

If you stock it, will they buy it? Healthy food availability and customer purchasing behaviour within corner stores in Hartford, CT, USA

Katie S Martin^{1,*}, Erin Havens², Katie E Boyle², Gregory Matthews³, Elizabeth A Schilling², Ofer Harel³ and Ann M Ferris²

¹Department of Allied Health Sciences, University of Connecticut, 263 Farmington Avenue, MC 6229, Farmington, CT 06030-6229, USA; ²Center for Public Health & Health Policy, University of Connecticut, East Hartford, CT, USA; ³Department of Statistics, University of Connecticut, Storrs, CT, USA

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Abstract

Objective: Literature on food environments has expanded rapidly, yet most research focuses on stores and community characteristics without integrating customer-level data. The present study combines customer shopping behaviour with store food inventory data.

Design: Face-to-face interviews were conducted with customers shopping in corner stores to measure food shopping behaviour, household food security and demographics. Store inventories were conducted to measure availability of healthy food in corner stores. Multilevel logistic regression models estimated the probability of customers purchasing a food item given the availability of that item in the store.

Setting: Nineteen corner stores in Hartford, CT, USA, average size 669 ft² (62.15 m²).

Subjects: Sample of 372 customers.

Results: The majority of customers were Black or Hispanic (54% and 40%, respectively) and 61% experienced food insecurity. For each additional type of fruits or vegetables available in the store, the estimated odds of a customer purchasing fruits increased by 12% ($P=0.03$) and the odds for purchasing vegetables increased by 15% ($P=0.01$). Customers receiving the Supplemental Nutrition Assistance Program (SNAP) were 1.7 times as likely to purchase fruit as those not receiving SNAP ($P=0.04$). Greater availability of reduced-fat milk was not associated with increased likelihood of customers purchasing reduced-fat milk.

Conclusions: There is a positive association between fruit and vegetable variety and the probability that a customer purchases fruits and vegetables. Increasing the selection of produce in corner stores may increase their consumption by food-insecure and low-income residents at risk for health disparities. These findings have implications for future store interventions and food policies.

Keywords
Corner stores
Customers
Healthy food

Diet is a modifiable risk factor for leading health concerns in the USA such as diabetes, CVD, cancer and obesity⁽¹⁾. Health disparities exist for these chronic conditions, particularly among minority and low-income families^(2,3). Food insecurity, defined as limited or uncertain availability of nutritionally adequate foods⁽⁴⁾, has been linked with adult obesity, particularly in women⁽⁵⁻⁷⁾. Possible explanations include the fact that high-fat/high-energy food costs less than healthy food⁽⁸⁾, and that healthy, affordable food is less available in low-income urban neighbourhoods^(9,10). Recent attention has focused on the importance of local food environments that can contribute to or help prevent health disparities.

Literature on food environments has expanded rapidly, documenting that a lack of healthy, affordable food exists in low-income, minority neighbourhoods compared with wealthier, non-minority suburbs⁽⁹⁻¹³⁾. The wide availability of energy-dense snack foods in corner stores may contribute to obesity⁽¹⁴⁾. Associations exist between the presence of different types of food stores and dietary patterns and diet quality⁽¹⁵⁻¹⁸⁾. According to the national Healthy Corner Store Network, a 'corner store' is defined as a small-scale store that sells a limited selection of foods and other products⁽¹⁹⁾, and we use this definition in the current study.

The majority of research on corner stores has focused on store-level and ignored customer-level data. Limited

*Corresponding author: Email katie.martin@uconn.edu

research has examined purchasing habits among customers within corner stores. Borradaile *et al.* conducted an observational study of elementary students and measured their snack purchasing behaviour in corner stores⁽²⁰⁾. Gittelsohn *et al.* evaluated a corner store intervention and its impact on customer purchases⁽²¹⁾. Few studies have examined the demographic characteristics of customers who shop in corner stores, measured their shopping behaviour, or linked store food availability to customer purchasing habits within the store. The present study begins to fill this gap.

The research reported herein contributes to the literature on food environments by combining customer shopping behaviour with store food inventory data. The goal of the study is to examine whether healthy food availability is associated with customer purchasing behaviour. We also examined the demographic characteristics of customers shopping in corner stores, including household food security and participation in food assistance programmes, and their typical shopping patterns.

