Published in final edited form as:

J Acad Nutr Diet. 2017 December ; 117(12): 1931–1940. doi:10.1016/j.jand.2017.02.007.

The association between food security and store-specific and overall food shopping behaviors

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Abstract

Background—Food security is a severe problem in the United States (US). Few studies have examined its relationship with food shopping behaviors.

Objective—This study aimed to examine the association between food security and store-specific and overall food shopping among residents of low-income neighborhoods.

Design—Cross-sectional study.

Participants/setting—527 households were recruited from two counties in South Carolina from November, 2013 to May, 2014, and 474 households were included in the final analysis.

Main outcomes measures—Food security was assessed using the 18-item US-Household Food Security Module questionnaire, and classified into three categories: high or marginal food security (FS), low food secure (LFS), and very low food secure (VLFS). Store-specific shopping behaviors including frequency, store type, and transportation were queried via in-person interview for the three most-frequented grocery stores. Distance from participants' homes to their reported stores was calculated using Geographic Information Systems (GIS).

Statistical analyses—Multivariate linear regression for analyses of distance and frequency and multinomial/ordinary logistic regression for analyses of store type and transportation were used.

Results—Compared to FS participants, a significantly higher proportion of VLFS participants reported a convenience/dollar store as their most-frequented store (odds ratio (OR) =2.31, 95% confidence interval (CI)=1.08, 4.95) or a lack of transportation (OR=2.04, 95% CI=1.25, 3.33). They also shopped less frequently ($b=-0.31$, p -value=0.03) at their third most-frequented store and

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traveled fewer total miles for shopping ($b=-4.71$, $p\text{-value}=0.04$). In analyses considering all stores jointly, LFS participants had lower odds of shopping at both supermarkets and convenience/dollar stores ($OR=0.44$, 95% $CI=0.21, 0.91$) compared to FS residents.

Conclusions—The current findings suggest that households with very low food security tend to shop more frequently in stores that have less healthful options, such as convenience/dollar stores. These findings lend support to ongoing community and policy interventions aimed at improving food access among food-insecure populations.

Keywords

shopping distance; shopping frequency; grocery store type; transportation; store type pattern

Introduction

In the United States (US), approximately 14% of US households were food insecure at some time during 2014, meaning that 17.4 million US households were uncertain of having, or were unable to acquire, enough food to meet the needs of their members because they had insufficient money or other resources for food ¹. Among these households, 8.4% (10.5 million) and 5.6% (6.9 million) experienced low food security or very low food security, respectively ¹.

Previous studies have shown that low-income households have less consumption of fruits and vegetables and lower intake of nutrients (e.g., calcium, vitamins, etc.) ^{2–10}. A number of factors contribute to poor dietary quality among low-income populations beyond economic constraints and food shopping choices could be one of these. In addition to in-store food purchasing behaviors, store utilization behaviors are of interest as well. Review of previous studies focusing specifically on food shopping behaviors suggests that low-income populations may grocery shop less frequently because of the timing of food assistance benefits, which would affect perishable items such as fresh fruits and vegetables ^{4–6,11–17}; they may have insufficient spatial access (living further away from a grocery store) to supermarkets and grocery stores selling healthful foods ^{4,5,16,18–21}; and they may lack transportation to facilitate food shopping ^{4,22}.

The few studies that have focused on a particular low-income group, Supplemental Nutrition Assistance Program (SNAP) recipients (previously called Food Stamp Program) ^{2–10}, generally support these findings. Specifically, the studies show that SNAP recipients usually use a supermarket as their main food store ^{4,7}; they do not usually shop at the nearest store because of the relatively high prices or lack of a store in their neighborhoods ^{3,8–10}; and sixty-eight percent of SNAP recipients drive themselves to shop for food ⁷.

