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Two studies compared food availability and prices in large and small stores across neighborhoods of varying income levels in New Haven, Connecticut. The findings suggest that supermarket access in lower-income neighborhoods has improved since 1971, and average food prices are comparable across income areas. Despite this progress, stores in lower-income neighborhoods (compared to those in higher-income neighborhoods) stock fewer healthier varieties of foods and have fresh produce of much lower quality. Policies are needed not only to improve access to supermarkets, but also to ensure that stores in lower-income neighborhoods provide high-quality produce and healthier versions of popular foods.


OBJECTIVE: Non-supermarket food retailers can be a promising channel for increasing the availability of healthy foods in underserved communities. The present paper reports on retailer practices, attitudes and beliefs about the supply of healthy foods before and after the introduction of new subsidies for healthy foods by the US Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in October 2009. DESIGN: We designed and conducted in-person standardized interviews with store owners and managers to assess perceptions of demand and profits for different foods, supply networks, barriers to stocking healthy foods and their changes following implementation of the new WIC packages. SETTING: Non-supermarket retailers in five towns of Connecticut, USA (n 68 in 2009 and n 58 in 2010). SUBJECTS: Owners and managers of WIC-authorized and non-WIC convenience stores and non-chain grocery stores. RESULTS: Retailers identified customer demand as the primary factor in stocking decisions. They reported observing a significantly weaker demand for healthy foods compared with unhealthy foods, although it improved for certain foods with the new WIC subsidies. Less healthy foods were also perceived as more profitable. Supplier networks varied by product from convenient manufacturer delivery for salty snacks to self-supply for produce. WIC retailers were able to quickly adapt and supply healthy foods required under the new WIC programme guidelines. CONCLUSIONS: Retailers other than supermarkets currently perceive little demand for healthy foods, but new WIC subsidies have the power to change these perceptions. Supply barriers seem secondary in the limited offerings of healthy foods by stores and could be overcome when policy changes generate new demand for healthy foods.

BACKGROUND: The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) has important potential for preventing diet-related disease in low-income children. WIC food packages were recently revised to offer foods that better reflect dietary recommendations for Americans. OBJECTIVE: This article reports on how implementation of the new healthier WIC food packages affected access of low-income populations to healthy foods (e.g., whole grains, fruit and vegetables, and lower-fat milk). DESIGN: A pre-post store inventory was completed using a standardized instrument to assess availability, variety, quality and prices of WIC-approved foods (65 food items). Stores were assessed before (spring 2009) and shortly after the new WIC package implementation (spring 2010). PARTICIPANTS/SETTING: All convenience stores and nonchain grocery stores located in five towns of Connecticut (N=252), including 33 WIC-authorized stores and 219 non-WIC stores. STATISTICAL ANALYSES PERFORMED: The healthy food supply score was constructed to summarize postrevision changes in availability, variety, prices of healthy foods, and produce quality. The effect of the WIC food package revisions was measured by differential changes in the scores for stores authorized to accept WIC benefits and stores not participating in WIC, including differences by neighborhood income. Multivariate multilevel regression models were estimated. RESULTS: The 2009 introduction of the revised WIC food packages has significantly improved availability and variety of healthy foods in WIC-authorized and (to a smaller degree) non-WIC convenience and grocery stores. The increase in the composite score of healthy food supply varied from 16% in WIC convenience and grocery stores in higher-income neighborhoods to 39% in lower-income areas. Improved availability and variety of whole-grain products were responsible for most of the increase in the composite score of healthy food supply. CONCLUSIONS: Designed as cost-neutral changes, the WIC food package revisions have improved access to healthy foods for WIC participants and society at large.


**Background:** We examined perceptions of Dietary Approaches to Stop Hypertension (DASH) and the food environment among African Americans (AA) with high blood pressure living in two low-income communities and objectively assessed local food outlets. **Methods:** Focus groups were conducted with 30 AAs; participants discussed DASH and the availability of healthy foods in their community. Sessions were transcribed and themes identified. Fifty-four stores and 114 restaurants were assessed using the Nutrition Environment Measures Survey (NEMS). Results. Common themes included poor availability, quality, and cost of healthy foods; tension between following DASH and feeding other family members; and lack of congruity between their preferred foods and DASH. Food outlets in majority AA census tracts had lower NEMS scores (stores: 11.7, p.01, restaurants: 8.3, p.001) compared with majority White areas. **Conclusions:** Interventions promoting DASH among lower income AAs should reflect the food customs, economic concerns, and food available in communities.

**Background:** Food environments may promote or undermine healthy behaviors, but questions remain regarding how individuals interact with their local food environments. **Purpose:** This study incorporated an urban food environment audit as well as an examination of residents’ food shopping behaviors within that context. **Methods:** In 2010, the research team audited the variety and healthfulness of foods available in 373 Philadelphia stores, using the validated Nutrition Environment Measures Survey in Stores (NEMS-S); higher scores indicate more diverse and healthful food inventories. The team also surveyed urban residents (n=514) regarding their food shopping. Descriptive and multivariate analyses (conducted in 2012) assessed variation in retail food environments and in shoppers’ store choices. **Results:** Corner and convenience stores were common (78.6% of food retail outlets) and had the lowest mean NEMS-S scores of any store type. Most participants (94.5%) did their primary food shopping at higher-scoring chain supermarkets, and the majority of participants did not shop at the supermarket closest to home. Supermarket offerings varied, with significantly fewer healthful foods at supermarkets closest to the homes of disadvantaged residents. In multivariate analyses, NEMS-S scores were strongly associated with residents’ preferred shopping destinations. **Conclusion:** These data suggest that, when possible, shoppers chose supermarkets that offered more variety and more healthful foods. Findings from this study also reinforce concern regarding unhealthy immediate food environments for disadvantaged residents, who disproportionately relied on nearby stores with more limited food items. Interventions to improve nutrition and health should address not only food store proximity but also diversity of healthful foods available.


**Objective:** To study the association between the availability of healthy foods and BMI by neighbourhood race and socio-economic status (SES). **Design:** Trained staff collected demographic information, height, weight and 24 h dietary recalls between 2004 and 2008. Healthy food availability was determined in thirty-four census tracts of varying racial and SES composition using the Nutrition Environment Measures Survey–Stores in 2007. Multilevel linear regression was used to estimate associations between healthy food availability and BMI. **Setting:** Baltimore City, Maryland, USA. **Subjects:** Adults aged 30–64 years (n 2616) who participated in the Healthy Aging in Neighborhoods of Diversity across the Life Span study. **Results:** Among individuals living in predominantly white neighbourhoods, high availability of healthy foods was associated with significantly higher BMI compared with individuals living in neighbourhoods with low availability of healthy food after adjustment for demographic variables (β = 3.22, P = 0.001). Associations were attenuated but remained significant after controlling for dietary quality (β = 2.81, P = 0.012). **Conclusions:** Contrary to expectations, there was a positive association between the availability of healthy food and higher BMI among individuals living in predominantly white neighbourhoods. This result could be due to individuals in neighbourhoods with low healthy food availability travelling outside their neighbourhood to obtain healthy food.

Objective: To examine the availability, quality, and price of key types of healthy and less-healthy foods found in corner stores in low-income urban neighborhoods and the associations between store characteristics and store food environments. Method: A sample of 246 corner stores was selected from all corner stores participating in the Philadelphia Healthy Corner Store Initiative (HCSI). The Nutrition Environment Survey for Corner Stores (NEMS-CS) was used to assess the availability, quality, and price of foods and beverages in 11 common categories between February and May, 2011. Results: NEMS-CS were completed in 23, 94.7% of the 246 stores approached. The healthier options were significantly less available in all food categories and often more expensive. Baked goods, breads, chips and cereals were sold at nearly all stores, with significantly far fewer offering low-baked goods (5.7%, p<0.0001), whole grain bread (56.2%, p<0.0001), or baked chips (35.2%, p<0.0001). Numbers of aisles was positively associated with availability score (p<0.05). Conclusions: Findings from this study point towards potential targets for intervention to improve the corner store food environment and dietary choices among low-income urban populations. Availability of certain healthier foods could be improved.


Objective: In response to the obesity epidemic, interventions to improve the food environment in corner stores have gained attention. This study evaluated the availability, quality, and price of foods in Philadelphia corner stores before and after a healthy corner store intervention with two levels of intervention intensity (“basic” and “conversion”). Methods: Observational measures of the food environment were completed in 2011 and again in 2012 in corner stores participating in the intervention, using the Nutrition Environment Measures Survey for Corner Stores (NEMS-CS). Main analyses included the 211 stores evaluated at both time-points. A time-by-treatment interaction analysis was used to evaluate the changes in NEMS-CS scores by intervention level over time. Results: Availability of fresh fruit increased significantly in conversion stores over time. Specifically, there were significant increases in the availability of apples, oranges, grapes, and broccoli in conversion stores over time. Conversion stores showed a trend toward a significantly larger increase in the availability score compared to basic stores over time. Conclusion: Interventions aimed at increasing healthy food availability are associated with improvements in the availability of low-fat milk, fruits, and some vegetables, especially when infrastructure changes, such as refrigeration and shelving enhancements, are offered.


