Inter-Rater Reliability of the Food Environment Audit for Diverse Neighborhoods (FEAD-N)

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ABSTRACT *Studies have shown that neighborhood food environments are important influences on dietary intake and may contribute to health disparities. While instruments with high reliability have been developed to assess food availability, price, and quality, few measures to assess items associated with the physical and social features of food stores have been developed. Yet, recent qualitative studies have documented aspects associated with such features of urban food stores that are barriers to food acquisition. We assessed the reliability of measures to assess multiple components of the food environment—including physical and social store features—in three geographically distinct and diverse communities in Detroit, Michigan, using the Food Environment Audit for Diverse Neighborhoods (FEAD-N). Using the FEAD-N, four trained observers conducted observations of 167 food stores over a 10-week period between October and December 2008. To assess inter-rater reliability, two trained observers independently visited, on the same day, a random subset of 44 food stores. Kappa statistics and percent agreement were used to evaluate inter-rater reliability. Overall, the instrument had mostly high inter-rater reliability with more than 75% of items with kappa scores between 0.80 and 1.00, indicating almost perfect reliability. More than half of the physical store features and 47% of the social store features had almost perfect reliability and about 37% and 47%, respectively, had substantial reliability. Measuring factors associated with the physical and social environment of food stores with mostly high reliability is feasible. Systematic documentation of the physical and social features of food stores using objective measures may promote a more comprehensive understanding of how neighborhood food environments influence health.*

KEYWORDS *Inter-rater reliability, Food environment, Physical store features, Social store features, Community-based participatory research*

INTRODUCTION

A growing body of evidence suggests that neighborhood food environments are important influences on dietary intake and may contribute to racial/ethnic and

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socioeconomic disparities in health.^{1–12} In general, this research has found that residents of low-income and racial/ethnic minority urban neighborhoods are among those most affected by poor access to supermarkets and healthy foods.^{5,8–18} Inadequate neighborhood access to healthy foods has been associated with poor dietary quality and increased risk for obesity.^{2,3,5,11,19,20}

To date, most quantitative research has characterized food environments by the type, density, and proximity of food stores in a given locale or the availability, price, and quality of products for sale. Recent qualitative studies, however, have documented multiple physical and social features of urban food stores that are barriers to food acquisition.^{4,21–23} For example, poor customer service and inappropriate employee behavior (e.g., swearing, joking, flirting, monitoring) have been identified as social factors that are stressful to consumers and create an undesirable shopping environment.^{4,21,22,24–26} These stressful social interactions may be associated with cross-cultural and language differences, for example, between immigrant (e.g., Middle Eastern, Korean), White, or African American store owners and customers.^{21,22,25–27} Tensions in merchant–customer interactions have also been attributed to racism.^{4,22} Social factors such as poverty and crime are relevant to food acquisition because they can lead to safety concerns—stemming from panhandling, loitering, drug solicitation, and harassment of shoppers—that deter shoppers.^{4,21,23} In some urban areas, security guards and security features such as mirrors and bullet proof glass at check-out are commonplace in food stores. These security features make some customers feel safer while shopping, but are signs of safety problems for others. Physical factors that may serve as barriers to food acquisition include lack of cleanliness inside and outside of the store²¹ and marketing of alcohol and tobacco products.^{1,28}

Just as the store environment can create real or perceived barriers to obtaining food, it can also enable food acquisition and promote healthy food purchases. For example, point-of-purchase nutrition information and nutrition-education brochures and posters have been used to communicate information to guide healthier food selections in supermarkets.^{29–32} In low-income settings, store acceptance of government food assistance program benefits of Women, Infants, and Children Supplemental Nutrition Assistance Program (WIC) and Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program, may determine where individuals shop and what foods they choose to purchase.²⁵

Instruments with high reliability, such as NEMS-S (Nutrition Environments Measures Survey in Stores),³³ have been developed to assess food availability, price, and quality. However, few instruments include measures to assess physical and social features of food stores. Reliable and valid measures to assess physical and social features of food stores that are grounded in residents' experiences are needed to promote a more comprehensive understanding of environmental influences on food acquisition. Thus, the purpose of this study was to assess the reliability of the Food Environment Audit for Diverse Neighborhoods (FEAD-N),³⁴ an instrument designed to assess multiple components of the food environment—including store physical and social features and availability of culturally specific foods—in diverse neighborhoods.³⁵ This study was conducted by the Healthy Environments Partnership (see “Acknowledgements” for a list of partner organizations), a community-based participatory research partnership established in 2000 to examine and develop interventions to reduce cardiovascular inequities in Detroit and is part of a larger study, the Lean and Green in Motown Project.³⁶

