

Where do U.S. households purchase healthy foods? An analysis of food-at-home purchases across different types of retailers in a nationally representative dataset

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ABSTRACT

Food shopping decisions are pathways between food environment, diet and health outcomes, including chronic diseases such as diabetes and obesity. The choices of where to shop and what to buy are interrelated, though a better understanding of this dynamic is needed. The U.S. Department of Agriculture's nationally representative Food Acquisitions and Purchase Survey food-at-home dataset was joined with other databases of retailer characteristics and Healthy Eating Index-2010 (HEI) of purchases. We used linear regression models with general estimating equations to assess relationships between trip, store, and shopper characteristics with trip HEI scores. We examined HEI component scores for conventional supermarkets and discount/limited assortment retailers with descriptive statistics. Overall, 4,962 shoppers made 11,472 shopping trips over one-week periods, 2012-2013. Trips to conventional supermarkets were the most common (54.4%), followed by supercenters (19.3%). Compared to conventional supermarkets, purchases at natural/gourmet stores had significantly higher HEI scores ($\beta=6.48$, $CI=[4.45, 8.51]$), while those from "other" retailers (including corner and convenience stores) were significantly lower (-3.89 , $[-5.87, -1.92]$). Older participants (versus younger) and women (versus men) made significantly healthier purchases (1.19 , $[0.29, 2.10]$). Shoppers with less than some college education made significantly less-healthy purchases, versus shoppers with more education, as did households participating in SNAP, versus those with incomes above 185% of the Federal Poverty Level. Individual, trip, and store characteristics influenced the healthfulness of foods purchased. Interventions to encourage healthy purchasing should reflect these dynamics in terms of how, where, and for whom they are implemented.

INTRODUCTION

Food shopping decisions present a means of assessing possible pathways between food environment, diet and health outcomes, including highly prevalent chronic diseases such as diabetes and obesity (Drewnowski et al., 2016b). In obtaining foods to be eaten at home, individuals make a series of decisions; chief among these are 1) where to shop (store choice) and 2) what to buy (food choice). Previous mixed-methods studies have developed a better understanding of food shopping behavior among low- income urban residents and how they navigate community and consumer food environments (Glanz et al., 2005). Numerous studies at both local and national scales have found that most shoppers travel beyond their closest supermarket to do most of their food shopping (Hillier et al., 2011; Ver Ploeg et al., 2015), and that multiple stores are often used over the course of a month (Chrisinger et al., in review; DiSantis et al., 2016; Zenk et al., 2014).

Previous research also shows that while distance is an important part of choosing among possible food retailers, other factors are also significant for many households. For instance, food store choice was found to vary with individual and household characteristics, such as income, vehicle ownership, race/ethnicity, and gender, and activity space of food shoppers (Hillier et al., 2015, 2017). Store characteristics, such as proximity to transit, prices, size, and availability of healthful foods also appear to influence store choice, (Hillier et al., 2011; Jilcott et al., 2011; Kerr et al., 2012), and households appear to form different expectations and transportation needs for different types of food shopping trips (e.g., big trips versus small trips) (Cannuscio et al., 2014; Chrisinger, 2016; Hirsch and Hillier, 2013). Other studies have explored the influence of these factors among participants in the primary U.S. federal food assistance programs: the cash-like

Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) in which over one in six households participated in 2017, and the item-specific, voucher-based Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) that reaches over seven million pregnant and postpartum women, their infants and young children (Gustafson, 2017; Hillier et al., 2017; Jilcott et al., 2011; Rose and Richards, 2004; U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, 2017; USDA Food and Nutrition Service, n.d.). Among studies of lower-income populations, the type of food store (e.g., full- service supermarket, limited assortment, convenience store) also appears to predict the healthfulness of foods purchased (Chrisinger et al., in review; Gustafson et al., 2013; Gustafson, 2017; Gustafson et al., 2012; Jilcott et al., 2011), perhaps, attributable to disparities in the consumer, or in-store, food environment, between types of retailers (Laska et al., 2010, 2015).

With the nationally representative National Household Food Acquisition and Purchase Survey (FoodAPS) dataset, we can broadly test nutritional differences between types of food retailers, and assess relationships between these differences and individual socioeconomic (SES) characteristics. Our analysis extends beyond lower-income populations, thus allowing us to compare how households that are eligible for food assistance programs shop compared to households with higher incomes. Our primary hypothesis was that purchases made at conventional supermarkets would be the healthiest compared to other retailer types, even after adjusting for individual, trip, and store-level characteristics thought to influence the items purchased. We also sought to explore possible variations in the healthfulness of purchases by

participation in SNAP or WIC, and by use of these assistance programs during specific transactions.

METHODS

Dataset

Data collection for FoodAPS included 4,826 households across the United States in 2012 and 2013, and was specifically designed to enable nationally representative assessments.

