

Annotated Bibliography of Literature on Food Environments

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Reviews

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Anderson, A., Dewar, J., Marshall, D., Cummins, S., Taylor, M., Dawson, J. Sparks, L. (2007). The development of a healthy eating indicator shopping basket tool (HEISB) for use in food access studies—identification of key food items. *Public Health Nutrition*, 10(12), 1440-1447.

This literature review of UK designations of "healthy food" in Scotland helps create objective criteria of "healthy food." The healthy eating indicator shopping basket (HEISB) was created through the review of surveys done throughout the UK. HEISB is based on UK Food Standards Assessment nutrient content, cultural acceptance, use of foods in previous models, price, convenience, variety. Using this model effectively would

take much ethnographic field-work to account for cultural acceptance of foods. Also, it is limited to only a specific list of foods and can ignore other healthy foods. Possibly food groups would be easier to manage and be more encompassing. However, the creation of a salient food basket is important for food access studies in the US that have been relying on the US Thrifty Food Plan (TFP) which is based on more policy than reality ([See Block & Kouba 2006 for a modification of the TFP for cultural-appropriateness](#)).

Ball, K., & Crawford, D. (2006). Socio-economic factors in obesity: a case of slim chance in a fat world? *Asia Pacific Journal of Clinical Nutrition*, 15 (Suppl), 15-20.

This is a review of the literature (mostly European; they are Australian) concerning socio-economic status and obesity. While the studies may not be applicable to US cases, they provide some suggestions for future research such as understanding the complexity of a socio-cultural model, understanding why some low socio-economic status populations are resilient to obesity, and use multi-level statistical modeling to find what variables are influencing obesity in low socio-economic status populations.

Ball, K., Timperio, A., & Crawford, D. (2006a). Understanding environmental influences on nutrition and physical activity behaviors: where should we look and what should we count? *International Journal of Behavioral Nutrition and Physical Activity*, 3, 33-42.

Ball et al. reviewed studies of nutrition and environment. They asked what is environment and conclude that it is made up of multiple nested contexts (e.g. neighborhood inside city inside state, etc.; see [Wang et al. 2007](#) for a good definition of neighborhood in a food environment study)

Theoretical selection and conceptualization of data is lacking in many studies. Perception and objectivity must be taken into account. [See Perceptions section](#).

"The lack of explicit evidence-based theoretical models is arguably the major limitation of work in this field to date and perhaps the greatest challenge we face in advancing research"

Casagrande, S. S., Whitt-Glover, M. C., Lancaster, K. J., Odoms-Young, A. M., & Gary, T. L. (2009). Built environment and health behaviors among African-Americans: A systematic review. *American Journal of Preventive Medicine*, 36(2), 174-181.

This review of built environment focusing on African-Americans found only [Morland et al 2002a](#) and [Zenk et al 2005b](#) addressing retail density in African-American communities. It is suggested that cultural food patterns should be taken into account. (See [James 2004](#), [Kumanyika 2008](#), behavioral framework of [Booth et al 2001](#)).

Eisenhauer, E. (2001). In poor health: Supermarket redlining and urban nutrition. *GeoJournal*, 53(2), 125-133.

Eisenhauer provides an historical overview of supermarkets in the urban US. She comes from an environmental theoretical perspective and is arguing that the environment has been ignored as a health issue among policy makers because of racism. However, this article was written before many studies had been conducted on retail food access and her assumptions are based on mostly economic studies that were on a national level.

Jago, R., Baranowski, T., & Baranowski, J. C. (2007a). Fruit and vegetable availability: a micro environmental mediating variable? *Public Health Nutrition*, 10(07), 681-689.

This is a review of literature that studies fruit and vegetable (F&V) consumption as it relates to availability, mostly from a household level. The majority of studies have found that consumption is most greatly influenced by the amount of, and availability of vegetables in homes. This reflects the idea that food environments are nested ([See Ball et al. 2006a](#)) and distance to stores is only one aspect of availability.

Kumanyika, S. K., Obarzanek, E., Stettler, N., Bell, R., Field, A. E., Fortmann, S. P., et al. (2008). Population-based prevention of obesity: The need for comprehensive promotion of healthful eating, physical activity, and energy balance: A scientific statement from American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (Formerly the Expert Panel on Population and Prevention Science). *Circulation*, 118(4), 428-464.

This release from the American Heart Association calls for prevention of obesity through individual *and* population approaches that they call “universal prevention.” It is an extensive review of the literature concerned with obesity prevention in the last few years, including over 400 citations. They cite [Morland et al. 2002a](#) and [Zenk et al. 2005b](#) as examples of food retail access studies that have influenced the need for population prevention of obesity.

Their upstream/downstream analogy to prevention is helpful to understand the theory behind population prevention based in an ecological approach: One must not just help those drowning as they attempt to go downstream, but also find where people are “falling in” upstream.”

Larson, N. I., Story, M. T., & Nelson, M. C. (2009). Neighborhood environments: Disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine*, 36(1), 74-81.e10.

This is a comprehensive review of food access studies in the US from 1985 to 2008.

Rural ([Powell et al. 2007a](#); [Morton 2007](#)), low-income ([Chung & Meyers 1999](#), [Zenk et al. 2006a](#), [Baker et al. 2006](#), [Horowitz et al. 2004](#), [Moore & Diez-Roux 2006](#), [Jetter & Cassady 2006](#), [Morland et al. 2002a](#)), and minority groups ([Block & Kouba 2006](#), [Morland et al. 2002a](#), [Powell et al. 2007a](#), [Baker et al. 2006](#), [Horowitz et al. 2004](#), [Zenk et al. 2005a](#), [Moore & Diez Roux 2006](#), [Morland & Filomena 2007](#), [Hosler et al. 2006](#)) have been shown to have limited access to supermarkets, chain stores, and healthful food.

They conclude that the current research suggests that neighborhoods with access to supermarkets and limited access to convenience stores have less prevalence of obesity. ([Bodor et al 2007](#); [Morland et al. 2006](#); [Laraia et al. 2004](#); [Rose & Richards 2004](#), [Wang et al. 2006](#); [Powell et al 2007a](#); [Liu et al. 2007](#)) Restaurant findings show that cost barriers to fast-food consumption and better access to full-service restaurants have less obesity. ([Powell et al. 2007a](#))

The limitations found by the authors are most valuable. Some problems are the validity and reliability of measures (See [Lytle 2009](#) for a discussion of psychometric tests), neighborhood definitions, and the cross-sectional nature of most studies. Commercially available lists of stores are also seen as problematic and suggest more truth-grounded or walking surveys. Also, distance people travel outside the neighborhood is not usually measured. They call for more longitudinal ([See Li et al. 2009](#)), multi-level, and intervention studies.

This review is an excellent collection of sources with a useful appendix.

Macintyre, S. (2007). Deprivation amplification revisited; or, is it always true that poorer places have poorer access to resources for healthy diets and physical activity? *International Journal of Behavioral and Physical Activity*, 4(32). 1-7

Macintyre argues through research that has been done in the UK that food access should be cautiously approached. Theory should be more evidence-based and broad assumptions such as supermarkets provide better food environments should be avoided without empirical evidence.

She claims that "there does not seem to be any consistent pattern in whether or not resources are located to the disadvantage of households in poorer communities." However, she cites [Morland 2002a](#), [Zenk et al 2005a](#), and [Chung & Meyers 1999](#), where it is found that socio-economic status factors, most notably race, do reflect access to supermarkets and other outlets of healthy food. She does claim that there are differences between countries, but ignores the consistency of US studies. Her only example from the US that strengthens her argument is from 1991.

Papas, M., Alberg, A., Ewing, R., Helzlsouer, K., Gary, T., & Klassen, A. (2007). The built environment and obesity. *Epidemiology Review*, 29, 129-143.

This is a review of studies of built environment and obesity between 2001 & 2005. It was found that 17 of the 20 articles reviewed found statistically significant relationships between obesity and the built environment. The majority of studies have concentrated on physical activity and not food. Those that have studied food either use density or distance to stores and not both. Some newer studies have done this (e.g. [Ball & Crawford 2009](#); [Bodor et al. 2007](#)).

Pothukuchi, K. (2004). Community Food Assessment: A First Step in Planning for Community Food Security. *Journal of Planning Education and Research*, 23(4), 356-377.

This review of seven Community Food Assessments (CFA) helps to illuminate the relevance of spatial and density measurements of food access for local planning. Pothukuchi realistically sees local food sources as not taking over the existing conventional system, but influencing it. Studies of food access allow for local communities to find where communities can improve and provide an opportunity for academic, government, private, and non-profit trans-disciplinary discourse. This, Pothukuchi argues, is most easily accomplished with the help of urban planners that can bridge the gap between academic research and policy.

[This whole issue 23(4) of JPER is focused on Community Food Security]

White, M. (2007). Food access and obesity. *Obesity Reviews*, 8 Supplement 1, 99-107.

This is a review of the literature regarding food access with suggestions for future research focusing on “studies where both retail factors (e.g. access, availability and price) and diet are measured as applicable to individuals, preferably longitudinally, so that the direction of causation can be inferred, and preferably with an experimental component, so that change in diet can be observed, contingent on change in retail access.”

Geographical Measures of Food Environment Inequality in the US

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Algert, S., Agrawal, A., & Lewis, D. (2006). Disparities in access to fresh produce in low-income neighborhoods in Los Angeles. *American Journal of Preventive Medicine*, 30(5), 365-370.

Food stores were mapped in relation to food pantry clients living within "reasonable walking distance of store" ([0.8 km Based on Bolen & Hecht 2003](#)). Individual residences provided a finer scale than zip codes or census units and the network distance through street layers provided a realistic measure of distance.

The California Nutrition Network database was used to geocode stores by "variety of produce" or "limited produce"/ excluding liquor stores and gas station convenience; some on-site inspection, telephone interview, and inference was conducted, however, much of the categories are subjective, (e.g. stores with produce in the name carry produce?). As with other studies, measuring what is healthy and where it is actually sold is difficult.

It was found that clusters of food pantry clients do not have access to produce and part of this study is to decide where mobile trucks should be used to supply produce. Over half of those studied did not live within walking distance of stores with a variety of produce.

Austin, S. B., Melly, S. J., Sanchez, B. N., Patel, A., Buka, S., & Gortmaker, S. L. (2005). Clustering of fast-food restaurants around schools: A novel application of spatial statistics to the study of food environments. *American Journal of Public Health*, 95(9), 1575-1581.

Austin et al. collected lists of fast food restaurants in Chicago through the Technomic Top 100 which is a database that keeps track of the leading chains of fast food. They cross-referenced this information with fastfoodsource.com and other private websites. Distance models and clustering models were used with the geographic data found on fast food restaurant in relation to schools.

Utilizing a fixed population like schools and comparing them with a fixed location like fast food restaurants created a fine spatial unit that can measure proximity and density. While this obviously was a limited snapshot of a particular population at a particular time, the clustering of fast food restaurants around schools may account for rates of obesity among younger populations. Interestingly, the concentration of fast foods around restaurants was less in lower-income neighborhoods ([See Rundle et al. 2009 for similar results](#)).

Baker, E., Schootman, M., Barnidge, E., & Kelly, C. (2006). The role of race and poverty in access to foods that enable individuals to adhere to dietary guidelines. *Preventing Chronic Disease*, 3(3), 1-11.

Spatial clustering analysis was used to measure the amount of supermarkets within particular St. Louis census tracts. Audits of supermarkets and fast food restaurants in the St. Louis area were conducted using the USDA Continuing Survey of Food Intakes. This is similar to the [Anderson 2007](#) model's use of the healthy eating indicator shopping basket (HEISB) in the UK. Such audits help in weighting food stores. Tertiles of clustering were created and compared to racial composition of census tract. None of the supermarkets in the highest tertile of fruit and vegetable (F&V) availability were in the African-American neighborhoods. Spatial clustering models showed the expected clustering of supermarkets indicating that Whites have a much better distribution. Fast food clustering was not different between racial groups.

More qualitative measurements are called for to find causality. Behavior among groups may reflect density of healthy food. They also call for more land-use patterns such as highways and airports to include in study ([See Dunn 2008](#)).

Block, J. P., Scribner, R. A., & DeSalvo, K. B. (2004). Fast food, race/ethnicity, and income: A geographic analysis. *American Journal of Preventive Medicine*, 27(3), 211-217.