METHODS

Setting

This study was conducted in three geographically distinct and diverse communities—eastside, northwest, and southwest—in Detroit, MI. The eastside is comprised of 19 US Census tracts. In 2000,³⁷ about 75% of the housing stock in this area was built prior to 1950. The median household income was \$20,811, and 15% of the residents were aged 65 or older. African Americans represented 97% of the population, and Whites represented 2% of the population. Between 1990 and 2000, the population of the eastside declined by 31%. Northwest Detroit is comprised of 10 US Census tracts. In 2000,³⁷ 41% of the housing stock in this area was built prior to 1950. The median household income was \$33,628, and 6% of the residents were aged 65 or older. African Americans represented 77% of the population, and Whites represented 19% of the population. Between 1990 and 2000, the population in this area declined by 27%. Southwest Detroit is comprised of 12 US Census tracts. In 2000,³⁷ 75% of the housing stock in this area was built prior to 1950. The median household income was \$24,956, and 8% of residents were aged 65 or older. Racially and ethnically, Hispanics comprise 60% of the population in this area; non-Hispanic Whites represent 21%, and non-Hispanic African Americans represent 16%. Between 1990 and 2000, the overall population in the southwest area declined by 16%.

Food Store Audit Instrument

The Food Environment Audit for Diverse Neighborhoods (FEAD-N) was adapted from several existing instruments^{8,15,33,38–40} and was designed to not only assess food availability and prices but also store physical and social features that may serve as potential barriers or facilitators to food acquisition and healthy food purchases.³⁵ Instrument items fell into eight categories including fruits (fresh, frozen, canned, juice), vegetables (fresh, frozen, canned, juice), meats (fresh, processed), beans (canned, dried), grains, dairy, fats and added sugars, and store features (physical, social) (see Table 1). The list of foods included more and less healthy items (e.g., skim milk and whole milk) commonly consumed in the USA. The FEAD-N also included culturally specific foods for African American (e.g., collard greens, okra) and Latino (e.g., tomatillo, mango) communities.^{41–46} For each food item ($n=130$ fresh fruits and vegetables and $n=83$ other food products), *availability* was assessed by documenting whether an item was present in the store. (While *price* was assessed for a subset of foods, including 12 fresh fruits and vegetables and 69 other food products, we have not included inter-rater reliability results because an insufficient number of stores carried most of these products.)

The FEAD-N also included measures to assess *store physical and social features* ($n=54$ items) that may hinder (e.g., candy or gum at check-out) or promote (e.g., health promotion signs) healthy food purchases. Store physical and social features were identified based on prior studies, existing instruments,^{38,40} informal observations and conversations at stores, formal interviews with community residents, and focus groups that took place over more than a decade of working together.^{21,38,47–51} For example, informal observations at stores revealed that shopping cart guard rails presented a barrier to food acquisition for individuals who use shopping carts to carry their groceries to their cars or homes. Therefore, shopping cart guard rails was included in the instrument as a store feature that may hinder healthy food purchases. For each store feature, observers

TABLE 1 Items from the Food Environment Audit for Diverse Neighborhoods (FEAD-N)³⁵