Respondents for each FoodAPS household reported all food acquisitions made over a one-week period, including food-at-home (FAH) and food-away-from-home (FAFH), using a variety of methods and instruments, described fully in USDA reports (USDA Economic Research Service, 2016). Information for each food shopping trip was extracted from participant data, including the number and type of foods purchased, amount spent, and the type and location of store. For our primary outcome variable, nutrient coding was applied to the primary FoodAPS dataset according to the Healthy Eating Index-2010 (HEI-2010), which is a density-based diet quality score (maximum score=100) designed to reflect adherence to the Dietary Guidelines for Americans (Guenther et al., 2013). The HEI-2010 is comprised of 12 component categories that account for both healthy and unhealthy foods: whole fruit, total fruit, whole grains, dairy, total protein foods, seafood and plant proteins, greens and beans, total vegetables, fatty acids, refined grains, sodium and empty calories (Guenther et al., 2013). We only included FAH transactions in this analysis.

We transformed and/or recoded several FoodAPS variables related to trip, store, and primary shopper characteristics for ease of interpretability. Our study variables included trip

characteristics: date of purchase (week versus weekend), week of the month (first, second, third, fourth/fifth), total purchase amount (which may have included non-food items, recoded as a categorical variable: <\$10.00, \$10.00-\$24.99, \$25.00-\$49.99, and \$50.00+), payment type (SNAP, WIC, debit card, credit card, cash or check, or other), and distance from shopper's home (defined in FoodAPS as Google Maps calculated driving distance in miles). We derived store type classifications from a linked Nielsen TDLinx dataset, which included conventional supermarkets, supercenters (e.g., SuperTarget, Walmart Supercenter), discount/limited assortment retailers (e.g., Aldi, Trader Joe's, Sav-A-Lot), conventional clubs (warehouse-type stores that charge a membership fee, such as Costco and Sam's Club), natural/gourmet stores, dollar stores (e.g., Dollar General, Dollar Tree, Family Dollar), and "other" retailers (including corner and convenience stores) (Rhone et al., 2017, p. 2). Primary shopper information in our analysis included gender, age (recoded as a categorical variable: 18-29, 30-39, 40-49, 50-59, 60+), SNAP status (based upon self-reported and USDA-estimated eligibility: SNAP-eligible non-participant, SNAP-ineligible with income 100-185% of the Federal Poverty Level (FPL), SNAP-ineligible with income 185%+ FPL, and SNAP participant) educational attainment, race/ethnicity, vehicle access (own/lease vehicle or not), and residence location.

Statistical Analyses

We generated descriptive statistics for all primary shopper and shopping trip variables (composite and component HEI scores for each trip, total number of items purchased, and amount spent), as well as the trip characteristics by store type. Linear regression models using general estimating equations were generated to assess the relationship between trip, store, and shopper characteristics with each trip's composite HEI score. Here, household ID was treated as

a repeated measure to account for varying numbers of trips between households. Based on our findings regarding discount/limited assortment retailers and conventional supermarkets, we also generated descriptive characteristics to compare the HEI composite and component scores between retailers and categories of household SNAP participation. Sampling weights were used for all statistical analyses.

RESULTS

Participant Characteristics

More than half of the participant sample was female (67.8%), non-Hispanic white (60.6%), was over the age of 40 (59.8%), had at least some college education (53.7%), and owned or leased a vehicle (86.2%). Approximately 45.0% of participants were not eligible for SNAP (6.8% with incomes 100-185% FPL, 38.2% with incomes above 185% FPL), while 32.5% were SNAP participants, and 22.5% were SNAP-eligible but not participating. See **Table 1** for a summary of all participant characteristics and their weighted prevalence across the dataset.

Shopping Trip Characteristics

In total, 4,962 primary shoppers made a total of 11,472 FAH shopping trips (only trips with non-missing data were included, n=10,789). Shopping trips were made proportionately during weekdays compared to weekend days (71.2% on the five weekdays versus 28.8% of trips on the two weekend days, respectively). Participants spent a median of \$19.79 per shopping trip, with 57.7% of trips involving expenditures of less than \$25. Cash or check (41.2%) and debit (26.2%) were the most common form of payment, followed by SNAP (15.6%) and credit card (13.4%).

Trips to conventional supermarkets were the most common (54.4% of all trips), followed by supercenters (19.3%) and “other” retailers (10.9%). Excepting dollar stores and retailers classified as “other,” all remaining retailers had mean purchase amounts over \$30.00; notably, the mean conventional club transaction was approximately \$100.00. Mean composite HEI scores ranged from 43.43 at dollar stores to 56.09 at natural/gourmet retailers. Other variations in trip characteristics between retailer types are described in **Table 2**.

Correlations with Composite HEI Scores for Individual Shopping Trips

Table 3 presents the results of the multivariate GEE model adjusting for all of the covariates included in the table. Compared to the HEI scores of purchases made at conventional supermarkets, those from purchases at natural gourmet stores were significantly higher ($\beta=6.43$, 95% CI=[4.46, 8.39]), while those from “other” retailers were significantly lower ($\beta=-4.63$, 95% CI=[-6.57, -2.70]). Older participants also made healthier purchases than younger participants ($\beta=1.98$, CI=[0.57,3.39]), as did women compared to men ($\beta=1.19$, CI=[0.29, 2.10]). Compared to non-Hispanic whites, Hispanic participants made significantly healthier purchases ($\beta=2.24$, CI=[1.18, 3.31]), as did non-Hispanic, non-Black/African American participants ($\beta=2.59$, CI=[0.64, 4.54]). In terms of education, participants with less than some college education made purchases with significantly lower HEI scores than those with more education, as did SNAP participants compared to households with income over 185% of the FPL.

