The Journal of Nutrition
Symposium: Access to Healthy Food: The Next Frontier for Research on Domestic Food Security

The Importance of a Multi-Dimensional Approach for Studying the Links between Food Access and Consumption[1–3]

Donald Rose,* J. Nicholas Bodor, Paul L. Hutchinson, and Chris M. Swalm

Tulane University School of Public Health and Tropical Medicine, New Orleans, LA 70112-2699

Abstract

Research on neighborhood food access has focused on documenting disparities in the food environment and on assessing the links between the environment and consumption. Relatively few studies have combined in-store food availability measures with geographic mapping of stores. We review research that has used these multi-dimensional measures of access to explore the links between the neighborhood food environment and consumption or weight status. Early research in California found correlations between red meat, reduced-fat milk, and whole-grain bread consumption and shelf space availability of these products in area stores. Subsequent research in New York confirmed the low-fat milk findings. Recent research in Baltimore has used more sophisticated diet assessment tools and store-based instruments, along with controls for individual characteristics, to show that low availability of healthy food in area stores is associated with low-quality diets of area residents. Our research in southeastern Louisiana has shown that shelf space availability of energy-dense snack foods is positively associated with BMI after controlling for individual socioeconomic characteristics. Most of this research is based on cross-sectional studies. To assess the direction of causality, future research testing the effects of interventions is needed. We suggest that multi-dimensional measures of the neighborhood food environment are important to understanding these links between access and consumption. They provide a more nuanced assessment of the food environment. Moreover, given the typical duration of research project cycles, changes to in-store environments may be more feasible than changes to the overall mix of retail outlets in communities. J. Nutr. 140: 1170–1174, 2010.

Introduction

There have been 2 broad strands of research in the field of neighborhood food access. Much of this literature has focused on documenting disparities between groups in their access to retail food outlets (1–6). A second line of this literature has explored the connection between the neighborhood environment and either dietary intakes (7–10) or weight status outcomes, such as obesity (11–13).

Assessment of the neighborhood food environment underlies both types of investigation and researchers have relied on 3 broad approaches to this assessment problem. One approach involves enumerating food stores within a given geographic unit of analysis, such as a census tract or zip code area. Studies using this approach either rely exclusively on preexisting business directories or health department listings (10,13), or, in some cases, include on-the-ground observations to verify these listings (5). This approach provides measures of food store access, e.g. characterizing the food environment by the density of supermarkets per zip code (1,4), the number of supermarkets per tract (10,12), or even the distance to the nearest supermarket (6,14).

A second approach to studying the food environment provides measures of in-store availability and relies heavily on in-store observations. For example, studies have conducted inventories to assess the availability or pricing of foods in the Thrifty Food Plan (15–17). Other studies have characterized the differences between store types (e.g. supermarket vs. small store) with respect to availability of specific healthy foods (15,18,19). Availability of different food groups within stores has been studied using shelf space (20). A comprehensive method for assessing the availability, price, and quality of foods in a store environment, known as the Nutrition Environment Measures Survey, has also been developed and tested (21).

Third, researchers have combined these 2 approaches to develop a more complete way of characterizing the neighborhood food environment that considers not just where stores are located but also what products are available inside these stores.

[1] Presented as part of the symposium entitled "Access to Healthy Food: The Next Frontier for Research on Domestic Food Security" at the Experimental Biology 2009 meeting, April 21, 2009, in New Orleans, LA. This symposium was sponsored the American Society for Nutrition Community and Public Health Nutrition RIS. Guest Editor for this symposium publication was Aryeh Stein. Guest Editor disclosure: no conflicts to disclose.

[2] Supported by the National Research Initiative of USDA, National Institute for Food and Agriculture (no. 2006-55215-16711), by the National Cancer Institute (no. R21CA121167), and by the CDC (no. 1U48DP001948-01).

[3] Author disclosures: D. Rose, J. N. Bodor, P. L. Hutchinson, and C. M. Swalm, no conflicts of interest.

* To whom correspondence should be addressed. E-mail: diego@tulane.edu.

First published online April 21, 2010; doi:10.3945/jn.109.113159.

We refer to this as a multi-dimensional assessment of access, because information is provided on the location dimension as well as dimensions regarding food product availability, pricing, and other in-store characteristics.

