American Journal of
Preventive Medicine

RESEARCH ARTICLE

Supermarket Purchases Over the Supplemental Nutrition Assistance Program Benefit Month: A Comparison Between Participants and Nonparticipants

Rebecca L. Franckle, ScD, MPH,[1,2] Anne N. Thorndike, MD, MPH,[3] Alyssa J. Moran, ScD, MPH,[4] Tao Hou, MPH,[2] Dan Blue, BA,[5] Julie C. Greene, MPH,[6] Sara N. Bleich, PhD,[7] Jason P. Block, MD, MPH,[8] Michele Polacsek, PhD, MHS,[9] Eric B. Rimm, ScD[2,10]

Introduction: The Supplemental Nutrition Assistance Program provides financial assistance for food and beverage purchases to approximately 1 in 7 Americans, with benefits distributed once monthly. Most Supplemental Nutrition Assistance Program benefits are spent early in the month, leading to decreased caloric intake later in the month. The effects of this early benefit depletion on the types of foods and beverages purchased over the course of the month is unclear.

Methods: Using individually tracked sales data from 950 participants enrolled in 2 supermarket-based RCTs in Maine (October 2015−April 2016 and October 2016−June 2017), purchases of selected food categories by Supplemental Nutrition Assistance Program participants (n=248) versus nonparticipants (n=702) in the first 2 weeks compared with the last 2 weeks of the Supplemental Nutrition Assistance Program benefit month were examined. Analyses were completed in 2019.

Results: For Supplemental Nutrition Assistance Program participants, adjusted mean food spending decreased 37% from the first 2 weeks to the last 2 weeks of the Supplemental Nutrition Assistance Program benefit month (p<0.0001) compared with a 3% decrease (p=0.02) for nonparticipants. The decline in spending by Supplemental Nutrition Assistance Program participants occurred in all examined categories: vegetables (−25%), fruits (−27%), sugar-sweetened beverages (−30%), red meat (−37%), convenience foods (−40%), and poultry (−48%). Difference-in-difference estimators comparing Supplemental Nutrition Assistance Program participants with nonparticipants were statistically significant (p<0.05) for all examined categories.

Conclusions: In the second half of the Supplemental Nutrition Assistance Program benefit month, individuals reduced purchases of all examined categories. More research is needed to understand the impact of these fluctuations in spending patterns on the dietary quality of Supplemental Nutrition Assistance Program participants.

Am J Prev Med 2019;57(6):800−807.

From the [1]Department of Biology, Boston College, Chestnut Hill, Massachusetts; [2]Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; [3]Department of Medicine, Massachusetts General Hospital and Harvard Medical School, Boston, Massachusetts; [4]Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland; [5]Hannaford Marketing, Hannaford Supermarkets, Scarborough, Maine; [6]Guiding Stars Licensing Company, Scarborough, Maine; [7]Department of Health Policy and Management, Harvard T.H. Chan School of Public Health, Boston, Massachusetts; [8]Department of Population Medicine, Harvard Pilgrim Health Care Institute, Harvard Medical School, Boston, Massachusetts; [9]Westbrook College of Health Professions, University of New England, Portland, Maine; and [10]Channing Division of Network Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts

Address correspondence to: Rebecca L. Franckle, ScD, MPH, Harvard T.H. Chan School of Public Health, 665 Huntington Avenue, Boston MA 02115. E-mail: rnf726@mail.harvard.edu.

0749-3797/$36.00
https://doi.org/10.1016/j.amepre.2019.07.025

INTRODUCTION

The Supplemental Nutrition Assistance Program (SNAP) aims to reduce poverty and food insecurity by supplementing the food budgets of low-income households. In 2018, SNAP had an annual budget of more than $65 billion and served 1 in 7 Americans each month.[1] Benefits are issued to participants once monthly, but most households spend majority of the benefits in the first 2 weeks after issuance[2–4] and may not have sufficient funds for groceries at the end of the month. The resulting food deprivation has important health effects, especially in the most vulnerable, high-risk populations, such as children and adults managing diet-related diseases.[5–7] For example, prior studies have documented declines in energy intake and diet quality,[2,8–11] increased hospital admissions for hypoglycemia,[5,6] and lower standardized test scores and more disciplinary actions for students over the benefit cycle.[12,13]

However, there is a lack of evidence documenting fluctuations in purchasing patterns of specific food and beverage groups using individually linked sales data. Specifically, it is important to determine if once-monthly distribution may differentially affect foods and beverages purchased throughout the month. The use of individually linked sales data, which provide an objective measure of all supermarket purchases including produce, bulk items, and deli and other prepared foods over an extended time period, provides the opportunity to build on previous studies examining fluctuations in purchasing patterns related to issuance and can provide evidence for the design of future supermarket-based interventions and policy proposals. Other data sources, such as FoodAPS or Nielsen Homescan, either have fewer included product categories, rely on customer self-report, or only have limited time periods of purchases. Given evidence that SNAP participants will spend more on food using SNAP dollars than non-SNAP income,[14] an important next step is to determine whether this relationship holds true for purchases of specific food and beverage categories of public health importance.