Significant associations were also observed between the purchase amount and HEI score, with smaller purchases having significantly lower values. Compared to paying by cash or check, WIC purchases (made with food-specific WIC vouchers) had significantly higher HEI scores ($\beta=8.29$,

CI=5.57, 11.00), as did those made with credit cards ($\beta=1.45$, CI=0.22, 2.68). Purchases made in the third or fourth weeks of the month were significantly less healthy than those made during the first seven days of the month. See **Figure 1** and **Table 3** for all variable coefficients and confidence intervals.

Differences in HEI Component Scores between Conventional Supermarkets and Discount/Limited Assortment Stores

Descriptive statistics of HEI scores from transactions at discount/limited assortment stores compared to supermarkets offer nuanced results (see **Figure 2** and **Supplemental Table A**); only differences that represented more than five percent of a possible component score are reported below. For SNAP participants, purchases at discount/limited assortment stores were healthier, on average, for total vegetables (12% higher HEI component score), total protein foods (9% higher), seafood and plant proteins (7% higher) and sodium (16% higher). SNAP-eligible non-participants also had higher total vegetables and total protein foods at discount/limited assortment stores (8% higher for both), and had 9% lower HEI scores for dairy and sodium. SNAP-ineligible households with incomes over 185% FPL had, on average, higher HEI scores for total fruits, whole fruits, and total vegetables at discount/limited assortment stores (6%, 9%, and 11%, respectively), and lower scores for whole grains (9% lower). At discount/limited assortment stores, SNAP-ineligible households with lower incomes (100-185% FPL) had higher average HEI component scores for seafood and plant proteins (8% higher) and sodium (17% higher), and lower scores for total fruits (6% lower), whole fruits (16% lower), greens and beans (8% lower), whole grains (10% lower), and total protein foods (12% lower).

For all SNAP participation categories (e.g., participant, eligible non-participant, not eligible), discount/limited assortment purchases had higher average HEI component scores for fatty acids, greens and beans, and total vegetables. On average, all SNAP participation categories had higher (healthier) refined grain scores at conventional supermarkets. Other HEI component scores varied between favoring discount/limited assortment and conventional supermarkets based on the SNAP participation status of the household (see **Figure 2** and **Table 2**). Most purchases at conventional supermarkets were by non-SNAP eligible participants (44.1%), especially those with incomes over 185% FPL (37.4%), while most purchases at discount/limited assortment stores were made by SNAP participants (42.0%).

DISCUSSION

Our analysis of the nationally representative FoodAPS dataset is consistent with many smaller studies of food shopping in the United States in terms of where household buy healthy and unhealthy foods (Cannuscio et al., 2014; Vaughan et al., 2017; Ver Ploeg et al., 2015). We find that conventional supermarkets are the most common food shopping destination, representing over half of all shopping trips in this sample (54.4%). Compared to conventional supermarket transactions, average HEI scores were significantly higher at natural/gourmet stores, and lower at “other” retailers, namely corner and convenience stores. While neither of these findings are surprising given the context of these trips (e.g., choice of a natural/gourmet store, in-store environment with healthy options, etc.) and previous literature (e.g., healthy food availability and purchasing at corner stores), we were surprised to find that discount/limited assortment store trips did not differ significantly, but, on average, were comparable to those made at conventional supermarkets. Direct comparison of HEI component scores suggests that much of this difference

is attributable to proportion of purchases comprised of vegetables at discount/limited assortment stores (total vegetable score mean=2.75, median=3.14) compared to conventional supermarkets (mean=2.27, median=1.80). Notably, total vegetable scores for trips to limited assortment stores were on average higher for participants across all income categories, and approximately higher by 12% (of the possible HEI score) than trips to conventional supermarkets for SNAP participants. Among SNAP participants, discount/limited assortment stores had higher average HEI component scores than conventional supermarket trips for 8/12 categories, while SNAP-eligible non-participants had higher components scores for 6/12 categories. While relatively small sample size may present another explanation for this finding (discount/limited assortment stores represent only 5.0% of trips), these retailers appear to be at least comparable with conventional supermarkets in terms of the healthfulness of purchases made.

Purchases made at “other” retailers (including corner and convenience stores) had significantly lower HEI scores compared to conventional supermarkets, consistent with other literature examining the nutritional quality of foods sold at these types of retailers (Caspi et al., 2017). From the descriptive statistics in **Table 3**, we see that these types of retailers had lower average values for all HEI component scores, compared to conventional supermarkets. Additionally, the average amount spent at these retailers was just over half of that spent at conventional supermarkets (\$20.67 at “other” retailers versus \$35.29 at conventional supermarkets).

