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Food Acquisition Practices, Body Mass Index and Dietary Outcomes by Level of Rurality

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Abstract

Purpose: Rural residents are more likely to be obese than urban residents. Research on how people navigate their local food environments through food acquisition behaviors, such as food shopping and restaurant use, in different types of communities may help to create a deeper understanding of the multilevel determinants of obesity.

Methods: Data are from a national sample of US adults ages 18 to 75. Respondents were recruited from an online survey panel in 2015 and asked about food shopping, restaurant use, diet and weight (N=3,883). Comparisons were made by level of rurality as assessed by Rural-Urban Continuum Codes (RUCC) and self-reported rurality of the area around their home.

Findings: Food acquisition behaviors varied minimally by RUCC-defined level of rurality, with the exceptions of type and distance to primary food store. Rural residents drove further and were more likely to shop at small grocery stores and supercenters than were residents of semi-urban or urban counties. In contrast, all of the food acquisition behaviors varied by self-reported rurality of residential areas. Respondents living in rural areas shopped for groceries less frequently, drove further, more commonly shopped at small grocery stores and supercenters, and used restaurants less frequently. In multivariable analyses, rural, small town, and suburban areas were each significantly associated with BMI and fruit and vegetable intake, but not percent energy from fat.

Conclusion: Findings show that self-reported rurality of residential area is associated with food acquisition behaviors and may partly explain rural-urban differences in obesity and diet quality.

Keywords

food shopping; nutrition; obesity; restaurants; rural

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Obesity rates among adults in the US remain high, especially among rural residents.[1–4] Obesity accounts for considerable disease burden, and contributes to diabetes, cancer, and cardiovascular disease.[5–9] A great deal of attention has been given to obesogenic environments, which make healthy eating and physical activity challenging.[10,11] Much of the research on food environments and related behaviors has been done in single urban areas such as Seattle, Detroit, and Boston, or is regional within states,[12,13] making comparisons across levels of rurality difficult. In their systematic review of retail food environments and obesity, Cobb and colleagues reported that geographic differences could not be easily summarized due to widely varying definitions of urban, rural, and suburban.[14] Rural food environments are qualitatively different from urban or suburban food environments, with fewer large grocery stores, longer distances to both food stores and restaurants, and fewer restaurant options.[15]

Although not specific to rural areas, research is accumulating to show that environments alone are not sufficient to explain the obesity epidemic and that changing the environment may be necessary, but not sufficient, to drive obesity rates down. Studies of local food environments and associations with weight and diet, in particular, have produced largely null and/or inconsistent findings,[10,12–14,16,17] and interventions to increase geographic access to healthy foods (eg, opening supermarkets in underserved areas) have had mixed impacts at the population level.[18,19] One potential explanation for the preponderance of null and inconsistent findings is that studies of the retail food environment typically equate exposure to food stores with their use. However, people do not use all of the stores to which they are exposed, and they routinely travel beyond their residential neighborhoods, the area of exposure most commonly examined in retail food environment studies, to acquire food.[20–23] This has led to renewed interest in actual food acquisition behaviors and how these behaviors may mediate the relationship between food environments and weight.[10,14,16]

Two particularly salient food acquisition behaviors are food shopping and restaurant use (eg, fast food, take out). Food shopping practices, including type of store used and frequency of use, have been examined in association with diet and weight in a number of studies over the past decade. Prior research has found that shopping at specialty grocery stores, farmers' markets, supermarkets, and higher-cost food stores was associated with greater fruit and vegetable intake, while shopping at supercenters or warehouse club stores was associated with higher BMI, even when controlling for socioeconomic status.[24–26] With regard to shopping frequency, one study found that grocery shopping frequency was associated with increased fruit and vegetable intake among adults in South Carolina,[20,27] and another found no association between shopping frequency and BMI among residents of low-income neighborhoods in Pittsburgh, Pennsylvania.[28]