Block et al used 2 types of geographic levels to measure fast food restaurant density (FFRD) in New Orleans: census tract and shopping area. To make sure that neighborhoods were urban and residential, census tracts with alcohol outlet density above 200 per 1000 people were excluded, but restaurants were not, on account of "shopping area" designation. Shopping area is defined by buffers around census tracts that people would travel into to purchase food. (1 mile and half-mile buffers were analyzed.) "Shopping areas" create a more realistic and dynamic measure of density than census tracts. However, their subjective nature would make generalizability difficult. Race, not income, was associated with the number of fast food outlets. Fast food density was twice as high in the African-American shopping areas ([see Powell et al. 2007a for similar results](#) and [Smoyer-Tomic et al. 2008 for conflicting results](#)).

[Powell et al. 2007a](#) claim that the regression model used for this study did not explicitly account for population size.

Bodor, J., Rose, D., Farley, T., Swalm, C., & Scott, S. (2007). Neighbourhood fruit and vegetable availability and consumption: the role of small food stores in an urban environment. *Public Health Nutrition*, 11(4), 413-420.

In-store density and distance to supermarkets and grocers were measured in relation to particular residences in New Orleans ([Similar to Ball & Crawford 2009](#)). The distance was straight-line (Euclidean), which is not as accurate as studies such as [Ball et al 2009](#) that use roadway distance. The in-store measurements make this study interesting.

Density of F&V retail was measured by shelf-space in stores dedicated to produce. Multivariate regression was employed using gender, ethnicity and age of the individual, as well as car ownership, income of the household and food assistance programs as predictor variables and distance to supermarket and local shelf space as independents. Similar to [Block & Kouba 2006](#) and [Ball et al 2009](#), supermarket proximity was not as important to vegetable consumption among African-Americans as small grocers that act as fill-ins complementing the large packaged foods from supermarkets ([See Raja et al 2008](#)). One limitation of this study was that the response rates of those that participated did not fit the census demographics. This is admitted, and can be a problem for researchers wanting to do residence-level studies. They also admit that this was only an exploratory study and inferences cannot be made between availability and intake of F&V.

Franco, M., Diez Roux, A. V., Glass, T. A., Caballero, B., & Brancati, F. L. (2008). Neighborhood characteristics and availability of healthy foods in Baltimore. *American Journal of Preventive Medicine*, 35(6), 561-567.

Franco et al. utilized the Nutrition Environment Measures Survey (NEMS-S) ([See Glanz et al. 2007 for description](#)) to investigate food stores in 158 Baltimore census tracts in relation to race. InfoUSA data was used to find stores. Checks were made with phone books, Health Dept. records, and driving through neighborhoods. A Healthy Food Availability Index (HFAI) was created for each store. The index was compared with census tract characteristics through multi-level modeling. 43% of African-American census tracts had poor access as opposed to 4% of White, while 19% of African-American tracts had high availability as opposed to 68% White. High-income areas also had better access. HFAI was 7.6 points higher in White tracts, with supermarkets scoring highest. However, supermarkets in African-American areas still scored lower than White areas.

The multiple-ethnicity study of atherosclerosis (MESA) was used to identify the sample ([See Moore & Diez Roux 2008](#))

Galvez, M. P., Morland, K., Raines, C., Kobil, J., Siskind, J., Godbold, J., et al. (2008). Race and food store availability in an inner-city neighbourhood. *Public Health Nutrition*, 11(06), 624-631.

Census blocks were studied in East Harlem of Manhattan. Through GIS mapping and multi-level regression, they found that African-Americans have no supermarkets or grocery stores, and also less convenience stores. Interestingly, Latinos had more access to all food stores than mixed race neighborhoods. They admit that adjacency was not taken into account, but it is telling that none of the African-American census blocks had access to large stores with healthy food. These findings were independent of median income, median rent and population density.

A strength of this study is the fact that researchers went into the field and physically identified all stores (See [Sharkey & Horel 2008](#), [Guy & David 2004](#), [Paquet et al 2008](#), [Gallagher 2007a](#)). They admit that cultural aspects should be taken into account (See [Freedman 2008](#), [James 2004](#), [Block & Kouba 2006](#), [Anderson et al 2007](#)). Also, they mention that transportation behaviors are not taken into account ([See Clifton 2004](#)).

Howard, P. H., & Fulfrost, B. (2007). The density of retail food outlets in the central coast region of California: Associations with income and Latino ethnic composition. *Journal of Hunger and Environmental Nutrition*, 2(4), 3-18.

Multi-level modeling was used to assess the retail density of three counties in CA in relation to income and ethnicity. Also, locations for fruit and vegetable stands were recommended. Census data is used on the census block level for ethnicity and the block group level for income. This is a much finer scale than others using Census tracts or zip codes (Also used by [Raja et al 2008](#), [Sharkey & Horel 2008](#), [Li et al 2009](#), [Wang et al 2007](#), [Galvez et al 2008](#)) CA Dept. of Health data is used to identify and classify stores. Also, stores are weighted by sales volume. No truth-grounded research was done to check reliability of store classification. Latino neighborhoods had less retail food density. However, as median income decreased, retail density increased.

The weighting of stores by sales volume may preclude the assumption that volume equals fruit and vegetable access. A small ethnic store with limited stock may provide more healthy food for some minority groups than a large supermarket. While it is true that two large supermarkets may provide more food, they may not fit the foodways of the local population (see [Short et al. 2007](#)). Also, some studies have found that supermarkets may not be the only important contributor to healthy eating (See [Short et al. 2007](#); [Block & Kouba 2006](#); [Bodor et al 2007](#); [Glanz et al. 2007](#); [Jago et al. 2007](#); [Raja et al 2008](#)).

Hosler, A. S., T Rajulu, D., Ronsani, A. E., & Fredrick, B. L. (2008). Assessing retail fruit and vegetable availability in urban and rural underserved communities. *Preventing Chronic Disease*, 5(4), 9.

Rural and urban areas in New York State (Albany) were mapped for F&V availability. Farmers markets were included with food stores. The field work is a strength of this study. Every store was visited and analyzed by criteria created by researchers (10 or more F&V was considered a large selection. Also it was noted if there were dark green and orange vegetables. Such an evaluation was created when they found irregularities using [Morland et al's 2002a](#) classification of food stores. However, they did not use these criteria in their analysis. Store weighting ([see Howard & Fulfrost 2007 for a different weighting system](#)) was created using the number of cash registers and hours of operation.

Each store was recorded with a GPS device at the front door. While the broad cross-section of this study may be a limitation, the comparative nature provides for further inquiry. The urban minority was much less serviced than the mixed urban, rural and small-town communities with and without the weighting of food stores.

Jago, R., Baranowski, T., Baranowski, J. C., Cullen, K. W., & Thompson, D. (2007b). Distance to food stores & adolescent male fruit and vegetable consumption: mediation effects. *The International Journal of Behavioral Nutrition and Physical Activity*, 4(35), 35.

204 Boy Scouts were studied in the greater Houston area. 12-week surveys were done to assess home F&V availability, Cullen Food Questionnaires were used for intake (high and low fat vegetables, fruits and juices), and homes were geo-coded. A one-mile radius was used to assess food retail access. They decided on this distance because kids are likely to cut across vacant lots and parking lots.

They found that access to smaller grocers was positively related to F&V intake and home availability, but supermarkets did not have any effect ([Timperio 2008](#); [Raja et al 2008](#)). Fast food increased high-fat vegetable intake such as French fries and lower F&V home availability, but did increase fruit juice consumption.

The finding that supermarkets did not affect consumption contrasts with other studies, but they suggest that adolescent, Texan males are a group that has not been well-studied. The use of in-home surveys is a good step toward investigating causality between distance to stores and consumption.

Moore, L., & Diez Roux, A. (2006). Associations of neighborhood characteristics with the location and type of food stores. *American Journal of Public Health*, 96(2), 325-331.

Census tracts were investigated for food retail density in Forsyth County NC, Baltimore, Manhattan and the Bronx. While supermarket measures were similar to other studies, i.e. minorities had less access, it was also found that there were less health food stores, bakeries and specialty stores in minority neighborhoods. Also there were more meat and fish stores in minority tracts than White tracts. Low-income areas had 4x as many grocery stores, and half as many supermarkets as high-income. There was no difference in the amount of liquor stores between White and minority tracts (In contrast to [Sturm 2008](#) and [Zenk et al 2006](#)). An interesting finding is that refusal rates are 12% for InfoUSA numbers, meaning that some stores are not allowing themselves to be counted in database. This indicates a need to cross-check food store data.

Morland, K., Wing, S., Diez Roux, A., & Poole, C. (2002a). Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine*, 22(1), 23-29.

Census tracts from 1990 were used in Jackson City, Mississippi; Forsyth County, North Carolina; Washington County, Maryland; and selected suburbs of Minneapolis, Minnesota as part of the Atherosclerosis Risk in Communities Study (ARIC) ([Morland](#)

[2002b](#)). Food stores were found through local departments of environmental health and state departments of agriculture. North American Industry Classification System (NAICS) codes were used to categorize food stores. Number of stores was compared against wealth and racial composition (Poisson models).

Supermarkets were 4 times more likely to be found in White neighborhoods than African-American and racially mixed neighborhoods. Three times as many supermarkets are also found in wealthier neighborhoods. Wealthier neighborhoods also had fewer small grocery stores, convenience stores (without gas stations), and specialty food stores. All types of food establishments were more prevalent in White and racially mixed neighborhoods except for bars and taverns. The addition of bars and taverns is interesting in this study. They also found that African-Americans have much less access to private transportation.

Powell, L. M., Slater, S., Mirtcheva, D., Bao, Y., & Chaloupka, F. J. (2007a). Food store availability and neighborhood characteristics in the United States. *Preventive Medicine*, 44(3), 189-195.

Powell et al. conducted a multivariate analysis of populations across 28,050 zip codes in the US in relation to access to supermarkets, independent grocers, and convenience stores. They admit that many limitations are inherent in such a large sample with such coarse measurements. The multivariate analysis took into account ethnicity, race, socio-economic status and income. The findings are consistent with earlier studies that African-Americans have greatly disadvantaged access to supermarkets even when controlling for income. Latinos and Asians had many smaller stores which may reflect cultural preferences ([See Short et al 2007 for similar results](#)). Rural areas were the most disadvantaged and suburban had the most chain supermarkets.

Powell, L. M., Chaloupka, F. J., & Bao, Y. (2007b). The availability of fast-food and full-service restaurants in the United States: associations with neighborhood characteristics. *American Journal of Preventive Medicine*, 33(4 Suppl), S240-245.

28,050 zip codes were measured across the US for restaurant density in relation to income and ethnicity. Restaurant information came from Dun & Bradstreet. Population density was also taken into account to separate urban measurements from rural as control variables. Through multivariate analysis they found that African-American areas actually had less density of fast food and any other restaurants. Near-low and middle income had the highest numbers of restaurants. However, the ratio of fast food restaurants to all restaurants was much more significant among African-American areas. An interesting statistic is added in the conclusion: The percentage of fast food restaurants out of total restaurants increased from 20% to 30% between 2003 and 2006. Their use of zip codes as geographic areas is extremely coarse.

Raja, S., Changxing, M., & Yadav, P. (2008). Beyond food deserts: Measuring and mapping racial disparities in neighborhood food environments. *Journal of Planning Education and Research*, 27(4), 469-482.

Neighborhoods in Erie County NY were investigated to test the hypothesis that areas of color have less access to healthy food. Gini coefficients were used to assess inequality (have not seen this used in any other study). Census block data was used. All but 14 blocks were studied across the county (this creates a more random sample than some other targeted studies.) Access is defined as the number of food destinations available within a 5-min travel time of the census tract centroid. 24 regression models were included (6 types of food destinations, three modes of travel, and the 6 types of food destinations provided by [Moore & Diez 2006](#) for comparison). The Reference USA database was used to identify food destinations. This was cross-checked through phone books and phone interviews of establishments. Direct markets such as farmers markets were also incorporated. Distance was measured by street layers through GIS. They found 26 restaurants per 10k people, and only .4 supermarkets per 10k people in the county. 60% of blocks only have restaurants as food destinations.

