**MESA Neighborhood Study (Ancillary Study AS023)**

**Built Environment Measures**

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Please include an acknowledgement:

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# Overview:

Data on food stores, eating establishments, recreational facilities, social engagement destinations, popular walking destinations, street network, population density, land use, and public transportation were collected as part of the MESA Neighborhood study.

Business data for food stores (ie: supermarkets, fast food, drinking places, and liquor stores), recreational facilities, social engagement destinations, and popular walking destinations were purchased using the National Establishment Time Series (NETS)[[1]](#footnote-1) data from Walls and Associates for all zip codes within a 5-mile buffer of any MESA address. This data is available for the years 2000-2010 and linked to the MESA addresses at the year of the exam. Densities were created for buffer sizes of ½, 1, and 3 miles around each address for both simple densities and kernel densities. In addition, Euclidean (straight-line) distance to nearest store was calculated.

Street connectivity was measured by intersection density and network ratio. All network and street calculations were performed using streets from Street Map 03 to represent year 2000 and from StreetMap Premium 2012 for year 2010 which is available for the entire US. Measures are available for ½ mile and 1 mile buffers.

Population density was created based on total population from census block population data from Census 2000 and Census 2010 SF1 data downloaded from the US Census American FactFinder within a study participant’s ½ mile and 1 mile buffers. In addition, the population density within residential area (per square kilometer) was created. To apply the data to exams, population from Census 2000 is used for years 2000-2005 and from Census 2010 for years 2006-2012. The residential area used matches with the land use by site (see below).

Data on land use was collected from various government sources from Los Angeles, CA; Chicago, IL; Baltimore, MD; St Paul, MN; Forsyth County, NC; and New York, NY. For each land use file, the parcels were coded into residential, retail, and commercial and percent of each was calculated for ½ and 1 mile buffers and the straight-line (Euclidean) distance to nearest retail and commercial. To apply the data across time for the MESA exams for longitudinal analyses, since there is data for at least two time points for all study sites, the data will be matched by exam date to the year closest in time. See Table 3 in details section for the timeline for how the data is applied by study site. Linear interpolations were also created for time between years where data is available.

Distances to nearest train/subway stops and bus lines were calculated based on public transit files obtained through various government sources. These are available for the 6 main MESA study sites (Los Angeles, CA; Chicago, IL; Baltimore, MD; St Paul, MN; Forsyth County, NC; and New York, NY). To apply the data across time for the MESA exams for longitudinal analyses, for sites that only have data available at one year, that year will be applied to all exams. For sites where there is more than one year available, the data will be matched by exam date to the year closest in time. See Table 4 in details section for how data was applied across study years. Linear interpolations were also created for time between years where data is available.

To create a combined measure that takes into account aspects of the built environment related to walking were created but extracting factors from a principle factor analysis with varimax rotation[[2]](#footnote-2). Variables included in the factor analysis were:

1. Population density per square mile (1 mile buffer)
2. Percent retail (1 mile buffer)
3. Percent residential (1 mile buffer)
4. Popular walking destinations – simple density (1 mile buffer)
5. Distance to bus
6. Network ratio

A three-factor model was chosen for these measures. Initial eigenvalues indicated that the first three factors explained 37%, 19%, and 15% of the variance, respectively. The three-factor solution, which explained 81% of the variance, was preferred because of: (a) the “leveling off” of eigenvalues on the scree plot after three factors; and (b) clarity of interpretation of the factor solution. Factor scores were created by multiplying the factor weights by the standardized variables and summing for variables loading at 0.8 or higher on that factor. Factor scores are 1) Intensity of development (popular walking density, population density, residential) and 2) Connected Retail centers (network ratio, retail). A separate score was not calculated for Factor 3, since only distance to bus was highly loaded on that factor.

To assess long-term cumulative exposure to the neighborhood environment, we created time-varying cumulative means, defined as the mean across all months from the baseline to each follow-up exam.

# Recommendations:

**Simple vs Kernel Densities**: The simple and kernel densities are highly correlated with one another. The choice as to which one to use needs to be carefully thought out in terms of the outcome of interest. The kernel density gives more weight to the facilities closer to the addresses while the simple densities give equal weight to everything within the buffer. In most cases, the kernel density will make more conceptual sense, but this is more complicated to interpret. This could have some policy ramifications. If using the kernel density, for any policy recommendations it should be understood that it’s not the full bandwidth that we’re saying has an impact. At about 80% of the radius (bandwidth) approximately 95% of the area under the kernel curve is represented (per Shannon Brines).

**Buffer size**: The choice as to which buffer size to use needs to be carefully thought out in terms of the outcome of interest. Since there is a lot of variability across the sites, it may be useful to use different buffer sizes for each site, although this will lead to more difficulty in interpretation of results. ½ mile buffers may need to be used with some caution for some of the variables, especially at certain sites, due to the high number of 0 values for the densities. To date, most analyses have used the 1-mile buffers.

**Retail vs Commercial:** Since retail is a subset of commercial, these variables should not be used together in analyses. It is best to select one or the other for use. In general, retail has been used in most analyses.

**Partial Buffers in data collection area**: For land use and public transportation, data was collected only for the six main study sites and selected surrounding area. For participants whose address falls completely outside the study area, these measures will be missing. For participants whose buffers fall partially within the study area, there is an indicator for the percent of the buffer within the area. It is recommended to restrict analysis to those with at least 90% of the buffer within the area.

Table 1: Recommended variables

| **Variable name** | **Description** | **Recommendation for when to use this** |
| --- | --- | --- |
| **FOOD STORES** | | |
| S1FAV | 1 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. | For contemporaneous exposure or change in exposure |
| A\_S1FAV | Cumulative average of 1 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. | For long-term exposure to environment |
| S1MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for 1 mile simple density. This is calculated from S1FAV/(S1FAV+S1UNFAV). | To explore relationship between healthy and unhealthy food availability |
|  |  |  |
| **RECREATIONAL/PHYSICAL ACTIVITY FACILITIES** | | |
| S1PAI | 1 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. | For contemporaneous exposure or change in exposure |
| A\_S1PAI | Cumulative average of 1 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. | For long-term exposure to environment |
|  |  |  |
| **SOCIAL ENGAGEMENT DESTINATIONS** | | |
| S1SOC | 1 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. | For contemporaneous exposure or change in exposure |
| A\_S1SOC | Cumulative average of 1 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. | For long-term exposure to environment |
|  |  |  |
| **POPULAR WALKING DESTINATIONS** | | |
| S1WALK | 1 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. | For contemporaneous exposure or change in exposure |
| A\_S1WALK | Cumulative average of 1 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. | For long-term exposure to environment |
|  |  |  |
| **STREET NETWORK** | | |
| NetRatio1 | 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. | For contemporaneous exposure or change in exposure |
| A\_NetRatio1 | Cumulative average of 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. | For long-term exposure to environment |
| NetRatio1ip | Interpolated 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. | Offers more variability over time. |
|  |  |  |
| **POPULATION DENSITY** | | |
| POPDENMI1 | Population density in 1 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. | For contemporaneous exposure or change in exposure |
| POPDENMI1ip | Interpolated Population density in 1 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. | Offers more variability over time. |
|  |  |  |
| **LAND USE** | | |
| PRET1 | 1 mile buffer percent of land devoted to retail use. | For contemporaneous exposure or change in exposure |
| A\_PRET1 | Cumulative average of 1 mile buffer percent of land devoted to retail use. | For long-term exposure to environment |
| PRET1ip | Interpolated 1 mile buffer percent of land devoted to retail use. | Offers more variability over time. |
|  |  |  |
| **PUBLIC TRANSPORTATION** | | |
| SBUS | Euclidean distance to nearest bus route (meters). | For contemporaneous exposure or change in exposure |
| STRN | Euclidean distance to nearest train/subway stop (meters). | For contemporaneous exposure or change in exposure |
|  |  |  |
| **BUILT ENVIRONMENT FACTOR SCORES** | | |
| BES1\_FACTOR1 | Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) | For contemporaneous exposure or change in exposure.  When want an overall summary measure of built environment |
| A\_BES1\_FACTOR1 | Cumulative average of Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) | For long-term exposure to environment  When want an overall summary measure of built environment |
| BES1\_FACTOR1ip | Interpolated Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) | Offers more variability over time.  When want an overall summary measure of built environment |

# Example Methodology Section for Manuscripts:

**FOOD STORES**

Based on prior work (Auchincloss 2012), favorable food stores were defined as chain and non-chain supermarkets and fruit and vegetable markets identified using National Establishment Time Series data from Walls and Associates (Walls 2010). A total of 15 Standardized Industrial Codes were used to identify supermarkets and fruit and vegetable markets. Supermarkets were defined as grocery stores (SIC #5411) with at least $2 million in annual sales or at least 25 employees and augmented using supermarket store name lists as described elsewhere (Auchincloss 2012). These data were enhanced by adding supermarket data from the Nielsen TDLinx Service Supermarket Retail Category Database (Nielsen 2008). Fruit and vegetable markets where defined as businesses with SIC code #5431. Fast food chains were defined as restaurants listed in the 75 top revenue fast food restaurants in the top 400 Chain Restaurants ranking in Restaurants and Institutions magazine in 2005 (Hume 2005). Fast food chains specialize in quick food preparation, have no table service, and exclude coffee, donut, and ice cream shops. Fast food non-chains are defined equivalently but are those fast food restaurants not on the aforementioned list. Data corresponding to the year that the individual MESA participants’ exam dates were used. For each MESA participant, the density of food stores was defined as the number of food stores within a 1-mile radius around their primary residential address using the point density command in ArcGIS 9.3 (ESRI 2011). Data are presented as businesses per square mile. Kernel estimation (Silverman 1986) was used to calculate the densities, such that healthy food stores and recreational facilities closer to participants’ addresses were given more weight than facilities farther away. One-mile densities were chosen as proxies for neighborhoods based on an area in which most individuals could reasonably walk and on federal government definitions of access to services (Ver Ploeg 2009).

Auchincloss AH, Moore KA, Moore LV, Diez Roux AV. Improving retrospective characterization of the food environment for a large region in the United States during a historic time period. *Health Place*. 2012;18:1341–1347.

Walls and Associates (2010) National Establishment Time-Series (NETS) Database: Database Description. Available: <http://youreconomy.org/pages/walls.lasso>. Accessed July 23, 2013.

Nielsen Company (2008) Retail Site Database, The Ultimate Source.: Trade Dimensions, a subsidiary of Nielsen Company.

Hume, S.,2005.Top400ChainRestaurants.RestaurantsandInstitutions 〈http:// www.rimag.com〉. Online(accessed2005).