Recognizing that people frequently bypass the food stores closest to their homes, there has been significant interest in understanding how far people travel to shop and whether distance traveled is associated with diet- or weight-related outcomes.[20–23] Among residents of 2 low-income counties in South Carolina, Liese and associates found that distance was not associated with obesity.[20] Similarly, Drewnowski and colleagues found no association between distance to most frequently used food store and obesity in Seattle[23] and in the same study, Aggarwal et al, found no association with fruit and vegetable intake.[26] However,

Inagami and associates found that traveling a longer distance to the grocery store was associated with higher BMI among adults in Los Angeles, California. None of these studies specifically examined level of rurality.[26]

Use of non-home food sources, or restaurant food, is a second major food acquisition behavior, with Americans consuming about 1/3 of their calories outside of the home.[29,30] Numerous studies have shown that use of non-home food sources is associated with poor dietary outcomes and obesity. Kant and colleagues examined data from NHANES 2007-2010 and found that frequency of away from home meals was associated with BMI and total cholesterol, as was frequency of fast food and pizza meals.[31] In a similar analysis using NHANES data from 2003 to 2010, An found that both fast food and full-service restaurant food and beverage consumption were associated with increased energy intake and obesity.[32] While few comparative studies have examined level of rurality and restaurant use, several studies have assessed associations between restaurant food purchases and diet- and weight-related outcomes in rural populations. For example, Bhutani and colleagues examined frequency of various types of away from home eating and associations with BMI in 6 non-urban Wisconsin communities.[33] They found that fast food and sit-down restaurant meals were positively associated with BMI, but fast casual and all-you-can eat were not. Among adolescents in rural Kentucky and North Carolina, unhealthy food purchasing patterns, including more frequent use of fast food, were associated with higher consumption of added sugars.[34]

The current study characterizes 2 key food acquisition behaviors—food shopping and restaurant use—in a national sample of US adults, including similarities and differences by level of rurality, and associations with BMI, meeting of US guidelines for fruit and vegetable intake, and percent calories from fat. Understanding how food acquisition behaviors relate to weight and dietary outcomes will help to determine whether these behaviors are appropriate intervention targets. Moreover, understanding food shopping and restaurant use by level of rurality will aid in developing interventions that are relevant to specific contexts.

Methods

Study Participants

Study participants were from an Internet panel maintained by Lightspeed GMI (www.lightspeedresearch.com). Participants were 18 to 75 years of age, lived in the US, and could read English. Participants were recruited in the fall of 2015 to complete a cross-sectional survey, with quota-based sampling to match national demographics on race/ethnicity, gender, age, income, and geographic region. Lightspeed GMI e-mailed existing panelists who then completed consent prior to initiating the survey. Response rate among those who gave consent was 39.9%. The remainder included those who were ineligible because quota requirements had already been met (30.7%) (eg, no more White women needed), because they only completed part of the survey (24.2%), or they failed in-survey quality control checks (5.2%). The survey took about 30 minutes to complete. We additionally excluded those for whom addresses could not be geocoded (n=726), outliers with respect to fruit and vegetable intake (n=193), and respondents with missing values on

key study variables (n=140). The analytic dataset included 3,883 respondents. The Emory University Institutional Review Board approved the study protocol.

Measures

Food Acquisition Measures—The measures for restaurant use asked 3 questions about how many days in the past week the participant had purchased: a) a meal from a fast food restaurant, b) a meal in a full service or sit-down restaurant, or c) picked up a meal as take-out/had a meal delivered to their home.[35,36] Several dimensions of food shopping were assessed, including store type, frequency of grocery shopping, and distance to the most frequently used store. The first was assessed with a single item that asked participants to indicate the type of store the primary food shopper(s) went to most frequently. Response options were: a large chain grocery store, smaller grocery store, superstore or supercenter, warehouse club store, dollar store, convenience store with or without a gas station attached, farmer's market or co-op, or a specialty store. Respondents indicated how many times per month the primary food shopper shopped at that store, with responses collapsed into: >4 times per month, 4 times per month, or <4 times per month for analyses.[37] Additionally, respondents indicated how many miles this store was from their home.