Use of SNAP benefits was not significantly related to HEI outcomes. This runs contrary to one recent study of transactions involving specific food items within a Northeastern supermarket chain that found select unhealthy foods more likely to be purchased with SNAP benefits

(Franckle et al., 2017), as well as to broader public policy discourse that often associates SNAP use with unhealthy purchasing (Barnhill, 2011; Chrisinger, 2017; Leung et al., 2013; Long et al., 2014). Still, this finding raises questions about why and how SNAP fell short of delivering on its namesake promise of “nutrition,” and possible avenues for improvement, such as the modest success of the Healthy Incentives Pilot, which offered participants additional SNAP bonuses when purchases were made on eligible healthy items (Bartlett et al., 2014; Klerman et al., 2014; Wilde et al., 2015). Conversely, we found that healthier transactions were predicted by WIC use. One straightforward explanation for the correlation of HEI with WIC use is the voucher-based nature of the program, which provides benefits that can be used only for designated healthy food items. Furthermore, the set of allowable food items within the WIC program was revised in 2009, with an emphasis on increasing participants’ purchasing of vegetables, fruits, whole grains, and low-fat dairy, all items that would favorably increase the HEI score of a food shopping trip (Guenther et al., 2013; Schultz et al., 2015).

Households who were income-ineligible for SNAP purchased significantly healthier items on food shopping trips compared to participants with lower incomes. One possible interpretation of this pattern is the influence of SES on diet. Compared to higher-SES status, lower-SES has been correlated with lower dietary quality in both metropolitan- and national-level studies in a graded manner (e.g., additional income yields dietary improvements, even for individuals with adequate food security), with the gap between these groups widening between 2000 and 2010 (Darmon and Drewnowski, 2008; Drewnowski, 2014; Drewnowski et al., 2016a; Drewnowski and Eichelsdoerfer, 2010; Wang et al., 2014). Factors such as poor physical access to food retailers, higher prices for healthy foods, lower nutritional knowledge, limited time for shopping or

cooking, or the high palatability and low satiety value of less-healthy foods have been identified as possible causal mechanisms explaining this relationship (Darmon and Drewnowski, 2008). In our study, the influence of SES on diet may also be illustrated by the positive and significant relationship with HEI among relevant indicators, including educational attainment, use of credit, and income above the SNAP eligibility threshold (Darmon and Drewnowski, 2008; Littwin, 2007).

Limitations

This study has several limitations. First, the FoodAPS dataset only represents one week of purchasing data per household. While making a rich dataset, it may still obscure important food purchasing habits of some households, especially those, like SNAP shoppers, who often make one or two large shopping trips per month (Hamrick and Andrews, 2016; Whiteman et al., in review). Second, while we analyzed the nutritional value of purchases made at different retailers with HEI, we do not actually know about household eating patterns. Thus, it is impossible to know how foods were prepared, or if they were shared equally between household members. Still, we believe it to be a reasonably robust and clinically relevant measure, as previous research has shown significant associations between diet and HEI, and between HEI and health outcomes (Guenther et al., 2013; Liese et al., 2015; McCullough et al., 2000, 2000; Rathod et al., 2012). Finally, we rely on a store classification system that allows us to analyze potentially meaningful differences between stores, though unobserved nuances are likely to exist within the largest category of conventional supermarket, such as store-specific merchandizing and promotions, presence of specific in-store departments (e.g., pharmacy, bakery, deli, etc.), and availability of culturally-relevant products. Further research should seek to incorporate additional store

variables, such as in-store pricing or promotion strategies, to better capture difference between types of retailers.

Conclusion

A variety of individual and contextual factors influence how food shopping decisions are made, including where to shop and what to purchase. In this study, we used a nationally-representative dataset to analyze the relative healthfulness of purchases made at different types of retailers, adjusting for a variety of individual, store, and trip characteristics. We found that the majority of trips were to conventional supermarkets, and that these transactions were significantly healthier than those made at “other” retailers (e.g., corner and convenience stores), and significantly less healthy than those made at natural/gourmet stores. Households of lower socio-economic status also made significantly less healthy purchases compared to households with higher incomes. In sum, this study provides a picture of food shopping behaviors across the United States, and spotlights potential populations and locations for future interventions.

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The authors have no conflicts of interest to declare.

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TABLES

Table 1: Descriptive characteristics of participants, food expenditures and shopping trips included in the FoodAPS food-at-home dataset, 2012-2013.

Individual Characteristics (unweighted n=4,962 having at least one trip)	<i>Unweighted n (weighted %)</i>
<u>Age groups (years)</u>	
18-29	1,003 (14.2)
30-39	990 (17.2)
40-49	952 (18.5)
50-59	940 (20.2)
60+	1,077 (29.9)
<u>Gender (Female)</u>	3,364 (63.7)
<u>Race/ethnicity</u>	
White (non-Hispanic)	3,006 (70.0)
Black/Af Am (non-Hispanic)	624 (10.2)
Hispanic (any)	1,013 (13.7)
Other (non-Hispanic)	319 (6.0)
<u>SNAP/Income Status</u>	
SNAP participant	1,614 (13.1)
SNAP eligible, non-participant	1,115 (19.3)
Non-SNAP eligible, 100-185% FPL	339 (4.7)
Non-SNAP eligible, 185+% FPL	1,894 (62.9)
<u>Education</u>	
<HS	808 (8.9)
HS/GED	1,476 (24.9)
Some college or more	2,666 (66.1)
Missing	12 (0.1)
<u>Own/lease car ^a</u>	4,275 (90.7) ^b
Food Expenditures and Trip Characteristics (n=11,472)	
<i>n (%)</i>	
Weekend	3,308 (30.0)