Environmental Systems Research Institute. ArcGIS Desktop Release 9.3. Redlands, CA: Environmental Systems Research Institute, 2011.

Silverman BW. Density Estimation for Statistics and Data Analysis. London, United Kingdom: Chapman & Hall/CRC; 1986.

Ver PLoeg M, Bereneman V, Farrigan T, et al. *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences: Report to Congress.*Washington, DC: United States Department of Agriculture; 2009.

Information on alcohol outlets was obtained from the National Establishment Time Series (NETS) data from Walls and Associates (Walls 2010) using Standard Industrial Classification (SIC) codes to identify liquor stores and on-site drinking places (restaurants and bars). SIC codes for grocery stores were not included due to large variation in alcohol-sale laws. Alcohol outlet densities were created for 1 mile buffers around participants' homes for liquor stores and on-site drinking places separately. Alcohol outlet density was also operationalized as a total outlet density score by standardizing liquor store density and drinking place density and then summing the scores. A one mile buffer Silverman kernel (ArcGIS kernel density function) (Silverman, 1986) was used in this analysis, as it has been found to result in the largest effect sizes in other studies (Schonlau 2008; Scribner 2000), and is a reasonable walking and driving distance. Kernel densities, unlike simple densities, assign greater weight to alcohol outlets that are closer to participants' homes (Silverman, 1986). Densities were created for liquor stores and on-site drinking places each year from 2000 to 2010, and were linked to the corresponding year of individual MESA data.

Walls and Associates (2010) National Establishment Time-Series (NETS) Database: Database Description. Available: <http://youreconomy.org/pages/walls.lasso>. Accessed July 23, 2013.

Silverman, B.W. (1986). *Density Estimation for Statistics and Data Analysis*. New York, NY: Chapman and Hall.

Schonlau,M., Scribner, R., Farley, T. A., Theall, K. P., Bluthenthal, R. N., Scott, M., & Cohen, D. A. (2008). Alcohol outlet density and alcohol consumption in Los Angeles county and southern Louisiana. *Geospatial Health*, *3*(1), 91–101.

Scribner, R. A., Cohen, D. A., & Fisher, W. (2000). Evidence of a structural effect for alcohol outlet density: A multilevel analysis. *Alcoholism: Clinical and Experimental Research*, *24*(2), 188–195.

**RECREATIONAL/PHYSICAL ACTIVITY FACILITIES**

GIS-based densities of physical activity resources were derived from commercially available business listings through the National Establishment Time-Series database (Walls 2010). One hundred and fourteen Standard Industrial Classification codes related to indoor conditioning, dance, bowling, golf, biking, hiking, team and racquet sports, swimming, physical activity instruction, and water activities were defined as physical activity resources (Gordon-Larsen 2006; Powell 2006). Data were obtained for each year from 2000 to 2010. Annual data were attributed to all months in the year. The simple densities of physical activity resources per square mile were calculated for a 1-mile buffer around each participant’s home address using ArcGIS software (ESRI, Redlands, California). The 1-mile buffer was selected for analyses on the basis of a study in a subsample of this cohort, in which a majority of physically active participants reported that they always exercised within 1 mile of their residences or did so at least half the time (Diez Roux 2007).

Walls and Associates (2010) National Establishment Time-Series (NETS) Database: Database Description. Available: <http://youreconomy.org/pages/walls.lasso>. Accessed July 23, 2013.

Gordon-Larsen P, Nelson MC, Page P, et al. Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics. 2006;117(2):417–424.

Powell LM, Slater S, Chaloupka FJ, et al. Availability of physical activity–related facilities and neighborhood demographic and socioeconomic characteristics: a national study. Am J Public Health. 2006;96(9):1676–1680.

Diez Roux A, Evenson K, McGinn A, et al. Availability of recreational resources and physical activity in adults. Am J Public Health. 2007;97(3):493–499.

**SOCIAL ENGAGEMENT DESTINATIONS**

GIS-based data on social engagement destinations were obtained from the National Establishment Time Series (NETS) database from Walls & Associates (Walls 2008) for years 2000–2010. Based on previous work, a total of 430 Standard Industrial Classification codes were selected as locations which may facilitate social interaction and promote social engagement (Hoehner 2010). These destinations include: participatory entertainment and physical activity (e.g., gyms, yoga, bowling, golf); cultural/intellectual (e.g., theaters, libraries, museums/galleries, social/political clubs); restaurants and night clubs; spiritual/religious (e.g., churches, synagogues, mosques); beauty salons and barbers; and gambling or coin operated entertainment (e.g., casinos, arcades). Destinations density (number per square mile) was created using ArcGIS 10.1 for 1-mile Euclidean buffers around each residential address and linked to each exam by calendar year.

Walls & Associates L. National Establishment Time-Series (NETS) Database: database description. Available at: [www.youreconomy.org/nets/NETSDatabaseDescription.pdf](http://www.youreconomy.org/nets/NETSDatabaseDescription.pdf). Accessed July 23, 2013.

Hoehner CM, Schootman M. Concordance of commercial data sources for neighborhood-effects studies. J Urban Health. 2010; 87(4): 713–725.

**POPULAR WALKING DESTINATIONS**

Built environment measures were also calculated during the MESA Neighborhood Ancillary Study. On the basis of previous frameworks (Handy 2002), we investigated 5 built environment domains: population density, zoned land-use patterns, access to destinations, public transportation, and street connectivity. Elements of these domains may make it easier for people to complete daily tasks on foot, subsequently increasing transport walking and physical activity levels and have been shown to be most associated with walking for transportation in this cohort (Hirsch 2014). Neighborhoods were defined by fitting Euclidean buffers around participants’ addresses. Primary results are reported for Euclidean buffers with a 1-mile radius because areas of this size are thought to best capture the relationship between built environment characteristics and walking in MESA’s diverse urban contexts. Walking destinations were identified using Standard Industrial Classification codes and data obtained from the National Establishment Time Series database (Hoehner 2010; Walls 2010). Details on these measures can be found elsewhere (Hirsch 2014).

Handy SL, Boarnet MG, Ewing R, et al. How the built environment affects physical activity: views from urban planning. Am J Prev Med. 2002;23(2 suppl):64–73.

Hoehner CM, Schootman M. Concordance of commercial data sources for neighborhood-effects studies. J Urban Health. 2010;87(4):713–725.

Walls & Associates. National Establishment Time-Series (NETS) Database: 2012 Database Description (Preliminary Release). Denver, CO: Walls & Associates; 2013. http://exceptionalgrowth.org/downloads/NETSDatabaseDescription2013.pdf. Accessed May 20, 2014.

Hirsch JA, Moore KA, Clarke PJ, Rodriguez DA, Evenson KR, Brines SJ et al. Changes in the built environment and changes in the amount of walking over time: longitudinal results from the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol 2014; 180: 799–809.

**STREET NETWORK**

Built environment measures were also calculated during the MESA Neighborhood Ancillary Study. On the basis of previous frameworks (Handy 2002), we investigated 5 built environment domains: population density, zoned land-use patterns, access to destinations, public transportation, and street connectivity. Elements of these domains may make it easier for people to complete daily tasks on foot, subsequently increasing transport walking and physical activity levels and have been shown to be most associated with walking for transportation in this cohort (Hirsch 2014). Neighborhoods were defined by fitting Euclidean buffers around participants’ addresses. Primary results are reported for Euclidean buffers with a 1-mile radius because areas of this size are thought to best capture the relationship between built environment characteristics and walking in MESA’s diverse urban contexts. Street calculations were performed using StreetMap and StreetMap Premium for ArcGIS (Esri). StreetMap files may be less accurate than data provided by municipalities (Frizzelle 2009), but they are uniform across cities. Road connectivity was measured as the proportion of the Euclidean buffer that is covered by a network buffer. The ratio varies between 0 and 1, with 0 meaning that none of the circle area can be reached through the road network and 1 meaning that the entire circle can be reached through the street network, denoting highest connectivity. Details on these measures can be found elsewhere (Hirsch 2014). Addresses of MESA participants at each examination were assigned to the data collected closest to the time of examination.

Handy SL, Boarnet MG, Ewing R, et al. How the built environment affects physical activity: views from urban planning. Am J Prev Med. 2002;23(2 suppl):64–73.

Frizzelle BG, Evenson KR, Rodriguez DA, et al. The importance of accurate road data for spatial applications in public health: customizing a road network. Int J Health Geogr. 2009;8:24.

Hirsch JA, Moore KA, Clarke PJ, Rodriguez DA, Evenson KR, Brines SJ et al. Changes in the built environment and changes in the amount of walking over time: longitudinal results from the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol 2014; 180: 799–809.

**POPULATION DENSITY**

Built environment measures were also calculated during the MESA Neighborhood Ancillary Study. On the basis of previous frameworks (Handy 2002), we investigated 5 built environment domains: population density, zoned land-use patterns, access to destinations, public transportation, and street connectivity. Elements of these domains may make it easier for people to complete daily tasks on foot, subsequently increasing transport walking and physical activity levels and have been shown to be most associated with walking for transportation in this cohort (Hirsch 2014). Neighborhoods were defined by fitting Euclidean buffers around participants’ addresses. Primary results are reported for Euclidean buffers with a 1-mile radius because areas of this size are thought to best capture the relationship between built environment characteristics and walking in MESA’s diverse urban contexts. Population density was measured using population counts from the US Census in 2000 and 2010 at the block level and divided by total land area in the buffer. When a block was not fully contained within a neighborhood, its population was assigned in direct proportion to the area of the block contained within the neighborhood, which assumes a uniform population density within each block. Details on these measures can be found elsewhere (Hirsch 2014). Addresses of MESA participants at each examination were assigned to the data collected closest to the time of examination within that site.

Handy SL, Boarnet MG, Ewing R, et al. How the built environment affects physical activity: views from urban planning. Am J Prev Med. 2002;23(2 suppl):64–73.

Hirsch JA, Moore KA, Clarke PJ, Rodriguez DA, Evenson KR, Brines SJ et al. Changes in the built environment and changes in the amount of walking over time: longitudinal results from the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol 2014; 180: 799–809.