Body Mass Index (BMI) and Diet Quality Measures—BMI was calculated from self-reported height and weight.[38] Participant's fruit and vegetable intake was assessed by asking about frequency and amount of intake for 9 categories of fruit or vegetables.[39] Responses were used to calculate total cups of fruit and vegetables consumed per day. Implausible values (those beyond 3 times the interquartile range) were excluded. Additionally, due to the non-normal distribution, fruit and vegetable intake was dichotomized based on the Dietary Guidelines for Americans 2015-2020, which recommend that the average adult consume 4.5 cups or more of fruit and vegetables per day.[40] Participants were classified as "meeting" or "not meeting" this recommendation. Percent calories from fat was assessed using the National Cancer Institute Quick Food Scan.[41]

Rurality—*A*ddresses were geocoded using Google Earth Pro© (Google LLC, Mountain View, CA). If an address was not identified using Google Earth Pro©, counties and geocodes were identified using the address locator tool on the Census website.[42] Each residential address was assigned a Rural-Urban Continuum Code (RUCC).[43] RUCCs classify US counties into 3 metro (RUCC 1-3) and 6 non-metro categories (RUCC 4-9). For analyses, counties were further collapsed into 3 categories of counties: 1) Urban (RUCC 1-3), 2) Semi-urban (RUCC 4-6), and 3) Rural (RUCC 7-9). Perceived or self-reported rurality of their residential area was assessed by asking respondents to indicate whether the area in which they live is urban, suburban, a small town, or rural. This allowed for examination of suburban residence, which is not explicitly defined in RUCC codes, and allows for a more nuanced classification of rural areas. We purposefully did not use the term neighborhood due to wide variation in interpretation.[44–47] Instead, we used "area in which they live" as an anchor point for their responses.

Demographics—Individual and household characteristics were assessed using questions on age, gender, race/ethnicity, state of residence, employment status, educational attainment,

marital status, pregnancy status, household income, size, and composition, housing type, benefits and/or assistance received, and the number of operable motor vehicles in the household.[38,48]

Data Analysis

Analyses were conducted using SAS software (SAS version 9.3, SAS Institute Inc., Cary, NC). Descriptive statistics were used to examine demographic, food acquisition, and diet-related variables. Independent t-tests and Chi-square tests of independence were used to explore relationships between food acquisition behaviors, BMI, and dietary behaviors, by self-reported neighborhood type and level of rurality as defined by RUCC. Multivariable linear and logistic regression models were used to assess the relationships between food acquisition behaviors and: a) BMI, b) meeting of fruit and vegetable intake guidelines, and c) percent calories from fat. All models were adjusted for gender, age, race, and income.

Results

Description of Participants

Table 1 describes study participants. Mean age was 46.3 years (SD=15.5) and 46.3% were male. The majority did not have children in the home (66.2%) and the majority were White (68.0%), with 12.1% African American and 13.9% Hispanic. Over half were employed (48.0% for wages and 6.9% self-employed). Annual household income was well distributed, with the largest proportion reporting $100,000 or more (22.1%) and 11.3% reporting <$15,000. The majority (73.5%) were in an urban county (RUCC 1-3), with 11.5% in a rural county (RUCC 7-9). More than half described living in an urban (27.0%) or suburban neighborhood (44.3%). The others were divided between small towns (15.4%) and rural areas (13.2%).

About one-third of respondents shopped for food less than 4 times per month, one-third 4 times per month, and one-third more than 4 times per month. Respondents most commonly (37.5%) spent $50-$99 per trip. Large grocery stores (53.9%) and supercenters (26.2%) were used most often. Mean distance to the primary food store was 5.4 miles (SD=7.6). Respondents ate fast food an average of 1.8 times per week (SD=1.8), full-service restaurant meals 1.7 times per week (SD=1.9), and take out/delivery 1.5 times per week (SD=1.9). Mean BMI was 27.7 (SD=6.6) and mean percent calories from fat was 34.5% (SD=4.6). Approximately 12.4% met national guidelines for fruit and vegetable intake.