While income/poverty and food security status are not perfectly correlated, households with poverty-level income are more likely to experience lower food security ²³. To our knowledge, only two studies exist on household food security status and food shopping ^{24,25}. Kirkpatrick et al. found that food security status was not associated with proximity to food retail outlets in Canadian families ²⁴. However, in another Canadian study, Sadler et al. found that food-insecure respondents lived significantly closer to nutritious food sources and

grocery stores than food-secure respondents²⁵. Of note, both studies characterized the food environment (availability of retail outlets in the neighborhood) instead of actual store utilization behaviors^{24,25}, and we do not know if these findings would generalize to communities of high poverty, mainly African American households in the southeastern US.

An additional consideration is that the majority of studies on food shopping (unrelated to food security) have focused on a single store only, either the primarily utilized or the nearest store^{5,12–15,19,26–31}. Thus, studies rarely capture the entire range of food shopping in a specified time period or assess shopping at multiple stores. A recent exception was the Food Acquisition and Purchase Survey (FoodAPS), which surveyed food shopping at two stores (primary and alternative)⁷. This study found that food insecure households were less likely to use a car of their own to conduct their primary food shopping. However, this report was descriptive and did not control for potential confounders.

Thus, the goal of this study was to examine the association between food security status of residents of low-income communities and store-specific and overall food shopping behaviors (i.e., type of store utilized, distance traveled to shop, shopping frequency and transportation).

Methods

Study population and data collection

The Food Access and Family Food Shopper study recruited primary grocery shoppers (defined as the person shopping for at least half of the household's food) from 527 households between November 2013 and May 2014 in two South Carolina counties (2.77 and 6.80 square miles of study area in each county). Recruitment focused on seven census tracts (six of which were United States Department of Agriculture (USDA)-designated food deserts, defined as a low-income population having low access to a supermarket or supercenter)³², with a combined population of 19,117 individuals and 6,459 households at the time of participant recruitment³³. To accommodate local community definitions of their neighborhoods, which extend beyond geographic boundaries of census tracts, we extended the boundaries for eligibility to one mile past the seven recruitment tract boundaries into adjacent tracts, but only if an adjacent tract had a poverty level greater than or equal to that of the state (16% of households below the federal poverty level). Thus, while recruitment focused on seven tracts, the final sample included residents of 18 tracts, of which 12 tracts were food desert tracts. Using purchased address lists from a survey sampling firm, letters addressed to the "family food shopper" were mailed to all residential addresses inviting them to call for information about a study of food access and food shopping. Multiple recruitment strategies (in-person, printed and electronic) followed this initial letter and resulted in 527 participants. In-person interviews were conducted with the primary grocery shoppers after obtaining written informed consent. The interview included socio-demographic, attitudinal, behavioral and health-related questions.

Data for the present, cross-sectional analysis study were from the baseline interviews of the Food Access and Family Food Shopper study, the overarching purpose of which was to evaluate a food hub intervention to increase healthy food access with a longitudinal, quasi-experimental study. The data presented in this analysis predated the opening of the food hub.

The study was reviewed and approved by the Institutional Review Board of the University of South Carolina.

Food shopping

Store-specific food shopping behaviors were queried for each participant's three most-frequented grocery stores (e.g., "what is the name of the store or market where you shopped the most often (store 1), the second most often (store 2) and the third most often (store 3) for food?"). Food shopping behaviors queried about included 1) type of stores 1–3 (convenience stop, drugstore/pharmacy, dollar variety store, farmers' market, food bank or food pantry, supermarket, supercenter, smaller grocery store, specialty store, warehouse club, or other type of food store such as a military commissary), 2) shopping frequency at each (e.g., for store 1: "over the past year, how often did you usually shop at [name of primary store answered before]?") Respondent could answer in their preferred units of times per day, week, month, or year. All responses were converted to times per month.) and 3) transportation used (i.e., drive your own car, van, truck or motorcycle; ride in the car, van, truck or motorcycle of family or friends; ride the bus; take a taxi; walk; or ride a bicycle) to store 1 only.