This study examined associations of accessibility, availability, price, and quality of food choices and neighborhood urban design with weight status and utilitarian walking. To account for self-selection bias, data on adult residents of a middle-to-high-income neighborhood were used. Participants kept a 2-day activity/travel diary and self-reported socio-demographics, height, and weight. Geographic Information Systems data were used to objectively quantify walking-related aspects of urban design, and number of and distance to food outlets within respondents’ 1 km residential buffers. Food outlets were audited for availability, price, and quality of healthful food choices. Number of convenience stores and in-store healthful food choices were positively related to walking for errands which, in turn, was predictive of lower risk of being overweight/obese. Negative associations with overweight/obesity unexplained by walking were found for number of...
grocery stores and healthful food choices in sit-down restaurants. Aspects of urban form and food environment were associated with walking for eating purposes which, however, was not predictive of overweight/obesity. Access to diverse destinations, food outlets and healthful food choices may promote pedestrian activity and contribute to better weight regulation. Accessibility and availability of healthful food choices may lower the risk of overweight/obesity by providing opportunities for healthier dietary patterns.


Grounded in community-based participatory research, this study assesses the food environment in a health-disparate city and determines whether differences exist in healthy food availability by block group race and income. Sixty stores and 124 restaurants were systematically audited using the Nutrition Environment Measures Survey (NEMS). The findings show low availability of healthy food options in low-income and predominately black block groups. Middle- to high-income white block groups had the highest availabilities of healthy items. Results will be disseminated through a community–academic partnership to prioritize future action.


Differential access to healthy foods has been hypothesized to contribute to health disparities, but evidence from low and middle-income countries is still scarce. This study examines whether the access of healthy foods varies across store types and neighborhoods of different socioeconomic statuses (SES) in a large Brazilian city. Across-sectional study was conducted in 2010–2011 across 52 census tracts. Healthy food access was measured by a comprehensive in-store data collection, summarized into two indexes developed for retail food stores (HFSI) and restaurants (HMRI). Descriptive analyses and multilevel models were used to examine associations of store type and neighborhood SES with healthy food access. Fast food restaurants were more likely to be located in low SES neighborhoods whereas supermarkets and full service restaurants were more likely to be found in higher SES neighborhoods. Multilevel analyses showed that both store type and neighborhood SES were independently associated with in-store food measures. We found differences in the availability of healthy food stores and restaurants in Sao Paulo city favoring middle and high SES neighborhoods.


Background: This paper describes Project FIT, a collaboration between the public school system, local health systems, physicians, neighborhood associations, businesses, faith-based leaders, community agencies and university researchers to develop a multi-faceted approach to promote physical activity and healthy eating toward the general goal of preventing and reducing childhood obesity among children in Grand Rapids, MI, USA. Methods/design: There are four overall components to Project FIT: school, community, social marketing, and school staff wellness - all that focus on: 1) increasing access to safe and affordable physical activity and nutrition education opportunities in the schools and surrounding neighborhoods; 2) improving the affordability and availability of nutritious food in the neighborhoods surrounding the schools; 3) improving the
knowledge, self-efficacy, attitudes and behaviors regarding nutrition and physical activity among school staff, parents and students; 4) impacting the 'culture' of the schools and neighborhoods to incorporate healthful values; and 5) encouraging dialogue among all community partners to leverage existing programs and introduce new ones. Discussion: At baseline, there was generally low physical activity (70% do not meet recommendation of 60 minutes per day), excessive screen time (75% do not meet recommendation of < 2 hours per day), and low intake of vegetables and whole grains and high intake of sugar-sweetened beverages, French fries and chips and desserts as well as a high prevalence of overweight and obesity (48.5% including 6% with severe obesity) among low income, primarily Hispanic and African American 3rd-5th grade children (n = 403).


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**Background:** Most studies on the local food environment have used secondary sources to describe the food environment, such as government food registries or commercial listings (e.g., Reference USA). Most of the studies exploring evidence for validity of secondary retail food data have used on-site verification and have not conducted analysis by data source (e.g., sensitivity of Reference USA) or by food outlet type (e.g., sensitivity of Reference USA for convenience stores). Few studies have explored the food environment in American Indian communities. To advance the science on measuring the food environment, we conducted direct, on-site observations of a wide range of food outlets in multiple American Indian communities, without a list guiding the field observations, and then compared our findings to several types of secondary data. **Methods:** Food outlets located within seven State Designated Tribal Statistical Areas in North Carolina (NC) were gathered from online Yellow Pages, Reference USA, Dun & Bradstreet, local health departments, and the NC Department of Agriculture and Consumer Services. All TIGER/Line 2009 roads (>1,500 miles) were driven in six of the more rural tribal areas and, for the largest tribe, all roads in two of its cities were driven. Sensitivity, positive predictive value, concordance, and kappa statistics were calculated to compare secondary data sources to primary data. **Results:** 699 food outlets were identified during primary data collection. Match rate for primary data and secondary data differed by type of food outlet observed, with the highest match rates found for grocery stores (97%), general merchandise stores (96%), and restaurants (91%). Reference USA exhibited almost perfect sensitivity (0.89). Local health department data had substantial sensitivity (0.66) and was almost perfect when focusing only on restaurants (0.91). Positive predictive value was substantial for Reference USA (0.67) and moderate for local health department data (0.49). Evidence for validity was comparatively lower for Dun & Bradstreet, online Yellow Pages, and the NC Department of Agriculture. **Conclusions:** Secondary data sources both over- and under-represented the food environment; they were particularly problematic for identifying convenience stores and specialty markets. More attention is needed to improve the validity of existing data sources, especially for rural local food environments.

Background: Inadequate availability of healthy foods may be a barrier to achieving recommended diets. Objective: The objective was to study the association between the directly measured availability of healthy foods and diet quality. Design: We conducted a cross-sectional study of 759 participants from the Baltimore site of the Multi-Ethnic Study of Atherosclerosis. Diet was characterized by using a food-frequency questionnaire and summarized by using 2 empirically derived dietary patterns reflecting low- and high-quality diets. For each participant, the availability of healthy foods was directly assessed by using 3 measures: in all food stores within their census tract, in their closest food store, and in all food stores within 1 mile (1.6 km) of their residence.

Results: Twenty-four percent of the black participants lived in neighborhoods with a low availability of healthy food compared with 5% of white participants (P < 0.01). After adjustment for age, sex, income, and education, a lower availability of healthy foods in the tract of residence or in the closest store was associated with higher scores on the low-quality dietary pattern (P < 0.05). Less consistent associations were observed for the high-quality dietary pattern. Conclusions: Healthy foods were less available for black participants. Low availability of healthy foods was associated with a lower-quality diet. The extent to which improvements in the availability of healthy foods results in higher-quality diets deserves further investigation.


Background: Differential access to healthy foods may contribute to racial and economic health disparities. The availability of healthy foods has rarely been directly measured in a systematic fashion. This study examines the associations among the availability of healthy foods and racial and income neighborhood composition. Methods: A cross-sectional study was conducted in 2006 to determine differences in the availability of healthy foods across 159 contiguous neighborhoods (census tracts) in Baltimore City and Baltimore County and in the 226 food stores within them. A healthy food availability index (HFAI) was determined for each store, using a validated instrument ranging from 0 points to 27 points. Neighborhood healthy food availability was summarized by the mean HFAI for the stores within the neighborhood. Descriptive analyses and multilevel models were used to examine associations of store type and neighborhood characteristics with healthy food availability. Results: Forty-three percent of predominantly black neighborhoods and 46% of lower-income neighborhoods were in the lowest tertile of healthy food availability versus 4% and 13%, respectively, in predominantly white and higher-income neighborhoods (p<0.001). Mean differences in HFAI comparing predominantly black neighborhoods to white ones, and lower-income neighborhoods to higher-income neighborhoods, were -7.6 and -8.1, respectively. Supermarkets in predominantly black and lower-income neighborhoods had lower HFAI scores than supermarkets in predominantly white and higher-income neighborhoods (mean differences -3.7 and -4.9, respectively). Regression analyses showed that both store type and neighborhood characteristics were independently associated with the HFAI score. Conclusions: Predominantly black and lower-income neighborhoods have a lower availability of healthy foods than white and higher-income neighborhoods due to the differential placement of types of stores as well as differential offerings of healthy foods within similar stores. These differences may contribute to racial and economic health disparities.