It was found that African-American blocks have a much smaller number of supermarkets compared with White and racially mixed blocks. However, there are twice as many small grocers and fruit and vegetable markets in the minority areas and the authors caution that assumptions should not be made that these stores cannot provide healthy, culturally-appropriate food (see [Block & Kouba 2000](#); [Bodor et al. 2007](#); [Clarke et al. 2002](#); [Jago et al. 2007a](#); [Jetter & Cassady 2005](#), [Short et al 2007](#)).

They compared the Thrifty Food Plan between Erie County grocery store and supermarkets and found that they are equally affordable and claim that the Hispanic community may be providing healthy food through small stores (See Short et al. 2007). [The methods section in this article is extremely clear and the statistical analysis is presented simply.] [Much of their methods were culled from Moore & Diez Roux 2006.](#)

This study was conducted with the hope that planners would use this info. The Gini coefficients help put this information into a language that is recognized by economists and planners.

Sharkey, J. R., & Horel, S. (2008). Neighborhood socioeconomic deprivation and minority composition are associated with better potential spatial access to the ground-truthed food environment in a large rural area. *The Journal of Nutrition*, 138(3), 620.

Food stores in 101 Census blocks in rural Texas were Geocoded using windshield surveys and GPS measurements at each location. A government database and phone books were then compared with ground-truthing. A population-weighted center was used to find proximity to stores. Density may have been a better measurement for such sparsely populated large census blocks. They test public listing versus ground-truth results and find that public lists created significantly longer distances from population centers to food stores. Also geographic-centered proximities were significantly larger. Unlike other studies, this study of rural populations finds that lower-income, minority groups in densely populated areas had better access than other groups to all types of food stores. However, even closer distances were relatively far compared to urban dwellers (about 4 km), expressing the access issues that are apparent among rural populations. This is one of the only studies concentrating on rural food access.

Sturm, R. (2008). Disparities in the food environment surrounding US middle and high schools. *Public Health*, 122(7), 681-690.

Type and density of retail food establishments are counted within a 400m (walking distance) and 800m (used because of the size of campuses) buffer radius around middle and high schools across the US. Info USA was used to identify stores and there is a good description of the North American Industry Classification System (NAICS) used to classify stores. Schools are classified by racial majority, location (urban, suburban, town, or rural), and income (Type I eligible, free meals). Enrollment population was not significant. While minorities, especially Latinos, are found to have more convenience stores, restaurants, and liquor stores around their schools, rural and urban may confound the finding of more off-licenses (liquor stores) around low-income, minority schools (they admit this limitation).

Zenk, S., Schulz, A., Israel, B., James, S., Bao, S., & Wilson, M. (2005a). Neighborhood racial composition, neighborhood poverty, and the spatial accessibility of supermarkets in metropolitan Detroit. *American Journal of Public Health*, 95(4), 660-667.

Supermarket proximity is measured in Detroit. Census tracts in metro Detroit are used to define neighborhoods. Access is measured based on Manhattan block distance (Euclidean). Stores are identified through the Michigan Department of Agriculture. Only supermarkets are used which can be a limitation of this study (see [Raja et al 2008](#); [Block & Kouba 2000](#); [Bodor et al. 2007](#); [Clarke et al. 2002](#); [Jago et al. 2007a](#); [Jetter & Cassady 2005](#), [Short et al 2007](#) for examples of small stores possibly providing F&V).

It was found that race does have an effect on access to supermarkets, even when adjusted for income. African Americans had significantly less access.

This study comes from an historical theoretical context based on the white-flight of urban areas in the northern industrial cities. They call for more longitudinal studies to assess the changes in food access as neighborhoods change racially.

Zenk, S., Schulz, A., Israel, B., James, S., Bao, S., & Wilson, M. (2006). Fruit and vegetable access differs by community racial composition and socioeconomic position in Detroit, Michigan. *Ethnicity & Disease*, 16(1), 275-280.

Four communities were studied in the Detroit area with differing race and socio-economic status. Food stores were identified through the USDA and surveys were conducted throughout the year in the stores to evaluate the availability and quality of F&V. One-mile Euclidean buffers were used around stores. While overall selection and price of F&V was similar across the communities, quality was much worse among African-American and lower socio-economic status communities. Four times more liquor stores were also found in African-American communities.

The authors claim that larger samples with more stores are necessary to find whether access is based on race and socio-economic status.

Zenk, S. N., & Powell, L. M. (2008). US secondary schools and food outlets. *Health & Place, 14*(2), 336-346.

Fast food and convenience store density was measured around (805m walking distance) secondary schools in the US to determine if neighborhoods (census tracts) with a school are more likely to have these establishments. Race, income, and school level were used as independent variables. Over 30,000 schools were used from the National Center for Education Statistics and food outlets were found through Dun & Bradstreet. Given the magnitude of this study, finer and more accurate data would have been impossible.

Unlike [Austin et al.'s 2005](#) study of Chicago schools, it is found that the number of fast food and convenience store outlets decrease as income increases. Fewer fast food outlets were also found around African-American schools ([see Morland et al. 2002a, Powell et al. 2007](#) for similar results). It is also found that tracts with schools are more likely to have fast food restaurants.

Measuring the Food Environment and its Associations with Health

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Anderson, M & Matsa, D.A.. (2009) Are restaurants really supersizing America? Department of Agricultural & Resource Economics, University of California, Berkeley.

A neo-classical economic approach of consumer optimization between satiation and caloric intake was applied to the existence of highway interchanges as an instrument of fast food accessibility and obesity in rural counties across 11 states. It is found through their model that obesity is not related to the existence of interchanges in zip codes and the authors suggest that legislating fast food would be a waste of money.

Body Mass Index (BMI) and overweight info is found through the Behavioral Risk Factor Surveillance System (BRFSS). This study has provoked similar studies ([Dunn 2009](#); [Currie et al 2009](#)).

Boumtje, P. I., Huang, C. L., Lee, J.-Y., & Lin, B.-H. (2005). Dietary habits, demographics, and the development of overweight and obesity among children in the United States. *Food Policy, 30*(2), 115-128.

Boumtje et al. used the USDA's Continuing Survey of Food Intake by Individuals (CSFII) 1994-96 and 1998 to investigate youths at-risk of obesity and obese. Being African-American and Hispanic was positively associated with obesity. Soft-drink consumption was also found to shift children from normal weight to obesity, indicating that access to soft drinks (e.g. fast food and liquor stores) may affect health.

Boutelle, K. N., Fulkerson, J. A., Neumark-Sztainer, D., Story, M., & French, S. A. (2007). Fast food for family meals: relationships with parent and adolescent food intake, home food availability and weight status. *Public Health Nutrition, 10*(01), 16-23.

Boutelle et al. found through surveying the parents of 902 adolescents in Minneapolis that the amount of fast food purchased by families relates to the amount of soft drinks consumed in the home, which in turn raises the risk of obesity among children ([see Boumtje et al 2005](#)).

Currie, J., DellaVigna, S., Moretti, E., Pathania, V. (2009). The effect of fast food restaurants on obesity. National Bureau of Economic Research. Berkeley CA

Unlike the other economic studies of fast food and obesity ([Dunn 2008](#); [Anderson & Matsa 2009](#)), specific residences of new mothers and specific locations of 9th graders' schools were compared with fast food restaurants, as opposed to using an instrument such as highway interchanges. Restaurant data was collected from Dun & Bradstreet. Straight line distances of .1, .25, and .5 miles were used from new mothers' residences and schools. A fast food outlet within .1 miles from a school resulted in a 5.2 percent increase in the incidence of obesity. They found that mothers that live near fast food restaurants are more likely to be minorities. A potential strength of this study is the use of body fat measurements found through the Fitnessgram data collected on 9th graders in CA. This is a much better estimate of obesity than BMI; especially self-reported BMI, although it does not apply to all the Fitnessgram data.

Dubowitz, T., Heron, M., Bird, C. E., Lurie, N., Finch, B. K., Basurto-Davila, R., et al. (2008). Neighborhood socioeconomic status and fruit and vegetable intake among whites, African-Americans, and Mexican Americans in the United States. *American Journal of Clinical Nutrition, 87*(6), 1883-1891.

This is a national survey of F&V intake compared with socio-economic status and racial composition of neighborhoods. Using a 24 hr recall from the National Health and Nutrition Examination NHANES III) and Census Tracts as neighborhood proxies (a limitation, but useful for such a large investigation) they concluded that socio-economic status affects intake of F&V among African-Americans more than Whites. While the gap between Whites and African-Americans halved as socio-economic status increased, it was still significant at $p < .05$. Interestingly, African-Americans and Non-Native people consumed more fruits than US-born people ([See Dubowitz et al 2007](#)). The positive association found with higher socio-economic status and F&V consumption gives a national cross-sectional overview of trends in food access and local environment. Mexican-Americans had comparable intakes of F&V with Whites across socio-economic status.

Dunn, R. (2008). Obesity and the availability of fast-food: an instrumental variables approach. 2007 6th World Congress: Explorations in Health Economics Paper.

This study is similar to [Anderson & Matsa. \(2009\)](#), where highway interchanges accounted for fast food access. However, it is on a county level. It was found that BMI is

most significantly affected among minorities, and rural and suburban whites are not affected.

Inagami, S., Cohen, D., Finch, B., Asch, S. (2006). You are where you shop. Grocery store locations, weight, and neighborhoods. *American Journal of Preventive Medicine*, 31(1), 10–17.

Secondary data was used from the LA Family and Neighborhood Study, which asked where people from particular census tracts shopped for food. Also, they were asked where they worshipped, went for medical care, recreated, and worked. It was found through multi-level regression that those who shop in disadvantaged census tracts have higher BMI. No other factors affected BMI. While this study did not use exact locations of residence and shopping, the comparison with other places for services makes a strong suggestion that where one shops affects health. Proximity was measured using census tract centroids.

Gallagher, M. (2007a). *Examining the impact of food deserts on public health in Detroit*: Mari Gallagher Research & Consulting Group. Chicago IL.

Through mapping of retail outlets and their relation to census tract centroids, a Food Balance score was created in Detroit by dividing the distance to grocers with that of fringe stores (liquor stores, conveniences stores, fast food etc). This was compared with a Years of Potential Life Lost (YPLL) indicator. It was found that over half of the city's populations have to travel twice as far to mainstream grocers. It is also claimed that fast food was not as negative for health as food stamp retailers, because the majority of food stamp retailers concentrate on selling liquor, cigarettes, and lottery tickets ([See Gallagher 2007b](#)). Truth-grounded reviews were done of all retailers that use food stamps, and were recorded if they specialized in the above products. Using the food balance model allows for studies to be conducted across different geographical areas (e.g. rural residents may have to travel far for a grocer, but also travel far for a fringe store).

Laraia, B., Siega-Riz, M., Kaufman, J. S., Jones, S. J. (2004). Proximity of supermarkets is positively associated with diet quality index for pregnancy. *Preventive Medicine*, 39(5), 869-875.

This study has been cited many times as justification for measuring access to supermarkets. Laraia et al. measure proximity to food retail outlets among pregnant women in North Carolina in the Raleigh area. Distance to food stores is compared with a diet quality index for pregnancy based on the Dietary Guidelines for Americans and the Food Pyramid. This was measured through questionnaires. Food stores were identified and Geocoded using the USDA 2000 inspection registry. They found that distance to supermarkets greatly affects the nutrition of these women. As distance to supermarkets increased diet quality decreased. The opposite was true for convenience stores. The use of resident locations gives a precise scale.

Li, F., Harmer, P., Cardinal, B. J., Bosworth, M., Johnson-Shelton, D., Moore, J. M., et al. (2009). Built environment and 1-year change in weight and waist

circumference in middle-aged and older adults: Portland neighborhood environment and health study. *American Journal of Epidemiology*, 169(4), 401-408.

A longitudinal study of obesity in Portland in relation to fast food restaurants and physical activity was conducted. Fast food retail density was found with INFO USA numbers at a census block level. While the study does not make very strong associations between fast food density and increase in obesity (those that had increased BMIs lived in the high density areas and ate at a fast food restaurant once a week), the methods used are a step toward providing less cross-sectional research and creating studies of causality.

Liu, G. C., Wilson, J. S., Rong, Q., & Jun, Y. (2007). Green neighborhoods, food retail and childhood overweight: Differences by population density. *American Journal of Health Promotion*, 21(4 suppl), 317-325.