Stores' and participants' home addresses were geocoded according to Topologically Integrated Geographic Encoding and Referencing (TIGER) road files for 2013 using ArcGIS 10.2³⁴. Network distances from participants' homes to stores 1–3 were calculated using ArcGIS 10.2³⁴. Shopping frequency was expressed as the number of shopping occasions per week and per month. For stores 1 and 2, weekly shopping frequency was dichotomized into two categories: 1 time per week or >1 time per week. Store 3 shopping frequency is presented as a frequency per month because few residents shopped more than once per week at this store. Store type was classified into supermarkets, supercenters (including supercenters and warehouse clubs) and other (including smaller grocery stores, convenience stores, dollar variety stores, drug/pharmacy stores and specialty stores).

Considering stores 1–3 jointly, several overall food shopping patterns were calculated. Total round-trip shopping miles per week were computed by multiplying store-specific shopping frequencies per week with distance to the three stores, multiplying this product by two and summing all three stores' distances. Total shopping frequency was calculated by summing all three stores' shopping frequencies in a month. Additionally, store-type patterns were identified based on the types of stores 1–3: 1) predominantly supermarket, if stores 1 and 2 were supermarkets or supercenters (n=361); 2) supermarket + convenience/dollar store, if the participant used a mixture of supermarket/supercenter for store 1 and other type for store 2 (n=58); and 3) convenience, if store 1 was a convenience/dollar store and store 2 was a supermarket, supercenter or other (n=55). Of 55 total participants in the third category, 44 (80%) used a convenience/dollar store as their primary source of food purchases and a supermarket or supercenter as a complementary source; only 11 (20%) participants shopped in a convenience/dollar store only.

Household food security

Food security was assessed by interview using a validated 18-item USDA US-Household Food Security Survey Module³⁵, and participants were classified as having high food

security (0 affirmative responses), marginal food security (MFS; 1–2 affirmative responses), low food security (LFS; 3–7 affirmative responses) or very low food security (VLFS; 8 affirmative responses). For analyses, the MFS and FS categories were combined, together referred to as FS.

Covariates

Sociodemographic information was collected during the in-person interview, including age, sex, race (recoded as black or not), marital status (recoded as married, ever married or never married), household size, education (recoded as less than high school, high school or some college and above) and income (in \$10,000 increments). Age, household size and self-reported annual household income (including government assistance) were treated as continuous, and sex, race, marital status and education were categorical.

Statistical analysis

Of the 527 participants, 53 were excluded because of missing data on food shopping, food security or sociodemographic information; thus, the final analysis included 474 participants. Descriptive analyses were performed by food security status. The extreme values of shopping distances to stores 1–3 were Winsorized (transformation of statistics by limiting extreme values in the statistical data to reduce the effect of possibly spurious outliers)³⁶ at a reasonable value of 10.84 miles (corresponding to the 99.5th percentile for store 1, 99.5th percentile for store 2 and 98th percentile for store 3). Likewise, food shopping frequencies per month were Winsorized at 16 times per month (95.8th percentile for store 1, 99.6th percentile for store 2, not applied to store 3 because the maximum value is 15). After winsorizing, the distribution of shopping distance and frequency were no longer extremely skewed.

The associations of food security status and store-specific food shopping distance and frequency, total shopping miles and total shopping frequency were estimated using ordinary least squares regression. Multinomial logistic regression was used to estimate the associations between food security status and various attributes of food shopping (e.g., type of store utilized) and overall shopping patterns (e.g., store-type pattern). Logistic regression was used to evaluate the relationship of food security status with dichotomized weekly shopping frequency for stores 1 and 2 (0=greater than once, 1=less than or equal to once) and with transportation (0=own vehicle, 1=rely on others) to store 1. Covariates (i.e., sociodemographic factors) were selected based on previous literature. All analyses were conducted using SAS 9.4 version³⁷.

