	13 (6.4)	15 (7.6)
60+	4 (2.0)	3 (1.5)
Gender		
Female	164 (80.4)	152 (77.2)
Race/Ethnicity		
Non-Hispanic White	179 (87.8)	178 (90.4)
Annual Household Income*		
<\$15,000	10 (4.9)	9 (4.6)
\$15,000-\$29,999	11 (5.4)	13 (6.6)
\$30,000-\$44,999	13 (6.4)	14 (7.1)
\$45,000-\$59,999	16 (7.8)	16 (8.1)
\$60,000-\$74,999	18 (8.8)	13 (6.6)
\$75,000 or more	66 (32.4)	56 (28.4)
Supplemental Nutrition Assistance Program (SNAP) Participation		
SNAP participation (self-reported)	35 (17.2)	54 (27.4)
SNAP participation (self-reported or used Electronic Benefit Transfer (EBT) during study period)	51 (25.0)	60 (30.5)

Participants could identify as one or more race. Participants missing baseline characteristics: household size (n=24), number of children (n=1), BMI (n=64), age (n=5), gender (n=6), race/ethnicity (n=8), annual household income (n=146) any household income (n=40), Supplemental Nutrition Assistance Program (SNAP) participation (n=5). *Participants were given the option to report weekly household income if annual income was not available (n=106).

Table 2.

Weekly spending (\$) among 354 shoppers participating in a randomized controlled trial of a double value incentive on fruits and vegetables in a Maine supermarket. Values are mean (SE) unless indicated otherwise.

	Intervention		Intervention/Redeemed Incentives		Control		Difference-in-Difference (Intervention vs. Control) Mean (95% CI)	% change	P-value	Difference-in-Difference (Intervention: Redeemed Incentives vs. Control) Mean (95% CI)	% change	P-value
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention						
Total fruits and vegetables	11.85 (1.11)	13.65 (1.08)	14.90 (1.38)	19.09 (1.34)	13.06 (1.15)	13.03 (1.11)	1.83 (0.29, 3.88)	15.4	0.02	4.23 (2.39, 6.06)	28.4	< 0.0001
Fruits	6.53 (0.69)	7.12 (0.67)	8.05 (0.87)	9.91 (0.85)	7.26 (0.71)	7.08 (0.69)	0.77 (-0.19, 1.73)	11.8	0.11	2.04 (0.90, 3.17)	25.3	< 0.0001
Vegetables	5.32 (0.50)	6.53 (0.48)	6.85 (0.62)	9.19 (0.59)	5.80 (0.52)	5.95 (0.49)	1.06 (0.23, 1.89)	19.9	0.01	2.19 (1.20, 3.18)	32.0	< 0.0001
Fresh fruits and vegetables	10.93 (1.05)	12.81 (1.02)	13.74 (1.31)	17.91 (1.26)	12.18 (1.08)	12.09 (1.05)	1.97 (0.49, 3.44)	18.0	< 0.01	4.25 (2.51, 6.00)	30.9	< 0.0001
Frozen fruits and vegetables	0.56 (0.07)	0.48 (0.07)	0.68 (0.09)	0.66 (0.09)	0.48 (0.07)	0.59 (0.07)	-0.18 (-0.33, -0.04)	-32.1	0.01	-0.12 (-0.29, 0.06)	-17.6	0.19
Canned fruits and vegetables	0.36 (0.05)	0.36 (0.05)	0.48 (0.07)	0.52 (0.06)	0.40 (0.05)	0.35 (0.05)	0.05 (-0.05, 0.15)	13.9	0.34	0.09 (-0.04, 0.21)	18.8	0.16

Values reflect spending before transaction-level discounts were applied. Holiday weeks of Thanksgiving (11/22–11/28) and Christmas (12/20–12/26) were excluded. "Intervention/redeemed-incentives" is defined as those shoppers assigned to incentives who made a transaction during the intervention period in which the 50% incentive was redeemed at least once (n=123). Statistical tests are two-tailed t-tests from regressions with random intercepts to account for clustering of observations within individuals. All models are unadjusted for demographics.

Weekly spending (\$) among 351 shoppers participating in a randomized controlled trial of a double value incentive on fruits and vegetables in a Maine supermarket, stratified by SNAP participation. Values are mean (SE) unless indicated otherwise.

Table 3.