<u>Week of month</u>	
First (days 1-7)	2,413 (21.8)
Second (days 8-14)	2,827 (23.4)
Third (days 15-21)	3,010 (24.8)
Fourth + Fifth (days 22-31)	3,222 (29.9)
<u>Amount spent (\$)</u>	
Median [IQR]	22.74 [9.43-48.46]
< \$10.00	3,380 (26.7)
\$10.00 - \$24.99	3,235 (26.3)
\$25.00 - \$49.99	2,370 (23.0)
\$50.00+	2,487 (24.1)
<u>Distance traveled from home (miles) Median [IQR]</u>	2.85 [1.36-6.82] ^c
<u>Payment type ^d</u>	
SNAP (any)	1,791 (6.2)
WIC	226 (0.8)
Cash or check	4,730 (40.9)
Debit card	3,000 (30.0)
Credit card	1,534 (20.4)
Other (TANF or gift card)	41 (0.2)
Missing	145 (1.4)

^a Reported at household level, but presented as individual level

^b Missing = 9

^c Missing = 552

^d Multiple payment types are possible

Abbreviations used: SNAP (Supplemental Nutrition Assistance Program), FPL (Federal Poverty Level), HS (high school degree), GED (General Equivalency Diploma), IQR (inter-quartile range), WIC (Special Supplemental Nutrition Program for Women, Infants and Children), TANF (Temporary Assistance for Needy Families Program).

Table 2. Distribution of 11,472 food shopping trips made by 4,962 shoppers in the FoodAPS food-at-home dataset (2012-2013), grouped by HEI-2010 score

		Amount spent	Overall HEI score (max=100)	HEI Total fruits (max=5)	HEI Total vegetables (max=5)^a	HEI greens and beans (max=5)	HEI whole grains (max=10)
<i>Store Type</i>	<i># trips (%)</i>	<i>Mean ± standard error Median [IQR]</i>					
Conventional supermarket	6,238 (53.6)	35.29±0.86 22.38 [9.88-45.01]	48.12±0.35 48.19 [37.99-58.10]	0.45±0.03 0 [0-0]	2.27±0.04 1.80 [0-4.99]	1.11±0.05 0 [0-0.34]	1.75±0.09 0 [0-1.00]
Supercenter	2,217 (18.5)	49.80±2.68 33.20 [14.46-68.51]	48.26±0.59 48.18 [38.68-57.48]	0.41±0.03 0 [0-0]	2.04±0.07 1.45 [0-4.63]	1.02±0.07 0 [0-0.49]	2.36±0.16 0 [0-4.17]
Discount/limited assortment	569 (4.8)	28.91±2.34 19.99 [9.94-34.86]	47.13±0.99 46.91 [35.67-58.18]	0.58±0.13 0 [0-0]	2.75±0.11 3.14 [0-5]	0.94±0.08 0 [0-0]	1.18±0.09 0 [0-0]
Conventional club	361 (4.1)	109.51±9.21 76.07 [40.52-148.59]	54.68±1.40 54.99 [42.76-67.23]	0.49±0.08 0 [0-0]	2.27±0.16 1.89 [0-4.91]	1.29±0.21 0 [0-3.03]	2.05±0.29 0 [0-2.58]
Natural/gourmet	270 (4.1)	40.48±2.42 30.68 [16.67-52.77]	56.09±0.81 57.40 [47.27-65.98]	0.67±0.18 0 [0-0]	2.93±0.18 3.78 [0.07-4.99]	1.79±0.13 0 [0-4.78]	2.36±0.32 0 [0-5.11]
Dollar store	570 (3.5)	13.30±1.19 7.55 [3.55-19.16]	43.43±0.74 43.63 [35.33-52.97]	0.23±0.05 0 [0-0]	1.25±0.09 0 [0-2.35]	0.36±0.09 0 [0-0]	1.51±0.18 0 [0-0]
Other	1,247 (11.3)	20.67±1.89 9.96 [4.24-24.63]	43.91±0.64 44.88 [31.63-54.94]	0.37±0.06 0 [0-0]	1.52±0.09 0 [0-4.48]	0.64±0.09 0 [0-0]	0.97±0.13 0 [0-0]
^a Includes vegetable-designated legumes Abbreviations used: HEI (Healthy Eating Index), IQR (inter-quartile range)							

Table 3. Results of Weighted and Adjusted Multivariate Generalized Estimating Equation Models^a assessing predictors of HEI-2010 scores among all food-at-home purchases in the FoodAPS dataset (2012-2013), displayed as effect (95% CI).