Results

Study participants' characteristics are summarized by household food security status in Table 1. The study population was mostly black (92.6%; 99.3% thereof non-Hispanic black) and female (80%). A lower proportion of participants with low levels of food security were married, and these participants had a lower mean annual household income and education level, whereas household size and SNAP participation were higher with more severe levels of food insecurity.

The description of food shopping behavior by food security status is provided in Table 2. Overall, the majority of participants across food security groups (80–92%) reported shopping at a supermarket or supercenter for all three stores. However, more VLFS participants (15%) than FS participants (8%) used a convenience or dollar store as their primary grocery source. The same pattern was noted for the joint store-type patterns when considering all three stores together. The shortest store-specific average shopping distance was observed among VLFS residents, followed by LFS and FS residents. Comparing store-specific shopping distances among stores 1–3, shopping distances increased from store 1 to store 3. Total shopping miles per week were lowest among VLFS participants (9.6 miles), followed by LFS (10.9 miles) and FS (14.7 miles) participants. Store-specific shopping frequency did not vary by the severity of food insecurity, but overall shopping frequency decreased from store 1 to store 3. No clear differences were observed for total shopping frequency in a month. The proportion of participants who used their own vehicles for primary shopping was lowest among the VLFS group (43%).

The associations between food security status and store-specific shopping behaviors from multivariate regression models are shown in Table 3. Compared to FS participants, VLFS participants had higher odds of identifying convenience/dollar stores as their most-frequented store (odds ratio (OR)=2.31, 95% confidence interval (CI)=1.08, 4.95) and taking someone else's car or public transportation to their primary store (OR=2.04, 95% CI=1.25, 3.33). There was no significant difference in food shopping behaviors between VLFS and FS participants for other store 1-related attributes (e.g., distance to store and frequency of shopping) or for any of the store 2 attributes. However, for store 3, VLFS residents shopped less frequently ($b=-0.31$, $CI=-0.59, -0.03$, $p\text{-value}=0.03$) than FS residents. No significant difference in store type was observed for store 3.

The relationships between food security status and overall shopping patterns, combining information from stores 1–3 are shown in Table 4. Considering store types for stores 1–3 jointly, LFS participants had a lower odds of using a mixture of primary shopping at a supermarket or supercenter and complementary shopping at a convenience/dollar store than of shopping predominately at a supermarket (OR= 0.44, 95% CI=0.21, 0.91), whereas VLFS participants had higher odds of being predominantly convenience/dollar store shoppers (OR=2.19, 95% CI=1.03, 4.66) compared to FS participants. VLFS participants traveled 4.71 fewer total shopping miles per week ($p\text{-value}=0.04$) compared to FS residents. No statistically significant differences were found between food security and total shopping frequency when combining all information from stores 1–3.

Discussion

The present study evaluated the associations between food security and store-specific and overall food shopping in a sample of residents of low-income areas in South Carolina, the majority of which had been designated as food deserts. More than 65% of study participants were receiving SNAP benefits.

The majority of participants shopped at a supermarket or supercenter (80–92%), irrespective of food security status. This finding is consistent with previous local studies conducted in

Baltimore (Maryland), New York (New York), Forsyth (North Carolina) and Columbia (South Carolina), in which this figure ranged from 75% to 95%^{13,18,19}. Additionally, the current study is consistent with earlier USDA reports on Food Stamp Program participants^{3,4,21}, and FoodAPS data, which indicated that 68–89% of participants shopped at a supermarket or supercenter, irrespective of the store being primary or alternative and regardless of food security status⁷. Even though the present study was conducted in an area characterized by low income and low access to a supermarket, the findings suggest that the presumed spatial access barriers to supermarkets and large grocery stores inherent in the food desert designation were overcome by most of the study participants, as the majority of residents shopped at a supermarket or supercenter. Thus, other considerations such as price, one-stop shopping, familiarity, or availability of a ride with a friend may outweigh distance.