	Intervention		Intervention/Redeemed Incentives		Control		Difference-in-Difference (Intervention vs Control) Mean (95% CI)	% change	P-value	Difference-in-Difference (Intervention: Redeemed Incentives vs Control) Mean (95% CI)	% change	P-value
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention						
SNAP												
Total fruits and vegetables	5.23 (1.40)	7.09 (1.34)	7.77 (2.05)	12.38 (1.95)	5.74 (1.39)	5.22 (1.33)	2.37 (-0.01, 4.75)	45.3	0.05	5.14 (1.93, 8.34)	66.2	<0.01
Fresh fruits and vegetables	4.79 (1.35)	6.74 (1.29)	7.13 (1.97)	11.87 (1.88)	5.45 (1.33)	4.85 (1.27)	2.55 (0.26, 4.84)	53.2	0.03	5.34 (2.26, 8.41)	74.9	<0.001
Non SNAP												
Total fruits and vegetables	14.00 (1.35)	15.79 (1.31)	16.63 (1.61)	20.72 (1.55)	15.72 (1.43)	15.94 (1.39)	1.57 (-0.35, 3.49)	11.2	0.11	3.88 (1.67, 6.08)	23.3	<0.001
Fresh fruits and vegetables	12.93 (1.27)	14.78 (1.23)	15.34 (1.52)	19.37 (1.47)	14.62 (1.35)	14.79 (1.31)	1.68 (-0.14, 3.51)	13.0	0.07	3.86 (1.76, 5.95)	25.2	<0.001

Values reflect spending before transaction-level discounts were applied. Holiday weeks of Thanksgiving (11/22–11/28) and Christmas (12/20–12/26) were excluded. “Intervention/redeemed-incentives” is defined as those shoppers assigned to incentives who made a transaction during the intervention period in which the double value incentive was redeemed at least once (n=123). Supplemental Nutrition Assistance Program (SNAP) is defined as shoppers who reported participating in SNAP or used SNAP during the study period. Shoppers missing SNAP were excluded (n=3). Statistical tests are two-tailed t-tests from regressions with random intercepts to account for clustering of observations within individuals. All models are unadjusted for demographics.

Table 4.

Weekly quantities of fresh fruits and vegetables purchased by 345 shoppers participating in a randomized controlled trial of a double value incentive on fruits and vegetables in a Maine supermarket, overall and by SNAP participation. Values are mean (SE) unless indicated otherwise.

	Intervention		Intervention/Redeemed Incentives		Control		Difference-in-Difference (Intervention vs Control) Mean (95% CI)	% change	P-value	Difference-in-Difference (Intervention: Redeemed Incentives vs. Control) Mean (95% CI)	% change	P-value
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention						
Overall												
Fruits and vegetables, sold by weight (lbs)	2.37 (0.20)	2.51 (0.19)	2.89 (0.24)	3.39 (0.23)	2.48 (0.21)	2.28 (0.20)	0.34 (0.06, 0.62)	14.3	0.02	0.71 (0.38, 1.03)	24.6	<0.0001
Fruits and vegetables, sold by quantity (n)	2.17 (0.19)	2.75 (0.19)	2.61 (0.23)	3.70 (0.22)	2.41 (0.20)	2.58 (0.19)	0.41 (0.10, 0.71)	18.9	<0.01	0.91 (0.56, 1.27)	34.9	<0.0001
SNAP												
Fruits and vegetables, sold by weight (lbs)	1.34 (0.25)	1.52 (0.24)	1.74 (0.34)	2.30 (0.32)	1.04 (0.25)	0.99 (0.24)	0.23 (-0.19, 0.64)	17.2	0.29	0.61 (0.09, 1.13)	35.1	0.02
Fruits and vegetables, sold by quantity (n)	0.88 (0.23)	1.37 (0.21)	1.23 (0.31)	2.23 (0.28)	1.12 (0.23)	1.13 (0.21)	0.48 (-0.01, 0.97)	54.5	0.05	0.99 (0.36, 1.62)	80.5	<0.01
Non SNAP												
Fruits and vegetables, sold by weight (lbs)	2.68 (0.24)	2.81 (0.23)	3.17 (0.28)	3.66 (0.28)	3.00 (0.26)	2.76 (0.25)	0.37 (0.02, 0.72)	13.8	0.04	0.73 (0.33, 1.13)	23	<0.001
Fruits and vegetables, sold by quantity (n)	2.57 (0.23)	3.18 (0.22)	2.95 (0.27)	4.06 (0.26)	2.81 (0.25)	3.05 (0.24)	0.36 (-0.01, 0.73)	14.0	0.06	0.86 (0.45, 1.28)	29.2	<0.0001

Values reflect spending before transaction-level discounts were applied. Holiday weeks of Thanksgiving (11/22–11/28) and Christmas (12/20–12/26) were excluded. SNAP participation is defined as shoppers who reported participating in the Supplemental Nutrition Assistance Program (SNAP) or used SNAP during the study period. Shoppers missing SNAP were excluded (n=3). Items sold by weight

account for 43% of fresh produce items purchased (n=13,784), and items sold by quantity account for 57% (n=18,544). Statistical tests are two-tailed t-tests from regressions with random intercepts to account for clustering of observations within individuals. All models are unadjusted for demographics.

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