Bivariate Associations by RUCC

Table 2 presents food shopping and restaurant use stratified by county-level RUCC. There were relatively few differences by level of rurality with this classification. The only significant differences were by type and distance to primary food store. Urban residents lived closer to their primary food store (5.2 miles in contrast to 6.0 miles). Rural residents were more likely to shop at supercenters and superstores (30.1%) compared to 25.3% among urban residents, and urban residents were more likely to shop at large grocery stores (54.7%) relative to rural residents (48.1%). Meeting of national guidelines for fruit and vegetable intake did not vary significantly by level of rurality as measured through RUCC, whereas

percent calories from fat varied significantly but the differences were quite small. BMI was slightly lower in urban counties relative to rural or semi-urban counties.

Bivariate Associations by Self-Reported Rurality of Their Residential Area

Table 3 presents food shopping and restaurant use by self-reported rurality of their residential area, with significant differences for each variable assessed. Those living in a rural area were less likely to grocery shop >4 times per month (27.2%) than those in more urban areas (34.5% in small towns, 34.5% suburban, 32.3% urban). Whereas dollars spent per month generally followed the same pattern across levels of rurality (ie, $50 to $99 spent per trip most commonly), primary store type differed. Rural and small town residents were more likely to report shopping in small grocery stores or supercenters than their more urban counterparts. For example, 35% of rural residents viewed supercenters as their primary food store, whereas 27.1% of urban and 22.1% of suburban reported the same. In contrast, 43.6% of rural residents versus 60.1% of suburban residents shopped at large grocery stores most commonly. Additionally, urban residents shopped at warehouse club stores more often than rural residents (6.3% versus 2.3%). Respondents living in rural areas traveled 10.3 miles to their primary food store, in contrast to 6.0 miles for those in small towns, 4.1 miles for those in suburban areas, and 4.9 miles in urban areas.

Large differences existed between urban dwellers and suburban, small town and rural residents in all types of restaurant use. For example, 48.6% of urban respondents ate fast food ≥2 times a week in contrast to 37.0% of rural respondents. Similarly, 43.1% of urban dwellers ate at a full-service/sit-down restaurant ≥2 times in the past week and 42.4% ordered take-out/delivery ≥2 in the past week, in contrast to 30.4% and 26.3% in rural areas, respectively. Residents of small towns more closely resembled rural than urban residents in their restaurant use.

BMI also varied by rurality of residential area, with the highest BMI in rural areas (28.6) and the lowest in urban areas (27.1). Meeting of national guidelines for fruit and vegetable intake also varied, with the highest proportion in urban areas (15.4%) and the lowest in small towns (8.9%) and rural areas (11.1%). Percent calories from fat also varied slightly, but not in a clear pattern by rurality of residence.

Multivariable Analyses

Table 4 presents regression models for 3 diet-related outcomes: BMI, meeting national guidelines for fruit and vegetable intake, and percent calories from fat.

BMI—While controlling for demographic variables, self-reported rurality of residential area was associated with higher BMI (b=1.31, 95% CI: 0.61-2.02 for rural areas; b=1.03, 95% CI: 0.38-1.69 for small towns, b=.87, 95% CI: 0.37-1.37 for suburban areas). More frequent grocery shopping was associated with lower BMI (b=−.82, 95% CI: −1.32 to −0.32 for shopping >4 times/month). Use of dollar or convenience stores as the primary food store was also associated with lower BMI (b=−2.64, CI: −4.52 to −0.76) relative to large grocery stores. Distance from home to most frequently used food stores, in contrast, was not

associated with BMI. Increased frequency of fast food consumption (b=1.33, CI: 0.80-1.85 for fast food ≥2 times in the past week) was associated with higher BMI.