A lower proportion of the study population used their own vehicle to facilitate their primary grocery shopping (65.4% for FS, 55.1% for LFS, 43.2 % for VLFS) compared to two national reports^{7,38}. The recent FoodAPS report showed that 91% of food-secure and 70% of food-insecure participants used their own car for food shopping⁷. A previous national report using the Current Population Survey showed that 90.2% of participants used a car, truck or motorcycle for grocery shopping³⁸. However, current results are consistent with a previous study on food stamp recipients⁴ and a recent national report⁷ that food-insecure households or food stamp recipients are less likely to drive a car of their own to do their primary food shopping and more likely to get rides from someone else. In the present study, the odds of VLFS participants relying on others for transportation to their primary shopping store were twice those for FS participants. These findings highlight the fact that national and regional data may mask the severity of household circumstances in the smaller geographic units of local communities, a potentially influential factor in policy advocacy discussions.

Furthermore, the findings suggest that distance to the utilized stores (stores 1–3) does not differ significantly among food security groups. Additional evaluation of transportation mode as an effect modifier when modeling store-specific and total shopping distance indicated that the association between food security and shopping distance did not vary by transportation mode. In the current study, only 14.2% of participants live in non-food desert areas. It is likely that the lack of opportunities for grocery shopping decreases the variation in shopping distance in the study area, in combination with the relatively small size of the study areas, and thus may be one explanation for the null finding. Alternatively, other aspects of economic affordability such as differences in food prices in the few available stores may have a role in the association of food security with food shopping behaviors.

One strength of the present study was the ability to calculate the network distance to grocery stores 1–3. Of those residents who shopped at supermarkets/supercenters, only 8–15% (data not shown) shopped at the nearest supermarket/supercenter. Among those who shopped at non-supermarkets/supercenters, 1–9% (data not shown) shopped at the nearest non-supermarket/supercenter. This finding is consistent with previous studies showing that participants rarely shop at the closest supermarket or other food outlet^{4,7,14,15,27,29,31}, especially among low-income families^{4,14} and residents of food deserts²⁶. Thus, there is now a body of evidence, including the present study, indicating that it is critical to assess the actual shopping distance to each participant's utilized store(s) rather than relying on distance

to the closest food store based on an overlay of food store location maps with residential addresses (without knowledge of store utilization).

Store-specific shopping frequencies ranged, on average, from 1.4 to 5.2 times per month, with an average total shopping frequency across all stores of 9.3 times per month. A higher frequency of shopping at store 1 (5.2 times per month) was found compared to the frequencies found in studies by Jilcott (1–3 times per month)¹⁵ and D'Angelo (1–2 times per month)¹³, which focused on primary food shopping store only. Le Doux and colleagues found that shopping frequency in a particular store type varied by socioeconomic status; that is, low-income households make more of their trips to discount supermarket and convenience stores than high-income households¹⁴. Also, the lower food expenditure limits the healthy food choices for lower socio-economic groups³⁹. Given that the present study sample had a high proportion (65%) of SNAP participation, with an even higher proportion (74%) among VLFS subjects, shopping frequency will be influenced by how many benefit installments SNAP recipients receive in a month (in South Carolina, the installments are issued once per month) and whether the issued benefits could cover their grocery needs in a month. Studies have shown that low-income households engage in strategic decisions such as menu planning, price matching and food storage to maintain a food supply throughout the month⁴⁰. An in-depth interview study on food security among SNAP recipients found that they are usually strategic in stretching their SNAP benefits out over the course of the month; many households clip coupons and compare prices across stores, but some are particularly adept at shopping for bargains, shopping often and at several different stores to capitalize on sales and carefully planning their menus around items that are on sale rather than on what the family would prefer to eat¹⁷.