Objectives: The purpose of this case study in San Lorenzo, Paraguay is to identify a food desert in a developing context and to test if food deserts shape residential obesity risk. This article reviews some of the debate surrounding whether food deserts really exist; and, if so, what are the dietary implications of living in a food desert. Methods: The research is an exploratory/explanatory design. The author mapped the downtown food retail district and the neighborhood food environment to identify what stores/markets. The author assessed each type of food store using an adapted version of the Nutrition Environment Measure Survey for Stores (NEMS-S) for Paraguay. Body mass index and household characteristics were collected with 68 households in a small neighborhood; and, the author matched the NEMS-S scores to the store reported by households as their primary grocery store for regression tests. Results: The results suggest that a tradeoff exists in the local food environment between food stores which negatively impact obesity risk for local residents. Exposure to this tradeoff appears to worsen as people live longer in the food desert. Thus, the results support the location of a food desert finding in Paraguay. Conclusions: The underlying factors of a food desert extend beyond food access to focus on the issues of justice. A way to improve upon future research to build scholarship on the relationship between deprivation and obesity requires that sample sizes are either large or representative of the population and that the research should be based on multiple neighborhood and city sites.


Obesity and other diet-related chronic disease affect low-income ethnic minority populations at high rates. Formative research was used to develop a food store–based intervention for low-income African Americans in Baltimore City. A combination of qualitative and quantitative methods were used, including in-depth interviews with food store owners (n = 19) and low-income residents (n = 17), food source assessment (n =11 census tracts), a consumer survey (n =50), and direct observations (n = 6). Healthy food options were poorly available in low-income census tracts, with no fresh fruits and vegetables sold in 6 census tracts. Local consumers purchase less healthy options and prepare foods in ways that add fat. Corner stores are a common food source, but store owners expressed reservations about stocking healthier food options, citing low consumer demand for healthier products. Residents were unhappy with the limited range of healthy food options available but tended to see obesity as the result of poor personal and parental choices. Neighborhood food stores have the potential to provide healthy food choices, reinforce health messages, increase the population reached by nutritional interventions, and work with local residents to facilitate healthier dietary choices.


Background: Eating, or nutrition, environments are believed to contribute to obesity and chronic diseases. There is a need for valid, reliable measures of nutrition environments. This article reports on the development and evaluation of measures of nutrition environments in retail food stores. Methods: The Nutrition Environment Measures Study developed observational measures of the nutrition environment within retail food stores (NEMS-S) to assess availability of healthy options, price, and quality. After pretesting, measures were completed by independent raters to evaluate inter-rater reliability and across two occasions to assess test–retest reliability in grocery and

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convenience stores in four neighborhoods differing on income and community design in the Atlanta metropolitan area. Data were collected and analyzed in 2004 and 2005. **Results:** Ten food categories (e.g., fruits) or indicator food items (e.g., ground beef) were evaluated in 85 stores. Inter-rater reliability and test–retest reliability of availability were high: inter-rater reliability kappas were 0.84 to 1.00, and test–retest reliabilities were .73 to 1.00. Inter-rater reliability for quality across fresh produce was moderate (kappas, 0.44 to 1.00). Healthier options were higher priced for hot dogs, lean ground beef, and baked chips. More healthful options were available in grocery than convenience stores and in stores in higher income neighborhoods. **Conclusions:** The NEMS-S tool was found to have a high degree of inter-rater and test–retest reliability, and to reveal significant differences across store types and neighborhoods of high and low socioeconomic status. These observational measures of nutrition environments can be applied in multilevel studies of community nutrition, and can inform new approaches to conducting and evaluating nutrition interventions.


**Objective:** Current nutrition environment instruments are typically designed to measure a small number of healthy foods based on national trends. They lack the depth to accurately measure the unique dietary choices of subpopulations, such as Texas consumers whose food preferences are influenced by Hispanic/Latino culture. Thus the purposes of the present study were to: (i) develop a comprehensive observational tool to measure the availability of healthy foods from retail stores in Texas; and (ii) conduct a pilot test to examine the tool’s reliability, as well as differences in the availability of healthy foods in stores between high- and low-income neighbourhoods. **Design:** Grocery and convenience stores were assessed for availability of healthy foods. Reliability was calculated using percentage agreement, and differences in availability were examined using 2 (store type) x 2 (neighbourhood income) ANOVA. **Setting:** One high-income and one low-income neighbourhood in Austin, Texas. Subjects: A sample of thirty-eight stores comprising twenty-five convenience stores and thirteen grocery stores. **Results:** The low-income neighbourhood had 324% more convenience stores and 56% fewer grocery stores than the high-income neighbourhood. High inter-rater (mean = 0.95) and test–retest reliability (mean = 0.92) and a significant interaction (P = 0.028) between store type and neighbourhood income were found. **Conclusions:** The TxNEA-S tool includes 106 healthy food items, such as fruits, vegetables, dairy, proteins and grains. The tool is reliable and face validity is affirmed by the Texas Department of Health. Grocery stores have more healthy foods than convenience stores, and high-income.


**Introduction:** Objective, observational measures of nutrition environments are now well established and widely used. Individuals’ perceptions of their nutrition environments may be equally or more important, but are less well conceptualized, and comprehensive measures are not available. This paper describes the development of the Perceived Nutrition Environment Measures Survey (NEMS-P), its test–retest reliability, and its ability to discern differences between lower- and higher-SES neighborhoods. **Methods:** This research involved five steps: (1) development of a conceptual model and inventory of items; (2) expert review; (3) pilot testing and cognitive interviews; (4) revising the survey; and (5) administering the revised survey to participants in neighborhoods of high and low SES on two occasions to evaluate neighborhood differences and test–retest reliability. Data were collected in 2010 and 2011 and analyzed in 2011 and 2012.
**Results:** The final survey has 118 items. Fifty-three core items represent three types of perceived nutrition environments: community nutrition environment, consumer nutrition environment, and home food environment. Test–retest reliability for core constructs of perceived nutrition environments was moderate to good (0.52–0.83) for most measured constructs. Residents of higher-SES neighborhoods reported higher availability scores in stores, stronger agreement that healthy options were available in nearby restaurants, and higher scores for accessibility of healthy foods in their homes. **Conclusions:** The NEMS-P has moderate to good test–retest reliability and can discriminate perceptions of nutrition environments between residents of higher- and lower-SES neighborhoods. This survey is available and ready to be used.


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**Objective:** The retail food environment may be one important determinant of dietary intake. However, limited research focuses on individuals’ food shopping behavior and activity within the retail food environment. This study’s aims were to determine the association between six various dietary indicators and 1) food venue availability; 2) food venue choice and frequency; and 3) availability of healthy food within food venue. **Methods:** In Fall, 2011, a cross-sectional survey was conducted among adults (n=121) age 18 years and over in Lexington, Kentucky. Participants wore a global position system (GPS) data logger for 3-days (2 weekdays and 1 weekend day) to track their daily activity space, which was used to assess food activity space. They completed a survey to assess demographics, food shopping behaviors, and dietary outcomes. Food store audits were conducted using the Nutrition Environment Measurement Survey-Store Rudd (NEMS-S) in stores where respondents reported purchasing food (n=22). Multivariate logistic regression was used to examine associations between six dietary variables with food venue availability within activity space: food venue choice; frequency of shopping; and availability of food within food venue. **Results:** 1) Food venue availability within activity space – no significant associations. 2) Food Venue Choice – Shopping at farmers’ markets or specialty grocery stores reported higher odds of consuming fruits and vegetables (OR 1.60 95% CI [1.21, 2.79]). Frequency of shopping - Shopping at a farmers’ markets and specialty stores at least once a week reported higher odds of consuming fruits and vegetables (OR 1.55 95% CI [1.08, 2.23]). Yet, shopping frequently at a super market had higher odds of consuming sugar-sweetened beverages (OR 1.39 95% CI [1.03, 1.86]). 3) Availability of food within store – those who shop in supermarkets with high availability of healthy food has lower odds of consuming sugar-sweetened beverages (OR 0.65 95% CI [0.14, 0.83]). **Conclusion:** Interventions aimed at improving fruit and vegetable intake need to consider where individuals’ purchase food and the availability within stores as a behavioral and environmental strategy.


**Objective:** The aim of the study was to determine the association between dietary outcomes and the neighbourhood food environment (street network distance from home to stores) and consumer food environment (Nutrition Environment Measurement Survey-Store (NEMS-S) audit). **Design:**
The neighbourhood food environment was captured by creating 0.5-mile and 1-mile network distance (street distance) around each participant's home and the nearest food venue (convenience store, grocery store, supermarket, farmers' market and produce stand). The consumer food environment was captured by conducting NEMS-S in all grocery stores/supermarkets within 0.5 and 1 mile of participants' homes. Setting: Fayette County, KY, USA. Subjects: Supplemental Nutrition Assessment Program (SNAP) participants, n 147. Results: SNAP participants who lived within 0.5 mile of at least one farmers' market/produce stand had higher odds of consuming one serving or more of vegetables (OR = 6.92; 95% CI 4.09, 11.69), five servings or more of grains (OR = 1.76; 95% CI 1.01, 3.05) and one serving or more of milk (OR = 3.79; 95% CI 2.14, 6.71) on a daily basis. SNAP participants who lived within 0.5 mile of stores receiving a high score on the NEMS-S audit reported higher odds of consuming at least one serving of vegetables daily (OR = 3.07; 95% CI 1.78, 5.31). Conclusions: Taken together, both the neighbourhood food environment and the consumer food environment are associated with a healthy dietary intake among SNAP participants.