**LAND USE**

Built environment measures were also calculated during the MESA Neighborhood Ancillary Study. On the basis of previous frameworks (Handy 2002), we investigated 5 built environment domains: population density, zoned land-use patterns, access to destinations, public transportation, and street connectivity. Elements of these domains may make it easier for people to complete daily tasks on foot, subsequently increasing transport walking and physical activity levels and have been shown to be most associated with walking for transportation in this cohort (Hirsch 2014). Data were obtained from regional governments or commercially available business listings and processed using ArcGIS 10.1 (Esri, Redlands, California). Neighborhoods were defined by fitting Euclidean buffers around participants’ addresses. Primary results are reported for Euclidean buffers with a 1-mile radius because areas of this size are thought to best capture the relationship between built environment characteristics and walking in MESA’s diverse urban contexts. Land-use parcel files were obtained from local planning departments, city governments, and regional entities in the six study sites. The data were dated between 2001 and 2012 depending on the site. Two investigators independently classified parcels into 2 mutually exclusive land use categories (retail and residential) based on land-use codes and any discrepancies were adjudicated by a third investigator. Availability of retail in each neighborhood was calculated using the percentage of land area in parcels that contain retail uses. Availability of residential in each neighborhood was calculated using the percentage of land area in parcels that contain primarily residential uses. Areas with higher percentages of land zoned for retail use and lower percentages zoned for residential use were considered to have a higher land-use mix. Details on these measures can be found elsewhere (Hirsch 2014; Rodriguez 2009). Addresses of MESA participants at each examination were assigned to the data collected closest to the time of examination within that site. For participants who moved outside of the study areas, we had no data on built environment measures after the move.

Handy SL, Boarnet MG, Ewing R, et al. How the built environment affects physical activity: views from urban planning. Am J Prev Med. 2002;23(2 suppl):64–73.

Hirsch JA, Moore KA, Clarke PJ, Rodriguez DA, Evenson KR, Brines SJ et al. Changes in the built environment and changes in the amount of walking over time: longitudinal results from the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol 2014; 180: 799–809.

Rodriguez, D., Evenson, K., DiezRoux, A., Brines, S., 2009. Land use, residential density, and walking: The Multi‐Ethnic Study of Atherosclerosis. Am. J.Prev. Med. 37(5),397–404.

**PUBLIC TRANSPORTATION**

Built environment measures were also calculated during the MESA Neighborhood Ancillary Study. On the basis of previous frameworks (Handy 2002), we investigated 5 built environment domains: population density, zoned land-use patterns, access to destinations, public transportation, and street connectivity. Elements of these domains may make it easier for people to complete daily tasks on foot, subsequently increasing transport walking and physical activity levels and have been shown to be most associated with walking for transportation in this cohort (Hirsch 2014). Data were obtained from regional governments or commercially available business listings and processed using ArcGIS 10.1 (Esri, Redlands, California). Files containing data on bus routes were obtained from local planning departments, city governments, and regional entities. Distance to nearest bus line was calculated as the Euclidean distance in meters. Details on these measures can be found elsewhere (Hirsch 2014). Addresses of MESA participants at each examination were assigned to the data collected closest to the time of examination within that site. For participants who moved outside of the study areas, we had no data on built environment measures after the move.

Handy SL, Boarnet MG, Ewing R, et al. How the built environment affects physical activity: views from urban planning. Am J Prev Med. 2002;23(2 suppl):64–73.

Hirsch JA, Moore KA, Clarke PJ, Rodriguez DA, Evenson KR, Brines SJ et al. Changes in the built environment and changes in the amount of walking over time: longitudinal results from the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol 2014; 180: 799–809.

**BUILT ENVIRONMENT FACTOR SCORES**

Based on previous frameworks (Handy 2002) we investigated six built environment measures across five built environment domains: population density, land-use patterns (zoned retail and residential uses), access to destinations, public transportation, and street patterns. Data were obtained from regional governments and commercially available business listings and processed using ESRI ArcGIS 10.1 (Redlands, CA). Neighborhoods were defined as a 1 mile buffer around participants’ addresses as they may represent the most salient environment across MESA’s diverse urban contexts. When data was not available for a given year, it was interpolated using a linear estimate between the two nearest measurements. Participants who moved outside of the study areas do not have built environment data post-move and are only included in analyses pre-move. As built environment metrics may be inter-related and highly collinear, principal component analysis was used to identify their underlying factors and compute composite scores. A composite score was created for each factor based on the weighted sum of the standardized items with heavy loadings (>0.5) for that factor. Additional information can be found elsewhere (Hirsch 2014).

Handy SL, Boarnet MG, Ewing R, Killingsworth RE. How the built environment affects physical activity: views from urban planning. Am J Prev Med 2002;23(2): 64-73.

Hirsch, J.A., et al., *Built environment change and change in BMI and waist circumference: Multi-ethnic Study of Atherosclerosis.* Obesity (Silver Spring), 2014. **22**(11): p. 2450-7.

# Published MESA Manuscripts Using the Data:

Rodriguez, D.A., et al., *Land use, residential density, and walking. The multi-ethnic study of atherosclerosis.* American journal of preventive medicine, 2009. **37**(5): p. 397-404.

Auchincloss, A.H., et al., *Improving retrospective characterization of the food environment for a large region in the United States during a historic time period.* Health & place, 2012. **18**(6): p. 1341-7.

Curl, C., et al., *Associations of Organic Produce Consumption with Socioeconomic Status and the Local Food Environment: Multi-Ethnic Study of Atherosclerosis (MESA).* PloS one, 2013. **8**(7).

Hirsch, J.A., et al., *Discrete land uses and transportation walking in two U.S. cities: the Multi-Ethnic Study of Atherosclerosis.* Health & place, 2013. **24**: p. 196-202.

Moore, K., et al., *Home and work neighbourhood environments in relation to body mass index: the Multi-Ethnic Study of Atherosclerosis (MESA).* Journal of epidemiology and community health, 2013. **67**(10): p. 846-53.

Hirsch, J.A., et al., *Changes in the built environment and changes in the amount of walking over time: longitudinal results from the multi-ethnic study of atherosclerosis.* Am J Epidemiol, 2014. **180**(8): p. 799-809.

Hirsch, J.A., et al., *Built environment change and change in BMI and waist circumference: Multi-ethnic Study of Atherosclerosis.* Obesity (Silver Spring), 2014. **22**(11): p. 2450-7.

Ranchod, Y.K., et al., *Longitudinal associations between neighborhood recreational facilities and change in recreational physical activity in the multi-ethnic study of atherosclerosis, 2000-2007.* American journal of epidemiology, 2014. **179**(3): p. 335-43.

Unger, E., et al., *Association of neighborhood characteristics with cardiovascular health in the multi-ethnic study of atherosclerosis.* Circ Cardiovasc Qual Outcomes, 2014. **7**(4): p. 524-31.

Albrecht, S.S., et al., *Change in waist circumference with longer time in the United States among Hispanic and Chinese immigrants: the modifying role of the neighborhood built environment.* Ann Epidemiol, 2015.

Berchuck, S.I., et al., *Spatially modelling the association between access to recreational facilities and exercise: the ‘Multi-ethnic study of atherosclerosis’.* Journal of the Royal Statistical Society: Series A (Statistics in Society), 2015: p. n/a-n/a.

Brenner, A.B., et al., *Associations of Alcohol Availability and Neighborhood Socioeconomic Characteristics With Drinking: Cross-Sectional Results From the Multi-Ethnic Study of Atherosclerosis (MESA).* Subst Use Misuse, 2015. **50**(12): p. 1606-17.

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# Dataset Description:

Participant inclusion: MESA participants who agreed to participate in the MESA Neighborhood study (N=6191)

Data set-up: Panel (stacked) dataset with 1 row per participant per exam; an exam indicator is included

Notes: Data will be missing for any addresses that were unable to geocode for all data sources. Land use and public transportation measures will be missing where the address falls outside the counties where these data were collected.