Methodology

The city of Hartford, CT is an important focus for food environment research due to high rates of poverty and diet-related diseases. The poverty rate in Hartford in 2009 was 32%, and 39% among children⁽²²⁾. The population is predominantly Hispanic (41%) and Black (37%). Based on a random sample of Hartford residents, 31% reported being diagnosed with hypertension, 13% reported a diagnosis of diabetes and 35% of respondents were obese⁽²³⁾.

Customers

The current study was conducted on a convenience sample of 372 customers shopping in nineteen corner stores in Hartford, CT. Inclusion criteria included being a resident of Hartford, over 18 years of age, and customers were asked if they did the majority of food shopping for their family. Researchers approached customers as they entered the store to ask if they were willing to participate in a research study related to food shopping, and if so, face-to-face interviews were conducted in the stores. Interviews were conducted at different times of the day and different days of the week to measure typical food shopping behaviour, household food security and household demographics. We did not collect information on customers who refused to participate, but the main reason for non-participation was lack of time.

Food shopping behaviour questions included where customers shop for food and how often, whether they participate in the Supplemental Nutrition Assistance Program (SNAP, formerly food stamps) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and if so, if they use their SNAP or WIC

benefits in the store. Customers were asked if they bought items at the store from a list of food products. The question stem was: 'Thinking about the foods that you bought at this store for you and the people you live with during the past three months, did you buy the following foods?' The food items included: (i) fresh fruits (six types and 'other' category); (ii) canned fruit; (iii) fresh vegetables (five types and 'other' category); (iv) canned and frozen vegetables; (v) types of milk (whole, 2%, 1% or skimmed); and (vi) types of bread (whole-wheat or white). The food items were informed by qualitative data from five focus groups with corner store customers in Hartford conducted in 2007 (K Martin, unpublished results).

Household food security was measured using the US Department of Agriculture (USDA) Food Security Module, which consists of eighteen questions that ask about a household's experiences with food insufficiency during the previous 12-month period⁽²⁴⁾. Responses were coded into the following categories using the USDA standardized labels: (i) high, (ii) marginal, (iii) low and (iv) very low food security. Responses were then dichotomized into food secure (levels i and ii) and food insecure (levels iii and iv) using USDA standard labels.

Customer demographic information included age, gender, education, employment, ethnicity, car ownership, marital status, and whether a member of the household has diabetes or high blood pressure. Customer data collection took place from March to May 2009.

Corner stores

We obtained a list of all grocery stores in the city of Hartford from Dun & Bradstreet, a commercial marketing firm (<http://www.dnb.com>). We merged this with data on Hartford stores certified to accept coupons for the WIC programme (data obtained monthly from Connecticut Department of Public Health). The current study was part of a multi-phase, longitudinal study to evaluate a community-based initiative targeting corner stores in Hartford, CT. The sampling frame included 123 stores with average sales of \$US 207 000 and an average of 2.5 employees.

For the present study, corner stores are defined as small, independent food stores less than 2500 ft² (232 m²) based on field measurements. By contrast, medium-sized grocery stores (such as Sav-A-Lot or C-Town) are approximately 15 000 ft² (1395 m²) and generally stock a limited number of custom-branded high-volume food items at a discount⁽²⁵⁾. Large supermarkets (such as Stop & Shop or Kroger) range from 40 000 to 80 000 ft² (3716 to 7432 m²) and in addition to groceries typically include delicatessens, bakeries, pharmacies, general merchandise and often banks. The nineteen stores in the present sample are defined as small corner stores. Gas stations, liquor stores and drug stores that sell food were excluded. Customers were asked how frequently they shop at small corner stores, medium-sized grocery stores and large supermarkets.

Sample size

Data for the present study were part of a larger longitudinal study developed to examine the impact of a community-based programme over time. Power calculations were originally made to determine the sample sizes needed to detect differences in intervention conditions related to that programme. Data for the present paper are from baseline measurements. Because the study used a cluster correlated design in which observations were nested within customers which were nested within stores, power calculations were determined using Optimal Design software version 1.55⁽²⁶⁾, a program developed to assist with power calculations for multilevel studies. We determined that a target sample of at least 350 customers within at least fourteen stores was needed to compare differences between stores. We oversampled to accommodate attrition.

