Evaluating the Impact of Financial Incentives on SNAP Transactions Shopping at Mobile Produce Markets

Pasquale Rummo  
NYU Langone Health  https://orcid.org/0000-0002-9285-5430

Reece Lyerly  
Tufts University

Jennifer Rose  
Wesleyan University

Yelena Malyuta  
Rhode Island Public Health Institute

Eliza Dexter Cohen  
Brown University

Amy Nunn  (amy_nunn@brown.edu)  
Brown University

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Abstract

Background. Offering financial incentives promotes increases in fruit and vegetable purchases in farmers’ markets and supermarkets. Yet, little is understood about whether food-insecure adults purchase more fruits and vegetables as a result of receiving financial incentives in mobile produce market settings.

Methods. In 2018-2019, Food on the Move provided a 50% discount to customers using Supplemental Nutrition Assistance Program (SNAP) benefits to purchase fruit and vegetables from 16 market locations in Rhode Island (n=412 market occasions). We used mixed multivariable linear regression to estimate the difference in total dollar sales per transaction per month between SNAP customers and non-SNAP customers. We also estimated the difference in out-of-pocket dollar sales per transaction per month between SNAP and non-SNAP customers, less the 50% discount. This reflects the actual amount spent on fresh fruits and vegetables purchased per visit. In both models, we controlled for the number of market sites per month, with fixed effects for quarter and year.

Results. In 2018-2019, the majority of market transactions (n=13,165) were SNAP transactions [n=8,293 (66.0%)]. On average, customers spent $17.32 (SD=16.61) on fruits and vegetables per transaction per month. However, SNAP customers spent significantly more on FVs per transaction per month [$21.68 (SD=17.87)] compared to non-SNAP customers [$9.89 (SD=10.71)] (β=$10.54; 95% CI: 9.85, 11.23). Similarly, out-of-pocket dollar sales per transaction per month (i.e., less the 50% discount) were significantly higher among SNAP customers [$11.47 (SD=9.44)] relative to non-SNAP customers [$9.48 (SD=9.36)] (β=$1.86; 95% CI: 1.44, 2.27).

Conclusions. Financial incentives contributed to higher fruit and vegetable purchases among low-income customers who shop at mobile produce markets compared to non-eligible customers. Higher spending on fruits and vegetables may promote healthy diet behaviors and reduce chronic disease risk among food-insecure adults.

Background

Daily fruit and vegetable consumption is essential for maintaining a healthy weight and preventing chronic diseases,(1) yet few U.S adults meet daily recommendations, particularly adults of low socioeconomic status.(2) Low-income and minority households are also disproportionately impacted by the burden of food insecurity,(3) which is defined as a the economic or social condition of limited or unsafe access to adequate food.(4) These social inequalities may also exacerbate health disparities among non-Hispanic Black and Hispanic households. (5) In the U.S., food insecurity is associated with higher healthcare use and costs and multiple chronic disease risk factors,(6–8) as well as limitations in activities of daily living among older adults.(9) Participation in the Supplemental Nutrition Assistance Program (SNAP) helps alleviate food insecurity, but may not be enough to help low-income adults purchase and consume adequate amounts of fruits and vegetables.(10) Previous studies suggest that cost and access are the main barriers preventing SNAP participants from purchasing and consuming fresh fruits and vegetables.(11, 12)

Mobile produce markets are portable markets designed to mitigate financial and physical barriers to healthy diet behaviors by selling affordable fruits and vegetables in areas with limited access to fresh produce.(13) A primary goal of mobile produce markets is to support the needs and preferences of underserved communities, including low-income, minority, and older customers. Many mobile produce markets operate out of vans, trucks, or carts, and target multiple community sites in a given day or week. A recent systematic review indicates that mobile
produce market use is associated with greater access to and higher consumption of fruits and vegetables, though results are not always consistent. Typically, mobile produce markets are developed and strengthened by building community partnerships and involving community members in the planning process. For example, seeking out input from community members is critical for understanding and accommodating cultural preferences in immigrant communities (e.g., which varieties of produce to sell) and physical impairments among adults with limited mobility (e.g., where to locate the market).