Multi-dimensional assessment of food access is an important development in this field, because it allows for a more nuanced way of assessing the food environment. Supermarkets do not carry just healthy foods, nor are all small stores devoid of them. In-store observations allow a better understanding of what specific foods are available in a given food environment and how much they cost. Combining the 2 types of information is also useful for orientation on different types of interventions. Not all communities can support a new supermarket. Deficiencies in availability of fresh produce among existing stores, e.g., might be better remedied by a low-cost policy option, such as a loan for a fruit and vegetable cooler.

This paper reviews work using multi-dimensional measures of food access, focusing on the links between access, consumption, and weight status. We begin by outlining a conceptual framework that integrates neighborhood food access with a typical model of consumer choice. We then describe research, including our own, that has used multi-dimensional measures of access to describe associations between access and dietary or body weight outcomes. We close with a summary and discussion of future research needs.

Conceptual framework

Much of the recent research on neighborhood food access, particularly studies that link access to consumption or health outcomes, is premised on the idea that environments influence behavior. In **Figure 1**, we present a theoretical framework for this approach that is based on an economic model of food consumption, adapted to include neighborhood effects. Economists view individuals as attempting to maximize their utility (or satisfaction) from goods given their tastes and preferences and subject to a budget constraint, determined by their income, food prices, and prices of other goods. Food demand, or purchases, is a function of income and prices, as well as tastes and preferences. We use "food cost," instead of "price," because the actual price that a consumer pays is a function of the in-store price and travel costs to the store where the food is purchased (22,23). These travel costs are a function of the availability of food stores, such as supermarkets or small groceries in a consumer's vicinity, and the in-store availability of specific foods. Even though a small grocery might be very close to an individual, if there is no in-store availability of fresh fruits, e.g., a consumer wanting those might have to travel to a distant supermarket. Car ownership could lower overall travel costs if it shortens travel time to stores.

A detailed specification of demographic characteristics, including age, race-ethnicity, schooling, and other variables, is useful for capturing unobserved information on consumers' tastes and preferences. Such tastes and preferences might be based on cultural food habits associated with particular ethnic groups, or they might be based on knowledge and concern of the consumer regarding diet and health outcomes. In-store food availability, including shelf space and placement of foods near registers, has a promotional effect that can influence consumers' preferences. A high concentration, or relative shelf space availability, of certain foods, e.g., energy-dense snack foods in corner groceries, could make these foods appear more socially acceptable and thus also influence consumers' preferences. The multi-dimensional nature of food access is captured in this framework in that food store locations, as well as features of the in-store environment, are relevant to consumption behavior.

Figure 1 is clearly a simplification designed to focus attention on a few aspects of neighborhood access and food consumption behavior, with many other factors being left out. Time constraints influence purchase decisions, because with less time available, households are more likely to purchase convenience or prepared foods. This process, as well as decisions regarding away-from-home foods, have been left out of the figure. We have drawn arrows in one direction, but food demand certainly influences supply. We have focused on details regarding the purchase of foods rather than their actual intake. But it is easy to envision that the causal chain extends further to the right, such that purchases affect intakes and ultimately weight status.

Links between access, consumption, and weight status

Cheadle et al. (1991) provide one of the earliest studies in the public health literature to study the connection between multi-dimensional measures of access and consumption (24). They conducted in-store surveys to measure shelf space devoted to low-fat meat and milk products and high-fiber breads and compared this with telephone interview responses to a FFQ of residents living in the same catchment area as these stores. The study was conducted in 12 communities (or counties), one in Hawaii and the rest in California. In this cross-sectional study, the authors found significant correlations between individuals' consumption and relative shelf space devoted to red meat, reduced fat-milk, and non-white bread in their communities' stores. However, in subsequent work that revisited these

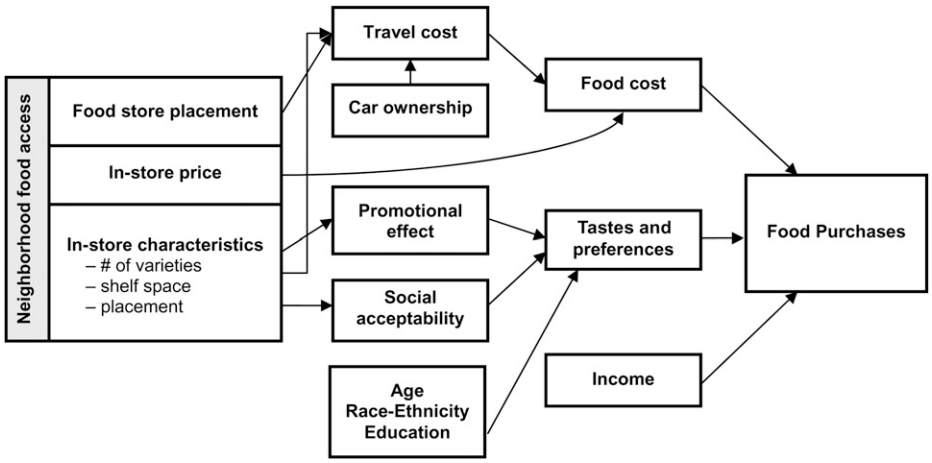

FIGURE 1 Conceptual framework integrating neighborhood food access into a model of consumer choice.