**Data Set Name: MESANBH\_BUILTENV10182016**

| **Variable Order** | **Variable name** | **Description** | **Coding** |
| --- | --- | --- | --- |
| 1 | idno | MESA ID number |  |
| 2 | EXAM | MESA Exam number |  |
| 3 | accuracy | Geocoding accuracy indicator. It is recommended that that only those with accuracy to at least zip code + 4 centroid are used in analyses, at least for sensitivity analysis. | 1 = Street level  2 = Zip+4 centroid level  3 = Zip+2 centroid level  4 = Zip code centroid  5 = Unable to geocode |
| 4 | cenid | Fake census tract id for clustering analysis. This should be used when using census tract level data in models. This is from 2000 census since census 2000 and ACS use this geography. |  |
|  |  |  |  |
| **FOOD STORES** | | | |
| 5 | K0SCH | 1/2 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 6 | K0SMALL | 1/2 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 7 | K0FFC | 1/2 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 8 | K0FFALL | 1/2 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 9 | K0LIQ | 1/2 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 10 | K0ALC | 1/2 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 11 | K0ALLALC | 1/2 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 12 | K0FAV | 1/2 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 13 | K0UNFAV | 1/2 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 14 | K0UNFAVFO | 1/2 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 15 | K0TOTFOOD | 1/2 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 16 | K0MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for ½ mile kernel density. This is calculated from K0FAV/(K0FAV+K0UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 17 | K0MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for ½ mile kernel density. This is calculated from K0FAV/(K0FAV+K0UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 18 | A\_K0SCH | Cumulative average of 1/2 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 19 | A\_K0SMALL | Cumulative average of 1/2 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 20 | A\_K0FFC | Cumulative average of 1/2 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 21 | A\_K0FFALL | Cumulative average of 1/2 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 22 | A\_K0LIQ | Cumulative average of 1/2 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 23 | A\_K0ALC | Cumulative average of 1/2 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 24 | A\_K0ALLALC | Cumulative average of 1/2 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 25 | A\_K0FAV | Cumulative average of 1/2 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 26 | A\_K0UNFAV | Cumulative average of 1/2 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 27 | A\_K0UNFAVFO | Cumulative average of 1/2 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 28 | A\_K0TOTFOOD | Cumulative average of 1/2 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 29 | K1SCH | 1 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 30 | K1SMALL | 1 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 31 | K1FFC | 1 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 32 | K1FFALL | 1 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 33 | K1LIQ | 1 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 34 | K1ALC | 1 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 35 | K1ALLALC | 1 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 36 | K1FAV | 1 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 37 | K1UNFAV | 1 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 38 | K1UNFAVFO | 1 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 39 | K1TOTFOOD | 1 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 40 | K1MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for 1 mile kernel density. This is calculated from K1FAV/(K1FAV+K1UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 41 | K1MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for 1 mile kernel density. This is calculated from K1FAV/(K1FAV+K1UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 42 | A\_K1SCH | Cumulative average of 1 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 43 | A\_K1SMALL | Cumulative average of 1 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 44 | A\_K1FFC | Cumulative average of 1 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 45 | A\_K1FFALL | Cumulative average of 1 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 46 | A\_K1LIQ | Cumulative average of 1 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 47 | A\_K1ALC | Cumulative average of 1 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 48 | A\_K1ALLALC | Cumulative average of 1 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 49 | A\_K1FAV | Cumulative average of 1 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 50 | A\_K1UNFAV | Cumulative average of 1 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 51 | A\_K1UNFAVFO | Cumulative average of 1 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 52 | A\_K1TOTFOOD | Cumulative average of 1 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 53 | K3SCH | 3 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 54 | K3SMALL | 3 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 55 | K3FFC | 3 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 56 | K3FFALL | 3 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 57 | K3LIQ | 3 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 58 | K3ALC | 3 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 59 | K3ALLALC | 3 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 60 | K3FAV | 3 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 61 | K3UNFAV | 3 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 62 | K3UNFAVFO | 3 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 63 | K3TOTFOOD | 3 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 64 | K3MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for 3 mile kernel density. This is calculated from K3FAV/(K3FAV+K3UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 65 | K3MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for 3 mile kernel density. This is calculated from K3FAV/(K3FAV+K3UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 66 | A\_K3SCH | Cumulative average of 3 mile kernel density supermarket chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 67 | A\_K3SMALL | Cumulative average of 3 mile kernel density supermarket chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 68 | A\_K3FFC | Cumulative average of 3 mile kernel density fast food chains. The unit of measure is a weighted number of businesses per square mile. |  |
| 69 | A\_K3FFALL | Cumulative average of 3 mile kernel density fast food chain+non-chain. The unit of measure is a weighted number of businesses per square mile. |  |
| 70 | A\_K3LIQ | Cumulative average of 3 mile kernel density liquor stores. The unit of measure is a weighted number of businesses per square mile. |  |
| 71 | A\_K3ALC | Cumulative average of 3 mile kernel density alcoholic drinking places. The unit of measure is a weighted number of businesses per square mile. |  |
| 72 | A\_K3ALLALC | Cumulative average of 3 mile kernel density total alcohol (stores+drinking places). The unit of measure is a weighted number of businesses per square mile. |  |
| 73 | A\_K3FAV | Cumulative average of 3 mile kernel density favorable (healthy) food stores. The unit of measure is a weighted number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 74 | A\_K3UNFAV | Cumulative average of 3 mile kernel density unfavorable food stores including alcohol outlets. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 75 | A\_K3UNFAVFO | Cumulative average of 3 mile kernel density unfavorable food stores excluding alcohol. The unit of measure is a weighted number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 76 | A\_K3TOTFOOD | Cumulative average of 3 mile kernel density total food stores. The unit of measure is a weighted number of businesses per square mile. This includes any business coded as a food store. |  |
| 77 | S0SCH | 1/2 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 78 | S0SMALL | 1/2 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 79 | S0FFC | 1/2 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 80 | S0FFALL | 1/2 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 81 | S0LIQ | 1/2 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 82 | S0ALC | 1/2 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 83 | S0ALLALC | 1/2 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 84 | S0FAV | 1/2 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 85 | S0UNFAV | 1/2 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 86 | S0UNFAVFO | 1/2 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 87 | S0TOTFOOD | 1/2 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 88 | S0MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for ½ mile simple density. This is calculated from S0FAV/(S0FAV+S0UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 89 | S0MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for ½ mile simple density. This is calculated from S0FAV/(S0FAV+S0UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 90 | A\_S0SCH | Cumulative average of 1/2 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 91 | A\_S0SMALL | Cumulative average of 1/2 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 92 | A\_S0FFC | Cumulative average of 1/2 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 93 | A\_S0FFALL | Cumulative average of 1/2 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 94 | A\_S0LIQ | Cumulative average of 1/2 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 95 | A\_S0ALC | Cumulative average of 1/2 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 96 | A\_S0ALLALC | Cumulative average of 1/2 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 97 | A\_S0FAV | Cumulative average of 1/2 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 98 | A\_S0UNFAV | Cumulative average of 1/2 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 99 | A\_S0UNFAVFO | Cumulative average of 1/2 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 100 | A\_S0TOTFOOD | Cumulative average of 1/2 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 101 | S1SCH | 1 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 102 | S1SMALL | 1 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 103 | S1FFC | 1 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 104 | S1FFALL | 1 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 105 | S1LIQ | 1 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 106 | S1ALC | 1 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 107 | S1ALLALC | 1 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 108 | S1FAV | 1 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 109 | S1UNFAV | 1 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 110 | S1UNFAVFO | 1 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 111 | S1TOTFOOD | 1 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 112 | S1MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for 1 mile simple density. This is calculated from S1FAV/(S1FAV+S1UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 113 | S1MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for 1 mile simple density. This is calculated from S1FAV/(S1FAV+S1UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 114 | A\_S1SCH | Cumulative average of 1 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 115 | A\_S1SMALL | Cumulative average of 1 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 116 | A\_S1FFC | Cumulative average of 1 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 117 | A\_S1FFALL | Cumulative average of 1 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 118 | A\_S1LIQ | Cumulative average of 1 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 119 | A\_S1ALC | Cumulative average of 1 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 120 | A\_S1ALLALC | Cumulative average of 1 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 121 | A\_S1FAV | Cumulative average of 1 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 122 | A\_S1UNFAV | Cumulative average of 1 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 123 | A\_S1UNFAVFO | Cumulative average of 1 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 124 | A\_S1TOTFOOD | Cumulative average of 1 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 125 | S3SCH | 3 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 126 | S3SMALL | 3 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 127 | S3FFC | 3 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 128 | S3FFALL | 3 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 129 | S3LIQ | 3 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 130 | S3ALC | 3 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 131 | S3ALLALC | 3 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 132 | S3FAV | 3 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 133 | S3UNFAV | 3 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 134 | S3UNFAVFO | 3 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 135 | S3TOTFOOD | 3 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 136 | S3MRFEI\_TOT | Modified Retail Food Environment Index (including alcohol) for 3 mile simple density. This is calculated from S3FAV/(S3FAV+S3UNFAV). | 999999999 = Favorable and Unfavorable are both 0 |
| 137 | S3MRFEI\_NOALC | Modified Retail Food Environment Index (excluding alcohol) for 3 mile simple density. This is calculated from S3FAV/(S3FAV+S3UNFAVFO). | 999999999 = Favorable and Unfavorable are both 0 |
| 138 | A\_S3SCH | Cumulative average of 3 mile simple density supermarket chains. The unit of measure is the number of businesses per square mile. |  |
| 139 | A\_S3SMALL | Cumulative average of 3 mile simple density supermarket chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 140 | A\_S3FFC | Cumulative average of 3 mile simple density fast food chains. The unit of measure is the number of businesses per square mile. |  |
| 141 | A\_S3FFALL | Cumulative average of 3 mile simple density fast food chain+non-chain. The unit of measure is the number of businesses per square mile. |  |
| 142 | A\_S3LIQ | Cumulative average of 3 mile simple density liquor stores. The unit of measure is the number of businesses per square mile. |  |
| 143 | A\_S3ALC | Cumulative average of 3 mile simple density alcoholic drinking places. The unit of measure is the number of businesses per square mile. |  |
| 144 | A\_S3ALLALC | Cumulative average of 3 mile simple density total alcohol (stores+drinking places). The unit of measure is the number of businesses per square mile. |  |
| 145 | A\_S3FAV | Cumulative average of 3 mile simple density favorable (healthy) food stores. The unit of measure is the number of businesses per square mile. This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 146 | A\_S3UNFAV | Cumulative average of 3 mile simple density unfavorable food stores including alcohol outlets. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 147 | A\_S3UNFAVFO | Cumulative average of 3 mile simple density unfavorable food stores excluding alcohol. The unit of measure is the number of businesses per square mile. This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 148 | A\_S3TOTFOOD | Cumulative average of 3 mile simple density total food stores. The unit of measure is the number of businesses per square mile. This includes any business coded as a food store. |  |
| 149 | ASDSCH | Euclidean distance to nearest supermarket chains (meters). |  |
| 150 | ASDSMALL | Euclidean distance to nearest supermarket chain+non-chain (meters). |  |
| 151 | ASDFFC | Euclidean distance to nearest fast food chains (meters). |  |
| 152 | ASDFFALL | Euclidean distance to nearest fast food chain+non-chain (meters). |  |
| 153 | ASDLIQ | Euclidean distance to nearest liquor stores (meters). |  |
| 154 | ASDALC | Euclidean distance to nearest alcoholic drinking places (meters). |  |
| 155 | ASDALLALC | Euclidean distance to nearest total alcohol (stores+drinking places) (meters). |  |
| 156 | ASDFAV | Euclidean distance to nearest favorable (healthy) food stores (meters). This includes supermarket chain and non-chain and fruit and vegetable markets. |  |
| 157 | ASDUNFAV | Euclidean distance to nearest unfavorable food stores including alcohol outlets (meters). This includes convenience stores, bakeries/nuts/candy/ice cream stores, liquor stores, drinking places alcoholic, fast food chains, and fast food non-chain. |  |
| 158 | ASDUNFAVFO | Euclidean distance to nearest unfavorable food stores excluding alcohol (meters). This includes convenience stores, bakeries/nuts/candy/ice cream stores, fast food chains, and fast food non-chain. |  |
| 159 | ASDTOTFOOD | Euclidean distance to nearest total food stores (meters). This includes any business coded as a food store. |  |
|  |  |  |  |
| **RECREATIONAL/PHYSICAL ACTIVITY FACILITIES** | | | |
| 160 | K0PAI | 1/2 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 161 | K0IPAI | 1/2 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 162 | K0OPAI | 1/2 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 163 | K0NRI | 1/2 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 164 | K0INRI | 1/2 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 165 | K0ONRI | 1/2 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 166 | A\_K0PAI | Cumulative average of 1/2 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 167 | A\_K0IPAI | Cumulative average of 1/2 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 168 | A\_K0OPAI | Cumulative average of 1/2 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 169 | A\_K0NRI | Cumulative average of 1/2 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 170 | A\_K0INRI | Cumulative average of 1/2 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 171 | A\_K0ONRI | Cumulative average of 1/2 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 172 | K1PAI | 1 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 173 | K1IPAI | 1 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 174 | K1OPAI | 1 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 175 | K1NRI | 1 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 176 | K1INRI | 1 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 177 | K1ONRI | 1 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 178 | A\_K1PAI | Cumulative average of 1 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 179 | A\_K1IPAI | Cumulative average of 1 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 180 | A\_K1OPAI | Cumulative average of 1 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 181 | A\_K1NRI | Cumulative average of 1 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 182 | A\_K1INRI | Cumulative average of 1 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 183 | A\_K1ONRI | Cumulative average of 1 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 184 | K3PAI | 3 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 185 | K3IPAI | 3 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 186 | K3OPAI | 3 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 187 | K3NRI | 3 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 188 | K3INRI | 3 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 189 | K3ONRI | 3 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 190 | A\_K3PAI | Cumulative average of 3 mile kernel density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 191 | A\_K3IPAI | Cumulative average of 3 mile kernel density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 192 | A\_K3OPAI | Cumulative average of 3 mile kernel density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 193 | A\_K3NRI | Cumulative average of 3 mile kernel density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 194 | A\_K3INRI | Cumulative average of 3 mile kernel density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 195 | A\_K3ONRI | Cumulative average of 3 mile kernel density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is a weighted number of facilities per square mile. |  |