To address this gap in the literature, the goal of this paper is to examine fluctuations in purchasing patterns of selected food and beverage categories over the course of the SNAP benefit month using individually tracked sales data from 950 shoppers in Maine, half of whom were selected randomly for a double dollar fruit and vegetable discount. The hypothesis was that there would be greater spending during the first 2 weeks versus the last 2 weeks following benefit issuance among SNAP households compared with non-SNAP households, and that the composition of the average SNAP transaction would change over the course of the month as benefits were depleted, perhaps with more convenience, packaged, or temperature-stable foods early in the month and perishable items throughout the month or while funds last. An additional aim was to explore whether any fluctuations in patterns in shopping were impacted by the fruit and vegetable discount program.

METHODS

Study Population

This study is a secondary analysis of 950 adult shoppers who participated in 2 separate randomized trials to test a same-day double dollar fruit and vegetable incentive of up to $10 per shopping trip.[15] Each study took place in 1 of 2 large supermarkets from the same chain, which were located in low-income Maine communities.

Methods for recruitment, randomization, data access from point-of-sales systems, and food categorization have been described previously.[15] Briefly, shoppers were recruited in the entryway of the 2 study stores. Participants were given a loyalty card at the time of enrollment that provided a 5% discount on all purchases at the study store during the study period and allowed for tracking of their purchases. Each study consisted of a several-month baseline period (when the 5% discount began and purchases were tracked), followed by randomization to a double dollar fruit and vegetable incentive intervention group or a control group.

To be eligible for the studies, adult shoppers had to have a child aged ≤18 years living in the household. Data from these studies provided up to 8 months of linkable sales data collected from the participants. Participants were excluded from the present analysis if they never used their loyalty card (n=52), if a duplicate identification number was assigned (n=2), or if they participated in both trials (n=2) (Figure 1).

Measures

Item-level scanner data were obtained from each of the 2 study stores. Scanner data included price and quantity of all items purchased in each transaction, including packaged foods and beverages (identified via universal product codes) and fresh meats and produce (identified via product lookup codes), as well as payment method (e.g., SNAP or cash) and the date of purchase. Purchases were linked to participants via loyalty card identification number, and the date of purchase was used to aggregate purchases to the daily and weekly level.

This analysis focused on 6 categories given prior research showing that, in transactions where SNAP benefits were used, there was higher relative spending on sugar-sweetened beverages (SSBs), red meat, and convenience foods (prepared or packaged foods, such as boxed macaroni and cheese) and lower relative spending on fruits, vegetables, and poultry compared with transactions made without SNAP benefits.[16] From the daily point-of-sale data, spending was aggregated in each category by day and week for each participant and assigned to the specific day and week of their monthly SNAP benefit cycle.

An enrollment survey gathered information on SNAP participation status, date of monthly SNAP benefit receipt, race/ethnicity