Background. The aim of the study is to determine how the food store environment modifies the effects of an intervention on diet among low-income women. Study Design. A 16-week face-to-face behavioral weight loss intervention was delivered among low income midlife women. Methods. The retail food environment for all women was characterized by (1) the number and type of food stores within census tracts; (2) availability of healthy foods in stores where participants shop; (3) an aggregate score of self-reported availability of healthy foods in neighborhood and food stores. Statistical Analyses. Multivariable linear regression was used to model the food store environment as an effect modifier between the intervention effect of fruit and vegetable serving change. Results. Among intervention participants with a low perception of availability of healthy foods in stores, the intervention effect on fruit and vegetable serving change was greater [1.89, 95% CI (0.48, 3.31)] compared to controls. Among intervention participants residing in neighborhoods with few super markets, the intervention effect on fruit and vegetable serving change was greater [1.62, 95% CI (1.27, 1.96)] compared to controls. Conclusion. Results point to how the food store environment may modify the success of an intervention on diet change among low-income women.


This article by Muskie School researchers assesses the impact of the rural food environment on the eating behaviors and BMI of rural low-income children, using a statewide (Maine, 2009) household survey of parents of children on Medicaid, oversampled in six rural communities, resulting in n=272 for six target communities. The food environment was measured using modified Nutrition Environment Measures Survey in Stores (NEMS-S) for 46 retail food outlets. Multivariate analysis assessed factors affecting home food environment, child's eating behavior and BMI. Results: Home food behaviors (how often: family eats together, child eats breakfast, vegetables served) and parent food consumption were significantly associated with children's healthy eating behaviors. The only significant predictor of childhood obesity was parent eating
behavior. We observed several alternative strategies such as hunting, gathering and buying from local farmers. Parents who drove over 20 miles to shop were found to shop at stores with higher NEMS scores as compared to parents who drove shorter distances.

Conclusion: Defining and identifying "food deserts" is not a promising approach to measuring the rural food environment due to long distance trips, careful price shopping, and local, alternative strategies. Strategies to place healthier food in the home should be combined with interventions directed at parents' and families' eating behaviors.


BACKGROUND: Literature on food environments is expanding rapidly, yet a gap exists regarding the role of the U.S. Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) on healthy food availability. In October 2009, the U.S. Department of Agriculture revised the WIC food package, requiring certified stores to stock fresh produce, whole grains, and lower-fat milk. PURPOSE: The goal of this study is to compare availability of foods in stores that are versus those that are not WIC-certified before and after the policy change. METHODS: Store inventories were collected in 45 corner stores in Hartford CT with four inventories each (180 total inventories) from January 2009 to January 2010. Data on availability and variety of fresh fruits, fresh vegetables, whole grains, and lower-fat milk were recorded. Analyses were completed in 2012 using Fisher's exact test, chi-square, and t-tests for descriptive analyses and multilevel models to measure food availability longitudinally (significance at p<0.05). RESULTS: Controlling for covariates, WIC-certified vendors carried more varieties of fresh fruit (p<0.01); a greater proportion of lower-fat milk (p<0.01); and had greater availability of whole grain bread (p<0.01) and brown rice (p<0.05) than vendors without WIC authorization after the policy change. Conversely, for all outcomes, stores without WIC authorization did not significantly increase healthy food availability. CONCLUSIONS: The 2009 WIC revisions increased availability of healthy foods among WIC-certified vendors compared to those without WIC authorization in Hartford CT. For many residents without a car, these changes can create a convenient shopping location for healthy foods when a larger supermarket is not nearby.


Total dietary fat and saturated fat intake are associated with obesity, elevated cholesterol, and heart disease. This study tested a group structural equation model to explore differences in the relative influence of individual, social, and physical environment factors on dietary fat intake amongst adults aged 40-70 years. Participants from four rural Georgia, U.S. counties (n = 527) completed a cross-sectional survey that included questions about eating patterns and individual and social influences on healthy eating. Observational measures of nutrition environments in stores and restaurants in these counties also were completed. Models for both women and men found significant positive relationships between self-efficacy for healthy eating and perceived nutrition environments and family support for healthy eating. The association between self-efficacy for eating a low-fat diet and frequency of eating out and grocery shopping was negative for both genders. The home nutrition environment was associated with dietary fat intake for women but not men. The results indicate that the influence of individual and environmental factors on dietary fat
intake differs for men and women, with the home environment playing a larger role for women in rural communities.


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Abstract: Research on the impact of the built environment on obesity and access to healthful foods often fails to incorporate information about how individuals interact with their environment. A sample of 198 low-income WIC recipients from two urban neighborhoods were interviewed about where they do their food shopping and surveys were conducted of food stores in their neighborhoods to assess the availability of healthful foods. Results indicate that participants rarely shop at the closest supermarket, traveling on average 1.58 miles for non-WIC food shopping and 1.07 miles for WIC shopping. Findings suggest that access to healthful foods is not synonymous with geographic proximity.


**Objective:** To evaluate the impact of the 2009 food package changes for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) on the availability of healthful food.

**Design:** Survey of all food stores in the study area before and after the changes were implemented. Setting: Two low-income neighborhoods in Philadelphia, 1 predominantly African-American, the other predominantly Hispanic. **Participants:** One hundred forty one supermarkets, grocery stores, and non-chain corner stores identified through field enumeration. **Main Outcome Measures:** Nutrition Environment Measure Survey for Stores (NEMS-S) to determine availability, price, and quality of fruit, vegetables, milk, cereal, beans, canned fish, meat, whole grains, and juice. **Analysis:** Comparison of NEMS-S scores before and after food package changes using t tests and ordinary least squares regression to understand the role of supermarket status, WIC participation, and racial and income composition in predicting NEMS-S scores; geographic information systems to calculate proximity of residents to food stores. **Results:** The availability of healthful food increased significantly in stores, overall, with more substantial increases in WIC-authorized stores. Supermarket status, WIC retail status, and NEMS-S scores at baseline were significant predictors of NEMS-S scores after the food package changes. **Conclusions and Implications:** Changes in the WIC food package were associated with increased availability of healthful food in 2 low-income neighborhoods.


This pilot research assessed the feasibility and utility of a study designed to examine the relationship between children’s BMI and food store, restaurant, and home food environments. Home visits were conducted with sixth-grade children (N = 12). BMI z-scores were calculated with weight and height measurements. Nutrition Environment Measures Surveys evaluated children's food environments. The study protocol involved a feasible time duration, minimal missing data for
primary variables, and participant satisfaction. Potential design problems included the homogeneous store environments and low restaurant exposure of the sample recruited from one school, and the adequacy of a single cross-sectional measure of the home environment.


Open access: www.cdc.gov/pcd/issues/2010/nov/09_0220.htm

Introduction: Researchers believe that nutrition environments contribute to obesity and may explain some health disparities. The Nutrition Environment Measures Surveys (NEMS) are valid and reliable observational measures of the nutrition environment. This article describes the dissemination of the measures, including the development, implementation, and evaluation of training workshops, and a followup survey of training participants. Methods: To disseminate the NEMS measures, we developed a 2-day intensive, participatory workshop. We used an immediate postcourse evaluation and a structured telephone follow-up interview to evaluate the workshops and the dissemination strategy. Topics included use of the NEMS measures, reactions to the workshops, and participants’ training others on the measures. Results: During the study period, 173 people participated in 14 workshops. Participants indicated a high level of satisfaction with the training workshops. Almost two-thirds of respondents reported using the measures to train an additional 292 people and to rate more than 3,000 food outlets. The measures have been used in diverse locations across the United States for various purposes. Respondents have reported NEMS results in peer-reviewed journals, master’s theses, newspaper articles, and presentations. Conclusion: The NEMS measures are the only nutrition environment measures that have been packaged for distribution and widely disseminated. The measures fill a need in the worlds of research and community action, and dissemination was successful in accelerating diffusion and promoting adoption of the measures. The use of an ongoing process to improve workshops and measures contributes to the usefulness of the surveys and accelerates their adoption and continued use.