Store inventories

Store inventories were conducted to measure availability and quality of healthy food in corner stores, using a modified version of the Nutrition Environment Measures Survey in Stores (NEMS-S)⁽²⁷⁾. The revised instrument included availability and quality of fresh fruits and vegetables, canned and frozen fruits and vegetables (a prescribed list of fruits and vegetables plus space to write in additional types for both fresh and canned), whole grains and reduced-fat dairy products. The proportion of all milk by container count that is reduced-fat (2% fat or less) was calculated from the inventory data.

Pairs of researchers conducted the store inventories to measure availability of foods within the store, and also square footage using a laser measurer (Stanley FatMax Tru Laser). Two sets of square foot measurements from the pair of researchers were averaged together to calculate store size. The inventory had high inter-rater reliability (Cronbach's $\alpha = 0.84\text{--}0.99$). Store inventories took place from January to February 2009. The University of Connecticut Institutional Review Board approved the protocol for the study. Both customers and store owners signed informed consents, and were paid \$US 5 for study participation.

Data analyses

Data were analysed using the SPSS statistical software package version 18 (SPSS Inc., Chicago, IL, USA) and the HLM (Hierarchical Linear Modeling) software program version 7 (Scientific Software International Inc., Lincolnwood, IL, USA). Descriptive statistics were calculated for customer demographics and store characteristics. Bivariate analyses were run to examine associations between customer demographics, store characteristics and purchasing behaviour using χ^2 tests for dichotomous variables and Spearman correlations for continuous variables. Variables at the customer level included car ownership, ethnicity (dummy variables were created for Hispanic and

Black), high-school education, employment, gender, age (as continuous variable), food security and whether the household receives SNAP or WIC. Variables at the store level included store size (continuous square feet) and WIC certification.

To estimate the probability of customers purchasing a food item given the availability of that item in the store, multilevel logistic regression models using a Bernoulli distribution with a random intercept were estimated. The estimation procedure used was full maximum likelihood with Adaptive Quadrature. We modelled the probability of customers purchasing: (i) fresh fruit related to the variety of fruit available in the store; (ii) fresh vegetables related to the variety of vegetables available in the store; and (iii) reduced-fat milk given the proportion of reduced-fat milk in the store. Each model controlled for car ownership, receiving SNAP, employment, ethnicity, high-school education and age. The models were estimated as follows:

Level-1 model

$$\begin{aligned} \text{Prob}(\text{BuyFruit}_{ij} = 1 | \beta_j) &= \phi_{ij} \\ \log[\phi_{ij}/(1-\phi_{ij})] &= \eta_{ij} \\ \eta_{ij} &= \beta_j + \gamma_{10} \times (\text{OwnCar}_{ij}) + \gamma_{20} \times (\text{SNAP}_{ij}) \\ &+ \gamma_{30} \times (\text{Working}_{ij}) + \gamma_{40} \times (\text{Hispanic}_{ij}) + \gamma_{50} \\ &\times (\text{Black}_{ij}) + \gamma_{60} \times (\text{HighSchool}_{ij}) + \gamma_{70} \times (\text{Age}_{ij}) \end{aligned}$$

Level-2 model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} \times (\text{FruitVariety}_j) + u_{0j}$$

where BuyFruit_{ij} is 1 if the i th person in the j th store purchases fruit and 0 if they do not; γ_{10} to γ_{70} are the fixed effects for the customer-level characteristics; and β_{0j} is the random effect to account for the second level in our model – the store-level data. γ_{00} and γ_{01} are the fixed intercept and fixed effect for FruitVariety_j and u_{0j} is the variability across stores.

Results

Customer characteristics

The average age of customers was 37.7 years, and 84% of the sample was female, see Table 1. The majority of customers were Black or Hispanic (54% and 40%, respectively). Over a third (35%) of customers had less than a high-school degree. Over half (57%) were currently unemployed, compared with a city-wide average of 16%⁽²⁸⁾. Only one in five customers (20%) owned a car, compared with a city-wide average of 41%. Over two-thirds (70%) of the sample were currently receiving SNAP. Among households with a child under 5 years of age, over half (56%) currently received WIC.