| 196 | S0PAI | 1/2 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 197 | S0IPAI | 1/2 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 198 | S0OPAI | 1/2 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 199 | S0NRI | 1/2 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 200 | S0INRI | 1/2 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 201 | S0ONRI | 1/2 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 202 | A\_S0PAI | Cumulative average of 1/2 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 203 | A\_S0IPAI | Cumulative average of 1/2 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 204 | A\_S0OPAI | Cumulative average of 1/2 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 205 | A\_S0NRI | Cumulative average of 1/2 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 206 | A\_S0INRI | Cumulative average of 1/2 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 207 | A\_S0ONRI | Cumulative average of 1/2 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 208 | S1PAI | 1 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 209 | S1IPAI | 1 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 210 | S1OPAI | 1 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 211 | S1NRI | 1 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 212 | S1INRI | 1 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 213 | S1ONRI | 1 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 214 | A\_S1PAI | Cumulative average of 1 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 215 | A\_S1IPAI | Cumulative average of 1 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 216 | A\_S1OPAI | Cumulative average of 1 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 217 | A\_S1NRI | Cumulative average of 1 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 218 | A\_S1INRI | Cumulative average of 1 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 219 | A\_S1ONRI | Cumulative average of 1 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 220 | S3PAI | 3 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 221 | S3IPAI | 3 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 222 | S3OPAI | 3 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 223 | S3NRI | 3 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 224 | S3INRI | 3 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 225 | S3ONRI | 3 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 226 | A\_S3PAI | Cumulative average of 3 mile simple density all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 227 | A\_S3IPAI | Cumulative average of 3 mile simple density Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 228 | A\_S3OPAI | Cumulative average of 3 mile simple density all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 229 | A\_S3NRI | Cumulative average of 3 mile simple density physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 230 | A\_S3INRI | Cumulative average of 3 mile simple density Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 231 | A\_S3ONRI | Cumulative average of 3 mile simple density Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional). The unit of measure is the number of facilities per square mile. |  |
| 232 | ASDPAI | Euclidean distance to nearest all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional) (meters). |  |
| 233 | ASDIPAI | Euclidean distance to nearest Indoor all physical activity facilities (indoor conditioning, recreational, team sports, water activities, racquet sports, instructional) (meters). |  |
| 234 | ASDOPAI | Euclidean distance to nearest all Outdoor physical activity facilities (recreational, team sports, water activities, racquet sports, instructional) (meters). |  |
| 235 | ASDNRI | Euclidean distance to nearest physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional) (meters). |  |
| 236 | ASDINRI | Euclidean distance to nearest Indoor physical activity facilities without recreational (indoor conditioning, team sports, water activities, racquet sports, instructional) (meters). |  |
| 237 | ASDONRI | Euclidean distance to nearest Outdoor physical activity facilities without recreational (team sports, water activities, racquet sports, instructional) (meters). |  |
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| **SOCIAL ENGAGEMENT DESTINATIONS** | | | |
| 238 | K0REL | 1/2 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 239 | K0CULTURE | 1/2 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 240 | K0SOC | 1/2 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 241 | A\_K0REL | Cumulative average of 1/2 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 242 | A\_K0CULTURE | Cumulative average of 1/2 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 243 | A\_K0SOC | Cumulative average of 1/2 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 244 | K1REL | 1 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 245 | K1CULTURE | 1 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 246 | K1SOC | 1 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 247 | A\_K1REL | Cumulative average of 1 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 248 | A\_K1CULTURE | Cumulative average of 1 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 249 | A\_K1SOC | Cumulative average of 1 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 250 | K3REL | 3 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 251 | K3CULTURE | 3 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 252 | K3SOC | 3 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 253 | A\_K3REL | Cumulative average of 3 mile kernel density religion institutions. The unit of measure is a weighted number of facilities per square mile. |  |
| 254 | A\_K3CULTURE | Cumulative average of 3 mile kernel density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is a weighted number of facilities per square mile. |  |
| 255 | A\_K3SOC | Cumulative average of 3 mile kernel density total social engagement destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 256 | S0REL | 1/2 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 257 | S0CULTURE | 1/2 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 258 | S0SOC | 1/2 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 259 | A\_S0REL | Cumulative average of 1/2 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 260 | A\_S0CULTURE | Cumulative average of 1/2 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 261 | A\_S0SOC | Cumulative average of 1/2 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 262 | S1REL | 1 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 263 | S1CULTURE | 1 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 264 | S1SOC | 1 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 265 | A\_S1REL | Cumulative average of 1 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 266 | A\_S1CULTURE | Cumulative average of 1 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 267 | A\_S1SOC | Cumulative average of 1 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 268 | S3REL | 3 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 269 | S3CULTURE | 3 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 270 | S3SOC | 3 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 271 | A\_S3REL | Cumulative average of 3 mile simple density religion institutions. The unit of measure is the number of facilities per square mile. |  |
| 272 | A\_S3CULTURE | Cumulative average of 3 mile simple density of cultural destinations (performance based entertainment, libraries, museums, art galleries). The unit of measure is the number of facilities per square mile. |  |
| 273 | A\_S3SOC | Cumulative average of 3 mile simple density total social engagement destinations. The unit of measure is the number of facilities per square mile. |  |
| 274 | ASDREL | Euclidean distance to nearest religion institutions (meters). |  |
| 275 | ASDCULTURE | Euclidean distance to nearest of cultural destinations (performance based entertainment, libraries, museums, art galleries) (meters). |  |
| 276 | ASDSOC | Euclidean distance to nearest total social engagement destinations (meters). |  |
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| **POPULAR WALKING DESTINATIONS** | | | |
| 277 | K0WALK | 1/2 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 278 | A\_K0WALK | Cumulative average of 1/2 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 279 | K1WALK | 1 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 280 | A\_K1WALK | Cumulative average of 1 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 281 | K3WALK | 3 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 282 | A\_K3WALK | Cumulative average of 3 mile kernel density popular walking destinations. The unit of measure is a weighted number of facilities per square mile. |  |
| 283 | S0WALK | 1/2 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 284 | A\_S0WALK | Cumulative average of 1/2 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 285 | S1WALK | 1 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 286 | A\_S1WALK | Cumulative average of 1 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 287 | S3WALK | 3 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 288 | A\_S3WALK | Cumulative average of 3 mile simple density popular walking destinations. The unit of measure is the number of facilities per square mile. |  |
| 289 | ASDWALK | Euclidean distance to nearest popular walking destinations (meters). |  |
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| **TOTAL STORES** | | | |
| 290 | K0TOTSTR | 1/2 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 291 | A\_K0TOTSTR | Cumulative average of 1/2 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 292 | K1TOTSTR | 1 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 293 | A\_K1TOTSTR | Cumulative average of 1 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 294 | K3TOTSTR | 3 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 295 | A\_K3TOTSTR | Cumulative average of 3 mile kernel density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is a weighted number of businesses per square mile. |  |
| 296 | S0TOTSTR | 1/2 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 297 | A\_S0TOTSTR | Cumulative average of 1/2 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 298 | S1TOTSTR | 1 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 299 | A\_S1TOTSTR | Cumulative average of 1 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 300 | S3TOTSTR | 3 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 301 | A\_S3TOTSTR | Cumulative average of 3 mile simple density of total stores (food, physical activity, social engagement, walking destinations). The unit of measure is the number of businesses per square mile. |  |
| 302 | ASDTOTSTR | Euclidean distance to nearest total stores (food, physical activity, social engagement, walking destinations) (meters). |  |
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| **STREET NETWORK** | | | |
| 303 | STRPOPYRD | Number of years between streets/population data collection and exam. Calculated by (Exam year – Data collection year). | 0 = Data collection in same year as exam  <0 = Data collection was after exam  >0 = Data collection was before exam |
| 304 | NetRatio0 | 1/2 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 305 | IntDen0 | 1/2 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
| 306 | A\_NetRatio0 | Cumulative average of 1/2 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 307 | A\_IntDen0 | Cumulative average of 1/2 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
| 308 | NetRatio0ip | Interpolated 1/2 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 309 | IntDen0ip | Interpolated 1/2 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
| 310 | NetRatio1 | 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 311 | IntDen1 | 1 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
| 312 | A\_NetRatio1 | Cumulative average of 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 313 | A\_IntDen1 | Cumulative average of 1 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
| 314 | NetRatio1ip | Interpolated 1 mile buffer Network Ratio – a measure of street connectivity. A number closer to 1 represents better connectivity. Calculated as Network area divided by total area of the buffer. |  |
| 315 | IntDen1ip | Interpolated 1 mile buffer intersection density (intersections per hectare) – a measure of street connectivity. A higher number indicates better connectivity. Calculated as Number of intersections divided by total area of the buffer. |  |
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| **POPULATION DENSITY** | | | |
| 316 | POPDENMI0 | Population density in 1/2 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 317 | PDRESKM0 | Population density per residential area in 1/2 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
| 318 | A\_POPDENMI0 | Cumulative average of Population density in 1/2 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 319 | A\_PDRESKM0 | Cumulative average of Population density per residential area in 1/2 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
| 320 | POPDENMI0ip | Interpolated Population density in 1/2 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 321 | PDRESKM0ip | Interpolated Population density per residential area in 1/2 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
| 322 | POPDENMI1 | Population density in 1 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 323 | PDRESKM1 | Population density per residential area in 1 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
| 324 | A\_POPDENMI1 | Cumulative average of Population density in 1 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 325 | A\_PDRESKM1 | Cumulative average of Population density per residential area in 1 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
| 326 | POPDENMI1ip | Interpolated Population density in 1 mile buffer (persons per square mile) based on Census population data. Calculated as population divided by total area of the buffer. |  |
| 327 | PDRESKM1ip | Interpolated Population density per residential area in 1 mile buffer (persons per square kilometer) based on Census population and land use data. Calculated as population divided by total residential area of the buffer. |  |
|  |  |  |  |
| **LAND USE** | | | |
| 328 | LUsite | Study site for land use data | 0 = Outside the study area  3 = Forsyth County  4 = New York  5 = Baltimore  6 = Minneapolis-St Paul  7 = Chicago  8 = Los Angeles |
| 329 | LUYRD | Number of years between land use data collection and exam. Calculated by (Exam year – Data collection year). | 0 = Data collection in same year as exam  <0 = Data collection was after exam  >0 = Data collection was before exam |
| 330 | PCTLU0 | Percent of 1/2 mile buffer in land use data area |  |
| 331 | PRES0 | 1/2 mile buffer percent of land devoted to residential use. |  |
| 332 | PRET0 | 1/2 mile buffer percent of land devoted to retail use. |  |
| 333 | PCOM0 | 1/2 mile buffer percent of land devoted to commercial use. |  |
| 334 | A\_PRES0 | Cumulative average of 1/2 mile buffer percent of land devoted to residential use. |  |
| 335 | A\_PRET0 | Cumulative average of 1/2 mile buffer percent of land devoted to retail use. |  |
| 336 | A\_PCOM0 | Cumulative average of 1/2 mile buffer percent of land devoted to commercial use. |  |
| 337 | PRES0ip | Interpolated 1/2 mile buffer percent of land devoted to residential use. |  |
| 338 | PRET0ip | Interpolated 1/2 mile buffer percent of land devoted to retail use. |  |
| 339 | PCOM0ip | Interpolated 1/2 mile buffer percent of land devoted to commercial use. |  |
| 340 | PCTLU1 | Percent of 1 mile buffer in land use data area |  |
| 341 | PRES1 | 1 mile buffer percent of land devoted to residential use. |  |
| 342 | PRET1 | 1 mile buffer percent of land devoted to retail use. |  |
| 343 | PCOM1 | 1 mile buffer percent of land devoted to commercial use. |  |
| 344 | A\_PRES1 | Cumulative average of 1 mile buffer percent of land devoted to residential use. |  |
| 345 | A\_PRET1 | Cumulative average of 1 mile buffer percent of land devoted to retail use. |  |
| 346 | A\_PCOM1 | Cumulative average of 1 mile buffer percent of land devoted to commercial use. |  |
| 347 | PRES1ip | Interpolated 1 mile buffer percent of land devoted to residential use. |  |
| 348 | PRET1ip | Interpolated 1 mile buffer percent of land devoted to retail use. |  |
| 349 | PCOM1ip | Interpolated 1 mile buffer percent of land devoted to commercial use. |  |
| 350 | SDRET | Euclidean distance to nearest land devoted to retail use (meters). |  |
| 351 | SDCOMM | Euclidean distance to nearest land devoted to commercial use (meters). |  |
| 352 | SDRETip | Interpolated Euclidean distance to nearest land devoted to retail use (meters). |  |
| 353 | SDCOMMip | Interpolated Euclidean distance to nearest land devoted to commercial use (meters). |  |
|  |  |  |  |
| **PUBLIC TRANSPORTATION** | | | |
| 354 | BUSYRD | Number of years between bus route data collection and exam. Calculated by (Exam year – Data collection year). | 0 = Data collection in same year as exam  <0 = Data collection was after exam  >0 = Data collection was before exam |
| 355 | SBUS | Euclidean distance to nearest bus route (meters). |  |
| 356 | TRNYRD | Number of years between train/subway data collection and exam. Calculated by (Exam year – Data collection year). | 0 = Data collection in same year as exam  <0 = Data collection was after exam  >0 = Data collection was before exam |
| 357 | STRN | Euclidean distance to nearest train/subway stop (meters). | 9999999 = No train line in existance |
|  |  |  |  |
| **BUILT ENVIRONMENT FACTOR SCORES** | | | |
| 358 | BES0\_FACTOR1 | Built Environment Factor 1 – Intensity of development: 1/2 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 359 | BE0\_FACTOR2 | Built Environment Factor 2 – Connected Retail centers: 1/2 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |
| 360 | A\_BES0\_FACTOR1 | Cumulative average of Built Environment Factor 1 – Intensity of development: 1/2 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 361 | A\_BE0\_FACTOR2 | Cumulative average of Built Environment Factor 2 – Connected Retail centers: 1/2 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |
| 362 | BES0\_FACTOR1ip | Interpolated Built Environment Factor 1 – Intensity of development: 1/2 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 363 | BE0\_FACTOR2ip | Interpolated Built Environment Factor 2 – Connected Retail centers: 1/2 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |
| 364 | BES1\_FACTOR1 | Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 365 | BE1\_FACTOR2 | Built Environment Factor 2 – Connected Retail centers: 1 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |
| 366 | A\_BES1\_FACTOR1 | Cumulative average of Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 367 | A\_BE1\_FACTOR2 | Cumulative average of Built Environment Factor 2 – Connected Retail centers: 1 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |
| 368 | BES1\_FACTOR1ip | Interpolated Built Environment Factor 1 – Intensity of development: 1 mile buffer. Calculated as: (0.88\*simple density of Walking Destinations)+(0.87\*Population density)+(-0.83\*percent residential) |  |
| 369 | BE1\_FACTOR2ip | Interpolated Built Environment Factor 2 – Connected Retail centers: 1 mile buffer. Calculated as: (0.80\*Network Ratio)+(0.85\*percent retail) |  |