Purpose: This study evaluated the food stores on and near postsecondary campuses varying in institutional size. Design: The design of the study is an environmental audit survey. Setting: Fifteen U.S. postsecondary education institutions participated in this study between 2009-2011. Subjects: Eighty-one stores (44% grocery, 17% campus, and 39% convenience/drug) were evaluated. Measures: The Nutrition Environment Measures Survey for Stores was modified to evaluate food stores. Analysis. Analysis of variance with post hoc Tukey B and t-tests assessed differences between store types and by institutional size. Results: Grocery stores had significantly higher scores than campus/convenience stores for healthy foods (19.5 ± 3.8 vs. 2.4 ± 1.7), and for the availability (19.5 ± 3.8 vs. 2.4 ± 1.7) and quality (5.9 ± 0.5 vs. 1.8 ± 2.2) of fruits/vegetables (p < .001). Healthy foods and beverages were significantly more expensive (-0.6 ± 3.4 vs. 0.9 ± 2.0; p < .031) than their less healthful alternatives in grocery stores, but not in convenience stores. There were no differences by institutional size for grocery stores; however, smaller institutions’ convenience stores had significantly lower availability and quality of fruits/vegetables and total food store environment scores. Conclusion: A college campus provides a food environment with
an array of shopping venues, most of which are not consistent with dietary recommendations for obesity prevention. The limited quality of healthy food in on-campus and convenience stores and the exacerbated deficiencies for small postsecondary institutions provide evidence to support environmental and policy initiatives to improve the quality of campus food store environments.


**Objective:** The present study evaluated the restaurant and dining venues on and near post-secondary campuses varying in institution size. **Design:** The Nutrition Environment Measures Survey for Restaurants (NEMS-R) was modified to evaluate restaurants as fast food, sit down and fast casual; and campus dining venues as dining halls, student unions and snack bar/cafés. ANOVA with post hoc Tukey's B and T tests were used to distinguish differences between dining venues and associated institutions by size. **Setting:** The study was conducted at fifteen US post-secondary institutions, 2009-2011. **Subjects:** Data presented are from a sample of 175 restaurants and sixty-eight on-campus dining venues. **Results:** There were minimal differences in dining halls by institution size, although medium-sized institutions as compared with small-sized institutions offered significantly more healthful side dish/salad bar items. Dining halls scored significantly higher than student unions or snack bar/cafés on healthful entrées, side dish/salad bar and beverages offerings, but they also had the most barriers to healthful dietary habits (i.e. all-you-can-eat). No differences were found by restaurant type for NEMS-R scores for total restaurant dining environment or healthful entrées and barriers. Snack bars had more healthful side dishes ($P = 0.002$) and fast-food restaurants had the highest level of facilitators (i.e. nutrition information; $P = 0.002$). **Conclusions:** Based on this evaluation in fifteen institutions, the full campus dining environment provides limited support for healthy eating and obesity prevention. The quality of campus dining environments can be improved via healthful offerings, providing nutrition information and other supports to facilitate healthy eating and prevent unwanted weight gain.


The purpose of the project described in this paper was to assess and describe the food environment facing public assistance clients in a rural county in Maine. Using the concept of a “food desert” and an objective tool for rating participating food outlets, the research team developed a spatial model of client access to healthy foods. The final map shows that most rural residents are within acceptable distances of well-rated stores, though these may not be supermarkets.

- Johnson JS, Nobmann ED, Asay, E. Factors related to fruit, vegetable and traditional food consumption which may affect health among Alaska Native People in Western Alaska. *International Journal of Circumpolar Health*, 71: 10.3402/ijch.v71i0.17345.

Free access: [www.ncbi.nlm.nih.gov/pmc/articles/PMC3417710/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3417710/)

**OBJECTIVES:** Determine intake of fruits, vegetables and traditional foods (TF), availability of foods, and attitudes towards increasing their consumption. **STUDY DESIGN:** Establish community baseline through a cross-sectional sample of residents who were weighed, measured and interviewed. Village stores were surveyed for food availability, price and quality. **METHODS:**
Eighty-eight respondents self-identified as the household member primarily responsible for food shopping and cooking were surveyed in 3 Western Alaska Native villages using a food frequency questionnaire, and village stores were evaluated using food environment surveys. RESULTS: Overweight (BMI[kg/m²] > 25) was present in 68% of participants. Fruit and vegetable intake (3.3 median servings/day) was low in comparison to recommended intakes of 5-9 servings/d. Seventy-two per cent were eating less than 5 servings/d of fruits and vegetables combined. Thirty-four per cent of respondents were trying to eat more vegetables; 41% were trying to eat more fruits. The median number of servings of TF was 3.2/d (mean 4.3/d). Seventy-seven per cent of respondents reported that they ate enough TF. CONCLUSION: Recommendations to continue use of TF and increase intake of fruits and vegetables are consistent with local attitudes. Our findings indicate that increasing the availability of fruits and vegetables would be well received. Information from this study provides a basis for nutrition education and food supplement programs that is responsive to the needs and perceptions of the residents. Continued TF intake and increased fruit and vegetable intake have the potential to benefit the health of rural residents.


**Background:** Assessment of basic dietary intake and community nutrition environment is lacking and needed to improve health outcomes for the growing U.S. Latino community. **Purpose:** The dietary intake and community nutrition environment of the Latino population in the Midwest was evaluated. **Methods:** In a community clinic, Block Food Frequency Screeners in Spanish were administered to measure daily fruit, vegetable and fat intake. The community nutrition environment, specifically store outlets, was evaluated on the basis of availability, price and quality of foods using Nutrition Environment Measurement Survey-Stores (NEMS-S). **Results:** The adult Latino community’s fruit, vegetable and fat intake is considered “good”, except adult males exhibited a “fair” consumption of fat. NEMS-S revealed a good availability and quality of “healthy” food options in the stores, but reported higher prices, on average, for “healthy” options. **Discussion:** Dietary intake may reflect a community in transition from a predominantly Mexican to a standard American diet. Additional built environment assessment tools should be administered, and those that capture more of the diverse eating practices should be considered for future research, such as the NEMS-Texas survey which was developed for a predominantly Latino population in Texas. **Translation to Health Education Practice:** The study data are being used and adopted by other social service organizations and to inform health policy makers in Milwaukee. Future directives for research should include dietary assessments that include food items from diverse culinary traditions that more accurately capture dietary intake in United States urban settings. The newer Texas NEMS that includes all fruits and vegetables, may be better suited for urban populations nationally that may have access to fruits and vegetables, may be better suited for urban populations nationally that may have access to fruits and vegetables from around the globe.


Restaurant foods represent a substantial portion of children’s dietary intake, and consumption of foods away from home has been shown to contribute to excess adiposity. This descriptive study aimed to pilot-test and establish the reliability of a standardized and comprehensive assessment tool, the Children’s Menu Assessment, for evaluating the restaurant food environment for children.
The tool is an expansion of the Nutrition Environment Measures Survey-Restaurant. In 2009-2010, a randomly selected sample of 130 local and chain restaurants were chosen from within 20 miles of Little Rock, AR, to examine the availability of children’s menus and to conduct initial calibration of the Children’s Menu Assessment tool (final sample: n=46). Independent raters completed the Children’s Menu Assessment in order to determine inter-rater reliability. Test–retest reliability was also examined. Inter-rater reliability was high: percent agreement was 97% and Spearman correlation was 0.90. Test–retest was also high: percent agreement was 91% and Spearman correlation was 0.96. Mean Children’s Menu Assessment completion time was 14 minutes, 56 seconds -10 minutes, 21 seconds. Analysis of Children’s Menu Assessment findings revealed that few healthier options were available on children’s menus, and most menus did not provide parents with information for making healthy choices, including nutrition information or identification of healthier options. The Children’s Menu Assessment tool allows for comprehensive, rapid measurement of the restaurant food environment for children with high inter-rater reliability. This tool has the potential to contribute to public health efforts to develop and evaluate targeted environmental interventions and/or policy changes regarding restaurant foods.


Availability and price of healthy foods in food stores has the potential to influence purchasing patterns, dietary intake, and weight status of individuals. This study examined whether demographic factors of the store neighborhood or store size have an impact on the availability and price of healthy foods in sample of grocery stores and supermarkets. The Nutrition Environment Measures Study-Store (NEMS-S) instrument, a standardized observational survey, was utilized to evaluate food stores (N = 42) in a multi-site (Vermont and Arkansas) study in 2008. Census data associated with store census tract (median household income and proportion African-American) were used to characterize store neighborhood and number of cash registers was used to quantify store size. Median household income was significantly associated with the NEMS healthy food availability score (r = 0.36, P < 0.05); neither racial composition (r = -0.23, P = 0.14) nor store size (r = 0.27, P = 0.09) were significantly related to the Availability score. Larger store size (r = 0.40, P < 0.01) was significantly associated with the NEMS-S Price scores, indicating more favorable prices for healthier items; neither racial composition nor median household income were significantly related to the Price score (P’s > 0.05). Even among supermarkets, healthier foods are less available in certain neighborhoods, although, when available, the quality of healthier options did not differ, suggesting that targeting availability may offer promise for policy initiatives. Furthermore, increasing access to larger stores that can offer lower prices for healthier foods may provide another avenue for enhancing food environments to lower disease risk.