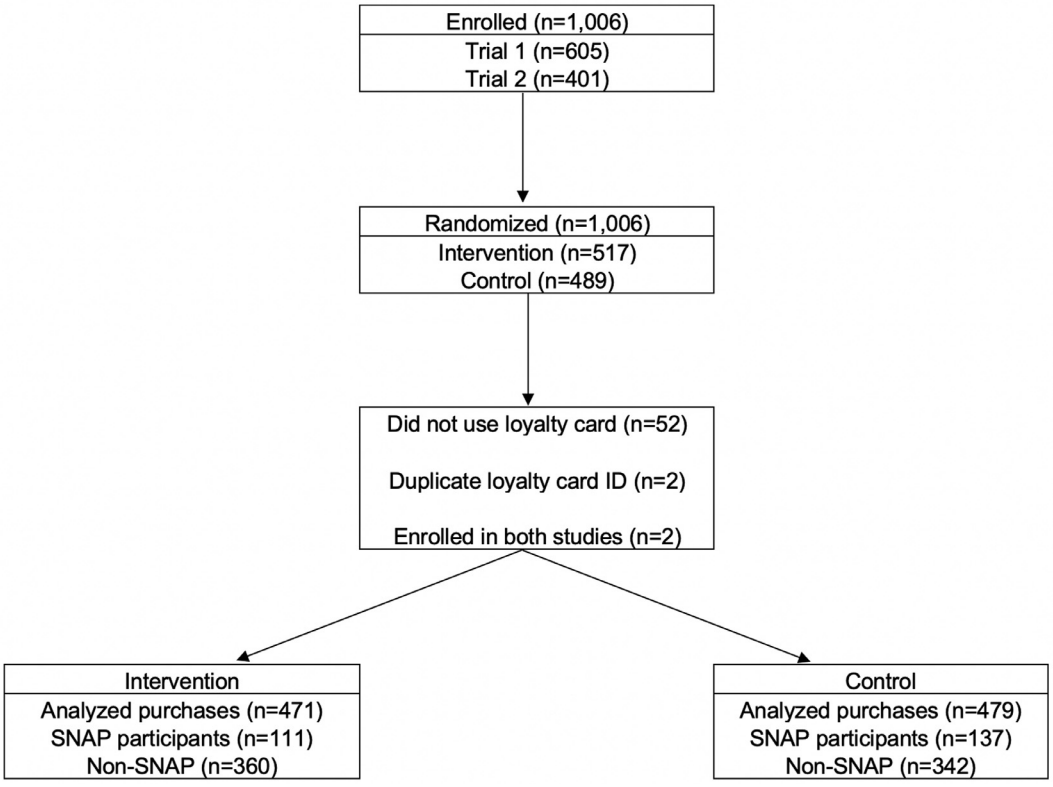

Figure 1. CONSORT flow diagram.
ID, identification; SNAP, Supplemental Nutrition Assistance Program.

and sex of the primary respondent, and size of household. SNAP participants receive benefits on the same day each month; the time between issuance periods is referred to herein as the "SNAP benefit month" and each week since issuance as the 1st, 2nd, 3rd, and 4th week of the benefit month, respectively. Day 1 of the SNAP benefit month was based on participant self-report of the day of benefit receipt. For nonparticipants and those SNAP participants who did not self-report their day of benefit receipt, Day 1 of the monthly cycle was defined as the 10th of each month (in Maine, SNAP benefits are issued between the 10th and the 14th of the month[17]; 94% of SNAP participants self-reported their day of benefit receipt).

Statistical Analysis

Difference-in-differences models were used to compare mean spending per transaction on all food and on selected categories from the first 2 weeks after SNAP benefit issuance with the last 2 weeks of the SNAP benefit month by SNAP participants versus nonparticipants. The primary independent variables were indicators for SNAP participation status, time of the benefit month (first or last 2 weeks of the SNAP month), and a SNAP X time interaction term (the difference-in-differences, which represents the differential effect of the time since SNAP benefit issuance on SNAP participants versus nonparticipants). Models were adjusted for demographic covariates (race/ethnicity, sex, age, and household size), season, store, and intervention arm, and included random intercepts for shopper to account for repeated observations; covariates were selected based on previous publications on purchasing patterns and theoretical association with purchasing behaviors. For the primary model, SNAP participation status was defined based on self-report at study enrollment. The following sensitivity analyses were also conducted:

1. Using an indicator for monthly SNAP participation status (i.e., based on whether or not point-of-sale data indicated a shopper used SNAP benefits during a given month rather than self-report at baseline to account for people who may have gone on or off SNAP during the study period);
2. Comparing the first week of the month to the remainder of the month;
3. Restricted to sales during the preintervention period only; and
4. Separate models stratified by intervention arm and restricted to the intervention period.

All analyses were completed in 2019 using SAS, version 9.4.

The Harvard T.H. Chan School of Public Health's IRB for the Protection of Human Subjects determined that this study was not human subjects research under 45 CFR Subsection 46.102(f).

RESULTS

Overall, most participants were white non-Hispanic (94%) and female (84%), had an average household size of 3.9 people, and had 27.3 transactions (3.4 per month

Table 1. Participant Characteristics of Shoppers in Maine Enrolled in Two Separate Supermarket-Based Fruit and Vegetable Incentive Programs