The amount of vegetation and proximity of supermarkets was compared with BMI of children with a mean age of 8 in Marion County IN. Proximity measured along streets (Euclidean) based on a 2 km buffer. Higher population density areas had an inverse relationship between obesity and supermarkets, while distance to convenience and grocery stores and fast food restaurants saw no significance. Lower density populations had a positive relationship for higher BMI with closer proximity to supermarket

Maddock J. (2004). The relationship between obesity and the prevalence of fast food restaurants: state-level analysis. *American Journal of Health Promotion*, 94(9), 137-43.

This was a national study using secondary data. Data was collected from the Behavioral Risk Factors Surveillance system, the Census, and the US Yellow pages. Square miles per fast food restaurant and the density of fast food were compared against the BMI of residents. The density of fast food restaurants was significantly associated with higher BMIs. The huge sample and use of Yellow Pages make this study fairly weak. However, it does give reason for further research on food environments and obesity.

Morland, K., Wing, S., & Diez Roux, A. (2002b). The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. *American Journal of Public Health*, 92(11), 1761-1767.

The sample studied in this report was selected from the atherosclerosis risk in communities study (ARIC) ([Morland et al 2002a](#)) because “ (a) these data have already been collected for a large population based sample with extensive information on dietary intake, (b) the geographic area from which the ARIC population was sampled is diverse with respect to the wealth and racial makeup of residential census tracts, (c) the ARIC participants are heterogeneous in terms of race, income, and education (all characteristics known to be associated with dietary intake), and (d) neighborhood differences in diet have been found for these community members.” Food frequency questionnaires were compared with the amount and type of food stores in census tracts. Stores were coded based on the North American Industry Classification System (NAICS).

They found that the existence of a supermarket within census tracts that are African-American significantly increase F&V consumption, over 2x more than in White neighborhoods.

Morland, K., Diez Roux, A. V., & Wing, S. (2006). Supermarkets, other food stores, and obesity: The atherosclerosis risk in communities study. *American Journal of Preventive Medicine*, 30(4), 333-339.

A sample of participants from Jackson City MS, Forsyth County NC, Washington County MD, and selected suburbs of Minneapolis MN was used. Census tracts were used to define each participant's neighborhood. They found that the presence of grocery stores and convenience stores is associated with higher rates of obesity, diabetes, and hypertension in relation to populations with only supermarkets. Store information was from local departments of environmental health and state departments of agriculture and was coded with the North American Industry Classifications (NAICS) system. Although this is a cross-sectional study with coarse units of analysis, the large sample size and diversity of locations are strengths.

Morland, K. B., & Evenson, K. R. (2009). Obesity prevalence and the local food environment. *Health & Place*, 15(2), 491-495.

Census tracts were measured for food store type and density in two distinct geographic locations of Forsyth County, NC, and the city of Jackson MS. Telephone interviews were used to assess demographics and BMI of specific residents. Distance from individual residences to food stores is measured. However, they do not mention if these are Euclidean or network. Results showed less prevalence of obesity with access to a supermarket and more with access to more than one fast food store ([See Rundle et al. 2009 for conflicting results](#)). However, obesity increased as distance to supermarkets increased on an individual level. Also, obesity decreased as distance to fast food increased. These results show that utilization of stores may not correlate with prevalence of stores. This research also used a sample with relatively high education and was self-reported. Also, factors such as race and income were calculated as individual-level variables but the majority of informants were white and female which could reflect the nature of using home phone interviews.

Pearce, J., Hiscock, R., Blakely, T., & Witten, K. (2009a). A national study of the association between neighbourhood access to fast-food outlets and the diet and weight of local residents. *Health & Place*, 15(1), 193-197.

New Zealand's small size allows for very specific statistics to be used for comparison of food access with BMI, fruit intake, and vegetable intake. Multi-level models were used that included ethnicity, population density, number of people in household, education and employment. Confounding variables such as smoking and physical activity were used in BMI analysis. Pearce et al. used the meshblock (similar to US Census blocks) listings of fast food outlets and the New Zealand Health Survey to compare individual health with the existence of fast food. This allows for an average of 20 individuals for each 100 person meshblock. They found that access to fast food outlets is not a significant indicator of BMI or F&V intake. ([Rundle et al. 2009](#) have similar results in US, while

[Morland & Evenson 2009](#) have conflicting results in the US). They claim that healthy food outlets should also be included.

Powell, L. M., Auld, M. C., Chaloupka, F. J., O'Malley, P. M., & Johnston, L. D. (2007c). Associations between access to food stores and adolescent body mass index. *American Journal of Preventive Medicine*, 33(4 suppl), S301-307.

Powell et al. compared data from the Monitoring the Future (MTF) study of BMI among 8th and 10th graders with food prices and food retail density of zip codes where schools were located. Food prices were found with the American Chamber of Commerce Research Association (ACCRA) cost of living index reports and food retail locations were found through Dun & Bradstreet Market Place. A model was created that holds various socio-economic status variables constant while estimating the association between BMI and food store access. The existence of chain supermarkets had a significant association with lower BMI with all control variables. Convenience stores were associated with higher BMI. African-American adolescents had a (3x) higher association between chain supermarkets and lower BMI. Mother's work status was also taken into account and it was found that those with full-time working mothers were more positively affected by supermarkets.

Zip codes are used to place schools in geographical context. This assumes that adolescents attending these schools live in the particular zip codes. Nevertheless, these data sets are representative of the US population and provide a solid beginning to further research.

Powell suggests that urban planning land use should increase the availability of chain supermarkets (see [Pothukuchi 2004](#)).

Rundle, A., Neckerman, K. M., Freeman, L., Lovasi, G. S., Purciel, M., Quinn, J., Richards, C., Sircar, N., Weiss, C. (2009). Neighborhood Food Environment and Walkability Predict Obesity in New York City. *Environmental Health Perspectives*, 117(3), 442-447.

Rundle et al. used information collected on BMI of 14,147 residents to compare food retail with obesity. They included the factors of walkability and population density along with the prevalence of healthy-BMI, moderate-BMI, and unhealthy-BMI weightings of food outlets. They include all food outlets, including restaurants. Their information on retail outlets was found through commercial datasets and there was no ground-truthed investigation. Nevertheless, the availability of BMI measurements allowed for a significant measurement of causality and food access. The neighborhood buffer zone used was a half-mile radius around each retail establishment. While this may be a valid measurement in NYC, other areas may not be as pedestrian-oriented and neighborhood definition may vary.

They found that healthy-BMI outlets account for lower BMI, while unhealthy-BMI outlets do not have significant effect on BMI. This conflicts some other studies of fast food outlets and BMI (e.g. [Morland et al. 2009](#)). They admit that the fact that unhealthy food is available in all neighborhoods may confound this variable.

The weighting analysis of stores is a strength of this study. The three categories were created using previous studies of the effects of store-type on obesity. Also, the coupling of walkability along with food access represents the fact that there are many factors to obesity that must be taken into account.

Smith, C., Butterfass, J., Richards, R. (2009) Environment influences food access and resulting shopping and dietary behaviors among homeless Minnesotans living in food deserts. *Agriculture and Human Values* [online only].

Qualitative and quantitative methods were used to investigate the BMI of homeless women, mostly with children, in Minneapolis in relation to the surrounding food environment. A Social Cognitive Theory framework was used that takes into account behavioral, personal, and environmental influences on food choice. Focus groups, behavior surveys, 24 hr. diet recall, BMI measures, and store surveys were used. The Thrifty Food Plan (TFP) was used to compare prices in a five block radius of two different shelters. The environment inside the shelters had as much to do with food choice as outside. Focus groups indicated that participants know that they do not have good access to reasonably priced healthy food. Many traveled on the bus outside the neighborhood for food.

BMI measures indicated that 80% of the women were overweight, and the food surveys showed that local stores do not carry most of the TFP items and are above the market basket price. The use of qualitative methods allows for valuable triangulation of the data. They found that the physical space and experiences with hunger may be significant causes of obesity in low-income people.

Sturm R, Datar A. (2005). Body mass index in elementary school children, metropolitan area food prices and food outlet density. *Public Health*, 119(12), 1059-1068.

A national representative sample of kindergarteners was measured over four years. BMI was compared with the price of food and the density of outlets. Density was found as per capita number of restaurants, grocery stores and convenience stores in the child's home and school zip code. Prices were found through Council for Community and Economic Research. Lower prices on vegetables accounted for lower gain of BMI. Lower meat prices had the opposite effect. Retail density had no effect. Density was measured at a large scale (zip codes).

Sturm, R., Datar, A. (2008). Food prices and weight gain during elementary school: 5-year update. *Public Health*, 122(11), 1140-1143.

This is a follow-up of Sturm & Datar 2005. They measured the change in BMI between the spring of kindergarten and the spring of fifth grade. The main explanatory variable was the price index for fruit/vegetables based on the fact that earlier density did not make a difference (although they had some limitations). There was a constant trend that higher prices of vegetables may account for higher rates of obesity among children.

Timperio, A., Ball, K., Roberts, R., Campbell, K., Andrianopoulos, N., & Crawford, D. (2008). Children's fruit and vegetable intake: Associations with the neighbourhood food environment. *Preventive Medicine*, 46(4), 331-335.

Parents of students 5-12 yrs old in Melbourne Catholic schools were surveyed to find the amount of vegetables consumed by the children. This was compared with the density and types of food stores within 800m (based on roadways) of their homes through GIS mapping. They found that there is a positive relation between distance of convenience stores, fast food, and supermarkets and F&V consumption. Those further from supermarkets actually consumed more F&V. (See [Jago et al. 2007a](#); [Raja et al 2008](#) for similar results)

Wang, M. C., Kim, S., Gonzalez, A. A., MacLeod, K. E., & Winkleby, M. A. (2007). Socioeconomic and food-related physical characteristics of the neighbourhood environment are associated with body mass index. *Journal of Epidemiology and Community Health*, 61(6), 491-498.

Wang et al. attempted to isolate food environments from individual socio-economic status characteristics in relation to food access utilizing information from 5 surveys done (1979-90) by the Stanford Heart Disease Prevention Program in California on BMI, neighborhood census block characteristics, and the CA State Board of Equalization lists of businesses. They found that only women are affected by the local food environment: closer proximity to supermarkets (See [Jago et al. 2007](#); [Raja et al 2008](#) for similar results) and ethnic stores was associated with higher BMI. A strength of this study was the neighborhood definitions that were found through not only public records, but also with local city planners. This provided more salient measures than census tracts and census blocks alone.

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Boyington, J. E. A., Schoster, B., Martin, K. R., Shreffler, J., & Callahan, L. F. (2009). Perceptions of individual and community environmental influences on fruit and vegetable intake, North Carolina, 2004. *Preventing Chronic Disease*, 6(1), A04.

A formative assessment was used that incorporates quantitative surveys with qualitative interviews, focus groups, cursory mapping, and photography conducted by participants. They found that income affects people's perceptions of F&V availability. Race has no effect. However, the majority of participants (75%) were White. Intrinsic variables, such as taste preference, seemed to affect F&V intake more than environmental variables. Interestingly, those with higher BMI (which was self-reported), claimed that they had better access to quality F&V. The qualitative dimension of this study is solid and has creative elements like photography. However, the mapping was extremely cursory (they took a drive through the neighborhoods), and the survey did not ask specific questions about where people shopped for food. They were just asked to assess the place they

shopped. Nevertheless, this is a good example of community involvement in food environment studies.

Clifton, Kelly J. (2004). Mobility Strategies and Food Shopping for Low-Income Families: A Case Study. *Journal of Planning Education and Research*, 23(4), 402-413.

Clifton interviews low-income residents in Austin, Texas to investigate how transportation plays a role in food provisioning. The majority of the participants shop in supermarkets that are not within walking distance and have devised plans for finding transportation, including busses there and taxis back, making only monthly trips, and borrowing cars. Some participants had cars and had to decide between household needs and maintenance. Most view shopping outside their own neighborhood as more cost-effective and search out ways to get to these locations.

Cummins, S., Findlay, A., Petticrew, M., & Sparks, L. (2008a). Retail-led regeneration and store-switching behaviour. *Journal of Retailing and Consumer Services*, 15(4), 288-295.

[Similar to Wrigley et al. 2004](#), Cummins et al. investigate the behavior of populations when given a new option for shopping. It is found that although shoppers may use the new store in a deprived area, they may not change eating behaviors. This is used to express the idea that more than supermarket interventions are needed to improve healthy food consumption. This may suggest that market-based interventions like those in [Bolen & Hecht 2003](#) may be more viable than the addition of supermarkets that still provide the unhealthy foods being consumed at lower prices with more convenience.