	Composite HEI
Store Type (ref: Conventional Supermarket)	
Supercenter	-0.54 (-1.93, 0.85)
Discount/limited assortment	0.90 (-0.78, 2.57)
Conventional club	2.18 (-0.63, 5.00)
Natural/gourmet	6.48 (4.45, 8.51)
Dollar store	-1.37 (3.25, 0.50)
Other	-3.89 (-5.87, -1.92)
Age groups (years) (ref: 18-29)	
30-39	-0.07 (-1.42, 1.28)
40-49	-0.76 (-1.99, 0.48)
50-59	1.27 (-0.41, 2.96)
60+	1.98 (0.57, 3.39)
Sex (Female)	1.19 (0.29, 2.10)
Race/ethnicity (ref: White [non-Hispanic])	
Black/Af Am (non-Hispanic)	0.16 (-1.04, 1.37)
Hispanic (any)	2.24 (1.18, 3.31)
Other (non-Hispanic)	2.59 (0.64, 4.54)
SNAP/Income Status (ref: Non-SNAP eligible, 185+% FPL)	
SNAP household	-1.96 (-2.76, -1.15)
SNAP eligible (non-household)	-0.92 (-1.64, -0.20)
Non-SNAP eligible, 100-185% FPL	-0.76 (-2.18, 0.66)
Education (ref: Some college +)	
<HS	-0.54 (-1.88, 0.80)
HS/GED	-1.49 (-2.34, -0.64)
Own/lease car	0.07 (-1.55, 1.68)
Weekend	-0.37 (-1.30, 0.56)
Week of month (ref: first [days 1-7])	
Second (days 8-14)	-0.04 (-1.45, 1.38)
Third (days 15-21)	-0.84 (-1.67, -0.01)
Fourth + fifth (days 22-31)	-1.12 (-2.18, -0.06)
Amount spent (ref: \$50.00+)	
< \$10.00	-10.38 (-11.49, -9.28)
\$10.00-\$24.99	-7.67 (-8.72, -6.61)
\$25.00-\$49.99	-5.10 (-6.07, -4.14)

Distance traveled from home (miles)	-0.02 (-0.05, 0.01)
Payment type (ref: cash or check)	
SNAP (any)	0.26 (-0.94, 1.46)
WIC	8.29 (5.57, 11.00)
Debit card	0.37 (-0.65, 1.39)
Credit card	1.45 (0.22, 2.68)
Other (TANF or gift card)	2.37 (-3.23, 7.82)
^a Based on the complete case (non-missing) total of n=10,789 Abbreviations used: HEI (Healthy Eating Index), FPL (Federal Poverty Level), SNAP (Supplemental Nutrition Assistance Program), HS (high school degree), GED (General Equivalency Diploma), WIC (Special Supplemental Nutrition Program for Women, Infants and Children), TANF (Temporary Assistance for Needy Families Program)	

FIGURES

Figure 1.