Participant characteristics	Overall, *n* (%) *n*=950	SNAP participants, *n* (%) *n*=248	Nonparticipants, *n* (%) *n*=702
Trial randomization			
Intervention (incentive) group	471 (50)	111 (45)	360 (51)
Control group	479 (50)	137 (55)	342 (49)
Sex			
Female	783 (84)	214 (89)	569 (82)
Male	153 (16)	26 (11)	127 (18)
Race/ethnicity			
White, non-Hispanic	881 (94)	229 (94)	652 (94)
Nonwhite (all other racial/ethnic groups)	53 (6)	14 (6)	39 (6)
Age, years			
18–29	176 (19)	82 (34)	94 (14)
30–39	393 (42)	90 (38)	303 (44)
40–49	283 (30)	47 (20)	236 (34)
50–59	65 (7)	16 (7)	49 (7)
≥60	17 (2)	5 (2)	12 (2)
BMI (kg/m^2), mean (SD)	28.1 (6.6)	29.8 (7.0)	27.5 (6.3)
Household size, mean (SD)	3.9 (1.3)	4.0 (1.7)	3.9 (1.1)
Percent federal poverty line[a]			
≤100%	201 (23.7)	150 (67.6)	51 (8.2)
≤130%	266 (31.4)	176 (79.3)	90 (14.4)
≤150%	307 (36.3)	193 (86.9)	114 (18.2)
≤180%	366 (43.2)	203 (91.4)	163 (26.1)
≤200%	419 (49.5)	212 (95.5)	207 (33.1)
Shopping patterns, mean (SD)			
Total transactions per shopper	27.3 (25.6)	22.0 (25.2)	29.2 (25.6)
Spending per trip on SNAP eligible items[b]	66.58 (70.08)	49.96 (65.76)	71.01 (70.53)
Spending per trip on sugar-sweetened beverages	2.44 (5.29)	3.02 (6.10)	2.29 (5.04)
Spending per trip on fruits	7.43 (14.80)	3.19 (8.78)	8.57 (15.85)
Spending per trip on vegetables	6.38 (10.50)	3.66 (8.91)	7.10 (10.77)
Spending per trip on red meat	6.00 (19.86)	6.32 (22.88)	5.92 (18.97)
Spending per trip on poultry	6.98 (24.92)	4.80 (20.56)	7.56 (25.93)
Spending per trip on cold convenience foods	4.10 (7.04)	4.38 (7.98)	4.03 (6.76)
Items (food only) per transaction	18.2 (16.1)	14.4 (15.3)	19.3 (16.2)
Monthly SNAP benefit (self-reported, $)	n/a	292.5 (168.6)	n/a
SNAP use (used benefits during study period)	286	227	59

Note: Values may not sum to 100% because of missing data.
[a]If annual income was reported, percent poverty was calculated by dividing the median of the annual household income category by the annual federal poverty guideline for the household size in 2016; if only weekly income was reported, the median of the income category was multiplied by 4.35 to obtain monthly income, which was divided by the monthly federal poverty guideline for the household size in 2016.
[b]Excluded transactions ≥$1,000.
n/a, not applicable; SNAP, Supplemental Nutrition Assistance Program.

on average) during the study period (Table 1). SNAP recipients spent an average of $49.96 per shopping trip on SNAP-eligible items and purchased an average of 14 items per trip, whereas nonparticipants spent an average of $71.01 per shopping trip and purchased an average of 19 items per trip.

There was an observable spike in transactions made by SNAP participants at the beginning of each month and differences in the use of SNAP benefits to make purchases over the month (Figure 2). The proportion of SNAP participants who paid for their transactions with SNAP benefits (versus with other means such as cash or credit card) markedly declined in Weeks 3 and 4 of the benefit month. Half of SNAP participants did not use benefits in the last week of the month, and 31% only did so once or twice over the entire study period.