Food on the Move (FOTM) is a mobile produce market based in Providence, RI, and has been operating for over a decade. The FOTM program was informed by the “Live Well, Viva Bien” intervention, which offered fruits and vegetables at a discounted price to residents living in low-income housing sites via bi-weekly produce markets. The market produce included over 70 varieties of fruits and vegetables, including staples, seasonal items, culturally-desired ethnic produce, and exotic produce. Participants in the “Live Well, Viva Bien” intervention group increased their intake of fruits and vegetables at markets located in senior housing sites, where the number of customers and sales were higher relative to family sites. In spite of the program’s popularity, customers identified cost as a barrier to shopping at the mobile markets. The Rhode Island Public Health Institute (RIPHI) drew upon the intervention’s findings to create the FOTM program, which intentionally targets senior housing sites for new market locations. In a recent study using survey data, more than 75% of SNAP customers reported being able to make their benefits last longer by shopping at FOTM.

With funding support from the United States Department of Agriculture (USDA), the FOTM program currently offers a 50% discount to all customers using SNAP benefits to purchase produce at markets, tendered immediately at the point-of-sale. Financial incentives may mitigate disparities in diet and obesity risk by making healthy food more affordable. Previous studies have shown that incentive programs at farmers’ markets, such as the Double Up Food Bucks (DUFB) Program, are linked to greater food security and higher fruit and vegetable intake among SNAP participants. Researchers have also tested the impact of financial incentives in supermarket settings, and have found that matching credits and discounts lead to higher spending on fresh fruits and vegetables among eligible customers.

Mobile produce markets may be an acceptable setting for SNAP incentive programs because they concurrently address physical access barriers to healthy food retailers and incorporate elements of community engagement in their program design. Though mobile produce markets are a promising strategy for mitigating financial barriers to healthy food consumption, few, if any, studies have examined whether SNAP participants purchase more fruit and vegetables as a result of receiving financial incentives in a mobile produce market setting. Similarly few studies have tested the impact of an immediate 50% discount (versus a matching credit) on fruit and vegetable purchases, or analyzed the effects among low-income immigrants living at senior sites.

To address these gaps in the literature, we sought to determine whether an automatic 50% discount on fruits and vegetables was associated with higher spending on fruits and vegetables among SNAP recipients at mobile produce markets. We hypothesized that customers using SNAP benefits would spend more on fruits and vegetables per month compared to those not using SNAP benefits in market transactions, as a result of the FOTM program. Based on the success of previous incentive programs in supermarket and farmer’s market settings, we hypothesized that offering financial incentives would increase fruit and vegetable purchases among customers shopping at mobile produce markets.
Methods

Setting and participants

FOTM is an evidence-based mobile produce market operated by RIPHI in Providence, RI. Market staff use a truck and refrigerated trailer to deliver a variety of culturally-appropriate fruits and vegetables to market sites (i.e., community-based locations where markets are held), where market events are held for at least two hours. FOTM often operates multiple market events at multiple market sites in one day. The majority of FOTM customers are female, Hispanic, over 50 years of age, live alone, earn less than $20,000 a year, currently receive SNAP benefits, and tend to be the primary food shopper for their household.\(^{(17)}\)

Study intervention

The FOTM program has shifted and expanded over time, as part of ongoing efforts for quality improvement and customer satisfaction. Initially, FOTM offered a matching credit, which allowed customers to earn $1 on a “Rhody Bucks” gift card for every $1 spent on produce. The gift card could be redeemed in a future purchase at FOTM markets. In response to customer feedback, particularly concerns regarding lost gift cards, FOTM transitioned from the “Rhody Bucks” gift card incentive to an automatic 50% discount incentive. The 50% discount incentive was initially implemented in five market sites in March, 2017, and subsequently all market sites in January, 2018 because of its popularity among customers and improved efficiencies with communication and checkout. Between 2018 and 2019, the FOTM program also transitioned from monthly market occasions at more market locations to weekly market occasions at fewer market locations.

Data and measures

We used point-of-sale data from January 1, 2018 to May 31, 2019 to evaluate whether SNAP recipients purchased more fruits and vegetables at FOTM mobile produce markets due to an automatic 50% discount. The point-of-sale data includes the date of transaction; total dollar sales; whether a 50% discount was applied; and whether an EBT card was used in the transaction. We used the latter to define whether a transaction was made by a SNAP recipient. Our primary outcome was the total dollar sales per transaction per month, inclusive of the value of the 50% discount. This reflects the total amount of fresh fruits and vegetables purchased at FOTM markets per visit in a given month. Our secondary outcome was out-of-pocket dollar sales per transaction, less the 50% discount. This reflects the actual amount spent on fresh fruits and vegetables purchased at FOTM markets per visit in a given month. The independent variable was whether a customer used an EBT card in a transaction (i.e., SNAP benefits).