Meeting of Guidelines for Fruit and Vegetable Intake—Rurality was negatively associated with likelihood of meeting fruit and vegetable intake guidelines. Residents of rural, small town, and suburban areas were less likely to meet the guidelines than those living in urban areas (rural: OR=0.70, 95% CI: 0.50-0.99; small town: OR=0.57, 95% CI: 0.40-0.80; suburban OR=0.76, 95% CI: 0.60-0.96). Frequency of grocery shopping more than 4 times a month was associated with meeting fruit and vegetable intake (OR=1.58, 95% CI: 1.23-2.02) relative to shopping less than 4 times per month. Use of 3 types of food stores was associated with meeting fruit and vegetable guidelines relative to those using large grocery stores: warehouse club stores (OR=1.79, 95% CI: 1.20-2.68); dollar/convenience stores (OR=3.13, 95% CI: 1.60-6.14); and farmer's market, co-op, specialty store (OR=2.27, 95% CI: 1.37-3.75). Distance from home to primary food store was positively associated with fruit and vegetable intake (OR=1.02, 95% CI: 1.01-1.03). Use of fast food once a week was associated with lower fruit and vegetable intake (OR=0.75, 95% CI: 0.57-0.97); more frequent use was not.

Percent Calories from Fat—The final model examined percent calories from fat. Rurality of residential area was not associated with percent calories from fat; neither was distance to primary food stores or frequency of food shopping. Dollar or convenience store as the primary food store, however, was significantly associated with percent calories from fat (b=3.92, 95% CI: 2.65-5.19) relative to large grocery stores. Use of fast food restaurants ≥2 times per week was also significantly associated with higher percent calories from fat (b=2.15, 95% CI: 1.80-2.50).

Discussion

This paper examines several food acquisition behaviors by level of rurality and their associations with weight and nutrition-related outcomes. To our knowledge this is one of the first studies to examine these food acquisition behaviors in a national sample and to examine rural-urban differences. We defined rurality in 2 ways: 1) by RUCC categorized as urban, semi-urban, and rural, and 2) self-defined rurality of residential area. The latter was more fruitful for identifying differences across a range of food acquisition behaviors, both related to food shopping and restaurant use. While county boundaries are not typically used in food environment research, they are frequently the default administrative unit for identifying rural-urban differences. Our research supports the use of smaller units and the value of perceptions when examining urban-rural differences in local food environments. Additionally, the apparent usefulness of a self-reported definition of rurality that distinguishes between living in a small town and a rural area, and explicitly recognizes suburbs, may allow for a more nuanced understanding of environments. The potential mismatch between county-level designations of urbanization and perceptions of neighborhoods is garnering increased attention as illustrated by the U.S. Department of Housing and Urban Development adding a question about perceived neighborhoods to the American Housing Survey and recent development of an Urbanization Perceptions Small Area Index.[49,50]

We compared 4 food shopping behaviors and various types of restaurant use by level of rurality. Distance to primary food store and store type varied by RUCC and self-reported rurality, with rural residents driving further (10 miles for rural areas and 6 miles for those in small towns). Prior research using a national sample documented a median distances of 2.9 miles,[51] while other studies using local samples have documented distances from 1.8 miles in Philadelphia to 8 to 15 miles for residents in 8 counties in South Carolina.[52,53] We also observed that residents who lived in rural areas shopped less often than those in small towns, suburban, or urban areas, possibly because of distance and the need or desire to stock up, although the latter was not reflected in amount spent per typical trip which was comparable across different levels of rurality. Residents of both rural areas and small towns were more likely to report primarily shopping in small grocery stores or supercenters than their urban counterparts. This is likely due to the types of stores available in rural communities. With respect to restaurant use, urban dwellers utilized fast food, full-service restaurants, and take-out/delivery much more frequently than those living in non-urban areas. These differences are likely due to availability in urban neighborhoods and related lifestyle differences.

Another important finding from our research is that living in a rural area remained significantly associated with BMI and fruit and vegetable intake in the multivariable models, even when controlling for demographic variables and food acquisition behaviors. This suggests that additional variables likely play a role in urban-rural differences in obesity and dietary behavior, perhaps related to physical activity and walkability of rural environments. Still, several food acquisition behaviors were associated with weight and/or diet-related outcomes. Our finding that more frequent grocery shopping was associated with lower BMI and greater odds of meeting guidelines for fruit and vegetable intake is generally consistent with prior research.[20,27] Distance to primary food store was weakly associated with meeting fruit and vegetable intake guidelines, but not in the direction expected. Prior research on distance has yielded mixed or null results.[20,23,26,54]