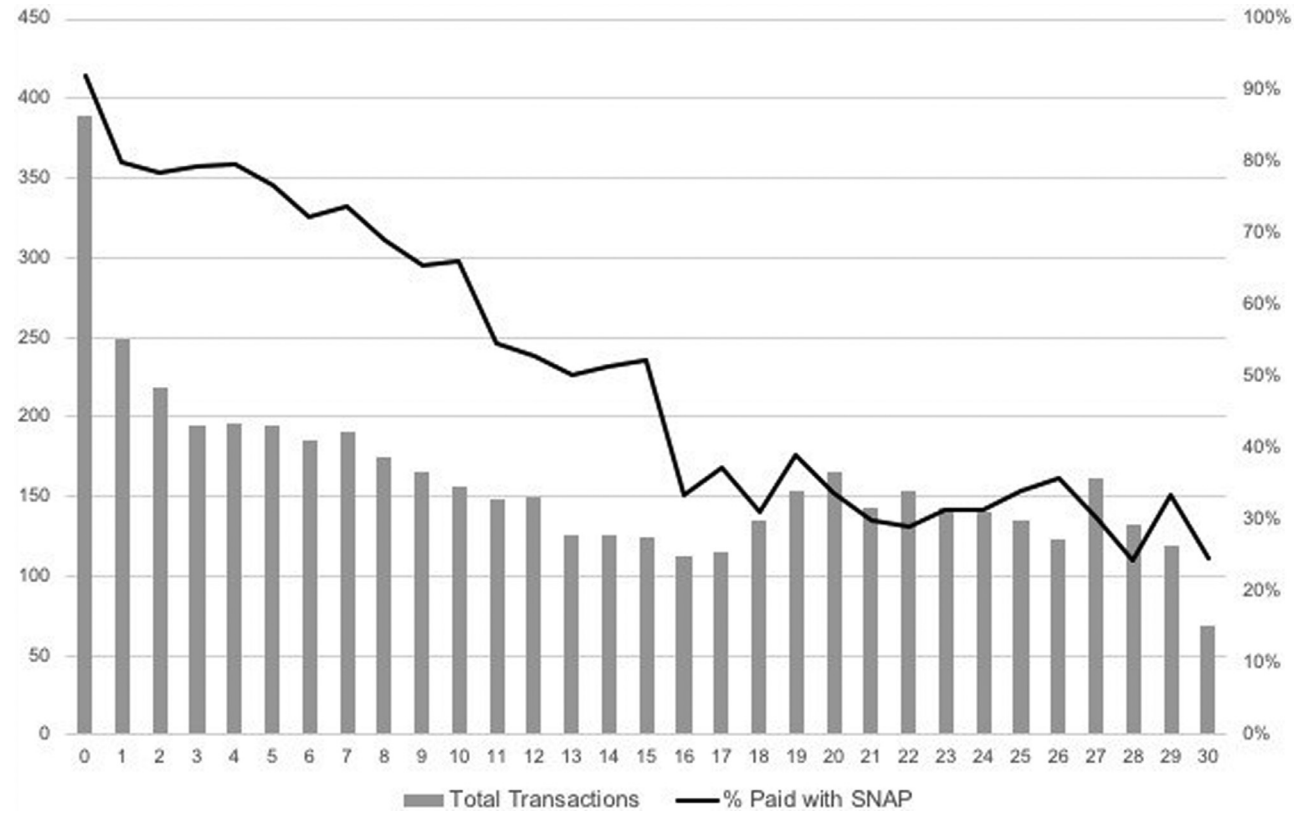

Figure 2. Proportion of SNAP participants paying with SNAP benefits by time since distribution of monthly benefits.
SNAP, Supplemental Nutrition Assistance Program.

Demographics of SNAP participants who continued to shop with benefits in Week 4 did not appreciably differ from the overall sample (data not shown).

Adjusted total mean food and beverage spending with and without SNAP dollars decreased 37% from the first 2 weeks to the last 2 weeks of the SNAP benefit month (from $58.06 to $36.37, $p<0.0001$) for SNAP participants, compared with a 3% decrease (from $63.46 to $61.56, $p=0.02$) for nonparticipants (Table 2). For the 248 SNAP participants, adjusted mean total spending significantly decreased across all examined categories from the first 2 weeks to the last 2 weeks of the SNAP benefit month ($p<0.01$). By contrast, adjusted mean spending for the non-SNAP participants only decreased significantly for two categories (−9% for meat and −15% for poultry, $p<0.05$). The decline in spending by SNAP participants occurred in all examined categories: vegetables (−25%), fruits (−27%), SSBs (−30%), red meat (−37%), convenience foods (−40%), and poultry (−48%). This decline was greater for SNAP participants than for nonparticipants (i.e., the difference-in-differences) for all examined categories ($p<0.05$).

Treatment arm (intervention versus control) was included as a covariate and was nonsignificant in all models. In sensitivity analyses, results did not change appreciably when using an indicator for monthly SNAP participation status (i.e., based on whether a shopper used SNAP benefits during a given month, rather than based on self-report at baseline; Appendix Table 1, available online), when comparing the first week of the month to the remainder of the month (Appendix Table 2, available online), when restricted to sales made only during the preintervention period (results not shown), or when stratified by intervention group (Appendix Table 3, available online).

DISCUSSION

For SNAP participants, declines in overall food and beverage spending were observed as well as for all examined categories over the course of the SNAP benefit month. Relative declines varied by category, with larger relative decreases for red meat, poultry, and convenience foods than for SSBs, fruits, and vegetables. The monthly decline in spending was greater for SNAP participants than for nonparticipants within all examined food categories, indicating there are fluctuations in spending specifically associated with SNAP issuance policy.

Table 2. Adjusted Mean Spending (Before Discounts) on Selected Food Groups by Shoppers at 2 Maine Supermarkets During the First 2 Weeks Versus the Last 2 Weeks of the SNAP Cycle

Mean spending per transaction ($)	SNAP[a]				Non-SNAP				Difference-in-difference			
	First 2 weeks	Last 2 weeks	Diff (% change)	*p*-value	First 2 weeks	Last 2 weeks	Diff (% change)	*p*-value	First 2 weeks	Last 2 weeks	Diff	*p*-value
Foods and beverages overall	**58.06**	**36.37**	**21.69 (–37)**	**<0.0001**	**63.46**	**61.56**	**1.90 (–3)**	**0.02**	**–5.40**	**–25.19**	**19.79**	**<0.0001**
Sugar-sweetened beverages	**3.66**	**2.57**	**1.09 (–30)**	**<0.0001**	2.21	2.10	0.11 (–5)	0.10	**1.45**	**0.47**	**0.98**	**<0.0001**
Fruits	**3.91**	**2.85**	**1.06 (–27)**	**0.005**	8.31	8.09	0.22 (–3)	0.24	**–4.40**	**–5.24**	**0.84**	**0.04**
Vegetables	**4.68**	**3.49**	**1.19 (–25)**	**<0.0001**	7.33	7.27	0.06 (–1)	0.64	**–2.65**	**–3.78**	**1.13**	**0.0001**
Red meat	**9.11**	**5.77**	**3.35 (–37)**	**<0.0001**	**6.49**	**5.87**	**0.61 (–9)**	**0.03**	**2.63**	**–0.10**	**2.73**	**<0.0001**
Poultry	**5.72**	**2.95**	**2.78 (–48)**	**<0.0001**	**6.91**	**5.88**	**1.03 (–15)**	**0.004**	**–1.19**	**–2.93**	**1.75**	**0.03**
Cold convenience foods	**5.23**	**3.13**	**2.11 (–40)**	**<0.0001**	3.61	3.75	–0.14 (4)	0.12	**1.62**	**–0.63**	**2.25**	**<0.0001**