# Details:

## National Establishment Time Series Based Data (General Information)

Business data for food stores, recreational facilities, social engagement destinations, and popular walking destinations were purchased using the National Establishment Time Series (NETS)[[3]](#footnote-3) data from Walls and Associates for all zip codes within a 5-mile buffer of any MESA address. This data is available for the years 2000-2010. The NETS-based data is linked to the MESA addresses at the year of the exam. For any addresses after Dec 2010, these are linked with the 2010 data for analysis purposes. Data may be missing for addresses that could not be geocoded (ie: incomplete information or foreign addresses).

Densities of NETS-based data were created for buffer sizes of ½, 1, and 3 miles around each address. Both simple densities and kernel (using the Silverman[[4]](#footnote-4) kernel as specified in the ArcGIS kernel density function) densities were created. These densities are straight line distances and do not take into account any barriers such as water or roads. To date, most people have used the 1 mile kernel or simple densities. Euclidean (straight-line) distance to nearest business were calculated for the categories of food stores, recreational facilities, social engagement destinations, and walking destinations listed below for each year the data is available (2000-2010) using the Near tool in ArcGIS using a search radius of 300 miles. All distances are calculated in meters. Boundaries for water/major roads/ect were not taken into consideration when calculating the distances. These also do not follow road networks.

### Food Stores

The food stores data consists of various types of food stores including supermarkets, fast food, drinking places, and liquor stores. Data is from the NETS database as described above.

It is assumed that the Nielsen/Trade Dimensions (TD) data[[5]](#footnote-5) is the “gold standard” for identifying chain supermarkets. Therefore, we sought to derive a name list for the “universe” of chain supermarkets from 2000 through 2010. To do this, we used 3 one-year cuts of Trade Dimensions data (2000, 2005, and 2010). The generated name list will then be applied to annual cuts of NETS data to identify large chain names in the NETS database. We define a large chain supermarket as a store having at least 8 records in Trade Dimensions. In the 2000 TD data, the large chain supermarkets are only 8% of the companies but own 74% of the stores. These are likely to be large supermarket chains and so constitute the majority of the records to be pulled from NETS.

It was determined that there were some stores that were represented in TD at a much greater rate than in NETS (ie: they had a lot of locations missing from the NETS data). The main reason for not being included in NETS is likely due to SIC categorization. Stores such as WalMart Supercenter, which are listed as supermarkets in TD are not included in NETS since the SIC is likely to be 0531 (Department Stores), 0533 (Variety Stores), or 0539 (Miscellaneous General Merchandise Stores) thus are not part of the food store category. We purchased the data from TD for the years 2000-2010 for stores that had 50 or more locations in TD compared to NETS. This lead to the purchase of 7 additional store names (as identified in TD):

1. ALDI aka "Aldi Food Store"

2. FRYS FOOD aka "Frys Food Store", "Frys Marketplace"

3. SAVE A LOT aka "Save A Lot", "Save A Lot Store"

4. SMART & FINAL aka "Smart & Final"

5. SUPER TARGET aka "SuperTarget Center"

6. TRADER JOES aka "Trader Joes Market"

7. WALMART SUPERCENTER aka "Wal Mart Neighborhood Mkt", "Wal Mart Supercenter"

These locations were then combined with the NETS dataset and assigned as supermarket chains for creation of the densities.

Fast food is defined as large chain eating places that specialize in low preparation time foods that are eaten cafeteria-style (no waiter service) or take-away. The list was derived from the top 75 *Restaurant and Institutions* revenue-ranked for the year 2005[[6]](#footnote-6). R&I top 400 includes many kinds of restaurants including casual dining, buffet, and coffee shops. We excluded all except fast-food (defined above) and excluded coffee, donut, and ice cream shops because those shops generally sell snacks and thus are not often thought of fast-food by consumers. MESA respondents who report on fast-food eating behaviors and presence of fast food in their neighborhood are not likely to count the coffee, donut, and ice cream restaurants.

The food stores are categorized into 15 categories as follows (note that not all separate categories are included in the dataset – only those that are commonly used are included). . Those establishments that are listed as headquarters in the NETS data were excluded from the coding since it was determined that many of these will not provide access for the general public.