Sixty-one per cent of customers experienced food insecurity, including 26% with low food security and 35%

Table 1 Household demographics of sampled customers shopping in corner stores, Hartford, CT, USA

Characteristic	n	%
Total sample	372	100
Household demographics		
Female	312	84.1
Not married	294	79.9
Have children	228	61.3
Have children under 5 years of age	119	32.0
Ethnicity		
Black	199	53.5
Hispanic	149	40.1
Other	24	6.4
Education		
Less than high-school degree	130	35.0
High-school degree/GED	157	42.4
Some college or higher	84	22.6
No adult employed	215	56.6
Own a car	73	20.0
Receive SNAP/food stamps	258	69.5
Receive WIC (with children under 5 years of age)	66	55.5
Food security		
Food secure	77	21.6
Marginal food security	63	17.6
Low food security	93	26.1
Very low food security	124	34.7
Self-reported diabetes in household	78	21.0
Self-reported high blood pressure in household	119	32.2

GED, General Educational Development; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

with very low food security, such that adults often skipped meals and cut back on the size and quality of their children's meals. In addition, 21% of customers self-reported that they or a member of their household had diabetes and 32% had high blood pressure.

Store characteristics

Among the nineteen corner stores in the present sample, the average size was 669 ft² (62.15 m²; median 572 ft² (53.14 m²)). Thirty-seven per cent of stores were certified to accept coupons for WIC. On average, stores carried 4.2 (SD 2.4) types of fresh fruits and 6.1 (SD 4.1) types of fresh vegetables, and 74% of stores had reduced-fat milk available. Average length of store ownership was 7 years.

Customer shopping behaviour

The majority of customers in the sample (52%) said they bought most of their food at medium-sized grocery stores, see Table 2. Sixty-one per cent of the sample said they shop at large supermarkets once a month or less, while 32% shop at corner stores nearly every day. Shopping habits were correlated with customer demographics. Employment, education and car ownership were all significantly associated with more frequent trips to large supermarkets ($P < 0.01$). Increased age, receiving SNAP and food insecurity were negatively associated with shopping at large supermarkets ($P = 0.05$, < 0.01 and < 0.01 , respectively).

Table 2 Food purchasing behaviour of sampled customers shopping in corner stores, Hartford, CT, USA

	n	%
Location buy most of their food		
Large supermarket (over 40 000 ft ²)	148	40.8
Medium grocery (approx. 15 000 ft ²)	188	51.8
Small corner store (less than 2500 ft ²)	27	7.4
How often shop at corner store		
Once or twice per month	123	34.1
Once or twice per week	121	33.5
Every day	117	32.4
Typical purchases at corner store		
Bread		
Bread of any kind	323	87.8
Whole-wheat bread	170	52.6
Milk		
Milk of any kind	319	86.7
Reduced-fat milk (2% or less fat)	180	48.9
Snacks	306	83.2
Fruit		
Fresh fruit	230	62.5
Canned fruit	172	46.6
Frozen fruit	105	28.5
Vegetables		
Fresh vegetables	187	50.7
Canned vegetables	197	53.4
Frozen vegetables	118	32.0

Customers said they typically buy milk (87%), snacks (such as chips, candy or ice cream) (83%), fruit (70%) and bread (70%) at their corner store. Among these, approximately half bought healthier versions such as whole-wheat bread (53%) and reduced-fat milk (49%). Among those participating in food assistance programmes, 90% of SNAP recipients said they use their benefits at their corner store and 54% of WIC recipients said they use their benefits at WIC-certified corner stores.

Purchasing behaviour with store characteristics

When controlling for potential covariates (listed in Methodology section), greater fruit variety was associated with an increased likelihood that customers purchase fruit at the store (see Table 3 for results from the multilevel regression models). For a one unit increase in the availability of varieties of fresh fruit, the likelihood that customers purchase fruit increased by 12% ($P = 0.03$). Those receiving SNAP were significantly more likely to purchase fruit compared with those not receiving SNAP (OR = 1.72; 95% CI 1.02, 2.91; $P = 0.04$).

Vegetable availability was also associated with an increased likelihood that customers purchase vegetables in the store. For a one unit increase in the number of vegetables available in the store, the estimated odds of a customer purchasing vegetables increased by 15% ($P = 0.01$). Increased age was significantly associated with purchasing fresh vegetables ($P < 0.01$) in the corner store.

Having a greater proportion of milk that was reduced-fat did not increase the likelihood that customers purchased reduced-fat milk in the store (results not shown).