In our study, at least one type of primary food store and frequency of meals from fast food restaurants were associated with each of the outcomes examined. The finding that use of warehouse club stores and farmer’s markets, co-ops or specialty stores were associated with fruit and vegetable intake is intuitive, with the latter consistent with prior research.[25] In contrast, the finding that use of dollar stores and convenience stores as the primary food store was associated with lower BMI and increased odds of meeting guidelines for fruit and vegetable intake was surprising, but may be unique to the small number of respondents in this group. Post-hoc analyses showed that these respondents tended to be male, had lower BMIs and ate out more than the rest of the respondents. The association between dollar stores and convenience stores and increased percent calories from fat is consistent with expectations. Lastly, our finding on fast food use associated with increased BMI, not meeting fruit and vegetable intake guidelines, and increased percent calories from fat is consistent with prior research.[31,33]

Limitations

The study has a number of limitations. Because the data are cross-sectional, we were unable to assess whether food acquisition behaviors are causally linked to BMI and diet. Additionally, the self-reported nature of the data increases vulnerability to social desirability bias. In addition, US adults without Internet access would have been systematically excluded from this study and the sample may not be representative of the US adult population in other important ways as well. By excluding respondents whose addresses could not be geocoded, we may have introduced unknown bias. However, comparisons between those we geocoded versus those we excluded showed no significant differences on major demographic variables. Lastly, use of a non-traditional measure of rurality of residential area may raise questions of validity and comparability. However, distribution of respondents across the types of residential areas in our study corresponds well to results from a recent American Household Survey that asked participants to classify their neighborhoods as urban (27% versus 27% in our study), suburban (52% versus 44% in our study), and rural (21% versus 29% in our study combining small town and rural areas).[49]

Conclusion

The current study provides an initial examination of rural-urban differences in food acquisition behaviors of relevance to research on food environments and how they may impact obesity and related behaviors. Findings show that self-reported rurality of residential area is associated with food acquisition behaviors such as food shopping and restaurant use and may partly explain rural-urban differences in obesity and diet quality. To our knowledge, this is the first study to examine these behaviors by rurality in a national sample. More research should be conducted to compare rural and urban food environments, rural-urban differences in food acquisition behaviors, and how both may be contributing to persistent rural-urban differences in obesity. Future intervention research should attempt to influence food acquisition behavior and assess whether those changes result in improved diets and healthier weights. Changes to the local food environments should also be assessed for potential impact on both food acquisition behaviors and more downstream dietary and weight-related outcomes.

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Table 1.

Descriptive of Survey Respondents (n=3883)

Characteristic		Frequency/Mean	Percent/SD
Age (Mean / SD)		46.3	15.5
Gender (%)	Male	1798	46.3
	Female	2085	53.7
Children in the home (%)	No	2571	66.2
	Yes	1312	33.8
Race (%)	White	2640	68.0
	Black	471	12.1
	Hispanic	538	13.9
	Asian	206	5.3
	Other	28	0.7
Education (%)	HS diploma, GED, or less	665	17.1
	Some College or Technical School	1222	31.5
	College Degree or More	1996	51.4
Employment (%)	Employed for wages	1865	48.0
	Self-employed	267	6.9
	Out of work	337	8.7
	Homemaker	389	10.0
	Student	217	5.6
	Retired	808	20.8
Income (%)	Less than $15,000	437	11.3
	$15,000 to $24,999	440	11.3
	$25,000 to $34,999	385	9.9
	$35,000 to $49,999	527	13.6
	$50,000 to $74,999	739	19.0
	$75,000-$99,999	496	12.8
	$100,000 or more	859	22.1
Region (%)	Northeast	694	17.9
	Midwest	870	22.4
	South	1438	37.0
	West	881	22.7
Rurality of Residential Area (%)	Rural	514	13.2
	Small town	598	15.4
	Suburban	1721	44.3
	Urban	1050	27.0
RUCC (%)	Rural (7-9)	445	11.5