Cummins, S., Findlay, A., Higgins, C., Petticrew, M., Sparks, L., Thomson, H. (2008b). Reducing inequalities in health and diet: findings from a study on the impact of a food retail development. *Environment and Planning A*, 40(2), 402-422

This is a more in-depth study presented in the other [Cummins 2008](#) article. Qualitative and quantitative data were collected on the intervention and non-intervention populations in Glasgow. The largest benefit of the addition of a hypermarket is the economic impact of increased jobs according to focus groups. Yet, the intervention did not have significant effects on F&V intake or self-perceived health.

Cummins, S. (2007a). Commentary: Investigating neighbourhood effects on health--avoiding the 'Local Trap'. *International Journal of Epidemiology*, [online only].

Cummins is criticizing the local unit of analysis for food access and also the "deprivation-amplification" ([see Macintyre 2007](#)) theoretical model. He claims that individual behavior should be taken into account because many people travel to stores outside their immediate neighborhood for varieties of reasons. His argument is bolstered by the [Pearce et al. 2007](#) study in New Zealand showing that access to food does not affect health. However, he is ignoring the social aspects of the US; namely, racial segregation.

Cummins, S. (2007b). Neighbourhood food environment and diet-Time for improved conceptual models? *Preventive Medicine*, 44(3), 196-197.

[This is a reply to Powell et al. 2007a](#). Cummins is questioning the "deprivation-amplification" ([See Macintyre 2007](#)) theoretical model that views the non-existence of healthy food outlets and the existence of unhealthy food outlets as the prime reason for unhealthy eating among particular populations. He mentions [Wrigley et al. 2003](#) and [Cummins et al. 2005](#) as examples of communities where supermarket intervention did not significantly change food ways among underserved populations. Basically, Powell is arguing that social aspects must not be taken out of the theoretical models explaining food access.

Dubowitz, T.; Acevedo-Garcia, D.; Salkeld, J.; Lindsay, A. C.; Subramanian, S. V.; Peterson, K. E. (2007). Lifecourse, immigrant status and acculturation in food purchasing and preparation among low-income mothers. *Public Health Nutrition*, 10(4), 396-404.

Dubowitz et al. used focus groups consisting of immigrant and native-born women in the Boston area to help create a social context for food retail access. The majority of the 44 interviewed were Latina and Spanish-speaking. They found that the immigrant perspective is shaped by experiences outside the US and they are willing to travel further and take more time for food acquisition than US-born women. They say access is good but quality is poor compared to their native countries. Also, US-born women were more likely to purchase fast food and convenience foods. This study, although limited by a small sample and possible language barriers (they admit that the researchers did not speak Spanish), indicates the importance of culture and social context when investigating food access.

Eikenberry, N., Smith, C. (2004). Healthful eating: perceptions, motivations, barriers, and promoters in low-income Minnesota communities. *Journal of the American Dietetic Association*, 104(7), 1158-1161.

Surveys developed through focus group participation were conducted in Minnesota urban and rural public places to investigate motivations and barriers to eating healthy among low-income populations. What was interesting was that the barriers to F&V were consistently monetary ([See Donkin et al 1999](#)) and behavioral and environmental accessibility was less of an issue. Studies such as these reflect the need for community involvement when studying food environments. Mapping food retail access should be coupled with studies such as these.

Fitch, D. (2004). Measuring convenience: Scots' perceptions of local food and retail provision. *International Journal of Retail & Distribution Management*, 32(2), 8.

This study utilized information from the Scottish Household Survey to measure retail food access from resident perception as opposed to geographic proximity. They found that rurality, mobility, and age are related with convenience of food retailing. Studies like these are easy in a country that supports such yearly surveys. Obtaining this data in the

US would be more difficult. However, perception is an important aspect to food retail access. See [Garesky 2005](#); [Moore & Diez-Roux 2008](#)

Garasky, S., Morton, L., & Greder, K. (2005). The food environment and food insecurity: Perceptions of rural, suburban, and urban food pantry clients in Iowa. *Family and Economics Nutrition Review*, 16(2), 41-48.

Food pantry clients were given questionnaires across Iowa and focus groups were conducted to assess perception of food access. It is found that transportation is the most important barrier to food access. It is also found that the rural communities perceive the most food insecurity. Suburban clients also viewed healthy food as more affordable.

Giskes, K., Van Lenthe, F. J., Brug, J., Mackenbach, J. P., & Turrell, G. (2007). Socioeconomic inequalities in food purchasing: The contribution of respondent-perceived and actual (objectively measured) price and availability of foods. *Preventive Medicine*, 45(1), 41-48.

Giskes et al. investigated food availability as expressed by where people shop and not where they live. Data was collected through interviews and store audits. The combination of qualitative and quantitative methods provides a decent comparison with perceived and objective access to food. They found the perceptions of price and availability is significant in regards to socio-economic status and food choice. Objective access is not significant. This fits well with other studies in the UK and Australia. However, objective access has been shown to be a considerable hindrance to healthy food among particular populations in the US (e.g. see [Dubowitz et al 2008](#)).

James, D. C. S. (2004). Factors influencing food choices, dietary intake, and nutrition-related attitudes among African-Americans: application of a culturally sensitive model. *Ethnicity & Health*, 9(4), 349-367.

James used focus groups to study the nutritional behaviors of African-Americans of varied socio-economic status. It was found that African-American populations view eating healthy as being associated with the dominant White culture ([See Freedman 2008](#)) and do not want to lose their own cultural identity. Soul food is important and a prevailing attitude of "you'll die of something" is prevalent. This study reminds us that assumptions of food access cannot be made without including cultural and social influences.

Kirkup, M., De Kervenoael, R., Hallsworth, A., Clarke, I. (2004). Inequalities in retail choice: exploring consumer experiences in suburban neighborhoods. *International Journal of Retail & Distribution Management*, 32(11), 511-522.

Kirkup et al. conducted focus groups in an England suburb that has seen the addition of large grocery stores that have taken the place of smaller grocers. They found that the addition of supermarkets has varying effects based on persons' socio-economic status, car ownership, age, etc., such as elderly folks do not like bulk deals and the size of stores. This study shows that perceptions may not meet objective accessibility. Whereas all of these areas have access to healthy foods, many do not believe that it is convenient and

were better off with the smaller stores. They are pushing for studies to take the smallest geographical level possible. They state, “We conclude that choice needs to be articulated as a dynamic concept, and is as much to do with having flexibility and options available than the extent of choice per se.”

Moore, L., Diez Roux, A., & Brines, S. (2008). Comparing perception-based and Geographic Information System (GIS)-based characterizations of the local food environment. *Journal of Urban Health*, 85(2), 206-216.

685 census tracts in Forsyth County NC, Baltimore, the Bronx, and Manhattan were chosen based on cardiovascular risk. Samples were chosen through the multiple-ethnicity study of atherosclerosis (MESA). Surveys were sent to assess perceptions of food access and mapping was done to measure access to food stores. A 1-mile buffer was used (20 min walk in surveys). InfoUSA was used to map stores. Non-whites had more smaller stores and supermarkets were denser for higher-income. Those without supermarkets rated their accessibility 17% less. Only NC respondents associated more smaller stores with greater access. One neighborhood in MD with lower density of smaller stores was positively associated with food access, indicating that smaller stores may be important in particular areas ([See Chung & Meyers 1999](#)). While they admit that there may be many measurement errors based on the aggregation of stores under similar types without actually visiting them and the subjectivity of perceptions, this study introduces a step toward linking populations' perceptions of food and objective measurements.

Morton, L., & Blanchard, T. (2007). Starved for access: life in rural America's food deserts. *Rural Realities*, 1(4), 1-10.

Morton & Blanchard claim that poor diet in rural areas may be a result of perceptions and buying behavior along with accessibility. They make a claim that ‘food deserts’ are places where people do not have access to supermarkets or superstores because these stores provide healthy food at reasonable prices. However, a survey of superstores and small grocers in an area in rural Iowa shows that healthy foods may actually be cheaper at the smaller stores and those surveyed did not feel that they did not have access to stores although they did not eat healthy. While this is a small case study in Iowa, it does reflect the differences between urban and rural food environments and the effects on populations. ([See Sharkey & Horel 2008](#)). Data was collected on a county scale.

Pearce, A.; Kirk, C.; Cummins, S.; Collins, M.; Elliman, D.; Connolly, A. M.; Law, C. (2009b). Gaining children's perspectives: A multiple method approach to explore environmental influences on healthy eating and physical activity. *Health & Place*, 15(2), 614-621.

Children from a north London local authority were studied to find how they perceive their own access to food and physical activity. While not much was discovered in relation to socio-economic status differences in food access, the mixed-methods approach of photos, maps, and focus groups allowed for triangulation of qualitative methods with a few themes emerging, such as why children may not eat healthy food and search out places to be physically active.

Rose, D., & Richards, R. (2004). Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. *Public Health Nutrition*, 7(8), 1081-1088.

The National Food Stamp Program Survey (NFSPS) was used to assess food stamp participant's access to fruits and vegetables. Weekly household F&V use were compared with self-reported access variables such as car ownership, type of store, and round-trip travel time. Urbanization, demographics, and personal behavior toward F&V consumption were also used as independent variables. It was found that the majority of those studied had "easy" access to a supermarket (meaning that their round-trip was less than 30 min.) Only fruit consumption was significantly related with living more than a 5 miles from a supermarket. Employment levels and single-parent status were taken into account. Those with jobs and single-parents consumed less household F&V. Although this report lacks "objective" measurements of food access, the addition of many demographic control variables is a strength.

Shaw, H. (2006). Food deserts: Towards the development of a classification. *Geografiska Annaler Series B - Human Geography*, 88B(2), 231-247.

250 square meter blocks were mapped as to whether they contained food stores carrying at least ten fruits and vegetables in Leeds. This information was compared with interviews of residents, institutional leaders, and store owners. A ternary model is created that takes into account ability, asset, and attitude. This is a demand-side look into food deserts. Creating models such as this would be extremely expensive and do not take into account other factors of power such as racial discrimination.

Wrigley, N., Warm, D.; Margetts, B. (2003). Deprivation, diet, and food-retail access: findings from the Leeds 'food deserts' study. *Environment and Planning A*, 35(1), 151-188 .

This was the first study conducted to measure the effects that the development of a large supercenter has on the eating habits of those in a food retail-deprived area. They accomplished this through before and after surveys of local residents in a Leeds neighborhood getting a new large super market. They found that the new retail center did improve access and slightly improved F&V consumption.

There is a good introduction describing the history of food retail access studies in the UK and how much policy was enacted to increase community development for food access without solid evidence on "food deserts," and how their study shows that local-scale interventions may not be the best way to increase food retail access among at-risk populations.

Yeh, M.-C., Ickes, S. B., Lowenstein, L. M., Shuval, K., Ammerman, A. S., Farris, R., et al. (2008). Understanding barriers and facilitators of fruit and vegetable consumption among a diverse multi-ethnic population in the USA. *Health Promotion International*, 23(1), 42-51.

Focus groups were conducted with urban and rural populations from North Carolina and Connecticut to find what types of barriers exist to eating healthy food. In regard to access, African-American participants claimed that they do not have access to quality F&V because of lack of supermarkets in neighborhoods and claim that it is easier to eat unhealthy food. Other racial groups did not share this sentiment. This study provides qualitative evidence for the racial disparity in food access.

Yoo, S., Baranowski, T., Missaghian, M., Baranowski, J., Cullen, K., Fisher, J. O., et al. (2006). Food-purchasing patterns for home: a grocery store-intercept survey. *Public Health Nutrition*, 9(03), 384-393.

To assess individual shopping behavior, participants were interviewed quickly outside Houston area supermarkets. Ethnicity and family size were related to the behaviors of F&V purchasing and the amount of trips taken to supermarkets. African-Americans ate less F&V and made less trips. Studies such as these can help provide a clearer picture of food retail access that includes not only the food environment but how individual behavior also affects food choice.

Zenk, S., Schulz, A., Hollis-Neely, T., et al. (2005b). Fruit and vegetable intake in African-Americans income and store characteristics. *American Journal of Preventive Medicine*, 29(1), 1-9.