Open access:
www.cdc.gov/mmwr/preview/mmwrhtml/mm6410a4.htm?s_cid=mm6410a4_e#.VQscqPNCjtA.email

The food environment is associated with obesity risk and diet-related chronic diseases. Despite extensive research conducted on retail food stores, little is known about prepared food sources (PFSs). We conducted an observational assessment of all PFSs (N = 92) in low-income neighborhoods in Baltimore. The most common PFSs were carry-outs, which had the lowest availability of healthy food choices. Only a small proportion of these carry-outs offered healthy sides, whole wheat bread, or entrée salads (21.4%, 7.1%, and 33.9%, respectively). These findings suggest that carry-out-specific interventions are necessary to increase healthy food availability in low-income urban neighborhoods.


Open access: http://www.cdc.gov/pcd/issues/2011/nov/10_0231.htm

**Introduction:** The availability of healthful foods varies by neighborhood. We examined the availability and price of more healthful foods by store type, neighborhood income level, and racial composition in a community with high rates of diet-related illness and death. **Methods:** We used the modified Nutrition Environment Measures Survey in Stores to conduct this cross-sectional study in 2008. We surveyed 73 stores (29% supermarkets, 11% grocery stores, and 60% convenience stores) in Leon County, Florida. We analyzed the price and availability of foods defined by the 2005 Dietary Guidelines for Americans as “food groups to encourage.” We used descriptive statistics, t tests, analysis of variance, and χ2 tests in the analysis. **Results:** Measures of availability for all more healthful foods differed by store type (P < .001). Overall, supermarkets provided the lowest price for most fresh fruits and vegetables, low-fat milk, and whole-wheat bread. Availability of 10 of the 20 fruits and vegetables surveyed, shelf space devoted to low-fat milk, and varieties of whole-wheat bread differed by neighborhood income level (P < .05), but no trends were seen for the availability or price of more healthful foods by neighborhood racial composition. **Conclusions:** Store type affects the availability and price of more healthful foods. In particular, people without access to supermarkets may have limited ability to purchase healthful foods. Nutrition environment studies such as this one can be used to encourage improvements in neighborhoods that lack adequate access to affordable, healthful food, such as advocating for large retail stores, farmer’s markets, and community gardens in disadvantaged neighborhoods.


**Objective:** Marketing strategies and food offerings in hospital cafeterias can impact dietary choices. Using a survey adapted to assess food environments, the purpose of this study was to assess the food environment available to patients, staff, and visitors at the food-service venues in all 14 California children's hospitals. **Methods:** We modified a widely-used tool to create the Nutritional Environment Measures Survey for Cafeterias (NEMS-C) by partnering with a hospital wellness committee. The NEMS-C summarizes the number of healthy items offered, whether calorie labeling is present, if there is signage promoting healthy or unhealthy foods, pricing structure, and the presence of unhealthy combination meals. The range of possible scores is zero (unhealthy) to 37 (healthy). We directly observed the food-service venues at all 14 tertiary care
Results: Inter-rater reliability showed 89% agreement on the assessed items. For the 14 hospitals, the mean score was 19.1 (SD = 4.2; range, 13-30). Analysis revealed that nearly all hospitals offered diet drinks, low-fat milk, and fruit. Fewer than one-third had nutrition information at the point of purchase and 30% had signs promoting healthy eating. Most venues displayed high calorie impulse items such as cookies and ice cream at the registers. Seven percent (7%) of the 384 entrees served were classified as healthy according to NEMS criteria. Conclusions: Most children's hospitals' food venues received a mid-range score, demonstrating there is considerable room for improvement. Many inexpensive options are underused, such as providing nutritional information, incorporating signage that promotes healthy choices, and not presenting unhealthy impulse items at the register.


PURPOSE: To assess whether adolescents purchasing food at a restaurant marketed as "healthy" (Subway) purchase fewer calories than at a competing chain (McDonald's). METHODS: We studied 97 adolescents who purchased a meal at both restaurants on different days, using each participant as his or her control. We compared the difference in calories purchased by adolescents at McDonald's and Subway in a diverse area of Los Angeles, CA. RESULTS: Adolescents purchased an average of 1,038 calories (standard error of the mean [SEM]: 41) at McDonald's and 955 calories (SEM 39) at Subway. The difference of 83 calories (95% confidence interval [CI]: -20 to 186) was not statistically significant (p = .11). At McDonald's, participants purchased significantly more calories from drinks (151 vs. 61, p < .01) and from side dishes (i.e., French fries or potato chips; 201 at McDonald's vs. 35 at Subway, p < .01). In contrast, they purchased fewer cups of vegetables at McDonald's (.15 vs. .57 cups, p < .01). CONCLUSIONS: We found that, despite being marketed as "healthy," adolescents purchasing a meal at Subway order just as many calories as at McDonald's. Although Subway meals had more vegetables, meals from both restaurants are likely to contribute to overeating.


Purpose: To adapt and validate a survey instrument to assess the nutrition environment of grab-and-go establishments at a university campus. Methods: A version of the Nutrition Environment Measures Survey for grab-and-go establishments (NEMS-GG) was adapted from existing NEMS instruments and tested for reliability and validity through a cross-sectional assessment of the grab-and-go establishments at the University of Toronto. Product availability, price, and presence of nutrition information were evaluated. Cohen’s kappa coefficient and intra-class correlation coefficients (ICC) were assessed for inter-rater reliability, and construct validity was assessed using the known-groups comparison method (via store scores). Results: Fifteen grab-and-go establishments were assessed. Inter-rater reliability was high with an almost perfect agreement for availability (mean κ = 0.995) and store scores (ICC = 0.999). The tool demonstrated good face and construct validity. About half of the venues carried fruit and vegetables (46.7% and 53.3%, respectively). Regular and healthier entrée items were generally the same price. Healthier grains were cheaper than regular options. Six establishments displayed nutrition information. Establishments operated by the university’s Food Services consistently scored the highest across all
food premise types for nutrition signage, availability, and cost of healthier options. **Conclusions:** Health promotion strategies are needed to address availability and variety of healthier grab-and-go options in university settings.


  **Objective:** To validate an adapted instrument that assesses the nutritional environment of food stores in Brazilian urban areas. **Methods:** The instrument measured aspects of food environment such as availability, prices and quality. The Harvard Healthy Eating Pyramid and the degree of processing were used to define healthy foods. The sample included 44 food stores in 3 census tracks in the city of Santos. Inter-rater reliability and stability coefficient were obtained with measurements performed by different individuals at different times. Internal consistency and construct validity were assessed by Cronbach a and the known-groups comparison method, respectively. **Results:** Inter-rater reliability was high. The mean intra-class correlation coefficient was 0.98 and the mean kappa was 0.77. Cronbach a values ranged from .68 to .93. **Conclusions and Implications:** The instrument can be useful in the development of interventions to promote healthy eating through actions focused on healthy food availability in Brazilian communities.


  A major challenge in studies of the impact of the local food environment is the accuracy of measures of healthy food access. The authors assessed agreement between self-reported and directly measured availability of healthful choices within neighborhood food stores and examined the validity of reported availability using directly measured availability as a “gold standard.” Reported availability was measured via a phone survey of 1,170 adults in Baltimore, Maryland, in 2004. Directly measured availability was assessed in 226 food stores in 2006 using a modified Nutrition Environment Measures Survey in Stores (NEMS-S). Whites, college-educated individuals, and higher income households (_$50,000) had significantly higher reported and directly measured availability than did blacks, those with less education, and lower income households. Persons in areas with above average directly measured availability reported above average availability 70%–80% of the time (sensitivity ¼ 79.6% for all stores within 1 mile (1.6 km) of participants’ homes and 69.6% for the store with the highest availability within 1 mile). Those with below average directly measured availability reported low availability only half the time. With revisions to improve specificity, self-reported measures can be reasonable indicators of healthy food availability and provide feasible proxy measures of directly assessed availability.


  **Abstract:** In light of the childhood obesity epidemic, many cities are adopting healthy park vending policies but the evidence on the effectiveness of these policies is scant. This study examines how implementation of a healthy vending policy in Carson, California, changes the types
of beverages that are available in park vending machines. The study design is a pre-posttest with post-only comparison group. The main outcome is proportion of beverages in vending machines that is consistent with caloric and sugar content guidelines for children as defined by the Nutrition Environment Measures-Vending (NEMS-V) tool. This study finds that prior to implementation of the vending policy, 70% of the beverages did not meet NEMS-V guidelines, on average. After implementation of the vending policy, this number declined to 7%. This study suggests that healthy vending policies can have an impact on the types of beverages that are available in city parks.