Characteristic		Frequency/Mean	Percent/SD
	Semi-urban (4-6)	584	15.0
	Urban (1-3)	2854	73.5
Frequency of grocery shopping (%)	<4 times/month	1356	34.9
	4 times/month	1249	32.2
	>4 times/month	1278	32.9
Dollar amount spent per shopping trip (USD) (%)	<25$	245	6.3
	$25-$49.99	896	23.1
	$50-$99	1457	37.5
	$100-$149.99	783	20.2
	$150-199.99	285	7.3
	≥$200	217	5.6
Primary store type (%)	Large grocery store	2092	53.9
	Smaller grocery store	446	11.5
	Superstore or supercenter	1019	26.2
	Warehouse club	186	4.8
	Dollar or convenience store	46	1.2
	Farmer's market, co-op or specialty store	94	2.4
Distance from home to store (Miles) (Mean/SD)		5.4	7.6
Fast food (days/week) (%)	0	1033	26.6
	1	1281	33.0
	≥2	1569	40.4
Average fast food (days/week) (Mean/SD)		1.8	1.8
Full-service/sit-down restaurant meals (days/week) (%)	0	1127	29.0
	1	1394	35.9
	≥2	1362	35.1
Average full-service/sit-down restaurant meals (days/week) (Mean/SD)		1.7	1.9
Take out/delivery (days/week) (%)	0	1452	37.4
	1	1210	31.2
	≥2	1221	31.4
Average take out/delivery frequency (days/week) (Mean/SD)		1.5	1.9
BMI (Mean/SD)		27.7	6.6
Meet F&V guidelines		480	12.4
Percent caloric intake from fat (Mean/SD)		34.5	4.6

Table 2.

Food Acquisition, BMI and Dietary Behaviors by RUCC (n=3883)

Characteristic		Rural RUCC 7-9	Semi-Urban RUCC 4-6	Urban RUCC 1-3	*P*
Frequency of grocery shopping	<4 times/month	36.0	38.5	34.0	
	4 times/month	28.8	31.3	32.9	.1212
	>4 times/month	35.3	30.1	33.1	
Dollar amount spent per shopping trip (USD)	<25$	7.6	5.5	6.3	
	$25-$49.99	25.2	23.6	22.6	
	$50-$99	35.3	39.2	37.5	.6198
	$100-$149.99	20.5	18.0	20.6	
	$150-199.99	7.4	7.5	7.3	
	≥$200	4.0	6.2	5.7	
Primary store type	Large grocery store	48.1	54.1	54.7	
	Smaller grocery store	16.2	11.3	10.8	
	Superstore or supercenter	30.1	27.9	25.3	
	Warehouse club	3.2	2.9	5.4	.0012
	Dollar or convenience store	0.9	1.5	1.2	
	Farmer's market, co-op or specialty store	1.6	2.2	2.6	
Average distance to primary food store (Miles)		6.0	6.0	5.2	.0139
Fast food frequency (days/week)	0	24.7	25.2	27.2	
	1	37.3	34.3	32.1	.2237
	≥2	38.0	40.6	40.8	
Full-service/Sit-down restaurant meals frequency (days/week)	0	29.2	32.2	28.4	
	1	39.3	33.9	35.8	.1357
	≥2	31.5	33.9	35.9	
Take out/delivery frequency (days/week)	0	41.1	38.2	36.7	
	1	30.8	32.4	31.0	.2298
	≥2	28.1	29.5	32.4	
Fruit & vegetable intake	Meeting guidelines	11.0	12.2	12.6	.6253
	Not meeting guidelines	89.0	87.8	87.4	
BMI		28.2	28.5	27.5	.0016
Percent calories from fat		34.8	34.9	34.4	.0476

Table 3.