Zenk et al. compared 83 suburban women with 183 Detroit women to find where they shop for food, if it is affordable, and F&V intake. Follow-up surveys from a previous study were conducted. Income did not affect F&V intake. Higher educated women shopped at more supermarkets. Most Detroit women shopped at small grocers, while suburban women shopped at supermarkets. Supermarkets were associated with more F&V intake. Specialty stores and shopping in suburbs were indirectly associated with greater F&V intake through better quality and selection.

This study is based solely on perception of the participants, but does provide a way to understand where shoppers are actually buying their produce as opposed to a geographical assessment of proximity. Also, stores were only based on chain affiliation and not size or other variables, as they admit. Also they address the fact that the statistics did not fit the hypothetical model. There is a good discussion of the needed research in diverse neighborhoods, individual determinants, and longitudinal studies.

Food Store Surveys

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Block, D. & Kouba, J. (2006). A comparison of the availability and affordability of a market basket in two communities in the Chicago area. *Public Health Nutrition*, 9(7), 837-845.

This is action research aimed at founding a community-owned food store. Community involvement led methods and focus in creating market basket price comparison of Austin and Oak Park in Chicago. USDA Thrifty Food Plan was augmented with culturally appropriate African-American foods. Stores were audited based on availability, cost, and quality; Focus groups were conducted with some independent grocers. Block & Kouba found that the small grocers and 'corner stores' do a good job of providing for the Austin community ([See Raja et al 2008](#), [Bolen & Hecht 2003](#), [Lavin 2005](#);). Store mix and neighborhood characteristics are important.

Bovell-Benjamin, A. C., Hathorn, C. S., Ibrahim, S., Gichuhi, P. N., & Bromfield, E. M. (2009). Healthy food choices and physical activity opportunities in two contrasting Alabama cities. *Health Place, 15*(2), 429-438.

Bovell-Benjamin et al. did a comprehensive audit of food availability in two contrasting Alabama cities. They use the Thrifty Food Plan to evaluate what foods are available at convenience stores, supermarkets and restaurants. Each store was physically surveyed for items at 9 in the morning. Tuskegee was found to be more expensive with less variety. Organics were not available. No convenience stores were present in Auburn, while Tuskegee's main outlets for food were convenience stores without much variety and higher prices. Collard greens and sweet potatoes were actually more expensive in the predominately African-American Tuskegee. This study provides an excellent example of store auditing that provides a general idea of healthy food access in a particular region. Such audits could be a good foundation for researchers interested in measuring food access among certain populations.

The results reinforce the findings that African-American neighborhood stores do not provide healthy foods.

Cassady, D., Jetter, K. M., & Culp, J. (2007). Is Price a Barrier to Eating More Fruits and Vegetables for Low-Income Families? *Journal of the American Dietetic Association, 107*(11), 1909-1915.

This study is similar to [Chung & Meyers' 1999](#) survey of food stores in relation to the Thrifty Food Plan. They created a new TFP market basket that fits the 2005 dietary guidelines to study the differences in price between neighborhoods and the effects of the new guidelines on low-income families. Only chain supermarkets, independent grocers, and bulk supermarkets were measured within particular zip codes and five miles outside ([see Rose & Richards 2004](#)). A strength of these surveys is the fact that they were conducted over a year to accommodate for seasonality. The change in cost from the TFP to USDA dietary guidelines was not significant.

Only the fruit and vegetable portion of the basket was investigated. Lower-income areas actually had a lower average cost for the market basket. However, the pricing was not consistent across stores (65 % in LA and 75% in Sacramento). Also, to meet the new guidelines would involve a 200 to 400% increase in expenditures for F&V. Quality was not investigated and neither was retail density.

Chung, C., & Myers, S. J. (1999). Do the poor pay more for food? An analysis of grocery store availability and food price disparities. *The Journal of Consumer Affairs*, 33(2), 276-296.

Chung and Meyers used grocery store surveys to what a "market basket" based on the Thrifty Food Plan would cost in urban poor areas as opposed to wealthier suburban areas in Minneapolis. Chain stores were overwhelmingly based in the suburban areas with convenience stores in the urban areas. OLS regression found that chains decrease the price for the generalized market basket by \$15.94 and the net impact of poverty (based on 1990 Census records) increases the price by \$3.41.

Gallagher, M. (2007b). *120 USDA food Stamp Retailers Likely to be Liquor Stores: Mari Gallagher Research & Consulting Group. Chicago IL.*

This study exemplifies the need for truth-grounded retail surveys. About 10% of stores in Chicago classified as convenience, small, or medium-sized grocery stores by the USDA were found to predominately sell liquor.

Glanz, K., Sallis, J., Saelens, B., & Frank, L. (2007). Nutrition Environment Measures Survey in stores (NEMS-S): development and evaluation. *American Journal of Preventive Med*, 32(4), 282-289.

This is an evaluation of the Nutrition Environment Measures Survey model conducted in Atlanta. They tested inter-rater variability ([See Lytle 2009 for a discussion of the need for psychometric evaluations of food environment instruments](#)) by sending two different researchers into the same stores to evaluate quantity of healthy foods as defined by federal guidelines, quality of produce, and price. Census tract socio-economic status was also taken into account. As in many other studies, lower income areas had less healthy food. A point-system was used to evaluate food stores. Inter-rater reliability was high.

This study was done multiple times with similar results indicating that stable estimates can be created from single assessments using this conceptual model, however seasonality must be taken into account. This study, they admit, is expensive and labor-intensive.

An interesting point is that small, walkable convenience stores provided better food than out-of-the-way stores. This could indicate that smaller stores could be important for contributing healthy food to high-density, urban areas. (See [Block & Kouba 2006](#), [Bolen & Hecht 2003](#), [Lavin 2005](#); [Raja et al 2008](#)).

Guy, C. M., & David, G. (2004). Measuring physical access to 'healthy foods' in areas of social deprivation: a case study in Cardiff. *International Journal of Consumer Studies*, 28(3), 222-234.

This is part 2 of the Cardiff study. Product availability and price were compared between supermarkets, affiliated stores, and small grocers. Interestingly, the middle-sized stores had highest prices. This study presents a good grounded truth approach to food access that has extended out of qualitative and GIS methods that were applied earlier. Behavioral

aspects found earlier helped guide the list of foods studied as opposed to the "market basket" approach that is based on most-purchased items at supermarkets (See [Block & Kouba 2006](#), [Cassady et al 2007](#), [Chung & Meyers 1999](#), [Short et al 2007](#)). Also, this is part of a longitudinal study investigating changing food environments in Cardiff.

Horowitz CR, Colson KA, Hebert PL, Lancaster K. (2004). Barriers to buying healthy foods for people with diabetes: evidence of environmental disparities. *American Journal of Public Health, 94, 1549 –54.*

Stores were categorized by census blocks in NYC and surveyed for foods that fit into a diet for persons with diabetes. A database from the New York State Department of Agriculture and Markets was used to identify stores. It is found that East Harlem (low-income/African-American) has lower prices and as good of access as other areas. However, there are not many large supermarkets.

Hosler, A., Varadarajulu, D., Ronsani, A., Fredrick, B., & Fisher, B. (2006). Low-fat milk and high-fiber bread availability in food stores in urban and rural communities. *Journal of Public Health Management and Practice, 12(6), 556-562.*

Food stores were visited in the Albany NY area and surrounding rural counties to assess the availability of low-fat milk and high-fiber bread. Each food store was mapped with handheld GPS. Existence of F&V was also assessed, finding that stores with milk and bread were more likely to sell cigarettes and alcohol than F&V.

Racial composition of census blocks was the only variable that was significant in relation to milk and bread access, with minority areas having less. The healthy food stores in urban areas were more likely to be convenience stores that accept food stamps ([see Gallagher 2007b](#)).

Jetter, K. M., & Cassady, D. L. (2005). The Availability and Cost of Healthier Food Items. *Preventive Medicine, 30(1), 96-97.*

Jetter & Cassady investigated stores in low-income, medium-income, and high-income neighborhoods in LA and Sacramento. The Thrifty Food Plan was used to evaluate whether food is more expensive in low-income neighborhoods. They also investigated how much more it would cost to replace some items on the TFP with healthier alternatives. This is an improvement on studies that only use the TFP (See [Block & Kouba 2006](#); [Bovell et al. 2009](#); [Cassady et al. 2006](#); [Chung & Meyers 1999](#); [Jordan 2007](#)).

They found that access to the healthier alternatives is provided by the smaller grocers in low-income areas and the price difference for the alternatives is not much more significant in these areas as opposed to others. Whole-wheat bread availability and small product sizes account for most of the increased cost. This contrasts assumptions that chain supermarkets are the best provider of healthy food.

Jordan, J. (2007). Grocery gap project: race, hunger and food access: Solid Ground. Seattle WA.

Thrifty Food Plans were compared in Rainier Valley (low-income) and Queen Anne (high-income) neighborhoods in Seattle. There was not a significant difference in price. An earlier investigation in Seattle suggested that supermarket access is fairly consistent across socio-economic status. However, there were less healthy options in the low-income neighborhoods.

One aspect of this study was the unrealistic nature of the food stamp program and TFP. Most food stamp participants talked to in focus groups could not afford the TFP on the allotment of entitlements. Therefore, access is not spatial, but economic.

Lavin, M. (2005). Supermarket access and consumer well-being. *International Journal of Retail & Distribution Management*, 33(5), 388-398.

Through a comparison of square-footage designated for healthy food in a Pathmark store in Harlem with suburban and higher-income areas of Manhattan, Lavin concluded that the Pathmark provides a comparable amount and price of F&V to other supermarkets. She then went on to assume that this indicates that the supermarket is providing where other stores in Harlem are not. Such findings could reflect the differing nature of food access across particular environments. Some studies have shown that small markets provide F&V ([Short et al 2007](#), [Block & Kouba 2006](#), [Bodor et al 2007](#), [Glanz et al. 2007](#), [Raja et al 2008](#)), while most others have focused primarily on supermarkets (e.g. [Zenk et al. 2005a](#), [Clarke et al. 2002](#)).

Leibtag, E. (2006). The impact of big-box stores on retail food prices and the consumer price index. U.S. Dept. of Agriculture, Economic Research Service, Economic Research Report Issue: 33

8,000 homes were studied across the US in an effort to find the discrepancies in the Consumer Price Index (CPI) as related to “traditional” and “non-traditional” stores, e.g. small grocers compared to Wal-Mart. The reason for the study is to rectify the Bureau of Labor Statistics’ (BLI) CPI to better reflect real cost-of-living. The conclusion is that these non-traditional retailers provide the same quality products at a lower price and traditional retailers should follow this format to compete. However, this study also illuminates the fact that those in urban, low-income areas pay more for food. Superstores, regardless of their impacts on local economies, do provide food at lower prices. According to this study, prices can vary up to 50%.

Morland, K., & Filomena, S. (2007). Disparities in the availability of fruits and vegetables between racially segregated urban neighbourhoods. *Public Health Nutrition*, 10(12), 1482-1489.

Brooklyn Community Districts were organized by census tract and 50% of food stores were randomly evaluated based on 18 types of fruit and 21 types of vegetables with in-store surveys. No supermarkets were found in the African-American sections and F&V variety was much lower in African-American and mixed districts. Canned produce was more prevalent in the African-American Districts. The list of produce may not have taken into account ethnic food choices, such as preferences for greens.

Short, A., Guthman, J., & Raskin, S. (2007). Food deserts, oases, or mirages? Small markets and community food security in the San Francisco bay area. *Journal of Planning Education and Research*, 26(3), 352-364.

Small, full-service stores were evaluated as contributors to community food security (CFS) as defined by the CFS Coalition: “all persons having access to culturally acceptable, nutritionally adequate food through local non-emergency sources at all times.” This study comes out of the neglect of these small stores as viable outlets for healthy food as opposed to supermarkets and alternative direct market outlets. Some studies have found these stores as important outlets of food for minority, urban populations ([Block & Kouba 2006](#); [Bodor et al. 2007](#), [Bolen & Hecht 2003](#), [Lavin 2005](#));). Mapping of small food stores was triangulated with market basket studies (based on the Thrifty Food Plan) and interviews of store managers. Food store locations were found by physically walking through neighborhoods and from the Department of Environmental Health and data from a 2004 study prepared by the Alameda County Department of Public Health.