  
  Open access: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3490726/pdf/1471-2458-12-376.pdf

**Background:** Recreational facilities are an important community resource for health promotion because they provide access to affordable physical activities. However, despite their health mandate, many have unhealthy food environments that may paradoxically increase the risk of childhood obesity. The Alberta Nutrition Guidelines for Children and Youth (ANGCY) are government-initiated, voluntary guidelines intended to facilitate children’s access to healthy food and beverage choices in schools, childcare and recreational facilities, however few recreational facilities are using them. **Methods:** We used mixed methods within an exploratory multiple case study to examine factors that influenced adoption and implementation of the ANGCY and the nature of the food environment within three cases: an adopter, a semi-adopter and a non-adopter of the ANGCY. Diffusion of Innovations theory provided the theoretical platform for the study. Qualitative data were generated through interviews, observations, and document reviews, and were analysed using directed content analysis. Set theoretic logic was used to identify factors that differentiated adopters from the non-adopter. Quantitative sales data were also collected, and the quality of the food environment was scored using four complementary tools. **Results:** The keys to adoption and implementation of nutrition guidelines in recreational facilities related to the managers’ nutrition-related knowledge, beliefs and perceptions, as these shaped his decisions and actions. The manager, however, could not accomplish adoption and implementation alone. Intersectoral linkages with schools and formal, health promoting partnerships with industry were also important for adoption and implementation to occur. The food environment in facilities that had adopted the ANGCY did not appear to be superior to the food environment in facilities that had not adopted the ANGCY. **Conclusions:** ANGCY uptake may continue to falter under the current voluntary approach, as the environmental supports for voluntary action are poor. Where ANGCY uptake does occur, changes to the food environment may be relatively minor. Stronger government measures may be needed to require recreational facilities to improve their food environments and to limit availability of unhealthy foods.


**Purpose:** In this mixed-methods case study, we explored factors influencing the adoption and implementation of the Alberta Nutrition Guidelines for Children and Youth within recreational

NEMS Related Publications and Abstracts, Updated 7/12/2016  pg.21
facilities, and assessed the impact of their implementation on the food environment. **Methods:** Qualitative data were generated via interviews, observations, and document reviews. The quality of the food environment was assessed using validated and newly developed food environment assessment tools. **Results:** Whereas few barriers existed in terms of adopting the guidelines, implementing them proved much more challenging. Implementation was impeded by concerns about the lack of profitability of healthy items, time, and resource constraints. Guidelines that do not restrict the availability of unhealthy options are better accepted by stakeholders. Implementation of the guidelines supported creation of a healthy food environment, but the availability of healthy items remained very limited within the concession (16%) and vending machines (20%), and children continued to purchase primarily unhealthy items. **Conclusions:** Findings suggest that children choose healthy options insufficiently when unhealthy items are present. Thus, although introducing the nutrition guidelines in a nonrestrictive format may have been advantageous in some ways, they should be strengthened over time so that they recommend near or total elimination of unhealthy options.


**BACKGROUND:** On August 9, 2010, Santa Clara County CA became the first U.S. jurisdiction to implement an ordinance that prohibits the distribution of toys and other incentives to children in conjunction with meals, foods, or beverages that do not meet minimal nutritional criteria. Restaurants had many different options for complying with this ordinance, such as introducing more healthful menu options, reformulating current menu items, or changing marketing or toy distribution practices. **PURPOSE:** To assess how ordinance-affected restaurants changed their child menus, marketing, and toy distribution practices relative to non-affected restaurants. **METHODS:** Children's menu items and child-directed marketing and toy distribution practices were examined before and at two time points after ordinance implementation (from July through November 2010) at ordinance-affected fast-food restaurants compared with demographically matched unaffected same-chain restaurants using the Children's Menu Assessment tool. **RESULTS:** Affected restaurants showed a 2.8- to 3.4-fold improvement in Children's Menu Assessment scores from pre- to post-ordinance with minimal changes at unaffected restaurants. Response to the ordinance varied by restaurant. Improvements were seen in on-site nutritional guidance; promotion of healthy meals, beverages, and side items; and toy marketing and distribution activities. **CONCLUSIONS:** The ordinance appears to have positively influenced marketing of healthful menu items and toys as well as toy distribution practices at ordinance-affected restaurants, but did not affect the number of healthful food items offered.


**Introduction:** The community food environment may contribute to obesity by influencing food
choice. Store and restaurant audits are increasingly common methods for assessing food environments, but are time consuming and costly. A valid, reliable brief measurement tool is needed. The purpose of this study was to develop and validate reduced-item food environment audit tools for stores and restaurants. **Methods:** Nutrition Environment Measures Surveys for stores (NEMS-S) and restaurants (NEMS-R) were completed in 820 stores and 1,795 restaurants in West Virginia, San Diego, and Seattle. Data mining techniques (correlation-based feature selection and linear regression) were used to identify survey items highly correlated to total survey scores and produce reduced-item audit tools that were subsequently validated against full NEMS surveys. Regression coefficients were used as weights that were applied to reduced-item tool items to generate comparable scores to full NEMS surveys. Data were collected and analyzed in 2008–2013. **Results:** The reduced-item tools included eight items for grocery, ten for convenience, seven for variety, and five for other stores; and 16 items for sit-down, 14 for fast casual, 19 for fast food, and 13 for specialty restaurants—10% of the full NEMS-S and 25% of the full NEMS-R. There were no significant differences in median scores for varying types of retail food outlets when compared to the full survey scores. Median in-store audit time was reduced 25%–50%. **Conclusions:** Reduced-item audit tools can reduce the burden and complexity of large-scale or repeated assessments of the retail food environment without compromising measurement quality.


Open access: http://www.biomedcentral.com/1471-2458/14/593

**Background:** Collecting data can be cumbersome and expensive. Lack of relevant, accurate and timely data for research to inform policy may negatively impact public health. The aim of this study was to test if the careful removal of items from two community nutrition surveys guided by a data mining technique called feature selection, can (a) identify a reduced dataset, while (b) not damaging the signal inside that data. **Methods:** The Nutrition Environment Measures Surveys for stores (NEMS-S) and restaurants (NEMS-R) were completed on 885 retail food outlets in two counties in West Virginia between May and November of 2011. A reduced dataset was identified for each outlet type using feature selection. Coefficients from linear regression modeling were used to weight items in the reduced datasets. Weighted item values were summed with the error term to compute reduced item survey scores. Scores produced by the full survey were compared to the reduced item scores using a Wilcoxon rank-sum test. **Results:** Feature selection identified 9 store and 16 restaurant survey items as significant predictors of the score produced from the full survey. The linear regression models built from the reduced feature sets had R2 values of 92% and 94% for restaurant and grocery store data, respectively. **Conclusions:** While there are many potentially important variables in any domain, the most useful set may only be a small subset. The use of feature selection in the initial phase of data collection to identify the most influential variables may be a useful tool to greatly reduce the amount of data needed thereby reducing cost.


Open access: http://www.cdc.gov/pcd/issues/2014/13_0291.htm

**Abstract:** Improving the food environment has the potential to be one effective primary prevention strategy to address rising rates of obesity, diabetes and heart disease. The study used the Nutrition
Environment Measures Survey for Restaurants (NEMS-R) and Stores (NEMS-S) to assess 34 restaurants, three grocery stores and five convenience stores in New Ulm. Findings were used to identify food environment interventions strategies to be implemented as part of a larger community-based heart disease prevention program.

This study is unique because while much research in the food environment focuses on access to types of consumer facilities (stores/restaurants/convenience stores) and associations of access with nutrition status, this assessment actually examined the availability of healthier food options. This level of detail combined with interviews with store/restaurant owners and managers helped identify some opportunities for interventions to increase healthful choices and promote those choices to consumers.


**Objective:** To develop a reliable food store observational data collection instrument to be used for measuring product availability, pricing, and promotion. 

**Design:** Observational data collection.

**Setting:** A total of 120 food stores (26 supermarkets, 34 grocery stores, 54 gas/convenience stores, and 6 mass merchandise stores) in the Chicago metropolitan statistical area. 

**Main Outcome Measures:** Inter-rater reliability for product availability, pricing, and promotion measures on a food store observational data collection instrument. 

**Analysis:** Cohen's kappa coefficient and proportion of overall agreement for dichotomous variables and intra-class correlation coefficient for continuous variables. 

**Results:** Inter-rater reliability, as measured by average kappa coefficient, was 0.84 for food and beverage product availability measures, 0.80 for interior store characteristics, and 0.70 for exterior store characteristics. For continuous measures, average intra-class correlation coefficient was 0.82 for product pricing measures; 0.90 for counts of fresh, frozen, and canned fruit and vegetable options; and 0.85 for counts of advertisements on the store exterior and property. 

**Conclusions and Implications:** The vast majority of measures demonstrated substantial or almost perfect agreement. Although some items may require revision, results suggest that the instrument may be used to reliably measure the food store environment.