For overall food shopping patterns, LFS participants were less likely to use a mixture of primary shopping at a supermarket or supercenter and complementary shopping at a convenience/dollar store. Compared to FS participants, VLFS participants were more likely to shop predominantly at convenience/dollar stores than at supermarkets and traveled fewer total shopping miles. No statistically significant differences were found in total shopping frequency by food security status after adjusting for sociodemographic attributes. The recent USDA report on FoodAPS presented data on primary- and alternative-utilized grocery stores in a national sample⁷. Shopping behaviors in the two utilized stores—including store type, shopping distance and transportation—were compared by food security for each store separately. However, the report did not further characterize the total shopping distance and store-type patterns, and no information on shopping frequency was collected. Thus, the findings from the present study are not directly comparable to the national report in terms of overall food shopping patterns. Also, because the majority of previous studies focused on shopping behaviors for the primary store only, the present findings on food shopping patterns can also not be compared to previous studies. To the best of our knowledge, this is one of the first US-based studies to collect data on multiple utilized food shopping destinations⁷, which allowed an initial characterization of food shopping patterns.

With respect to study limitations, the current findings might not be generalizable to other areas of the US with different geographic and demographic configurations. Second, the study's lack of information on transportation mode to stores 2 and 3 meant that the

association between transportation and food security beyond the primary store could not be assessed. Third, the assessment of the joint shopping patterns of three stores was rather simplistic, compared to some of the more sophisticated methods that have been used, such as GPS-based actual travel patterns from which activity spaces can be computed and mapped; however, assessing travel patterns in detail was not within the scope of the study. Furthermore, it was assumed that all shopping trips originated from home, although some of the grocery shopping trips may have commenced at work or from other points of origin. Last, the findings were based on cross-sectional data, which limited the ability to draw causal inferences. Nevertheless, the results underscore the importance of obtaining data beyond an individual's primary shopping store to capture a broader picture of food shopping.

Conclusions

Even though the majority of participants across food security groups (80–92%) reported shopping at a supermarket or supercenter for all three stores, the current findings suggest that households with very low food security tend to shop more frequently in stores that have less healthful options, such as convenience/dollar stores. These findings lend support to ongoing community and policy interventions aimed at improving food access among food-insecure populations. Future studies are needed on how to address associations of food shopping in terms of economic accessibility and food security and how to improve food access among the food-insecure population.

Acknowledgments

The authors appreciate the work of the interviewers and recruiters and the assistance of many community leaders and organizations in conducting this research. Research reported in this manuscript was supported by the National Cancer Institute of the National Institutes of Health under Award Number R01CA180336. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Table 1

Demographic characteristics of 474 participants at the baseline (2013/2014) interview by food security status from disadvantaged communities in a study of food access, food shopping, and food security in South Carolina.

Characteristics	FS ^a n=179	LFS ^b n=155	VLFS ^c n=140	All n=474
Age (years), mean (SD) ^d	52.1 (15.9)	51.7 (14.5)	51.1 (12.3)	51.7 (14.4)
Black, %	93.9	94.8	88.6	92.6
Female, %	77.1	82.6	80.7	80.0
Marital status, %				
Married	26.8	24.5	22.9	24.9
Ever married	31.3	32.3	35.0	32.7
Never married	41.9	43.2	42.1	42.4
Household size, mean (SD)	2.3 (1.4)	2.3 (1.2)	2.4 (1.5)	2.3 (1.4)
Income, % [*]				
\$0–9,999	41.3	49.0	50.7	46.6
\$10,000–19,999	29.1	32.3	36.4	32.3
\$20,000–29,999	15.1	11.6	7.9	11.8
\$30,000–39,999	6.7	3.9	3.6	4.9
\$40,000–49,999	3.9	2.6	1.4	2.7
\$50,000 or more	3.9	0.7	0	1.7
Education, % [*]				
Less than high school	22.4	34.2	36.4	30.4
High school	39.7	39.4	35.0	38.2
Some college and above	38.0	26.5	28.6	31.4
WIC ^e participation, %	11.7	9.0	7.2	9.5
SNAP ^f participation, % [*]	58.4	64.9	74.3	65.3

^aFS: food security and marginal food security.

^bLFS: low food security.

^cVLFS: very low food security.

^dSD: standard deviation.