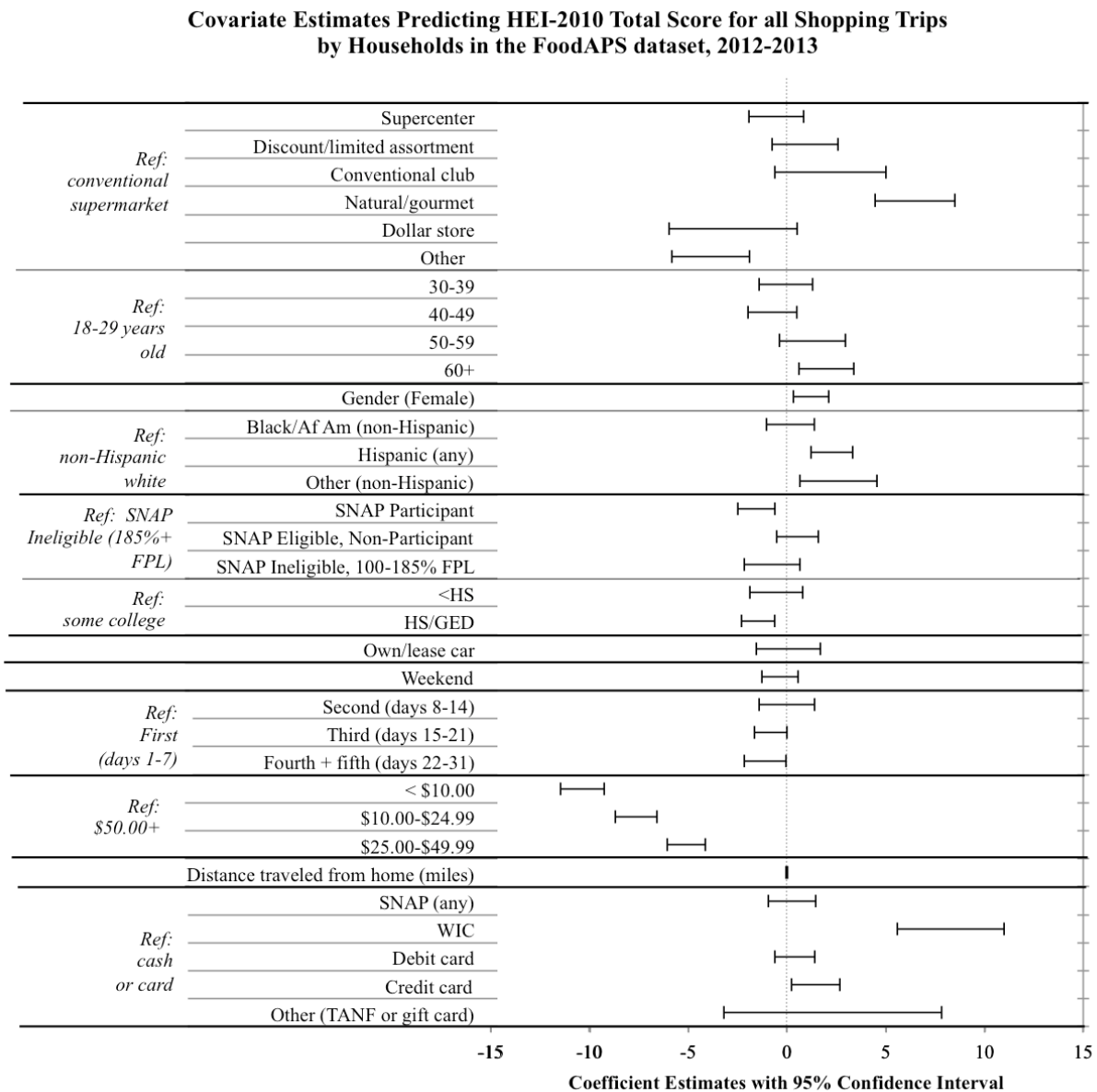
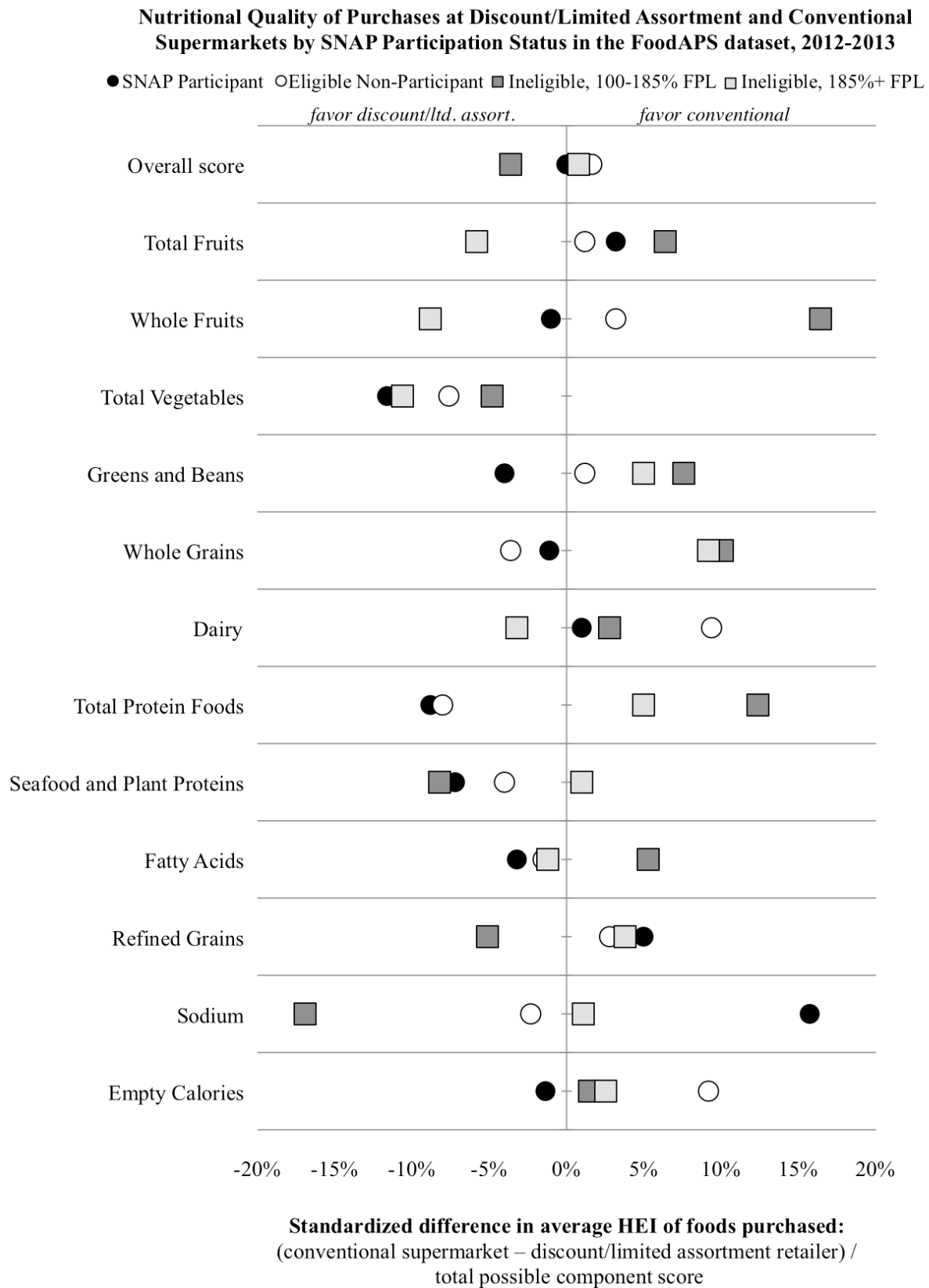


Figure 2.