communities as part of a larger intervention project, the authors did not find significant associations between changes in availability and consumption across these communities (25).

Fisher and Strogratz (26) conducted similar research, focusing specifically on low-fat milk in New York State. Their phone interviews with household residents randomly selected from 19 zip code areas assessed which type of milk was present or usually present in the refrigerator. Surveys conducted in stores randomly selected from the same areas counted the percent of all milk on shelves that was low-fat. Analogous to the results of Cheadle et al. (24) and using the zip code area as the unit of analysis, they found a positive association between the proportion of low-fat milk in area stores and the prevalence of low-fat milk consumption in households.

Edmonds et al. (27) used census tracts as proxies for neighborhoods in their analyses of fruit, vegetable, and juice consumption among African-American boys in Houston, Texas. They found no correlations between consumption of these foods and availability in grocery stores as measured by shelf space. The authors conjectured that the census tract may have been too small a level of aggregation, because many households shop outside their tract. Interestingly, there were positive correlations between consumption of juices and vegetables and restaurant availability of these foods, a finding strengthened by the observation that many respondents reported patronizing restaurants in their census tracts.

Recent work in this area has become more nuanced both in geographic assessments, in-store observations, and in controlling for personal characteristics that affect consumption. Franco et al. (21,28) used a modified Nutrition Environment Measures Survey instrument to assess stores at varying distances from an individual's household, including the closest store, all stores within the individual's census tract, and all stores within 1 mile of each individual's residence. In this Baltimore study, they found that lower availability of healthy foods was associated with a lower-quality diet, after controlling for age, sex, income, and education (though not for race-ethnicity) for both the closest store and for an average of all stores within the census tract. Results were not significant when considering all stores within 1 mile of an individual's residence.

Our initial work in central city New Orleans used telephone interviews and a modified 24-h recall instrument to assess fruit and vegetable consumption of residents in 4 census tracts (29). We assessed fruit and vegetable shelf space in stores in the immediate vicinity (100 m) of respondents' residences and found a significant positive relationship between vegetable availability in these stores and consumption, after controlling for age, gender, race-ethnicity, income, food assistance participation, car ownership, and distance to the nearest supermarket. The availability of produce in the immediate vicinity of respondent households may have been important for fill-in shopping between larger shopping trips conducted at supermarkets.

Fruit and vegetable shelf space, as well as that devoted to energy-dense snack foods (candies, pastries and cookies, sodas, and salty snacks) was also assessed in work we did in a larger sample of urban census tracts (n = 103) randomly selected from a 28-county area of southeastern Louisiana (30). All stores in these study tracts were observed and hot-deck imputations based on store type were used to assign shelf space values from these observed stores to all of the unobserved stores that were situated in neighboring tracts. This procedure allowed for assessing the neighborhood food environment at various distances, 500 m, 1 km, and 2 km, from respondents' residences. Phone interviews in study tracts with respondents (n = 1243) chosen by random digit dial techniques assessed self-reported heights and weights and other sociodemographic variables, such as age, gender, race-ethnicity, income, education, and car ownership. In regression models that controlled for all of these variables, neighborhood shelf space of fruits and vegetables was not associated with BMI, but aggregate availability of energy-dense snack foods, particularly within 1 km of respondents' households, was positively associated with BMI.

Discussion

In general, findings from these studies that use multi-dimensional measures of access, i.e. combining in-store measures with mapping of store locations, show significant relationships between the neighborhood food environment and measures of consumption or weight. Although not directly comparable, the results are generally consistent with earlier studies that have relied on food store access measures (i.e. no observations inside the stores). A number of these earlier studies documented that easier access to supermarkets, measured in a number of different ways, was associated with food consumption, particularly improved fruit or vegetable intakes (10,14), or overall diet quality (8,9). Supermarket access has also been shown to be negatively associated with obesity (11–13,31,32), whereas easy access to convenience stores has been positively associated with obesity (12,13,31).