1. **Grocers**
   1. *Technical definition:* Any food store with fewer than 25 employees, sales less than $2million, and not on the supermarket name list, and a primary SIC code of 54110000, 54110100, 54110101, 54110102, 54110103, 54110104, 54110105, 54119900, 54119901, 54119904, or 54119905.
   2. *General description:* This category was derived from whatever stores remained after removing supermarkets and convenience stores. Thus, it includes all smaller, non-supermarket, non-convenience stores.
   3. *Assumed health association:* Unknown. This is a heterogeneous category including stores that sell fresh food and stores that almost exclusively sell food with a long shelf life.
2. **Supermarket Chains**
   1. *Technical definition:* Industry defines a “chain” supermarket operators as having >=10 locations. For this study, we defined it as companies that operate 8 or more stores in the study area. This cut point is slightly lower than the industry definition reflecting that there will be fewer stores in MESA ZIP codes. We use the standardized supermarket name list from Trade Dimensions to determine “chain” companies (that had 8 or more locations within the 2000, 2005, or 2010 data).
   2. *General description:* For this study, the store is a chain if it has the company and/or trade name of any of the 263 stores.
   3. *Assumed health association:* Favorable. A wide variety of fruits, vegetables and low-fat foods are assumed to be available, though unhealthy food options are also available. Food sold in large markets is typically cheaper than food sold in small grocers. If healthier food is more expensive than unhealthy food, then supermarkets may encourage healthier food purchases.
3. **Supermarket Non-Chain**
   1. *Technical definition:* Any food store with 25 employees or greater or sales of $2 million or greater, and a primary SIC code of 54110000, 54110100, 54110101, 54110102, 54110103, 54110104, 54110105, 54119900, 54119901, 54119904, or 54119905 and not part of Supermarket Chains above.
   2. *General description:* The categories of grocers (described above) and supermarkets derive from the constellation of SIC Codes that generally apply to all types of grocery stores and supermarkets.
   3. *Assumed health association:* Favorable. A wide variety of fruits, vegetables and low-fat foods are assumed to be available, though unhealthy food options are also available. Food sold in large markets is typically cheaper than food sold in small grocers. If healthier food is more expensive than unhealthy food, then supermarkets may encourage healthier food purchases.
4. **Convenience**
   1. *Technical definition:* Any food store with a primary SIC code of 54110200, 54110201, or 54110202.
   2. *General description:* National Association of Convenience Stores, an international trade association and publisher of the industry trade publication Convenience Store News, defines the channel as small stores between 800 and 3,000 square feet, carrying between 500 and 1,500 SKUs, and meet the following criteria: operating at least 13 hours per day, the store must carry a limited selection of grocery items including at least two of the following: toilet paper, soap, disposable diapers, pet foods, breakfast cereal, tuna fish, toothpaste, ketchup, and canned goods. These stores may or may not sell gasoline and offer fast food services.
   3. *Assumed health association*: Unfavorable. Assumed to sell mostly highly processed snack food, fast food to go (microwave burgers, etc.) and low quantity (if any) fresh produce.
5. **Deli, meat, fish, dairy (not ice cream)**
   1. *Technical definition:* Any food store with a primary SIC code of 54119902, 54210000, 54210100, 54210101, 54210102, 54210200, 54210201, 54210202, 54999902, 54999904, 54510000, 54519900, 54519901, 54519902, or 54519904.
   2. *General description*: Stand-alone stores that sell primarily meat, fish, egg products, milk, cheese, and/or other dairy products (except ice cream) including delicatessens and gourmet shops.
   3. *Assumed health association:* Unknown. These places tend to offer foods that are high in fat and cholesterol but they also stock foods that may not be highly processed and are a part of a healthy Mediterranean diet.
6. **Fruit, vegetable**
   1. *Technical definition:* Any food store with a primary SIC code of 54319900, 54310000, 54319901, or 54319902.
   2. *General description:* Stand-alone stores that sell primarily fruits and vegetables. This category may be too small to analyze on its own and could be combined with several different categories, depending on the research question.
   3. *Assumed health association*: Favorable.
7. **Bakeries, pastry, candy, nuts, ice cream**
   1. *Technical definition:* Any food store that is NOT a fast food restaurant (see categories 11 and 12) with a primary SIC code of 54610000, 54619900, 54619901, 54619902, 54410000, 54419900, 54419901, 54419902, 54419903, 54419904, 54419905, 54519903, 54619903, 54619904, 54619905, 54619906, 54619907, 54619908, 54999901, 58120202, 58120203, 58120204, or 58120200.
   2. *General description:* Bakeries, candy and nut shops, and ice cream parlors.
   3. *Assumed health association:* Unfavorable. Though some of the bakeries may provide fresh breads and some of the nut stores may have plain/unprocessed nuts, it is impossible to differentiate these stores from providers of cupcakes, cookies, pastries, and candied nuts. It is assumed that the majority of these stores sell high calorie and high sugar foods.
8. **Health food, vitamins, and supplements**
   1. *Technical definition*: Any food store with a primary SIC code of 54990100, 54990102, 54990103, or 54990101.
   2. *General description:* Small stores that specialize in natural foods, vitamins and nutritional supplements. These SIC categories were kept together because stores listed under these codes are indistinguishable from each other (health food stores classify themselves as vitamin stores so are not able to be separated). This category may be too small to analyze on its own.
   3. *Assumed health association*: Unknown. Health food stores are generally considered to be healthy. However, stores that exclusively sell vitamins and supplements are not comparable to food stores, rarely sell fresh produce, and may sell supplements that can be harmful to health (e.g., athletic supplements).
9. **Liquor**
   1. *Technical definition:* Any food store with a primary SIC code of 59210000, 59210100, 59210101, 59210102, 59219900, or 59219901.
   2. *General description*: Stores that primarily sell alcohol for consumption elsewhere.
   3. *Assumed health association:* Unfavorable
10. **Drinking places (non-alcohol)**
    1. *Technical definition:* Any food store with a primary SIC code of 54990200, 54990201, 54990202, 54990203, 54990204, 54990205, 58120205, 58120206, or 58120304.
    2. *General description:* Food stores that sell coffee, smoothies, juices, and tea for consumption on site.
    3. *Assumed health association*: Unknown. These beverages are generally not thought to be health promoting, but 100% fresh juices and green tea can be beneficial. There may be other social benefits from having local places like these.
11. **Drinking places (alcohol)**
    1. *Technical definition:* Any food store with a primary SIC code of 58130000, 58130101, 58130202, 58130103, 58130200, 58130201, 58130100, 58130102, 58130104, 58130105, 58130106, or 58130203.
    2. *General description:* Food stores that primarily sell alcohol for consumption on site.
    3. *Assumed health association*: Unfavorable.
12. **Fast food (chains)**
    1. *Technical definition:* Any food store regardless of SIC code that appears on the list of fast food eating places.
    2. *General description:* Large chain eating places that specialize in low preparation time foods that are eaten cafeteria-style (no waiter service) or take-away. The list of the largest chains was derived from pulling the top 75 revenue-ranked fast-food restaurants for the year during 2005 (derived from Restaurant & Institutions Top 100)[[7]](#footnote-7). We excluded coffee, donut, and ice cream shops because those shops generally sell snacks and thus are not often thought of fast-food by consumers and so MESA respondents who report on fast-food eating behaviors and presence of fast food in their neighborhood are not likely to count the coffee, donut, and ice cream restaurants.
    3. *Assumed health association*: Unfavorable. Foods tend to be highly processed and therefore high in calories, saturated fat, salt, and sugar.
13. **Fast food (non-chain)**
    1. *Technical definition:* Any food store with the limited service restaurant SIC 581203 (except 58120304: Coffee shops) that are not on the fast food chain list as described in above Fast food chains.
    2. *General description:* Eating places that specialize in low preparation time foods that are eaten cafeteria-style (no waiter service) or take-away. Fast food is defined by the industry as being "designed for ready availability, use or consumption and sold at eating establishments for quick availability or take-out. Fast food restaurants are also known as quick-service restaurants. That definition has low specificity so we added cafeteria style (no waiter service).
    3. *Assumed health association*: Unfavorable. Foods tend to be highly processed and therefore high in calories, saturated fat, salt, and sugar.
14. **Other eating places**
    1. *Technical definition:* Any eating place with SIC 5812 that is not in the fast food categories above.
    2. *General description:* A wide variety of restaurants and other eating places that are not considered to be fast food.
    3. *Assumed health association:* Unknown. There is a wide variety of different types of restaurants in this category.
15. **Other**
    1. *Technical definition:* Any food establishment not already in a category including stores with "general" or "unknown" SIC codes 54119903, 54990000, 54999900, 54999903, or 54999905.
    2. *General description*: All other food stores not in another category.
    3. *Assumed health association:* Unknown.

These categories were then collapsed into broader categories for analysis purposes of:

1. Favorable food stores
   1. Consist of supermarkets (chain and non-chain) and fruit and vegetable markets.
2. Unfavorable food stores (with alcohol)
   1. Consists of convenience stores, bakeries/nuts/candy/ice cream, liquor stores, drinking places alcoholic, and fast food (chain and non-chain).
3. Unfavorable food stores (no alcohol)
   1. Consists of convenience stores, bakeries/nuts/candy/ice cream, and fast food (chain and non-chain).

The following summary measure was created to capture the relationship of favorable to unfavorable food stores:

1. Modified Retail Food Environment Index

This is calculated as:

MRFEI\_TOT = (Favorable)/(Favorable+Unfavorable including alcohol) and

MRFEI\_NOALC = (Favorable)/(Favorable+Unfavorable excluding alcohol)

Where Unfavorable including alcohol is defined as convenience stores, bakery, candy, nuts, ice cream, liquor stores, drinking places alcoholic, and fast food (chain and non-chain), Unfavorable excluding alcohol is defined as convenience stores, bakery, candy, nuts, ice cream, and fast food (chain and non-chain), and Favorable is defined as supermarkets (chain and non-chain) and fruit and vegetable markets.

This is based on the mRFEI variable as defined by the CDC. Modifications were made to the definition of unfavorable to include bakery/candy/nut/ice cream shops, liquor stores, and alcoholic drinking places.

This will give a proportion of favorable food stores compared to the total amount of favorable and unfavorable where the larger the number, better the access to favorable food (ie: if there is a high number close to 1, there is better access to favorable food). For those where both favorable and unfavorable food stores are 0, this will be coded as 999999999. This indicates that there are no stores in the area.

When using any of these indices, careful consideration needs to be taken into account as to how to use them when the denominator is 0. In general, these indices work better for the simple densities rather than the kernel densities which weight for the distance away from the address and cause these ratios to be difficult to interpret.

For the mRFEI, it is recommended by Stephen Onufrak at the CDC (through Latetia Moore) to use this variable in analysis as a categorical variable (ie: quartiles) rather than a continuous variable. Values where there are no food stores (healthy or unhealthy) should be categorized as a separate category.

### Physical Activity/Recreational Resources

The recreational facilities data consists of places to get physical activity and other recreation activities. SIC codes selected were based on previous work[[8]](#footnote-8). Data is from the NETS database as described above.

The recreational facilities are categorized into 12 categories as follows (note that not all separate categories are included in the dataset – only those that are commonly used are included). Each SIC code was assigned to one category. Establishments that are listed as headquarters are included as recreational facilities. This is different from the food stores data where they are excluded. For the recreational facilities, they are included because it was felt that there are fewer chains where they would have just an administrative head that didn’t offer any services as opposed to the food stores where there are many more chains where the headquarters represent just an administrative head without services. There will be some locations that don’t actually offer any services but this will be a small minority of the locations. Only about 2% of the locations at each year 2000-2010 are considered headquarters in the recreational facilities data.