Category	Subcategory	# Items	Examples of items
Fruits	Fresh	44 ^a	Apples, banana, cherimoya, cherries, grapefruit, grapes, kiwi, mango, watermelon, oranges, strawberries
	Frozen	6 ^b	Blueberries, mangos, peaches, mixed berries, raspberries, strawberries
	Canned	6 ^b	Apricots, mangos, oranges, peaches, pear, pineapple
	Juice	1 ^b	100% orange juice (fresh)
Vegetables	Fresh	86 ^a	Avocado, green bell pepper, broccoli, carrot, chard, collard greens, green cabbage, tomatillo, tomato
	Frozen	7 ^b	Broccoli, carrots, collard greens, corn, green beans, spinach, sweet peas
	Canned	6 ^b	Carrots, corn, green beans, sweet peas, spinach, tomatoes
	Juice	1 ^b	100% tomato or V-8 juice
Meat	Fresh	7 ^b	Boneless skinless chicken breast, split chicken breast with skin, extra lean ground beef, regular ground beef, extra lean ground turkey, lean ground turkey, ground turkey
	Processed	4	Regular hot dogs, low-fat hot dogs, regular lunch meats, turkey or low-fat lunch meats
Beans	Canned	6 ^b	Black beans, black-eyed peas, garbanzo beans, red or white kidney beans, pinto beans, red beans
	Dried	6 ^b	Black beans, black-eyed peas, garbanzo beans, red or white kidney beans, pinto beans, red beans
Grains	—	14 ^c	100% whole wheat bread, white bread, high fiber bread, brown rice, white rice, 100% whole wheat pasta, white pasta, whole-wheat or whole-grain “blend” pasta, 100% whole wheat tortilla, corn tortilla, flour tortilla, high fiber cereal, sweetened cereal, other cold cereal
Dairy	—	9 ^d	Skim milk, 1% milk, whole milk, low-fat yogurt, regular yogurt, low-fat cheese, regular cheese, low-fat soy milk or Lactaid, regular soy milk or Lactaid
Fats and added sugars	—	10	Diet soda; regular soda; low-fat salad dressing; regular salad dressing; low-fat snack chips or pretzels; regular snack chips; low-fat breakfast bars, cereal bars or granola bars; regular breakfast bars, cereal bars or granola bars; low-fat cookies; regular cookies
Store features	Physical	34	Infrastructure (store type, parking lot available, number of operational cash registers, store signs in languages other than English); services (bakery, butcher, deli section, pharmacist, gas station, sign for jitney); products (primary product for sale,

TABLE 1 (continued)

Category	Subcategory	# Items	Examples of items
			fresh produce section, fresh meat or poultry section, alcohol available, carry-out food/fast food, most food pre-packaged or ready-to-eat/heat items); marketing (5-A-Day, nutritional information, Food Guide Pyramid, Fruits and Veggies–More Matters, ads for alcoholic beverages on storefront, ads for tobacco products on storefront, liquor largest sign on storefront, candy or gum at check-out); government assistance program participation (WIC, Food Stamps/SNAP); disorder outside (broken glass, graffiti, visible trash/debris); disorder inside (foul odor, dirty floors, visible trash/debris, store cleanliness)
	Social	20	Security features (security guard, security camera, security bars on doors or windows, bullet-proof glass at check-out, enclosed check-out counter with turnstile, security mirror, elevated area/office for store management, shopping cart guard rails); disorder inside (people “hanging out” or loitering, panhandling); disorder outside (people “hanging out” or loitering, panhandling); behaviors of owner or employees (swearing/cursing, joking around/talking loudly, smoking); race/ethnicity of employees and owners (White, African American, Latino/Hispanic, Asian, Middle Eastern)

^aPrice assessed for a subset of six items
^bPrice assessed for all items
^cPrice assessed for a subset of 12 items
^dPrice assessed for a subset of seven items

were asked to indicate its presence on a checklist. (See Zenk and colleagues for a more detailed description of the development of the FEAD-N.)³⁵

Observer Training and Certification

Five Detroit residents completed 25 hours of training (classroom and field work) in the fall of 2008 to prepare them for conducting observations using the FEAD-N. The classroom component of the training included instructions on field procedures, review of operational definitions, information on safety while collecting data, and guidance for interactions with store owners and employees.

Several evidence-based strategies⁵² were used during training to promote high inter-rater reliability. First, the instrument included detailed instructions, color

photographs of each fresh fruit and vegetable, and operational definitions of more ambiguous items (e.g., store cleanliness).

Second, observers audited five practice stores as a group, in pairs, and individually. After each practice store, group debriefings were held to review results and to allow observers to ask questions about items and operational definitions. Group debriefings also were used as an opportunity to further refine the instrument; observers' experiences as residents and data collectors were incorporated into the final instrument. For example, one observer who lived and shopped in the predominantly Latino community of southwest Detroit commented that increasing the pre-specified size indicated on the instrument for corn tortillas would increase the likelihood of finding the correct item in the store and thus increase inter-rater reliability for availability and price of corn tortillas.

Third, to promote consistency in observers' responses, oral and written feedback was provided to observers based on inter-rater reliability results from the practice stores. Inter-rater reliability scores (percent agreement) for the group and for each individual observer compared to the "gold standard"—a postdoctoral research fellow who was also a registered dietitian working with HEP—were computed and shared with observers on an ongoing basis. The same research team member served as the gold standard throughout the training period. Inter-rater reliability results were discussed with observers during subsequent training sessions. For group results, items with low levels of observer agreement were highlighted, and feedback from observers was elicited to determine reasons for low inter-rater reliability. Observers were encouraged to use this feedback to improve their performance.