Previous research has indicated that the vast majority of households eligible for assistance from the Food Stamp Program shop at supermarkets (33). But this same research indicated that these households also shop at 3–4 different types of stores besides their main store and these included neighborhood groceries, convenience stores, and drug stores. One way to capture this shopping behavior is to rely solely on indicators of store type. But multi-dimensional measures of access provide a more nuanced approach in that they allow for understanding food-based features of the neighborhood environment. By combining information from in-store studies with geo-referencing of food outlets, researchers can study, e.g., the total amount of shelf space devoted to sugar-sweetened beverages, the variety of fresh fruits and vegetables, or the average price for low-fat milk found in a given neighborhood. If environments influence behaviors, and if shopping throughout the month, or fill-in shopping, is an important contributor to overall consumption baskets of low-income households, particularly those without cars, then understanding these specific food-related features of neighborhood environments is crucial.

Research in this field is not without limitations. In this review, we have focused on retail food access for at-home use, but considerable portions of the diet are consumed away from home in fast food and other restaurants. A second limitation of the work reviewed here is the exclusion of price as one of the dimensions in the overall assessment of access. The price of foods, of course, is a key determinant of consumer demand. But previous researchers who have combined in-store observations with store access maps have yet to include prices as an explanatory variable for consumption.

Another limitation of the studies reviewed here is that they are based on cross-sectional designs, so that the direction of causality cannot be determined. The work by Cheadle et al. (24,25), described above, was conducted ahead of the current wave of interest in environmental approaches to the obesity epidemic. Interestingly, the studies were written assuming consumption patterns affected food store supplies, rather than vice versa; that is, the authors were testing whether measures of the food environment could be used as reliable markers of consumption. But food stores, like any market, are based on a

simultaneous determination of supply and demand, so that influences work in both directions. Figure 1 is really just one-half of a conceptual framework, because food purchases would influence what is offered in stores. This simultaneity is best addressed with longitudinal studies or experimental designs to understand the true effects of manipulating the food environment.

The need to explore causality through investigation of interventions may be one of the best arguments for why more work is needed that combines in-store measures with geographically mapped access. Intervention budgets are limited and bringing new stores to a neighborhood is a complex, costly, and time-consuming process. Interventions that make use of the existing retail environment can focus energies on in-store changes, which, though not easy, may be less difficult to accomplish within a research grant time cycle than bringing new stores to a neighborhood (34,35). In-store changes to the food environment may also be more sustainable in the long-run, because they build on an existing infrastructure and therefore may lead to more appropriate policies.

There has been considerable growth in the development of food environment measures over the last decade (36). We have demonstrated how a simple rolling tape measure can be used to assess relative shelf space availability of key food groups in different types of stores (20). The Thrifty Food Plan has been used to assess availability and pricing of a healthy food basket in stores (15,16). Glanz et al. (21) have developed the Nutrition Environment Measures Survey, the comprehensive instrument that gathers availability, price, and quality data on a wide range of foods sold in retail outlets. More recent efforts are applying the Healthy Eating Index to food environments (37).

It will be important that future work in this area uses tools that strike a balance between understanding the complexity of the food environment and capturing the salient features in a transparent manner. Investigators are right to be wary of simplistic descriptions, because they likely do not capture the nuances that affect food choice. However, overly complex characterizations of the food environment may not facilitate understanding the science of how this environment influences consumption behavior, nor how it can be modified by policy. For example, what does it mean to have a 10% higher score on a nutrition environment index? Is it something for which we should advocate? And if so, is it something we could achieve through a policy intervention?

Improving access to healthy food has been suggested as one approach for addressing the obesity epidemic (38). If the association between the food environment and weight status were causal, we would expect this to operate through consumption, such that greater availability of low-energy healthy foods (e.g. fruits and vegetables) would lead to an increase in their consumption, be substituted for energy-dense foods, and thereby lower overall energy intake. Our work showed that access to healthy foods, i.e. fruits and vegetables, was not associated with BMI, but access to energy-dense foods was, and in the expected direction (30). This finding is consistent with studies using food store maps as the measure of access, which have found positive associations of obesity with convenience store access, even when controlling for supermarket access (12,13,31). Individuals may be responding to their food environments but not necessarily substituting low-energy foods for energy-dense ones. This suggests that the call to increase healthy food access may be only a part of an environmental approach to the obesity problem, perhaps necessary, but not sufficient.