SUPPLEMENTAL MATERIAL

Supplemental Table A.

Table 5. Differences in HEI-2010 between conventional supermarkets and discount/limited assortment stores of the food shopping trips made by shoppers in the FoodAPS food-at-home dataset, 2012-2013

	Conventional Supermarket (n=6,238 trips)			Discount/Limited Assortment (n=569 trips)		
HEI scores*	SNAP Household (n=2,081)	SNAP eligible, NOT receiving SNAP (n=1,482)	Non-SNAP eligible (n=2,675)	SNAP Household (n=239)	SNAP eligible, NOT receiving SNAP (n=118)	Non-SNAP eligible (n=212)
Overall score	45.77±0.29 45.68 [36.93-55.00]	47.10±0.34 46.93 [37.86-56.30]	48.38±0.27 48.52 [38.40-58.47]	45.92±0.81 45.72 [36.36-54.99]	47.49±1.16 47.61 [38.39-55.67]	49.50±0.97 50.31 [38.23-60.00]
Total Fruits	0.40±0.03 0 [0-0]	0.41±0.03 0 [0-0]	0.44±0.02 0 [0-0]	0.20±0.05 0 [0-0]	0.42±0.12 0 [0-0]	0.53±0.10 0 [0-0]
Whole Fruits	1.43±0.05 0 [0-3.31]	1.64±0.06 0 [0-4.82]	1.89±0.04 0 [0-5]	1.34±0.13 0 [0-2.47]	1.60±0.20 0 [0-3.96]	2.23±0.16 1.16 [0-5]
Total Vegetables	2.02±0.05 1.15 [0-4.97]	2.18±0.06 1.40 [0-5]	2.36±0.04 2.07 [0-5]	2.33±0.13 2.18 [0-5.00]	2.89±0.20 3.52 [0-5]	2.73±0.15 2.99 [0-5]
Greens and Beans	0.77±0.04 0 [0-0]	0.93±0.05 0 [0-0]	1.20±0.04 0 [0-1.57]	0.79±0.11 0 [0-0]	1.00±0.18 0 [0-0]	1.22±0.14 0 [0-1.81]
Whole Grains	1.27±0.06 0 [0-0]	1.54±0.08 0 [0-0]	1.74±0.07 0 [0-1.18]	1.63±0.21 0 [0-0.82]	1.34±0.25 0 [0-0.33]	1.50±0.20 0 [0-1.70]
Dairy	3.27±0.08 1.58 [0-6.07]	3.13±0.10 1.19 [0-5.79]	3.35±0.07 1.54 [0-6.53]	3.09±0.23 1.56 [0-5.04]	2.91±0.33 1.22 [0-4.84]	3.87±0.26 2.84 [0-6.91]
Total Protein Foods	2.61±0.05 2.97 [0-5]	2.54±0.06 2.73 [0-5]	2.66±0.04 3.14 [0-5]	2.93±0.14 3.94 [0.10-5]	2.59±0.21 3.11 [0-5]	2.63±0.15 3.03 [0-5]
Seafood and Plant Proteins	1.06±0.04 0 [0-0.78]	1.11±0.05 0 [0-0.87]	1.33±0.04 0 [0-3.23]	1.50±0.14 0 [0-4.27]	1.06±0.18 0 [0-0.88]	1.54±0.15 0 [0-4.51]
Fatty Acids	4.96±0.09 4.83 [0-10]	5.17±0.11 5.13 [0-10]	5.01±0.08 4.77 [0-10]	5.37±0.26 5.36 [1.06-10]	5.36±0.38 5.79 [0.15-10]	5.38±0.28 5.83 [0.49-10]
Refined Grains	6.20±0.09 8.80 [1.30-10]	6.18±0.11 8.69 [0.79-10]	6.34±0.08 9.29 [1.11-10]	5.79±0.28 7.09 [0.26-10]	6.09±0.39 8.28 [1.17-10]	5.86±0.29 6.99 [0.44-10]
Sodium	6.20±0.09 8.31 [1.41-10]	6.29±0.11 8.39 [1.97-10]	6.16±0.08 8.05 [1.57-10]	5.03±0.27 5.08 [0-10]	6.37±0.39 9.09 [1.56-10]	6.07±0.28 7.31 [2.08-10]
Empty Calories	15.55±0.13 18.87 [12.63-20]	15.98±0.15 19.59 [13.44-20]	15.90±0.12 20.00 [13.24-20]	15.93±0.37 19.42 [13.11-20]	15.84±0.55 19.67 [13.69-20]	15.95±0.41 20.00 [13.77-20]

Abbreviations used: SNAP (Supplemental Nutrition Assistance Program), IQR (inter-quartile range)

* Presenting as:

Mean ± standard error

Median [IQR]