Fourth, observers were certified for the food store audit data collection based on their individual inter-rater reliability results. At the end of their training, observers were certified and hired if they achieved the certification criterion of 80% agreement as compared to the gold standard on each section of the food store audit instrument at a test store located outside of the study communities. Observers had the opportunity to attempt up to three test stores for certification. Following each certification attempt, individual feedback was provided on the observers' performance compared with the gold standard. Three residents met the certification requirement on their first attempt; one met the requirement on her second attempt, and one resident did not meet the certification requirement.

Overview of Data Collection

A list of stores that sold food in Detroit was obtained from the Michigan Department of Agriculture. The list included all grocery stores, convenience stores, liquor stores, specialty food stores, pharmacies, and dollar stores. Through a review of the list, we identified all stores with zip codes that intersected the study communities. Before going into the field, this subset of stores was mailed a letter describing the study and the voluntary nature of their participation. We used a ground-truthing procedure in which observers systematically drove along every street in the study communities to confirm that the stores included on the Michigan Department of Agriculture list had not permanently closed and to identify any additional stores that sold food in the communities of interest.

Upon arriving at a store, observers introduced themselves to the store manager/owner and obtained permission to conduct the audit. Due to the relatively sensitive nature of some items assessing store physical and social features (e.g., race/ethnicity of store employees and owners, security features, store cleanliness), observers were instructed to leave the last page of the instrument with these sensitive items in their

vehicle and take notes relevant to each item while in the store. Immediately after conducting the audit, observers completed these items in their vehicles. The average length of time to conduct the audit was 26.6 minutes with a range of 15 minutes for small stores (e.g., convenience store) to 60 minutes for large stores (e.g., grocery store).

Of the 174 stores on the original list from the Michigan Department of Agriculture across the three study communities, eight stores were out of business and two residential homes were misclassified as food stores. Six additional stores were identified through the ground-truthing procedure. Thus, a total of 170 stores were identified across the three study communities. Three of these stores refused to participate. In-store observations were completed at all 167 stores over a 10-week period between October and December 2008. Overall, the four observers each visited about 55 stores. To assess inter-rater reliability, two observers independently visited a random subset of 44 food stores on the same day (not necessarily at the same time). University of Michigan Institutional Review Board approved the Lean and Green in Motown Project on July 6, 2005.

Data Analysis

Kappa statistics and percent agreement are commonly used to evaluate inter-rater reliability. The kappa statistic provides a chance-corrected measurement of agreement between two observers and ranges from +1 (perfect agreement) to 0 (no agreement above that expected by chance) to -1 (agreement less than that expected by chance).⁵³ Landis and Koch (1977) provide the following guidelines for evaluating level of agreement in scores based on categorical data: 0.81–1.00, almost perfect; 0.61–0.80, substantial; 0.41–0.60, moderate; 0.21–0.40, fair; 0–0.20, slight; < 0, poor.⁵⁴ For items with low frequency of availability (e.g. broccolini, 100% whole wheat pasta), we used percent agreement as a more accurate reflection of reliability.⁵⁵ All data analysis was completed using SAS Windows 9.2 and %Magree macro.

RESULTS

Table 2 summarizes inter-rater reliability results for the instrument overall and by each of its eight categories of items; it shows the percentage of items falling within each guideline for level of agreement proposed by Landis and Koch (1977). Overall, more than 75% of the items had a kappa score between 0.81 and 1.00, indicating almost perfect reliability, and almost 21% had substantial reliability (0.61–0.80). About 2% of items had moderate reliability (0.41–0.60), and only one item, candy or gum at check-out, had fair reliability (0.21–0.40). No items in this instrument had a kappa score below 0.21.

Table 3 shows inter-rater reliability of items assessing the store physical and social features. More than half of the physical features and 47% of social features had almost perfect reliability (0.81–1.00). About 37 and 47% of physical features and social features, respectively, had substantial reliability (0.61–0.80). Three items—foul odor, most foods pre-packaged or ready-to-eat, and bullet proof or thick glass at check-out—had moderate reliability (0.41–0.60). One item, candy or gum at check-out, had fair reliability with a kappa of 0.28. Of the 54 items assessing the store environment, five occurred too infrequently to generate a kappa. We calculated percent agreement for these items with results ranging from 97.7 to 100%.