Statistical analysis

To estimate the difference in total and out-of-pocket dollar sales per transaction between SNAP customers and non-SNAP customers, we used mixed multivariable linear regression with bootstrapping and a random intercept for date of transaction. In all analyses, we controlled for the number of market sites per month, with fixed effects for quarter and year to account for seasonal and annual effects, respectively. To evaluate whether SNAP customers spent more than non-SNAP customers in 2018 versus 2019, we also included an interaction term for year and whether an EBT card was used in the transaction. We used a chi-square difference test to evaluate the significance of the interaction and compare the models with and without the interaction. Statistical significance was defined at the $\alpha = 0.05$ level. All analyses were performed using R version 3.5.3.
Results

There were 412 markets events at 16 market locations and between 2018 and 2019, including 287 market events at 16 market locations in 2018 and 125 market events at 8 market locations during the first half of 2019 (Table 1). Approximately 63% of transactions (n = 8,293) were made by a SNAP customer across both years, with a small increase in the percentage from 2018 (61.0%) to 2019 (66.6%). The 50% discount was applied to all transactions made by SNAP customers in 2018 (n = 4,937) and 2019 (n = 3,058). The total value of the 50% discount distributed to SNAP customers was $84,659.80 across the study period.
In 2018–2019, total dollar sales per month at all markets was $18,997 (SD = 10,940) (inclusive of the value of the 50% discount). On average, customers spent $17.32 (SD = 16.61) per transaction on fruits and vegetables (Table 1). However, the average total dollar sales per month was higher among SNAP customers [$14,980 (SD = 8,794)] than non-SNAP customers [$4,017 (SD = 2,431)] (Fig. 1). Based on our regression model, spending on fruits and vegetables was significantly higher among SNAP transactions [$21.68 (SD = 17.87)] compared to non-

### Table 1

Total dollar sales\(^a\) per transaction per month, SNAP and non-SNAP transactions\(^b\)

|                      | All Transactions | SNAP Transactions | Non-SNAP Transactions |
|----------------------|------------------|-------------------|-----------------------|
|                      | 2018  | 2019  | 2018–2019 | 2018  | 2019  | 2018–2019 | 2018  | 2019  | 2018–2019 |
| **Market Location (N (%))** | 16     | 8     | 16        | 16     | 8     | 16        | 16     | 8     | 16        |
| **Market Event (N (%))** | 287    | 125   | 412        | 287    | 125   | 412        | 287    | 125   | 412        |
| **Transactions (N (%))** | 8515 (64.6) | 4655 (35.4) | 13165 (100) | 5194 (61.0) | 3099 (66.6) | 8293 (63.0) | 3316 (39.0) | 1556 (33.4) | 4872 (37.0) |
| **Transactions with 50% Discount (N (%))** | 4937 (61.8) | 3058 (38.2) | 7995 (60.7) | 4937 (61.8) | 3058 (38.2) | 7995 (60.7) | -       | -     | -         |
| **$ Total Sales per Month (mean (SD))** | 11317 (3426) | 18432 (3264) | 18997 (10940) | 8669 (2843) | 15145 (3497) | 14980 (8794) | 2647 (981) | 3288 (712) | 4017 (2431) |
| **$ Out-of-Pocket Sales per Month (mean (SD))** | 7231 (2006) | 10898 (1739) | 8309 (2547) | 4662 (1376) | 7830 (1854) | 5594 (2092) | 2569 (954) | 3068 (630) | 2716 (883) |
| **$ Sales per Transaction, Total (mean (SD))\(^†\)** | 15.96 (14.97) | 19.79 (19.0) | 17.32 (16.61) | 20.03 (16.14) | 24.43 (20.14) | 21.68 (17.87) | 9.58 (10.02) | 10.56 (12.01) | 9.89 (10.71) |
| **$ Sales per Transaction, Out-of-Pocket (mean (SD))** | 10.20 (8.85) | 11.71 (10.41) | 10.73 (9.46) | 10.77 (8.66) | 12.63 (10.52) | 11.47 (9.44) | 9.30 (9.07) | 9.86 (9.94) | 9.48 (9.36) |
| **$ 50% Discount per Transaction (mean (SD))** | 9.74 (8.03) | 11.96 (9.94) | 10.59 (8.87) | 9.74 (8.03) | 11.96 (9.94) | 10.59 (8.87) | -       | -     | -         |

\(^a\)Inclusive of the value of the 50% discount.