Note: Boldface indicates statistical significance ($p<0.05$). Models are adjusted for race/ethnicity (white vs nonwhite), sex, age, household size, season, store, and intervention arm.
[a]Shoppers who use SNAP benefits defined as individuals who self-reported receipt of benefits at enrollment.
Diff, difference; SNAP, Supplemental Nutrition Assistance Program.

There are several possible reasons for the observed spending fluctuations by SNAP participants over the course of the month. One reason is the once-monthly frequency of benefit issuance. The larger declines observed for red meat, poultry, and convenience foods would be expected given that these items are often shelf-stable or can be frozen, facilitating shoppers' ability to stock up on items when benefits are newly available at the beginning of the SNAP benefit month. The lesser declines in purchases of fruits and vegetables indicate that shoppers continue to purchase produce at the end of the month when resources are scarce. Previous work has shown that shoppers prefer fresh produce over frozen or canned fruits and vegetables, despite the difference in price and perishability.[15] The incentives were available to shoppers in the intervention groups at each visit to the supermarket throughout the benefit month. It is possible that timing the incentive to coincide with times of decreased benefit availability (i.e., the end of the month) could further influence the observed declines in spending at the end of the monthly cycle. More research is needed to understand the effects of financial incentives for fruits and vegetables on fluctuations in spending over the course of the benefit month.

A second possible reason for the observed fluctuations is retailer response to the timing of benefit issuance. Larger spikes in purchases of convenience foods and red meat were observed at the beginning of the benefit month relative to fruits and vegetables, which could be related to fluctuations in retail prices and marketing of certain food and beverage categories in response to SNAP benefit issuance.[3,18] All 50 states are federally mandated to distribute SNAP benefits to individual participants once per month, but the scheduling for this is determined at the state level. Several states distribute benefits to all beneficiaries on a single day (i.e., single-day issuance) and others distribute benefits over a longer timeframe (from 3 to 28 days each month, depending on state; i.e., extended issuance).[17] Prior research demonstrates that food spending peaks sharply immediately following issuance[2–4]; thus, grocers in those states with single-day or compressed (i.e., ≤5 days) issuance schedules can more easily target SNAP customers on these days by changing prices or promoting certain high-demand items such as highly processed foods and SSBs.[18,19]

Finally, the spending fluctuations could be due to inadequacy of the total benefit. Previous work has shown that a documented decline in caloric consumption at the end of the benefit month went away during the period of increased SNAP benefits under the American Recovery and Reinvestment Act.[20] An increase in overall benefits could have a similar smoothing effect on monthly

spending patterns. Future studies that collect comprehensive purchasing data, including item-level payment information, would help to fully evaluate this question.

There are several policy alternatives that could address the fluctuations in spending that are associated with monthly SNAP issuance. For example, benefits could be issued to participants twice per month (split issuance), or participants could be given the choice to receive their benefits once or twice based on individual preferences and needs. In addition, all states could be required to distribute benefits over longer timeframes (as many, but not all, currently do) to alleviate the incentive for stores to conduct predatory marketing practices such as promoting SSBs during the dates of benefit issuance.[18] If issuance remains the same, incentives for healthful purchases could be incorporated to align with times when benefits are likely depleted. Alternative issuance policies need to be tested to determine whether they would have the desired effect of promoting healthier purchases. It is also critical to consider the possibility of unintended consequences of such changes. For example, twice-monthly issuance may be preferred by some participants as a budgeting tool, but it may force other participants to shop more frequently than is feasible or preferable.[21]

Finally, it is important to note that both SNAP participants and nonparticipants had very low purchases of fruits and vegetables throughout the month, much lower than recommended by the Dietary Guidelines for Americans. All shoppers would benefit from additional strategies that lead to more purchase and consumption of fruits and vegetables and other healthy foods to improve health.