It was found that small Latino markets actually provide quality produce at low prices in two of the areas studied. Interviews found that produce is actually a loss-leader in the small markets to attract customers. Interestingly, the areas with the most African-Americans were found to have store owners focusing on Latino populations. As the authors claim, more questions are created by their study than answers. This study uncovers a much-neglected aspect of food retail in urban areas and is a clear, and easy to understand article.

Food Access Policy & Solutions

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Anderson, M. (2007). Making Healthy Food More Accessible for Low-Income People: Farm and Food Policy Project.

This is a report of the Farm and Food Policy Project to inform the Farm Bill. It argues for a food environment perspective in health, specifically on obesity and food insecurity. A report by the American Heart Association ([Kumanyaki et al. 2008](#)) reflects this changing attitude toward population health. Anderson provides policy recommendations based on the findings by [Chung and Meyers, 1999](#), among other 90s studies, for food access among low-income populations, including expanding existing programs that improve low-income people’s access to healthy foods by allocating and appropriating adequate federal funds, improving public transportation access to supermarkets, creating a national fund to finance development of healthy food options in low income neighborhoods, subsidizing Electronic Benefits Transfer (EBT) technology for farmers markets, and increasing the minimum food stamp benefit. This article helps support the reasoning for investigating food environments as contributors to the health of populations along with individual behavior.

Bolen, E., & Hecht, K. (2003). *Neighborhood Groceries: New Access to Healthy Food in Low-Income Communities*. California Food Policy Advocates. San Francisco CA:

This report produced by the California Food Policy Advocates provides three case-studies of market-based solutions to food retail access. They found that the most viable solutions involve careful understanding of the local demographics and locations that are underserved either through lack of retail outlets with fresh produce at reasonable prices or a lack of public transit to supermarkets. Three case-studies of improving a corner store, creating a produce market with support from local policy, and the creation of a store with private capital showed that the first two were most viable and that success is based on partnerships between those that are familiar with the produce business, existing business owners, and in the case of the second market, support from local revitalization monies.

Cassady, D., & Mohan, V. (2004). Doing Well by Doing Good? A Supermarket Shuttle Feasibility Study. *Journal of Nutrition Education and Behavior*, 36(2), 67-70.

The feasibility of shuttles to supermarkets for transportation-dependent people was investigated. The finding shows that only a 10% participation rate among California zip codes with low income, low vehicle ownership, and high population density would create a profit for supermarkets. This may be a way to help those in areas without good access to healthy foods.

Curran, S., Gittelsohn, J., Anlikers, J., Ethelbah, B. Blake, K., Sangita, S., Caballero, B. (2005). Process evaluation of a store-based environmental obesity intervention on two American Indian Reservations. *Health Education Research*, 20(6), 719-729.

Curran et al. used grocery store interventions on the Apache reservation in east-central Arizona to prove that these types of interventions can contribute to the health of a marginalized population. Store surveys, mass media logging, cooking demonstrations and customer evaluations were the instruments used. The reach and fidelity of each intervention was measured by the customer evaluations. In-store interventions that promoted new healthy products and the cooking demonstrations were most effective. This article is an example of process evaluation that is called for by to measure the efficacy of intervention programs

Freedman, D. (2008). Politics of food access in food insecure communities. Vanderbilt, Nashville TN.

This is Freedman's dissertation where food access was investigated through a materialist-praxis theoretical orientation. She feels that qualitative measures must be used to investigate the political aspects of food access in food insecure communities. Through action-based methods she investigated the creation of farmers markets around Boys and Girls Clubs in Tennessee. She claims that GIS approaches are valuable, but cannot uncover the social aspects of food access. Her theoretical outlook is population-based as opposed to the popular notion of individual behaviorist approaches to health issues. A part of her mixed-methods research was to conduct food audits for a one-mile radius of the clubs using store surveys and GIS. Stores were physically visited and evaluated ([Sharkey & Horel 2008](#), [Guy & David 2004](#), [Paquet et al 2008](#), [Gallagher 2007a](#)). Both income and race were related with access to healthy food. African-American areas of the study area had less access to healthy food and more access to tobacco and alcohol. This

was coupled with participant-observation, interviews, and surveys of parents of those in Boys & Girls Clubs. Focus groups were conducted with parents and some with local stakeholders.

The idea of the intersection between race and place became important through Freedman's interviews. Eating healthy food was equated with "being white." (See [Zenk et al 2005b](#), [James 2004](#)).

Freedman provides a very thorough study of a particular population in a particular space. She admits that generalizations can't be made across communities. However, her creation of farmers markets through research is an excellent example of community-involved research that uses quantitative methods as a complement to participant-praxis-based-observation.

Freedman, D. A. (2007a). Food oasis or food desert? An examination of food store accessibility surrounding Boys and Girls Clubs: *Food Security Partners of Middle Tennessee*.

This is the retail density part of Freedman's dissertation. It is discussed [above](#).

Freedman, D. A. (2007b). A community health case study: Creating a food oasis in a food desert. *The Community Psychologist*, 40(2), 3.

This is a report based on her thesis ([Freedman 2008](#)) that shows F&V consumption increased in the neighborhood while the farmers market run by the local kids existed. While this was a small case study in particular city and causality can't be inferred because of being a cross-sectional study, it does suggest that there may be diverse options for bringing F&V to underserved populations.

Freedman, D. (2009). Local food environments: They're all stocked differently. University of South Carolina.

Unpublished article on the above study. [Jetter & Cassady \(2005\)](#) are possibly misinterpreted as being used to support the assumption that small stores do not provide healthy alternatives.

Gittelsohn, J., Dyckman, W., Tan, M. L., Boggs, M. K., Frick, K. D., Alfred, J., Winch, P. J., Haberle, H., Neal, P. A. (2006). Development and implementation of food store-based intervention to improve diet in the Republic of the Marshall Islands. *Health Promotion Practice*, 7(4), 396-405.

This is very similar to [Curran et al 2005](#). Similar interventions were used

Gittelsohn J., Franceschini, M. C T., Rasooly, I. R., Ries, A. V., Ho, L. S., Pavlovich, W., Santos, V. T., Jennings, S. M., Frick, K. D. (2007). Understanding the food environment in a low-income urban setting: Implications for food store interventions. *Journal of Hunger & Environmental Nutrition*, 2(2/3), 33-50.

This is a formative study used to decide what interventions would best improve food access in a Baltimore neighborhood.

Methodological & Instrumentation Issues

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Black, J. L. & Macinko, J. (2008). Neighborhoods and obesity. *Nutrition Reviews*, 66(1), 2-20.

A conceptual model for studying the environmental effects influences of obesity that takes into account macro, meso, and individual-level environments and behaviors was created. This review of obesity and environment studies shows that lower physical activity is more consistently associated with obesity than food environment.

Booth, S. L., Mayer, J., Sallis, J. F. et al. (2001). Environmental and societal factors affect food choice and physical activity: Rationale, influences, and leverage points. *Nutrition Reviews*, 59(3), S21.

A group of experts created a database of influences on eating and physical activity. A conceptual model was created that maps influences from a lifestyle center to external leverage points. Lifestyle, which involves biological, cultural, social variables, and enablers of choice such as cost, convenience, and time are the most important contributors to food choice. According to their model, intervention takes place outside the lifestyle center. While they admit that most behaviors cannot easily be changed, environmental leverage points can meet at the lifestyle needs to accommodate for positive changes in food choice.

Such a framework is good to keep in mind when measuring food access. The lifestyle core should not be ignored as an important aspect to behavior. Proper intervention must understand that the leverage points for change exist outside and must accommodate to lifestyles.

Colabianchi, N., Dowda, M., Pfeiffer, K., Porter, D., Almeida, M., & Pate, R. (2007). Towards an understanding of salient neighborhood boundaries: adolescent reports of an easy walking distance and convenient driving distance. *International Journal of Behavioral Nutrition and Physical Activity*, 4(1), 66.

This study is included just to mention the variability of neighborhood boundaries among different populations and the difficulty of creating units of analysis in spatial mapping. A few interesting points the authors make through their results is that overweight girls actually chose a longer convenient walking distance than others and Whites chose a longer distance than African-American. This study shows that we must be careful to generalize boundaries in studies, and that distances are subjective according to populations

Gittelsohn, J., Sharma, S. (2009). Physical, consumer, and social aspects of measuring the food environment among diverse low-income populations. *American Journal of Preventive Medicine*, 36(4S), S161-S165.

This is an assessment of the instruments used in food environment interventions by the authors on [Arizona reservations](#), the [Marshall Islands](#), eight reservations in Canada, and [inner-city Baltimore](#). They recommend that formative assessments of the physical, consumer, and social environments are necessary for measuring and assessing the food environments. For example, neighborhood definitions should be used cautiously because consumers may shop outside their own neighborhoods. Accurate definitions of food stores are also important. Access should also be measured inside the stores, not just based on geographic location. Seasonality should be considered. Cultural and social differences in food choice and behavior should also not be ignored.

The conceptual framework dividing physical, consumer, and social aspects used in this review is based on [Glanz et al 2005](#). Also, they define instruments and not methodologies. This distinction is discussed in [McKinnon et al 2009](#).

Glanz, K., Sallis, J. F., Frank, L.D. (2005). Healthy nutrition environments: Concepts and measures. *American Journal of Health Promotion*, 19(5), 330-333.

Glanz et al create a conceptual model for conceptualizing and measuring food environments based on:

- 1). Policy variables, including government and industry
- 2). Environmental variables, including community nutrition environments (food store accessibility), Organizational environments (home, school, work), Consumer Nutrition Environment, and the information environment (media).
- 3.) Individual variables, including psychosocial factors such as perceived nutrition environment.
- 4.) Behavior

Lytle, L. A. (2009). Measuring the food environment: State of the science. *American Journal of Preventive Medicine*, 36(4S), S134-144.

A small percentage of food environment studies that use psychometric instruments have incorporated any sort of validation or reliability ([See Glanz et al 2007](#)). The authors claim that environmental measures may not be useful for hypothesis testing on account of the fact that most are cross-sectional. More studies are called for that take into account the behavior of individuals ([Giskes et al 2007 are used as an example of incorporating individual behavior](#)). Lytle provides four recommendations for future studies.

- 1). More construct validity is needed. She suggests that maybe the measures should come from community involvement.

- 2). Provide more transparency in data-reduction
- 3). More rigorous study designs. For example, more multi-level analysis
- 4). More studies like [Giskes et al 2007](#) where the individual is put back in the equation.

McKinnon, M. Reedy, J., Morrisette, M., Lytle, L. Yaroch. (2009). Measures of the food environment: A compilation of the literature, 1990-2007. *American Journal of Preventive Medicine*, 36(4S), S124-S133.

137 articles were reviewed that measure food environment. Of those studies, 68 were geographical analyses. 97 were from between 2002 and 2007. Only 18 of the studies tested for psychometric properties ([See Lytle 2009](#)) of instruments. McKinnon et al. make the distinction between instruments such as interviews and methodologies such as geographic analyses. This list of articles was compiled as a representation of the measures that have been used over the last twenty years in studying the food environment.

Oakes, M. J., Masse, L. C., Messer, L. C. (2009) Work group III: Methodological issues in research on the food and physical activity environments. Addressing data complexity. *American Journal of Preventive Medicine*, 36(4S), S177-S181.

Four challenges are presented in the studies of the effects of environment on food and physical activity.

- 1). Conceptual models and theories: There are no elaborate theories or models making research prone to mis-measurement leading to false relationships. This is difficult given the transdisciplinary nature of food environment studies.
- 2). Study designs are more observational than experimental and qualitative methods are not being employed enough.
- 3). Analysis: Statistical inference and scientific explanation are not properly understood. Assumptions should be recognized in analyses.
- 4). Measurement error: Validity concerns are superseded by reliability.

They suggest that researchers need to think more about theoretical aspects studies before and while they are conducting them, use more cross-validation of data from different samples, and have a better understanding of measurement error.

Odoms-Young, A. M., Zenk, S, Mason, Maryann. (2009). Measuring food availability and access in African-American communities: Implications for intervention and policy. *American Journal of Preventive Medicine*, 36(4S). S145-S150.

The authors claim that no existing, over-arching tools are available to study the food environment among African Americans. They offer four main challenges.