Previous marketing research has documented with experimental designs that shelf space and in-store displays can affect overall sales (39–42), which is reflected in our inclusion of promotional effects and social acceptability in our conceptual framework (Fig. 1). If promotional influences on food choice are roughly equivalent for healthy foods and those that are relatively unhealthy, our in-store studies suggest that there are significant challenges that lie ahead. We found that shelf space availability of energy-dense snack foods was 3–5 times greater than space allocated to fruits and vegetables in the small stores common to many low-income neighborhoods (20). Although there has been a recent trend to document the problems of food deserts (43), the inundation of our food environments with energy-dense foods, a phenomenon we refer to as food swamps, may be a more serious problem (23).

Acknowledgments

D.R. wrote the paper and had primary responsibility for final content; J.N.B., P.L.H., and C.M.S. assisted in manuscript preparation. All authors read and approved the final version of the paper.

Literature Cited

1. Alwitt LF, Donley TD. Retail stores in poor urban neighborhoods. J Consum Aff. 1997;31:139–64.
2. Moore LV, Diez Roux AV. Associations of neighborhood characteristics with the location and type of food stores. Am J Public Health. 2006;96:325–31.
3. Morland K, Wing S, Diez Roux A, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. Am J Prev Med. 2002;22:23–9.
4. Powell LM, Slater S, Mirtcheva D, Bao Y, Chaloupka FJ. Food store availability and neighborhood characteristics in the United States. Prev Med. 2007;44:189–95.
5. Sharkey JR, Horel S. Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. J Nutr. 2008;138:620–7.
6. Zenk SN, Schulz AJ, Israel BA, James SA, Bao S, Wilson ML. Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. Am J Public Health. 2005;95:660–7.
7. Jago R, Baranowski T, Baranowski JC, Cullen KW, Thompson D. Distance to food stores and adolescent male fruit and vegetable consumption: mediation effects. Int J Behav Nutr Phys Act. 2007; 4:35.
8. Laraia BA, Siega-Riz AM, Kaufman JS, Jones SJ. Proximity of supermarkets is positively associated with diet quality index for pregnancy. Prev Med. 2004;39:869–75.
9. Moore LV, Diez Roux AV, Nettleton JA, Jacobs DR Jr. Associations of the local food environment with diet quality–a comparison of assessments based on surveys and geographic information systems: the multiethnic study of atherosclerosis. Am J Epidemiol. 2008;167:917–24.
10. Morland K, Wing S, Diez Roux A. The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. Am J Public Health. 2002;92:1761–7.
11. Lopez RP. Neighborhood risk factors for obesity. Obesity (Silver Spring). 2007;15:2111–9.
12. Morland K, Diez Roux AV, Wing S. Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. Am J Prev Med. 2006;30:333–9.
13. Powell LM, Auld MC, Chaloupka FJ, O'Malley PM, Johnston LD. Associations between access to food stores and adolescent body mass index. Am J Prev Med. 2007;33:S301–7.
14. Rose D, Richards R. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. Public Health Nutr. 2004;7:1081–8.
15. Connell CL, Yadrick MK, Simpson P, Gossett J, McGee BB, Bogle ML. Food supply adequacy in the Lower Mississippi Delta. J Nutr Educ Behav. 2007;39:77–83.