\(^b\)SNAP transaction defined as a transaction where an EBT card was used.
SNAP transactions [$9.89 (SD = 10.71)] (β=$10.54; 95% CI: 9.85, 11.23) (Table 2). Compared to non-SNAP transactions, the average total dollar sales among SNAP transactions was significantly higher in 2019 compared to 2018 (β=$1.86; 95% CI: 1.44, 2.27).

Table 2
Mixed multivariable linear regression results, Total dollar sales and out-of-pocket sales

|                        | Total sales ($) | Out of-pocket sales ($) |
|------------------------|-----------------|-------------------------|
|                        | β               | 95% CI                  | β                      | 95% CI                  |
| (Intercept)            | 7.90            | 4.43, 11.36             | 9.11                   | 6.69, 11.52             |
| SNAP transaction       | 10.54           | 9.85, 11.23             | 1.86                   | 1.44, 2.27              |
| Number of market sites per month | 0.01         | -0.10, 0.13             | -0.02                  | -0.10, 0.06             |
| Quarter                |                 |                         |                        |                         |
| 1st                    | REF             | REF                     | REF                    | REF                     |
| 2nd                    | 1.20            | -0.24, 2.63             | 0.40                   | -0.61, 1.41             |
| 3rd                    | 1.42            | -0.31, 3.15             | 0.45                   | -0.75, 1.66             |
| 4th                    | 0.63            | -1.21, 2.47             | -0.41                  | -1.70, 0.87             |
| Year                   |                 |                         |                        |                         |
| 2018                   | REF             | REF                     | REF                    | REF                     |
| 2019                   | 1.16            | -0.45, 2.76             | 0.38                   | -0.71, 1.47             |
| SNAP transaction x Year| 3.36            | 2.17, 4.55              | 1.12                   | 0.41, 1.83              |

aInclusive of the value of the 50% discount.

bSupplemental Nutrition Assistance Program (SNAP) transaction defined as a transaction where an Electronic Benefit Transaction (EBT) card was used.

The average out-of-pocket dollar sales per transaction per month was higher among SNAP customers [$5,594 (SD = 2,092)] than non-SNAP customers [$2,716 (SD = 883)] (Table 1). Similarly, out-of-pocket dollar sales per transaction was significantly higher among SNAP customers [$11.47 (SD = 9.44)] relative to non-SNAP customers [$9.48 (SD = 9.36)] (β=$1.86; 95% CI: 1.44, 2.27) (Fig. 2). The out-of-pocket dollar sales per transaction was also significantly higher in 2019 compared to 2018 (β=$1.12; 95% CI: 0.41, 1.83) (Table 2), which was paralleled by the increase in total incentives distributed per month in 2019 (Fig. 3).

Discussion
In 2018–2019, the FOTM program offered a 50% discount on fresh produce to SNAP customers shopping at their mobile produce markets. The incentive was associated with significantly higher spending on fruits and vegetables compared to non-SNAP customers, with greater effects in 2019. Indeed, total dollar sales and out-of-
pocket dollar sales were both higher among SNAP customers; this suggests SNAP customers purchased a higher quantity of fruits and vegetables and spent more fruits and vegetables at FOTM markets than non-SNAP customers. These results suggest that the FOTM program is effective in improving healthy diet behaviors among low-income consumers, most of whom are low-income Hispanic/Latino populations and older adults.

In a recent study, we analyzed responses from a survey of 314 customers shopping at FOTM markets in 2018, and found that that the 50% discount was associated with higher self-reported consumption of fruits and vegetables among SNAP (versus non-SNAP) customers. The survey also showed that 75.6% of SNAP customers were able to make their benefits last longer by shopping at FOTM, which may explain why SNAP customers spent more out-of-pocket than non-SNAP customers. Taken together, the results of the two studies suggest that higher spending on fruits and vegetables observed in the current study may correspond with higher consumption of fruits and vegetables by increasing the affordability of fresh produce for customers receiving food assistance.

Our findings are consistent with previous evaluations of similar programs. Prior research has shown that offering subsidies and discounts for produce increases fruit and vegetable purchases among SNAP participants shopping in supermarkets and farmer markets. The most prominent example is USDA's Healthy Incentives Pilot (HIP), which offered SNAP participants an incentive of 30 cents for every dollar of SNAP benefits that they spent on eligible fruits and vegetables in participating supermarkets. Spending on eligible fruit and vegetables increased by 11% and consumption of fruit and vegetables increased by 26% in HIP households compared to non-HIP households. Our findings demonstrate that financial incentives are also effective in promoting fruit and vegetable purchases in mobile produce markets, which have the added benefit of improving access to healthy food in food deserts and among vulnerable populations.