- 1). Neighborhood definition: Neighborhood perception does not fit neatly with proxies such as zip code and census tract. They suggest that research should include sample group perceptions of neighborhood (See [Colabianchi et al 2007](#), [Boyington et al 2004](#), [Yeh 2008](#), [Cummins 2007a](#)).
- 2). Identification of relevant food outlets: Small retail outlets may not be represented properly in databases (See [Moore & Diez-Roux 2006](#)). Alternative stores such as street vendors may be important to African American communities. The authors found through qualitative work in Chicago African American neighborhoods that mobile food vendors and other sources are important (the study is not published).
- 3). Cultural preferences: Few studies have included cultural preferences in studies of African American communities ([James 2004](#), [Block & Kouba 2006](#), [Short et al 2007](#)). More mixed-methods approaches are needed.
- 4). Social impacts of neighborhoods; The authors found through interviews in Chicago that safety in neighborhoods can be a barrier to food access. Relations with immigrant store owners have been shown to also be a barrier.

Paquet, C., Daniel, M., Kestens, Y., Léger, K., & Gauvin, L. (2008). Field validation of listings of food stores and commercial physical activity establishments from secondary data. *International Journal of Behavioral Nutrition and Physical Activity*, 5:58.

The reliability of commercial databases and Internet searches of food and physical-related establishments were tested through ground truthing with field observations in Canada. They found that in relation to food establishments the commercial database had high positive predictive values and the Internet was moderate. Socio-economic status did not have a significant effect. Therefore, the authors claim that commercial databases are an acceptable alternative to expensive field research. However, Canada may be unique in comparison to the US. As [Moore & Diez Roux 2006](#) state, Info USA claims that 12% of businesses refuse to be counted. (See [Wang et al. 2006 also](#)).

Saelens, B. E & Glanz, K. (2009). Work Group I: Measures of the Food and Physical Environment. Instruments. *American Journal of Preventive Medicine*, 36(4S), S166-S170.

Saelans and Glanz provide three challenges to the instruments used for measuring food and physical activity environments:

- 1). Balance between new and old instruments: fewer instruments have been created for measuring the food environments, but researchers should be aware of their existence. This is the main crux of their argument. Information should be shared freely and some sort of depository should be created that promotes this sharing.

2). Research should respond to community involvement and be sensitive to changes in the environment.

3). Scale: In relation to food access, the biggest issue is what is a neighborhood? Also, they suggest that more than a single environmental unit should be utilized in studies.

They offer common guidelines for reporting research that provides: a rationale for the instrument used, the constructs purported to be measured, reliability and validity testing, detailed protocols on the use of the instrument, scoring and scaling, modifications added to the instrument, the setting of the research, and ways to access the instrument.

A few other suggestions are to keep environmental and individual measurements separate and not concentrate only on obesity in food studies.

Wang, M., Gonzalez, A., Ritchie, L., & Winkleby, M. (2006). The neighborhood food environment: sources of historical data on retail food stores. *International Journal of Behavioral Nutrition and Physical Activity*, 3:15.

Types of historical food retail store data were investigated: two from government sources (a city business licensing department, and the State Board of Equalization, SBOE) and three from commercial sources (Dun & Bradstreet, Trade Dimensions, and the telephone business directory). They found that SBOE databases under-represent stores and phone books over-represent by comparing the different types. This study suggests that secondary data sources should be strengthened through observation. (See Paquet et al. 2008 for an argument on the validity of current databases).

One author qualitatively studied a socio-economically diverse group of women and found that ethnic markets and not grocery stores are dominant sources of quality, affordable food (this was kind of shoe-horned into the discussion, but is reflected in other studies).

Geographic Food Environment Assessments outside the US

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Apparicio, P., Cloutier, M., & Shearmur, R. (2007). The case of Montreal's missing food deserts: evaluation of accessibility to food supermarkets. *International Journal of Health Geographics*, 6:4.

Census tract centroids were used as proxies for store access in Montreal with 1000m buffers. They conclude that there are not problems with food access. Diversity was measured as the number of supermarkets and variety was the mean distance to the 3 closest supermarkets.

This quote reinforces the need for mixed methods and multiple levels in food access studies: "The choice to take into account the geographic position of supermarkets but not

their characteristics could be considered as a limitation in our study. In fact, supermarkets can vary greatly in terms of floor areas and quality of products but these variables are not taken into account in our accessibility measures, and neither are potential qualitative data related to purchasing behaviour." This study in Canada does not reflect what has been found in US cities.

Ball, K., Crawford, D., & Mishra, G. (2006b). Socio-economic inequalities in women's fruit and vegetable intakes: a multilevel study of individual, social and environmental mediators. *Public Health Nutrition*, 9(5), 623-630.

This multi-level analysis of women in Melbourne suburbs found that socio-economic status factors (namely education) and social support may influence F&V intake more than environmental factors on account of the fact that those with high F&V intake were not necessarily better served by retail outlets. Supermarkets and food stores were not weighted and were found through the Yellow Pages. What is a fruit and vegetable store? A strength of this study is the use of physical surveys given to the sample group. A weakness is the fact that the women were from suburban areas where retail access may not necessarily be an issue.

Ball, K., Timperio, A., & Crawford, D. (2009). Neighbourhood socioeconomic inequalities in food access and affordability. *Health & Place*, 15(2), 578-585.

Specific addresses of women in Melbourne from high, moderate, and low-income provide an extremely precise population measurement. They used [Apparicio et al. 2007](#) measures of density, proximity, variety and price. A 2 km buffer zone from each residence via roads was used based on [Donkin et al. 1999](#) to measure density. Audits of supermarkets and food stores were conducted similar to [Baker et al. 2006](#) to ascertain variety and price. ANOVA variance and Bonferroni adjustments found that lower socioeconomic position (SEP) had less supermarket density, but the majority of F&V was equal. This is inconsistent with most US studies and they acknowledge that US cities are possibly unique ([See Apparicio et al 2007](#)). High fat foods did not vary. F&V were cheaper in lower SEP neighborhoods. They admit that this may reflect quality and more research is needed in this area. This is a cross-sectional study, but they did use regression analysis clustering and found no variation from the cross-sectional results. Interestingly, the findings contradict the perception that F&V are more expensive and less accessible to low SEP households ([see Giskes et al. 2007](#) and [Moore & Diez Roux. 2008](#)).

Clarke, G., Eyre, H., & Guy, C. (2002). Deriving indicators of access to food retail provision in British cities: Studies of Cardiff, Leeds and Bradford. *Urban Studies*, 39(11), 2041.

Clarke et al. searched for food deserts as defined by areas that have populations unable to access food by car and are under serviced in regards to supermarkets. They admit that this may be unrealistic because people may use stores outside the "food deserts." Economic Spatial interaction models were created to estimate "shopping flow" using square feet of retail as measure. The model takes into account attractiveness of stores, social class, and distance to retailer and size of retailer and predicts flows from residence to shopping destinations.

Three spatial indicators were used: simple provision indicators were used as a coarse indicator of retail space per household. Accessibility indicators were created through GIS measuring 500m around each retail store (This distance was chosen based on Wrigley 2002 and policy makers' suggestions). Model-based indicators used the spatial indicators to determine where food deserts exist.

These methods are based on the neo-classical economic assumption that people behave particular ways based on socio-economic status and the presence of retail establishments. While Clarke et al. do admit that their assumptions about smaller retailers providing a reduced selection of food as subjective, there is no admittance of the lack of interaction with those being studied to investigate motivation and behavior.

The scenarios that they provide based on the addition of large supermarkets in less serviced areas are interesting. Their models show that the supermarkets could actually decrease food access by shutting down small retailers.

Cummins, S., McKay, L., & MacIntyre, S. (2005). McDonald's restaurants and neighborhood deprivation in Scotland and England. *American Journal of Preventive Medicine*, 29(4), 308-310.

This is a very simple study of McDonald's restaurants found in the Yellow Pages and Census data in Scotland and England. No measures of obesity were incorporated and only general deprivation as defined by the census was used as a measure of each area. It is found that those with higher deprivation have more McDonald's. This study is in the context of Cummins' argument that broader studies are needed that avoid the "local trap." He mentions the study in New Orleans ([Block & Kouba 2004](#)) and claims that their scale is too small.

Donkin, A. J. M., Dowler, E. A., Stevenson, S. J., & Turner, S. A. (1999). Mapping access to food at a local level. *British Food Journal*, 101(7), 554.

Donkin et al. provide a "first indicator" of food accessibility for two estates in the UK. This initial overview used a straight-line 2km radius from two groups of dwellings. While they admit that this does not create a full picture of access, there are a couple of strengths to this study. Four separate food lists were created based on ethnic taste. Also, every store in the area was surveyed for availability and price. One interesting finding is the fact that a UK white person on welfare would have to spend 50% of his or her income to be provided with a healthy diet. This expresses the fact that accessibility is not only spatial, but economic.

Pearce, J., Blakely, T., Witten, K., & Bartie, P. (2007). Neighborhood deprivation and access to fast-food retailing: a national study. *American Journal of Preventive Medicine*, 32(5), 375-382.

Fast-food access and healthy food access (as defined by supermarkets, convenience stores, and service stations) was measured in relation to meshblocks (census blocks of 100 people) and schools in New Zealand. Socio-economic deprivation was used as the independent variable, and it was found that access is better for "deprived" blocks and

schools for fast food outlets. However, there was also better access to healthy food outlets, indicating that population density may effect more access.

Larsen, K., & Gilliland, J. (2008). Mapping the evolution of 'food deserts' in a Canadian city: Supermarket accessibility in London, Ontario. *International Journal of Health Geographics*, 7(16), 1961-2005.

GIS was used to map supermarkets in London, Ontario in relation to walking and public transit. Also, a longitudinal perspective was used through the mapping of supermarkets in 1961 as compared with 2005. A network buffer of 1000m was used based on foot and bus paths (10 min bus ride) to block centroids. Supermarket locations were found through phone directories, websites, calling stores, air photos, maps, and site visits. GIS was manually reviewed. Local business directories were used for 1961 locations ([see Wang et al. 2006 et al. for a review of historical data use](#)).

Socioeconomics of Census tracts were used to investigate disparities by income: walking access was poorer in low-income, but better for low-income in relation to bussing. Distance to supermarkets in general was not significantly different between census tracts. Supermarket access in general has significantly diminished since 1961.

Pearson, T., Russell, J., Campbell, M., & Barker, M. (2005). Do 'food deserts' influence fruit and vegetable consumption?--A cross-sectional study. *Appetite*, 45(2), 195-197.

This is a cross-sectional study of 1000 addresses in four wards of South Yorkshire. Surveys were sent to homes asking demographics and a 24 hour food recall. This was compared with road travel distance to nearest supermarket. They found that gender and age have more to do with F&V intake than poverty and distance to supermarkets. They also found that those without a car did not have less consumption of F&V. The small sample size of this study makes this only a cursory look at this population. Nevertheless, it reflects other studies from outside the US that reflect little inequality to food access based on socio-economic status. They suggest that cultural factors should be taken into account, bring the issue of food security back to the individual level ([See Macintyre 2007](#)).

Rex, D., & Blair, A. (2003). Unjust des(s)erts: food retailing and neighbourhood health in Sandwell. *International Journal of Retail & Distribution Management*, 31(9), 459-465.

Postal codes were investigated in Sandwell for walking access (500m) to stores carrying eight types of fruits and vegetables at reasonable prices. This was accomplished by visiting every store because they claim that shop type may not describe what is sold (see [Sharkey & Horel 2008](#)). They found that it is much easier to purchase junk food and cigarettes than F&V. They also interviewed shop owners and found that demand does not account for the lack of F&V but is based on shelf life of perishables. The inclusion of qualitative studies of stores suggests that retail type and not personal behavior causes disparity ([See Macintyre 2007 for opposing view](#)).

This study suggests that there are actually “food deserts” in the UK.

The conclusions section includes community intervention strategies.

Smoyer-Tomic, K. E., Spence, J. C., Raine, K. D., Amrhein, C., Cameron, N., Yasenovskiy, V., et al. (2008). The association between neighborhood socioeconomic status and exposure to supermarkets and fast food outlets. *Health & Place, 14*(4), 740-754.

Only supermarkets and fast food outlets were mapped by census blocks in Edmonton and evaluated for race/ethnicity, income, employment, education, age, housing tenure, and population density. They note that income is the only significant indicator of food environment, most notably access to fast food restaurants; lower income has easier access.

Alphabetical Index

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