^{*} for P < 0.05, ** for P < 0.01, and *** for P < 0.001

^eWIC: Special Supplemental Nutrition Assistance Program for Women, Infants, and Children.

^fSNAP: Supplemental Nutrition Assistance Program.

Table 2

Food shopping behavior by food security status of 474 participants at the baseline (2013/2014) interview by food security status from disadvantaged communities in a study of food access, food shopping, and food security in South Carolina.

Food shopping behaviors	FS ^a n=179	LFS ^b n=155	VLFS ^c n=140	All n=474
Store 1				
Distance (miles), mean (SD) ^d	2.8 (3.2)	2.7 (1.9)	2.4 (1.4)	2.7 (2.4)
Frequency (per month), mean (SD)	5.4 (5.3)	4.9 (4.7)	5.4 (5.2)	5.2 (5.1)
Type, %				
Supermarket	63.7	60.0	57.1	60.6
Supercenter	28.5	27.1	27.9	27.9
Other ^e	7.8	12.9	15.0	11.6
Transportation ^f , %				
Own vehicle/bike or walk	65.4	55.5	42.9	55.5
Someone else's car or public transportation	34.6	44.5	57.1	44.5
Store 2				
Distance (miles), mean (SD)	3.0 (1.9)	2.8 (1.8)	2.6 (1.4)	2.8 (1.7)
Frequency (per month), mean (SD)	2.8 (2.6)	2.4 (2.2)	2.5 (2.3)	2.6 (2.4)
Type, %				
Supermarket	64.3	65.2	61.4	63.7
Supercenter	19.0	24.5	22.1	21.7
Other	16.8	10.3	16.4	14.6
Store 3				
Distance (miles), mean (SD)	4.9 (14.5)	4.0 (13.6)	2.9 (2.3)	4.0 (11.9)
Frequency (per month), mean (SD)	1.6 (1.6)	1.4 (1.0)	1.3 (0.9)	1.4 (1.2)
Type, %				
Supermarket	66.5	69.0	68.6	67.9
Supercenter	13.4	12.3	15.0	13.5
Other	20.1	18.7	16.4	18.6
Overall Food Shopping Pattern				
Total shopping miles (per week)	14.7 (30.4)	10.9 (12.5)	9.6 (8.2)	12.0 (20.6)
Total shopping frequency (per month)	9.9 (8.2)	8.6 (6.8)	9.1 (7.4)	9.3 (7.5)
Store-type pattern				
Predominantly supermarket ^g	77.1	79.4	71.4	76.2
Supermarket and convenience/dollar stores ^h	15.1	7.7	13.6	12.2
Convenience ⁱ	7.8	12.9	15.0	11.6

^aFS: food security and marginal food security.

^bLFS: low food security.

^cVLFS: very low food security.

^dSD: standard deviation.

^eOther includes small grocery stores, convenience stops, dollar variety stores, specialty stores and drug stores.

^fOwn vehicle/bike or walk includes travel by their own car/van/truck, or motorcycle, walk, or ride a bike; someone else's car or public transportation includes riding in the car/van/truck/motorcycle of family or friends, riding the bus, or taking a taxi.

^gPredominantly supermarket: stores 1 and 2 are supermarket and supercenter.

^hSupermarket and convenience/dollar stores: mixture of supermarket for store 1 and convenience store/dollar store for store 2.

ⁱConvenience: convenience store/dollar store for store 1 and supermarket or convenience/dollar store for store 2.

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Association between food security status and store-specific food shopping among the 474 study participants from disadvantaged communities in a study of food access, food shopping, and food security (2013/2014) in South Carolina^a.