Food Acquisition, BMI and Dietary Behaviors by Rurality of Residential Area (n=3883)

Variable		Rural	Small town	Suburban	Urban	*P*
Frequency of grocery shopping	<4 times/month	39.1	35.3	30.6	39.8	
	4 times/month	33.7	30.3	35.0	27.9	<.0001
	>4 times/month	27.2	34.5	34.5	32.3	
Dollar amount spent per shopping trip (USD)	<25$	5.3	6.7	6.1	7.0	
	$25-$49.99	19.8	23.2	23.5	23.9	
	$50-$99	38.9	37.0	38.5	35.5	.0438
	$100-$149.99	20.8	19.4	21.4	18.3	
	$150-199.99	8.4	8.2	6.1	8.4	
	≥$200	6.8	5.5	4.4	7.0	
Primary store type	Large grocery store	43.6	48.3	60.1	51.9	
	Smaller grocery store	15.6	15.9	9.7	9.9	
	Superstore or supercenter	35.0	29.3	22.1	27.1	
	Warehouse club	2.3	2.8	5.3	6.3	<.0001
	Dollar or convenience store	1.8	1.5	0.6	1.6	
	Farmer’s market, co-op or specialty store	1.8	2.2	2.2	3.2	
Average distance to primary food store (Miles)		10.3	6.0	4.1	4.9	<.0001
Fast food frequency (days/week)	0	27.8	27.3	28.6	22.4	
	1	35.2	35.8	33.8	29.1	<.0001
	≥2	37.0	37.0	37.7	48.6	
Full-service/sit-down restaurant meals frequency (days/week)	0	32.7	34.6	26.7	27.8	
	1	37.0	35.6	39.9	29.1	<.000*
	≥2	30.4	29.8	33.4	43.1	
Take out/delivery frequency (days/week)	0	43.4	42.1	37.3	32.0	
	1	30.4	31.8	34.6	25.6	<.0001
	≥2	26.3	26.1	28.2	42.4	
Fruit & vegetable intake	Meeting guidelines	11.1	8.9	12.1	15.4	.0008
	Not meeting guidelines	88.9	91.1	87.9	84.6	
BMI		28.6	28.0	27.7	27.1	.0005
Percent calories from fat		35.0	34.7	34.1	35.0	<.0001

Table 4.

Multivariable Regression Models for BMI and Dietary Outcomes

Predictor Variables	Regression 1: BMI *N = 3883*			Regression 2: Fruit and Vegetable Intake (Meeting/not meeting guidelines) *N = 3883*			Regression 3: Percent Calories from Fat *N = 3883*		
	Estimate		95% CI	OR		95% CI	Estimate		95% CI
Rurality of Residential Area									
Urban (Reference)									
Rural	1.31	0.61	2.02	0.70	0.50	0.99	0.09	−0.39	0.57
Small town	1.03	0.38	1.69	0.57	0.40	0.80	−0.11	−0.55	0.34
Suburban	0.87	0.37	1.37	0.76	0.60	0.96	−0.56	−0.90	−0.22
Frequency of grocery shopping									
<4 times/month (Reference)									
4 times/month	−0.79	−1.29	−0.28	1.19	0.92	1.54	−0.24	−0.58	0.10
>4 times/month	−0.82	−1.32	−0.32	1.58	1.23	2.02	0.14	−0.20	0.48
Distance from home to store (Miles) Store type	−0.01	−0.04	0.02	1.02	1.00	1.03	0.02	0.00	0.04
Large grocery store *(ref)*									
Smaller grocery store	0.15	−0.51	0.80	0.78	0.54	1.11	0.23	−0.21	0.68
Superstore or supercenter	0.41	−0.08	0.90	1.15	0.90	1.46	0.19	−0.14	0.52
Warehouse club	0.60	−0.37	1.58	1.79	1.20	2.68	0.36	−0.30	1.02
Dollar or convenience store	−2.64	−4.52	−0.76	3.13	1.60	6.14	3.92	2.65	5.19
Farmer’s market, co-op or specialty store	−0.98	−2.30	0.35	2.27	1.37	3.75	−0.18	−1.08	0.71
Fast food frequency in a week									
0 (Reference)									
1	0.85	0.32	1.38	0.75	0.57	0.97	0.73	0.38	1.09
≥2	1.33	0.80	1.85	0.95	0.74	1.22	2.15	1.80	2.50

Note: Adjusted for gender, age, race and income