16. Morris PM, Neuhauser L, Campbell C. Food security in rural America: a study of the availability and costs of food. J Nutr Educ. 1992;24 Supp 1:52S–58S.
17. Jetter KM, Cassady DL. The availability and cost of healthier food alternatives. Am J Prev Med. 2006;30:38–44.
18. Bustillos B, Sharkey JR, Anding J, McIntosh A. Availability of more healthful food alternatives in traditional, convenience, and nontraditional types of food stores in two rural Texas counties. J Am Diet Assoc. 2009;109:883–9.
19. Liese AD, Weis KE, Pluto D, Smith E, Lawson A. Food store types, availability, and cost of foods in a rural environment. J Am Diet Assoc. 2007;107:1916–23.
20. Farley TA, Rice J, Bodor JN, Cohen DA, Bluthenthal RN, Rose D. Measuring the food environment: shelf space of fruits, vegetables, and snack foods in stores. J Urban Health. 2009;86:672–82.
21. Glanz K, Sallis JF, Saelens BE, Frank LD. Nutrition Environment Measures Survey in stores (NEMS-S): development and evaluation. Am J Prev Med. 2007;32:282–9.
22. Feather PM. Valuing food store access: policy implications for the Food Stamp Program. Am J Agric Econ. 2003;85:162–72.
23. Rose D, Bodor JN, Swalm CM, Rice JC, Farley TA, Hutchinson PL. Deserts in New Orleans? Illustrations of urban food access and implications for policy. Electronic conference proceedings (full paper) from Understanding the Economic Concepts and Characteristics of Food Access, UM-National Poverty Center and USDA-Economics Research Service, January 2009; Washington, DC [cited 2009 25 Nov]. Available from: http://www.npc.umich.edu/news/events/food-access/index.php.
24. Cheadle A, Psaty BM, Curry S, Wagner E, Diehr P, Koepsell T, Kristal A. Community-level comparisons between the grocery store environment and individual dietary practices. Prev Med. 1991;20:250–61.
25. Cheadle A, Psaty BM, Curry S, Wagner E, Diehr P, Koepsell T, Kristal A. Can measures of the grocery store environment be used to track community-level dietary changes? Prev Med. 1993;22:361–72.
26. Fisher BD, Strogatz DS. Community measures of low-fat milk consumption: comparing store shelves with households. Am J Public Health. 1999;89:235–7.
27. Edmonds J, Baranowski T, Baranowski J, Cullen KW, Myres D. Ecological and socioeconomic correlates of fruit, juice, and vegetable consumption among African-American boys. Prev Med. 2001;32:476–81.
28. Franco M, Diez-Roux AV, Nettleton JA, Lazo M, Brancati F, Caballero B, Glass T, Moore LV. Availability of healthy foods and dietary patterns: the Multi-Ethnic Study of Atherosclerosis. Am J Clin Nutr. 2009;89:897–904.
29. Bodor JN, Rose D, Farley TA, Swalm C, Scott SK. Neighbourhood fruit and vegetable availability and consumption: the role of small food stores in an urban environment. Public Health Nutr. 2008;11:413–20.
30. Rose D, Hutchinson PL, Bodor JN, Swalm CM, Farley TA, Cohen DA, Rice JC. Neighborhood food environments and body mass index: the importance of in-store contents. Am J Prev Med. 2009;37:214–9.
31. Bodor JN. Neighborhood food access in New Orleans: racial disparities, dietary intake, and obesity [dissertation]. New Orleans: Tulane University School of Public Health and Tropical Medicine; 2009.
32. Morland KB, Evenson KR. Obesity prevalence and the local food environment. Health Place. 2009;15:491–5.
33. Ohls JC, Ponza M, Moreno L, Zambrowski A, Cohen R. Food stamp participants' access to food retailers. Alexandria (VA): Office of Analysis and Evaluation, USDA, Food and Nutrition Service; 1999.
34. Gittelsohn J, Song HJ, Suratkar S, Kumar MB, Henry EG, Sharma S, Mattingly M, Anliker JA. An urban food store intervention positively affects food-related psychosocial variables and food behaviors. Health Educ Behav. In press 2010. doi:.10.1177/1090198109343886.
35. Song HJ, Gittelsohn J, Kim M, Suratkar S, Sharma S, Anliker S. A corner store intervention in a low-income urban community is associated with increased availability and sales of some healthy foods. Public Health Nutr. 2009;12:2060–2067.
36. McKinnon RA, Reedy J, Morrissette MA, Lytle LA, Yaroch AL. Measures of the food environment: a compilation of the literature, 1990–2007. Am J Prev Med. 2009;36:S124–33.
37. Reedy J, Krebs-Smith SM, Bosire C. Evaluating the food environment: application of the Healthy Eating Index-2005. Am J Prev Med. In press 2010. doi: 10.1016/j.amepre.2010.01.015.
38. Institute of Medicine. Local government actions to prevent childhood obesity. Washington, DC: The National Academies Press; 2009.
39. Cox KK. The effect of shelf space upon sales of branded products. J Mark Res. 1970;7:55–8.
40. Curhan RC. The effects of merchandising and temporary promotional activities on the sales of fresh fruits and vegetables in supermarkets. J Mark Res. 1974;11:286–94.
41. Chevalier M. Increase in sales due to in-store display. J Mark Res. 1975;12:426–31.
42. Wilkinson JB, Mason JB, Paksoy CH. Assessing the impact of short-term supermarket strategy variables. J Mark Res. 1982;19:72–86.
43. Institute of Medicine and NRC. The public health effects of food deserts: workshop summary. Washington, DC: The National Academies Press; 2009.