This study examined food availability along children's paths to and from elementary school, and associations with change in body mass index (BMI) and waist circumference over 1 year. Secondary data from 319 children aged 8-13 years from the "Multiple Opportunities to Reach Excellence" Project was used. Child anthropometry and demographic variables were obtained at baseline (2007) and 1 year follow-up. Food outlet locations (n = 1,410) were obtained from the Baltimore City Health Department and validated by ground-truthing. Secondary data on healthy food availability within select food stores in Baltimore City in 2007 were obtained via a validated food environment assessment measure, the Nutrition Environments Measures Study. Multilevel models were used to examine associations between availability of healthy food and number of various food outlets along paths to school and child anthropometric change over 1 year. Controlling for individual-, neighborhood-, and school-level characteristics, results indicated that higher healthy food availability within a 100 m buffer of paths to school was associated with 0.15 kg/m(2) lower BMI gain (p = 0.015) and 0.47 cm smaller waist circumference gain (p = 0.037) over 1 year. Although prior research has illuminated the importance of healthy food choices within
school and home environments, the current study suggests that exposure to the food environment along paths to school should be further explored in relation to child health outcomes.


**Background:** Recent attempts to improve the healthfulness of away-from-home eating include regulations requiring restaurants to post nutrition information. The impact of such regulations on restaurant environments is unknown. **Purpose:** To examine changes in restaurant environments from before to after nutrition-labeling regulation in a newly regulated county versus a nonregulated county. **Methods:** Using the Nutrition Environment Measures Survey–Restaurant version audit, environments within the same quick-service chain restaurants were evaluated in King County (regulated) before and 6 and 18 months after regulation enforcement and in Multnomah County (nonregulated) restaurants over a 6-month period. Data were collected in 2008–2010 and analyses conducted in 2011. **Results:** Overall availability of healthy options and facilitation of healthy eating did not increase differentially in King County versus Multnomah County restaurants aside from the substantial increase in onsite nutrition information posting in King County restaurants required by the new regulation. Barriers to healthful eating decreased in King County relative to Multnomah County restaurants, particularly in food-oriented establishments. King County restaurants demonstrated modest increases in signage that promotes healthy eating, although the frequency of such promotion remained low, and the availability of reduced portions decreased in these restaurants. The healthfulness of children’s menus improved modestly over time, but not differentially by county. **Conclusions:** A restaurant nutrition-labeling regulation was accompanied by some, but not uniform, improvements in other aspects of restaurant environments in the regulated compared to the nonregulated county. Additional opportunities exist for improving the healthfulness of away-from-home eating beyond menu labeling.


**Background:** Americans are increasingly eating out, but nutrition environments in restaurants are poorly understood. An observational measure was developed to assess factors believed to contribute to food choices in restaurants, including availability of more healthy foods, facilitators and barriers to healthful eating, pricing, and signage/promotion of healthy and unhealthy foods. **Methods:** Inter-rater and test–retest reliability were assessed in 217 sit-down and fast-food restaurants in four neighborhoods in 2004 and 2005. **Results:** Inter-rater reliability was generally high, with most kappa values greater than 0.80 (range 0.27–0.97) and all percent-agreement values greater than 75% (77.6–99.5). Test–retest reliability was high, with most kappa values greater than 0.80 (0.46–1.0) and all percent agreement values greater than 80% (80.4–100). There were several differences (p_0.05) between nutrition environment variables in sit-down versus fast-food restaurants, although neither restaurant type was consistently more healthful. Fast-food restaurants had greater healthy entrée and main-dish salad availability, but sit-down restaurants had a higher proportion of healthy main-dish salads and more healthy food and beverage items. Fast-food restaurants more often encouraged large portions, unhealthful eating, and overeating, and offered relative cost savings for combination meals, but were also more likely to provide nutrition information and highlight healthy options. **Conclusions:** Testing hypotheses about food environment influences on obesity and eating patterns requires psychometrically sound
measurement of nutrition environments. This Nutrition Environment Measures Study restaurant assessment (NEMS-R) has evidence of reliability, and can discriminate restaurant types. The NEMS-R can be used in research and practice to characterize restaurant environments.


**Abstract:** The number of farmers’ markets in the United States is growing. Although there are tools to analyze food availability at grocery stores, corner stores, and convenience stores, little research exists about the availability of food types at farmers’ markets. This research developed an audit tool to measure the food environment at farmers’ markets in rural and urban food environments and examined its psychometric properties, including face validity, interrater reliability, and discriminant validity. The Farmers’ Market Audit Tool was reviewed by content experts, revised, and then tested in six farmers’ markets by researchers across three states in 2013, including Kentucky, North Carolina, and Montana. Seven food categories were developed, including vegetables, fruits, meats, cheeses, eggs, grains, and samples. Interrater reliability was high within farmers’ market across states. As expected, discriminant validity indicated a systematic disagreement within and between states due to seasonality and ability to grow different types of food across different farmers’ markets. The total scores assessing the healthfulness of each farmers’ market was 38 (range = 28-50). Using the Farmers’ Market Audit Tool at farmers’ markets is a reliable and valid method to capture the availability of food offerings.


This study describes a rural food environment, identifying positive and negative determinants of diet. Eleven food stores in a rural Florida community were mapped using Geographic Information Systems (GIS) and surveyed for price, availability, and quality of food items using the Nutrition Environment Measurement Survey-stores (NEMS-S). Findings reveal that convenience stores comprise 72% of food stores in this rural town. Availability, the presence or absence of specified healthy items, differs by store type with supermarkets selling a variety of fresh produce and other healthy items. Convenience stores demonstrate poor availability of many healthful options including low-fat milk, low-fat baked goods and lean meats. Regarding price, baked chips, the healthier version item, are more expensive compared to regular chips and healthy baked goods cost less than regular baked goods. Beverages and cereals are more expensive at convenience stores. Supermarkets have high quality produce and convenience stores provide quality produce when it is available. Convenience stores make up a large percentage of the available food sources in this small rural town and mediocre to poor composite scores (price + availability + quality = composite) for each store indicate that all stores that make up this rural food environment have room for improvement.

Researchers determined a need to develop an instrument to assess the vending machine environment that was comparably reliable and valid to other Nutrition Environment Measures Survey tools and that would provide consistent and comparable data for businesses, schools, and communities. Tool development, reliability testing, and dissemination of the Nutrition Environment Measures Survey–Vending (NEMS-V) involved a collaboration of students, professionals, and community leaders. Inter rater reliability testing showed high levels of agreement among trained raters on the products and evaluations of products. NEMS-V can benefit public health partners implementing policy and environmental change initiatives as a part of their community wellness activities. The vending machine project will support a policy calling for state facilities to provide a minimum of 30% of foods and beverages in vending machines as healthy options, based on NEMS-V criteria, which will be used as a model for other businesses.


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**Introduction:** Hospitals are the primary worksite of over 5 million adults in the United States, and millions of meals are procured and consumed in this setting. Because many worksite nutrition initiatives use an ecological framework to improve the dietary habits of employees, the nutrition values of foods served in hospitals is receiving attention. **Methods:** This study used the Hospital Nutrition Environment Scan for Cafeterias, Vending Machines, and Gift Shops to quantitatively describe the consumer nutrition environments of 39 hospitals in Southern California. Data were collected by visiting each facility once from February 2012 through May 2012. **Results:** On average, hospitals achieved only 29%, 33%, and less than 1% of the total possible points for their cafeteria, vending machines, and gift shops sections, respectively; overall, hospitals scored 25% of the total possible points. Large facility size and contracted food service operations were associated with some healthy practices in hospital cafeterias, but we found no association between these variables and the sectional or overall nutrition composite scores. **Conclusion:** The average consumer nutrition environment of hospitals in this sample was minimally conducive to healthful eating. Nutrition-related interventions are warranted in hospital settings.

According to ecological models, the physical environment plays a major role in determining individual health behaviors. As such, researchers have started targeting the consumer nutrition environment of large-scale foodservice operations when implementing obesity-prevention programs. In 2010, the American Hospital Association released a call-to-action encouraging health care facilities to join in this movement and improve their facilities’ consumer nutrition environments. The Hospital Nutrition Environment Scan (HNES) for Cafeterias, Vending Machines, and Gift Shops was developed in 2011, and the present study evaluated the inter-rater reliability of this instrument. Two trained raters visited 39 hospitals in southern California and completed the HNES. Percent agreement, kappa statistics, and intraclass correlation coefficients were calculated. Percent agreement between raters ranged from 74.4% to 100% and kappa statistics ranged from 0.458 to 1.0. The intraclass correlation coefficient for the overall nutrition composite scores was 0.961. Given these results, the HNES demonstrated acceptable reliability metrics and can now be disseminated to assess the current state of hospital consumer nutrition environments.


Public markets serve many consumers and play a role in the food environment, yet few studies have assessed the foods commonly offered in them. This study examined prepared food sources (PFSs; n = 100) at Baltimore’s public markets by direct observations and gauged intention to sell healthy items through lease agreement review. A healthy food availability (HFA) score was created for standardized comparisons and 41% of PFSs scored below 1, indicating few healthier options. The findings suggest that urban public market PFSs currently offer few but showed intention to sell healthy items. Programs aimed to increase healthy food availability should include public markets.