TABLE 2 Percentage of items by section with kappa scores within each guideline range for agreement proposed by Landis and Koch (1977)

	Slight or poor	Fair	Moderate	Substantial	Almost perfect
	< 0.20	0.21–0.40	0.41–0.60	0.61–0.80	0.81–1.00
Fruits					
Fresh	0	0	0	3.4	96.6
Frozen	0	0	0	20.0	80.0
Canned	0	0	0	16.6	83.4
Juice	0	0	0	100	0
Vegetables					
Fresh	0	0	3.6	12.5	83.9
Frozen	0	0	0	0	100
Canned	0	0	0	16.6	83.4
Juice	0	0	0	0	100
Meat					
Fresh	0	0	0	0	100
Processed	0	0	0	33	66.7
Beans					
Canned	0	0	0	0	100
Dried	0	0	0	0	100
Grains	0	0	0	30.8	69.2
Dairy	0	0	0	22.2	77.8
Fats and added sugars	0	0	0	60.0	40.0
Store features	0	0.02	0.08	42.2	46.6
Overall	0	0.5	2.9	20.4	76.2

DISCUSSION

This study provides insights into the reliability of FEAD-N, an instrument that includes a wide range of foods and store physical and social features. Other researchers have developed and assessed the reliability of measures to evaluate food availability, quality, and price.^{5,14,33,56} We obtained comparable inter-rater reliability results for observations of food availability using the instrument described in this study to those reported earlier. The unique contribution of this study is the addition of a wide range of measures to assess physical and social features of food stores that can hinder or promote food acquisition in low-income, racially/ethnically diverse urban neighborhoods.

Overall, 89% of items assessing the store environment had inter-rater reliability scores above 0.60, indicating substantial to almost perfect reliability. In general, inter-rater reliabilities for items assessing physical features were higher than those for the social features. One physical feature, candy or gum at check-out, had only fair reliability. Fair reliability for this item may have been caused by observers assessing different check-out counters, overlooking a display of candy or gum due to cluttered check-out counters, or ambiguity over the area that is considered the “check-out,” especially in smaller stores with diverse layouts at check-out. The presence of such point-of-purchase displays also can be difficult to assess without standing directly in front of the check-out counter which may be intrusive, especially when customers are waiting in line to make purchases.

TABLE 3 Inter-rater reliability of store features

Store features	Kappa	Percent agreement
Physical features		
Infrastructure		
Store type	0.76	
Parking lot available	0.88	
Number of operational cash registers	0.92	
Store signs in languages other than English (excluding store name)	0.92	
Services		
Bakery available	0.66	
Butcher available	1	
Deli section available	1	
Pharmacist available	1	
Gas station available	1	
Sign for jitney	a	100
Products		
Primary product for sale	0.70	
Fresh produce section available	0.92	
Fresh meat or poultry section available	1	
Alcohol, including beer and wine, available	1	
Carry-out food/fast food available	0.94	
Most foods pre-packaged or ready-to-eat/heat items	0.58	
Marketing		
5-A-Day (fruits and vegetables)	1	
Nutritional information	1	
Food Guide Pyramid	a	100
Healthy recipes	a	100
Fruits and Veggies—More Matters	a	97.7
Ads for alcoholic beverages on storefront	0.70	
Ads for tobacco products on storefront	0.76	
Liquor (including beer or wine) largest sign on storefront	0.80	
Candy or gum at check-out	0.28	
Government assistance programs		
WIC	0.74	
Food Stamps (SNAP)	0.84	
Disorder (outside)		
Broken glass	0.66	
Graffiti	0.76	
Visible trash/debris	0.82	
Disorder (inside)		
Foul odor	0.48	
Dirty floors	0.66	
Visible trash/debris	0.70	
Store cleanliness	0.74	
Social features		
Security features		
Security guard	1	
Security camera	0.76	
Security bars on doors or windows	0.68	
Bullet-proof or thick glass at check-out	0.44	
Enclosed check-out counter with turnstile	0.64	
Security mirror	0.60	
Elevated area/office for store management	0.66	

TABLE 3 (continued)