This is the first known study to consider the impact of the SNAP issuance cycle on individually linked purchases of specific food and beverage categories of both SNAP participants and nonparticipants. This study builds on previous research[2,3,5,8–14] with greater detail on total dollars (SNAP and non-SNAP) spent on specific food and beverage categories, a control group consisting of SNAP nonparticipants, and substantial prospective follow-up over multiple seasons. Use of individually linked sales data and use of difference-in-differences models comparing SNAP participants with nonparticipants over time allows for stronger inferences regarding the effect of the current once-monthly SNAP issuance policy on shopper behaviors.

Limitations

This study also has limitations. Because SNAP eligibility and other demographics are self-reported, there could be inaccuracies because of under-reporting or real changes in SNAP status over the study period. When validated information based on sales data was used and included a floating indicator based on use of monthly SNAP benefits, results did not appreciably differ. It is possible that secular trends or current events may have influenced the results, though this impact was likely minimized owing to the inclusion of many months of sales. Only purchasing data were analyzed, and consumption patterns by month could not be determined; conclusions address only purchasing behaviors. If food choices shifted within categories (e.g., if customers purchased less-expensive items), spending does not necessarily reflect the quantity purchased. Information regarding what proportion of a transaction, or which specific items, were paid for with SNAP benefits versus other tender types was unavailable. Another limitation is that sales data are drawn from 2 stores from a single supermarket chain in Maine, which limits generalizability. Shoppers also may shop at multiple stores, and only data from a single store were analyzed for each study. Previous work has shown that 92.4% of traditional food sales take place at grocery stores and supermarkets as opposed to convenience stores or specialized markets.[22] Also, participants were recruited who reported doing most of their grocery shopping at the store, and all participants were incentivized to take part in these trials through a 5% discount for every shopping trip. Participant feedback showed that this incentive was a very successful motivator for shoppers to use the study store preferentially. The study data were not collected for the purpose of this analysis.

CONCLUSIONS

In this study of the monthly shopping habits of SNAP participants and nonparticipants, fluctuations in spending patterns were observed whereby SNAP participants substantially reduced the purchase of all examined categories over the course of the benefit month, but more so for red meat, poultry, and convenience foods than for fruits, vegetables, and SSBs. More research is needed to understand the implications of once-monthly distribution of SNAP benefits on dietary quality of low-income individuals on government food assistance. Demonstration projects of alternative benefit structures are necessary to determine whether they might alleviate this seemingly detrimental pattern of purchasing that is observed under the current program structure.

ACKNOWLEDGMENTS

This manuscript was supported by a grant from the Tufts UConn Research Innovation and Development Grants in Economics (RIDGE) program (grant 101383-00001). R.L. Franckle was supported by a postdoctoral fellowship (award T32HL098048)

from the NIH. Data collection was supported through a grant from Healthy Eating Research, a national program of the Robert Wood Johnson Foundation, and through a grant from the National Institute for Food and Agriculture/U.S. Department of Agriculture (award 2016-68001-24961). The content is solely the responsibility of the authors and does not represent the official views of RIDGE or the U.S. Department of Agriculture. The sponsors of this study had no role in the study design or data collection, management, analysis, or interpretation, and did not require final approval of the manuscript.

Author contributions: RLF conducted the final data analyses and drafted the manuscript. RLF and TH had full access to the study data and take responsibility for the integrity of the data and the accuracy of the data analysis. RLF and EBR conceptualized and obtained funding for the study. ANT, AM, TH, DB, JG, SNB, JPB, MP, SNB, and EBR provided methodological and content expertise relevant to study design and data interpretation. All authors provided critical revisions and approved the final version of the manuscript. Preliminary results were presented at the 2017 Annual Meeting of the International Society of Behavioral Nutrition and Physical Activity and the 2018 RIDGE Center Final Grantee Meeting.

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

SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2019.07.025.