In addition to main effects, we also observed that the difference in dollar sales was relatively higher in 2019 than 2018, suggesting that the impact of the incentive became more pronounced over time. During this period, FOTM made two programmatic changes that may have driven increased program engagement. First, FOTM transitioned all of their sites from monthly to weekly markets, allowing customers to shop more regularly at the markets. This required FOTM to reduce the total number of market sites, selectively keeping the highest performing sites in the transition to monthly markets. Second, FOTM focused on increased outreach and engagement at the remaining market sites, leading to both a larger customer base and more frequent visits. This evidence supports the expansion of the FOTM program, including additional market sites and locations, and the development of similar programs in other locations.

One of the challenges with the success of the 50% discount model is that FOTM's distribution of SNAP incentives greatly outpaced the funding capacity of RIPHI, threatening the long-term sustainability of the program. In 2019, FOTM distributed its entire annual Food Insecurity Nutrition Incentive (FINI) budget for SNAP incentives in less than five months, necessitating additional scaling back of the program. Other similar programs, such as Massachusetts HIP, have had similar challenges related to demand and greatly exceeding funding capacity. While this growth is successful from a public health perspective, it puts at undue burden on non-profit organizations that depend on grant funding to sustain their incentive programs. One strategy to support these efforts is to eliminate the non-federal match requirement and increase the funding allotment for the Gus Schumacher Nutrition Incentive Program (formerly FINI).
This study has several limitations, including a lack of baseline data and food intake data. The lack of baseline data prevented us from characterizing purchases in the pre-intervention period, and thus we cannot know whether trends in produce purchases between SNAP and non-SNAP customers were constant over time. This undermines the internal validity of our analysis and our ability to establish a causal relationship between the 50% discount and fruit and vegetable purchases. To our knowledge, however, our study is the first evaluation of the impact of financial incentives on fruit and vegetable purchases using point-of-sale data from mobile produce markets. The lack of food intake data does not allow us to explicitly link individual purchases with individual consumption, though our previous work shows that self-reported consumption of fruits and vegetables was also higher in our target population. (17) Though mobile produce markets and incentives may be feasible and effective solutions to food insecurity in many localities, our focus on a specific state and minority and older adults also reduces the generalizability of our findings.

Mobile produce markets may improve food access among low-income adults living in senior sites and minority communities. (13) Our study shows that offering financial incentives may also contribute to higher fruit and vegetable purchases among food-insecure adults who shop at mobile produce markets by making produce more affordable. Higher spending on fruits and vegetables may mitigate economic disparities in food insecurity, and thus chronic disease risk among minority and older adults receiving SNAP benefits. In the future, researchers should explore whether the type of financial incentive matters (e.g., matching credit, 50% discount) and other ways to optimize the mobile produce markets.

List Of Abbreviations

Supplemental Nutrition Assistance Program (SNAP); Food on the Move (FOTM); Rhode Island Public Health Institute (RIPHI); Food Insecurity Nutrition Incentive (FINI)

Declarations

Ethics approval and consent to participate:

All study protocols were approved by the Brown University Institutional Review Board.

Consent for publication:

Not applicable.

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests:

No conflicts of interest or financial disclosures were reported by the authors of this paper.

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Authors’ contributions:

AN was responsible for leading the overall study from which these data originated, including study design, funding acquisition, implementation, and supervision; RL and YM were responsible for various components of data collection, data management and quality control; JR completed the data analyses; and PR formulated the research questions and drafted the original manuscript, with the support of the co-authors. All authors assisted in interpreting the final results and critically revising the manuscript for intellectual content, including reading and approving it.

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Figures
Figure 1

Total dollar sales per transaction per month, SNAP and non-SNAP transactions. aInclusive of the value of the 50% discount. bSupplemental Nutrition Assistance Program (SNAP) transaction defined as a transaction where an Electronic Benefit Transaction (EBT) card was used.
Figure 2

Out of-pocket dollar salesa per transaction per month, SNAP and non-SNAP transactionsb. aOut-of-pocket dollar sales equals total dollar sales less the 50% discount. bSupplemental Nutrition Assistance Program (SNAP) transaction defined as a transaction where an Electronic Benefit Transaction (EBT) card was used.
Figure 3

Total 50% discount incentives distributed a per transaction per month. aOnly transactions where an Electronic Benefit Transaction (EBT) card was used were eligible for the 50% discount incentive.