Table 3 Results of multilevel logistic regression models predicting purchases among sampled customers shopping in corner stores, Hartford, CT, USA

	OR	95% CI	P value
Purchase fruit			
Intercept	1.04	0.32, 3.48	0.94
Fruit variety in store	1.12	1.01, 1.25	0.03
Own a car	0.97	0.55, 1.73	0.93
Receive SNAP	1.72	1.02, 2.91	0.04
Employed	0.84	0.50, 1.39	0.49
High-school education	0.60	0.36, 1.01	0.06
Hispanic	1.01	0.39, 2.59	0.98
Black	0.92	0.37, 2.32	0.87
Age	1.00	0.98, 1.02	0.83
Purchase vegetables			
Intercept	0.59	0.17, 2.12	0.39
Vegetable variety in store	1.15	1.07, 1.23	0.01
Own a car	1.13	0.61, 2.08	0.70
Receive SNAP	1.10	0.63, 1.93	0.73
Employed	1.07	0.63, 1.85	0.79
High-school education	0.63	0.37, 1.09	0.10
Hispanic	0.99	0.37, 2.72	0.99
Black	0.64	0.24, 1.74	0.39
Age	1.05	1.02, 1.07	0.01

SNAP, Supplemental Nutrition Assistance Program.

Discussion

Lack of supermarkets paired with high poverty rates and health disparities highlight the need to explore food availability and food purchasing habits among urban residents. The majority of customers in the present sample said they bought most of their food at medium-sized grocery stores which tend to have custom brands and lower prices than large supermarkets, yet they shop frequently at small corner stores to buy staple foods and snacks. Customers in our sample have high rates of food insecurity and diet-related health conditions including diabetes and high blood pressure. Those who shop most frequently at corner stores have higher rates of food insecurity and lower socio-economic status (no car, limited education and employment) than those shopping more frequently at large supermarkets, exacerbating their risk for health disparities. This highlights the importance of corner store interventions and local food policies to reach those most in need.

In order to address health disparities, a healthy food environment requires both supply and demand from customers and store owners. Most of the literature on corner stores focuses on the supply side. The present study adds to the literature by combining customer purchasing information with food availability in the stores where they shop. Our findings show that customers are more likely to purchase fruits and vegetables when there is a wider variety in the store. Corner store owners may be concerned about lack of demand from customers and limited shelf space and refrigeration to stock fresh produce⁽²⁹⁾. The present results indicate that demand is related to supply, which may encourage store owners to stock a larger supply of produce.

While our study has several strengths, there are some notable limitations. The study was conducted in a non-representative sample of stores in one medium-sized city and therefore results are limited to the study area. It was conducted among a convenience sample of customers, and it is possible that customers who declined to participate have different purchasing habits compared with study participants. Shopping behaviour is based on self-report rather than direct observations or sales data; therefore some caution in interpretation is advised. Food prices were also not collected for the study but they very likely contribute to purchasing decisions. Data are also cross-sectional and causality cannot be implied.

Implications

Acknowledging the need for further confirmation of the direction and cause of effect in the present cross-sectional study, increasing the number and selection of produce in corner stores may increase their purchase and ultimately consumption by food-insecure and low-income residents who need them most. The majority of customers in the present sample who participate in SNAP and WIC utilize their benefits in corner stores, and those who receive SNAP have increased odds of purchasing fresh fruit in the store. The additional purchasing power and nutrition education associated with SNAP may encourage low-income families to purchase fruit compared with similar families not receiving SNAP. With the recent changes to the WIC food package including fruits, vegetables, whole grains and low-fat milk (which occurred after the present data were collected), additional research is needed to document changes to availability of these foods within stores and customer purchasing habits among WIC clients.

There appear to be regional differences in corner store sizes. For example, several studies mention a definition of corner stores as less than 200 ft² (18.58 m²)^(14,20). No stores in the present sample were less than 200 ft², stressing the importance of defining and measuring store size. Square foot measurements are feasible to administer and future research should take different store sizes into consideration.

Classifying areas with few large supermarkets as food 'deserts' may overlook the availability of healthy foods that exist within corner stores, the purchasing habits among low-income customers and the purchasing power of SNAP that contributes to healthy food shopping within corner stores. Many households that are most at risk for diet-related diseases have less access to large supermarkets^(16,17). Increasing the availability and affordability of healthy foods within corner stores is needed to serve those most in need.

The present study fills a gap in the literature by combining store-level food availability with customer purchasing habits within those stores. Corner store customers in the current sample have high rates of chronic diseases

and food insecurity. Consumption of healthy foods can help decrease the risk for these diseases. Our results show that when stores carry a greater variety of fruits and vegetables, customers tend to buy them. These results may have practical benefits for organizations and municipalities working with corner stores in other urban environments.

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