Store features	Kappa	Percent agreement
Shopping cart guard rails	0.64	
Disorder (inside)		
People “hanging out” or loitering	0.90	
Panhandling	1	
Disorder (outside)		
People “hanging out” or loitering	0.64	
Panhandling	0.88	
Behaviors of owner or employees		
Swearing/cursing	1	
Joking around/talking loudly	0.84	
Smoking	0.64	
Race/ethnicity of employees and owners		
White	0.88	
African American	0.88	
Latino/Hispanic	0.72	
Asian	^a	100
Middle Eastern	0.92	

^aItems which occurred too infrequently to generate a kappa

Some measures of social features were of a sensitive nature (e.g., employees swearing). Our data collection protocol instructed observers to complete the last page of the instrument with these sensitive items once they returned to their vehicles. Thus, differences in note-taking may account for, at least in part, the lower inter-rater reliability scores for items measuring store social features. Further, some of the items are subjective (e.g., loitering, employees’ race/ethnicity), which may also contribute to lower inter-rater reliability.

It is possible that more training, better operational definitions, or enhanced data collection protocols may increase the reliability of items assessing the store environment. Purchasing food (or other items) while conducting the audit may also increase the likelihood of accurately indicating the presence or absence of measures such as bullet-proof or thick glass at check-out and candy or gum at check-out. However, despite the somewhat lower inter-rater reliability scores for items assessing the store physical and social features than those found for food availability, the inter-rater reliabilities for these items were mostly high and demonstrate the feasibility of conducting observational assessments of the physical and social features of food stores. Moreover, the items emerged from conversations with urban residents and participant observations as well as qualitative literature^{21,57,58} on the food shopping experiences of residents living in low-income, ethnically/racially diverse urban neighborhoods. These lend support to the face and construct validity of our instrument.

As shown by previous studies, food acquisition is influenced not only by food availability, price, and quality—the foci of most extant studies on the food environment—but also the physical and social features of stores.^{4,21–26,38} Urban food stores may present a number of physical (e.g., lack of cleanliness inside and outside of the store) and social (e.g., poor customer service) barriers^{4,21–23} which deter food acquisition. The physical and social features of food stores also present opportunities to promote health as demonstrated by a recent study which showed that stocking and promoting healthy foods can lead to increased sales of these items.³² Thus, efforts to improve urban food

environments may need to address the physical and social features of stores in addition to food availability, price, and quality.

This study has limitations. First, while it evaluated multiple components of the food environment that are relevant to Detroit and to other low-income, racially/ethnically diverse urban areas, the FEAD-N may not be appropriate for all settings. While common measures are important for advancing science on neighborhood food environments, there is also a need for instruments that are relevant for the local context and population. Engaging residents in the process of identifying and defining relevant items (e.g., environmental features that make them feel more or less safe in a store) can help to assure that the instrument reflects the local context and residents' experiences of that context.³⁵ Second, our study involved a substantial investment in training observers. While this investment resulted in improvements in inter-rater reliability during the training period and in high data quality, this degree of training may not be feasible in all situations and may have implications for achieving high inter-rater reliabilities. Third, despite evidence from earlier ethnographic and qualitative studies that a range of social factors (e.g., poor customer service, inappropriate employee behavior, racial or intergroup tensions) may negatively influence shopping experiences, such factors are difficult to adequately capture using an observational check list such as that used in this study. For example, because studies have shown that racial or intergroup tensions negatively influence shopping experiences, particularly for African Americans,²² the instrument included an item to measure the race/ethnicity of store employees and owners. However, this item does not capture social exchanges between employees or owners and customers and therefore provides only a partial view of how store environments may influence food shopping experiences. Given the limits of how much data can be collected using an observational tool, using food audits in conjunction with other research methods (e.g., focus groups, participant observation, in-depth interviews) is recommended.³⁵

CONCLUSION

Despite these limitations, we believe that the FEAD-N makes several important contributions to our understanding of food environments. Although instruments with high reliability have been developed to assess food availability, price, and quality, few instruments include measures to assess factors associated with the physical and social features of food stores. Given the potential negative impacts that can result from real or perceived physical and social barriers to obtaining food,^{4,21} objective assessments of the physical and social features of food stores are needed to promote a more comprehensive understanding of how the neighborhood food environment influences health. Our study shows that reliably measuring these features is feasible. Using a community-based participatory research approach that engages neighborhood residents can ensure that instruments used to assess the neighborhood food environment have face and construct validity.^{25,26,59} Although food availability, quality, and price remain important influences on food acquisition, improving the physical and social features of food stores may be necessary in order to increase access to healthy foods in low-income, racially/ethnically diverse urban neighborhoods.

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