REFERENCES

1. U.S. Department of Agriculture, Food and Nutrition Service. Supplemental nutrition assistance program participation and costs. www.fns.usda.gov/sites/default/files/pd/SNAPsummary.pdf. Updated April 5, 2019. Accessed April 25, 2019.
2. Wilde PE, Ranney CK. The monthly food stamp cycle: shopping frequency and food intake decisions in an endogenous switching regression framework. *Am J Agric Econ.* 2000;82(1):200–213. https://doi.org/10.1111/0002-9092.00016.
3. Hastings J, Washington E. The first of the month effect: consumer behavior and store responses. *Am Econ J Econ Policy.* 2010;2(2):142–162. https://doi.org/10.1257/pol.2.2.142.
4. U.S. Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis. Benefit redemption patterns in the supplemental nutrition assistance program. www.fns.usda.gov/snap/benefit-redemption-patterns-supplemental-nutrition-assistance-program. Published February 2011. Accessed April 25, 2019.
5. Seligman H, Bolger A, Guzman D, Lopez A, Bibbins-Domingo K. Exhaustion of food budgets at month's end and hospital admissions for hypoglycemia. *Health Aff (Millwood).* 2014;33(1):116–123. https://doi.org/10.1377/hlthaff.2013.0096.
6. Basu S, Berkowitz SA, Seligman H. The monthly cycle of hypoglycemia: an observational claims-based study of emergency room visits, hospital admissions, and costs in a commercially insured population. *Med Care.* 2017;55(7):639–645. https://doi.org/10.1097/mlr.0000000000000728.
7. Seligman HK, Jacobs EA, Tschann J, Fernandez A, Fernandez A. Food insecurity and glycemic control among low-income patients with type 2 diabetes. *Diabetes Care.* 2012;35(2):233–238. https://doi.org/10.2337/dc11-1627.
8. Shapiro JM. Is there a daily discount rate? Evidence from the food stamp nutrition cycle. *J Public Econ.* 2005;89(2–3):303–325. https://doi.org/10.1016/j.jpubeco.2004.05.003.
9. Sanjeevi N, Freeland-Graves J. Monthly variations in dietary intake of women participating in the Supplemental Nutrition Assistance Program. *J Acad Nutr Diet.* 2019;119(2):261–271. https://doi.org/10.1016/j.jand.2018.05.012.
10. Whiteman ED, Chrisinger BW, Hillier A. Diet quality over the monthly Supplemental Nutrition Assistance Program cycle. *Am J Prev Med.* 2018;55(2):205–212. https://doi.org/10.1016/j.amepre.2018.04.027.
11. Hamrick KS, Andrews M. SNAP participants' eating patterns over the benefit month: a time use perspective. *PLOS ONE.* 2016;11(7):e0158422. https://doi.org/10.1371/journal.pone.0158422.
12. Gassman-Pines A, Bellows L. Food instability and academic achievement: a quasi-experiment using SNAP benefit timing. *Am Educ Res J.* 2018;55(5):897–927. https://doi.org/10.3102/0002831218761337.
13. Gennetian L, Seshadri R, Hess N, Winn A, George R. Supplemental Nutrition Assistance Program (SNAP) benefit cycles and student disciplinary infractions. *Soc Serv Rev.* 2016;90(3):403–433. https://doi.org/10.1086/688074.
14. Smith TA, Berning JP, Yang X, Colson G, Dorfman JH. The effects of benefit timing and income fungibility on food purchasing decisions among Supplemental Nutrition Assistance Program households. *Am J Agric Econ.* 2016;98(2):564–580. https://doi.org/10.1093/ajae/aav072.
15. Polacsek M, Moran A, Thorndike AN, et al. A supermarket double-dollar incentive program increases purchases of fresh fruits and vegetables among families with children: the Healthy Double Study. *J Nutr Educ Behav.* 2018;50(3):217–228.e1. https://doi.org/10.1016/j.jneb.2017.09.013.
16. Franckle RL, Moran A, Hou T, et al. e131–e138. Transactions at a Northeastern Supermarket Chain: Differences by Supplemental Nutrition Assistance Program Use. *Am J Prev Med.* 2017;53(4). https://doi.org/10.1016/j.amepre.2017.06.019.
17. U.S. Department of Agriculture, Food and Nutrition Service. Monthly issuance schedule all states. www.fns.usda.gov/sites/default/files/snap/Monthly-Issuance-Schedule-All-States.pdf. Published 2017. Accessed April 25, 2019.
18. Moran AJ, Musicus A, Findling MTG, et al. Increases in sugary drink marketing during Supplemental Nutrition Assistance Program benefit issuance in New York. *Am J Prev Med.* 2018;55(1):55–62. https://doi.org/10.1016/j.amepre.2018.03.012.
19. Saslow E. Food Stamps Put Rhode Island Town on monthly Boom-and-bust Cycle. *Washington Post.* www.washingtonpost.com/national/food-stamps-put-rhode-island-town-on-monthly-boom-and-bust-cycle/2013/03/16/08ace07c-8ce1-11e2-b63f-f53fb9f2fcb4_story.html?utm_term=.27-b1a3ee6736. Published 2013. Accessed April 25, 2019.
20. Todd JE. Revisiting the Supplemental Nutrition Assistance Program cycle of food intake: investigating heterogeneity, diet quality, and a large boost in benefit amounts. *Appl Econ Perspect Policy.* 2015;37(3):437–458. https://doi.org/10.1093/aepp/ppu039.
21. Kinsey EW, Oberle M, Dupuis R, Cannuscio CC, Hillier A. Food and financial coping strategies during the monthly Supplemental Nutrition Assistance Program cycle. *SSM Popul Health.* 2019;7:100393. https://doi.org/10.1016/j.ssmph.2019.100393.
22. U.S. Department of Agriculture Economic Research Service. Retailing and wholesaling - retail trends. www.ers.usda.gov/topics/food-markets-prices/retailing-wholesaling/retail-trends. Accessed April 25, 2019.