Table 3

Food Security	Distance (miles)		Frequency/month		Dichotomous weekly frequency		Store type		Transportation ^b	
	b ^d (95%CI ^e)	p	b (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
Store 1										
LFS ^g vs. FS ^h	0.05 (−0.28–0.37)	0.78	−0.31 (−1.19–0.58)	0.50	1.02 (0.63–1.65)	0.93	1.08 (0.64–1.80)	0.78	1.80 (0.84–3.83)	0.13
VLFS ⁱ vs. FS	−0.30 (−0.64–0.03)	0.08	0.12 (−0.79–1.04)	0.76	0.83 (0.51–1.35)	0.44	1.14 (0.67–1.95)	0.62	2.31 (1.08–4.95)	0.03^j
Store 2										
LFS vs. FS	−0.11 (−0.43–0.20)	0.48	−0.38 (−0.90–0.13)	0.15	1.97 (0.85–4.56)	0.11	1.19 (0.68–2.06)	0.55	0.51 (0.26–1.02)	0.06
VLFS vs. FS	−0.28 (−0.61–0.04)	0.09	−0.25 (−0.78–0.29)	0.37	1.19 (0.55–2.56)	0.66	1.17 (0.65–2.09)	0.60	0.89 (0.47–1.69)	0.72
Store 3										
LFS vs. FS	−0.11 (−0.49–0.26)	0.55	−0.26 (−0.53–0.00)	0.05	--	--	0.97 (0.49–1.91)	0.92	0.82 (0.47–1.46)	0.51
VLFS vs. FS	−0.36 (−0.76–0.03)	0.07	−0.31 (−0.59–0.03)	0.03	--	--	1.19 (0.60–2.36)	0.61	0.75 (0.41–1.38)	0.35

^aModel adjusts for location, age, sex, race/ethnicity, household size, marital status, education and income.

^bOwn vehicle/bike or walk includes travel by their own car/van/truck, or motorcycle, walk, or ride a bike; someone else's car or public transportation includes riding in the car/van/truck/motorcycle of family or friends, riding the bus, or taking a taxi.

^cOther includes small grocery stores, convenience stops, dollar variety stores, specialty stores and drug stores.

^db: point estimate from multiple linear regression model for continuous outcomes, which are distance to primary shopping store and shopping frequency.

^e95% CI: 95% confidence interval.

^fOR: odds ratio is from the multinomial logistic regression model for primary store type and the ordinary logistic model for dichotomous weekly frequency and transportation.

^gLFS: low food security.

^hFS: food security and marginal food security.

ⁱVLFS: very low food security

⁵⁹_f Bold font indicates P<0.05.

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Table 4

Association between food security status and overall food shopping among the 474 study participants from disadvantaged communities in a study of food access, food shopping, and food security (2013/2014) in South Carolina ^a.

Food Security	Total shopping miles per week		Total shopping frequency per month		Store type patterns			
	b ^e (95%CI) ^f		p		Supermarket and convenience/dollar stores ^b VS predominantly supermarket ^c (ref)		Convenience ^d VS predominantly supermarket (ref)	
					OR ^g (95%CI)		OR (95%CI)	
LFS ^h vs. FS ⁱ	-2.67	(-7.06-1.73)	0.23	0.19	0.44 (0.21-0.91)		1.57 (0.74-3.33)	
VLFS ^k vs. FS	-4.71	(-9.27-0.14)	0.04	0.55	0.86 (0.44-1.68)		2.19 (1.03-4.66)	

^aModel adjusts for location, age, sex, race/ethnicity, household size, marital status, education and income.

^bSupermarket and convenience/dollar stores: mixture of supermarket for store 1 and convenience store/dollar store for store 2.

^cPredominantly supermarket: store 1 and 2 are supermarket and supercenter.

^dConvenience: convenience store/dollar store for store 1 and supermarket or convenience/dollar store for store 2.

^eb: point estimate from multiple linear regression model for continuous outcomes, which are total shopping miles in a week and total shopping frequency in a month.

^f95% CI: 95% confidence interval.

^gOR: odds ratio is from the multinomial logistic regression model for shopping patterns.

^hLFS: low food security.

ⁱFS: food security and marginal food security.

^jBold font indicates P<0.05.

^kVLFS: very low food security.