1. **Indoor Conditioning Activities**
   1. *Technical definition:* Any recreational facility with SIC codes 79110100, 79110101, 79110102, 79910000, 79910100, 79910101, 79910102, 79910300, 79910301, 79910302, 79970000.
   2. *General description*: Physical fitness facilities, dancing–aerobics/ballet, athletic club exercise.
2. **Recreational**
   1. *Technical definition:* Any recreational facility with SIC codes 79330000, 79339901, 79339902, 79339903, 79920000, 79970100, 79970400, 79979906, 79979907, 79979908, 79990202, 79990204, 79990205, 79990601, 79990602, 79990603, 79990700, 79990701, 79991200, 79991202, 79991204, 79991604, 79999903, 79999907, 79999910, 79999912, 79999917, 79990501, 79991205, 79970302, 79990000, 79339900, 79990402, 79990600.
   2. *General description*: Bowling, golf, ice sports, outdoor field clubs, horse riding, lawn bowling, skating–ice or roller, shooting/hunting, archery, trail hiking, baseball batting cage, recreation centers/services, trampolines, biking, ping pong.
3. **Team Sports**
   1. *Technical definition:* Any recreational facility with SIC codes 79970101, 79970102, 79970401, 79970402, 79970404, 79979902.
   2. *General description*: Curling, hockey, baseball, football, soccer, bowling league/team.
4. **Water Activities**
   1. *Technical definition:* Any recreational facility with SIC codes 79970201, 79970202, 79991402, 79991512, 79991513, 79991409, 79991410, 79991411.
   2. *General description*: Boating, beach club/bathing beach, waterslide, wave pool, rowboat/canoe rental, sailboard/surfing rental.
5. **Water Activities that involve Conditioning**
   1. *Technical definition:* Any recreational facility with SIC codes 79970200, 79970203, 79991412.
   2. *General description*: Swimming clubs and pools.
6. **Racquet Sports**
   1. *Technical definition:* Any recreational facility with SIC codes 79970500, 79970501, 79970502, 79970503, 79970504, 79990101, 79990102, 79990300, 79990301, 79990302, 79990303.
   2. *General description*: Handball, racquetball, squash, tennis.
7. **Camps/Vacation**
   1. *Technical definition:* Any recreational facility with SIC codes 70110200, 70110201, 70110202, 70320000, 70320100, 70320101, 70320102, 70320300, 70320301, 70320302, 70330000, 70339900, 70339901, 70339902, 79991602.
   2. *General description*: Non-regular use and/or may be used by out-of-town people more than locals.
8. **Instructional in Indoor Conditioning**
   1. *Technical definition:* Any recreational facility with SIC codes 79110000, 79110200, 79110202, 79110203, 79110204, 79991111, 79991112, 79991113, 79991127, 79991123.
   2. *General description*: Instruction in indoor conditioning.
9. **Instructional in Recreational**
   1. *Technical definition:* Any recreational facility with SIC codes 79990200, 79990203, 79991104, 79991118, 79991119, 79991201.
   2. *General description*: Instruction in recreational activities.
10. **Instructional in Team Sports**
    1. *Technical definition:* Any recreational facility with SIC codes 79991102, 79991103, 79991110.
    2. *General description*: Instruction in team sports.
11. **Instructional in Water Activities**
    1. *Technical definition:* Any recreational facility with SIC codes 79991107, 79991115, 79991116, 79991121, 79991122.
    2. *General description*: Instruction in water activities.
12. **Instructional in Racquet Sports**
    1. *Technical definition:* Any recreational facility with SIC codes 79990100, 79990103.
    2. *General description*: Instruction in racquet sports.

These categories were then collapsed into broader categories for analysis purposes of:

1. Total Physical Activities with Instructional and Water Activities including recreational
   1. Consists of Indoor Conditioning, Recreational, Team Sports, Water Activities, Water Activities Conditioning, Racquet Sports, Instructional in Indoor Conditioning, Instructional in Recreational, Instructional in Team Sports, Instructional in Water Activities, Instructional in Racquet Sports
2. Total Physical Activities with Instructional and Water Activities excluding recreational
   1. Consists of Indoor Conditioning, Team Sports, Water Activities, Water Activities Conditioning, Racquet Sports, Instructional in Indoor Conditioning, Instructional in Team Sports, Instructional in Water Activities, Instructional in Racquet Sports

All of the above categories are also available as indoor and outdoor activities. Indoor and outdoor are not mutually exclusive categories (ie: a facility could be categorized as both indoor and outdoor).

### Social Engagement Destinations

The social engagement data consists of places which promote social engagement and social interaction. SIC codes were selected based on previous work by Christine Hoehner[[9]](#footnote-9). A total of 430 SIC codes were purchased as social engagement destinations. For non-food based SIC codes, establishments that are listed as headquarters are included as social engagement destinations. This is different from the food stores data where they are excluded. For the non-food based, they are included because it was felt that there are fewer chains where they would have just an administrative head that didn’t offer any services as opposed to the food stores where there are many more chains where the headquarters represent just an administrative head without services. There will be some locations that don’t actually offer any services but this will be a small minority of the locations. Less than 2% of the locations at each year 2000-2010 are considered headquarters.

The social engagement destinations are categorized into 15 categories as follows (note that not all separate categories are included in the dataset – only those that are commonly used are included):

1. **Beauty Shops and Barbers**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7231, 7241.
   2. *General description*: Beauty shops and barbers including cosmetology and nail salons.
2. **Performance Based Entertainment**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7832, 7911 (except 79110200, 79110202, 79110203, 79110204), 7922, 7929.
   2. *General description*: Locations for watching performances. Includes movie theaters, dance studios and theaters, opera production, performing arts centers, entertainment and musical groups.
3. **Participatory Entertainment**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7933, 7992 or 6 digit SIC code in 799901 (except 79990103), 799902 (except 79990203), 799903, 799904, 799906, 799907, 799908, 799914 (except 79991409, 79991410, 79991411) or 8 digit SIC code in 79999902, 79999903, 79999905, 79999907, 79999909, 79999910, 79999912.
   2. *General description*: Clubs and sporting and game venues in which the use participates in the activities that typically do not require a membership. Includes bowling centers, golf courses, tennis clubs, indoor court sports, table tennis, billiards, skating rinks, archery and other shooting ranges, card and bingo halls, bath houses, beaches, and recreation centers.
4. **Sports and Professional Stadium Entertainment**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7941, 7948 or 8 digit SIC code in 79999913.
   2. *General description*: Sporting venues in which the user watches an event but does not participate. Includes professional sports clubs (ie: baseball, basketball, football, ect), motor vehicle racing, horse racing, and dog racing.
5. **Exercise Facilities**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7991.
   2. *General description*: Exercise facilities where the user participates in physical fitness activities in gym or class setting. Includes athletic clubs, spas, and exercise classes.
6. **Coin-Operated Amusements and Gambling**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7993 or 6 digit SIC code in 799913.
   2. *General description*: Venues for gambling or other machine-based entertainment. Includes gaming machines, arcades, gambling machines, and gambling and lottery services.
7. **Amusement Parks, Carnivals, and Rodeos**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7996 or 6 digit SIC code in 799909, 799910, 799912 (except 79991201, 79991205) or 8 digit SIC code in 79990000, 79991502, 79991503, 79991504, 79991505, 79991506, 79991508, 79991509, 79991512, 79991513, 79991514, 79991516, 79991604, 79999900, 79999904, 79999917.
   2. *General description*: Amusement parks and other recreational shows and activities typically not used frequently. Typically includes places with amusement rides or shows. Includes amusement parks, animal and circus shows, exhibitions, fairs, carnivals, rodeo and riding stables, go carts, scenic trains, waterslides, wave pools, and fireworks.
8. **Membership Sports and Recreational Clubs**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 7997 or 6 digit SIC code in 869901 or 8 digit SIC code in 86990000, 86999900, 86999906.
   2. *General description*: Sports and activities clubs that require a membership typically with monetary dues. Includes boating and beach clubs, swimming club, gun clubs, team sports clubs, ice sports clubs, racquet sports clubs, bowling club, golf club, riding club, and other athletic clubs (all require membership).
9. **Libraries**
   1. *Technical definition:* Any social engagement destination with 4 digit SIC code 8231.
   2. *General description*: Libraries and other places for book check out and reading. Includes general and specialized libraries and book rentals.
10. **Museums and Art Galleries**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 8412 or 8 digit SIC code in 79999901.
    2. *General description*: Museums and galleries to observe art, history, science, etc. Includes museums, art galleries, historical societies, science centers, and planetarium.
11. **Zoo, Aquarium, and Arboretum**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 8422 or 8 digit SIC code in 79991515.
    2. *General description*: Zoos, aquariums, etc to observe wildlife or plants. May not be used on a regular basis. Includes zoos, botanical gardens, aquarium, and arboretum.
12. **Civil, Social, and Political Clubs**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 8651 or 6 digit SIC code in 864101, 864102, 864105, 864199 or 8 digit SIC code in 86410000, 86410400, 86410402, 86410403, 86990200, 86990202, 86990203, 86999901, 86999902, 86999903, 86999904, 86999905, 86999908, 86999909, 86999910.
    2. *General description*: Political, civil, and social clubs that typically require membership. Includes political organizations, fraternal associations, alumni associations, university clubs, business person club, homeowners associations, booster club, environmental protection club, PTA, charitable organization, travel club, and historical club.
13. **Religion**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 8661 or 8 digit SIC code in 86990201, 86990204.
    2. *General description*: Religious organizations or other places of worship. Includes churches, temples, synagogue, mosque, and religious reading rooms.
14. **Eating and Dining Places**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 5812 or on fast food chain name list as described in the Food Stores section.
    2. *General description*: Food stores designed for dining out and consumption on site.
15. **Night Clubs and Bars**
    1. *Technical definition:* Any social engagement destination with 4 digit SIC code 5813 or 8 digit SIC code in 79999918, 86410401.
    2. *General description*: Night clubs, dance halls, and bars. May or may not serve alcohol. These categories were then also summed together for a total social engagement destination environment.

There is also an overall social engagement destinations variable which sums together all of the above categories which is the recommended measure to use.

### Popular Walking Destinations

The popular walking data consists of places which promote walking. SIC codes were selected based on previous work by Christine Hoehner[[10]](#footnote-10). A total of 137 SIC codes were purchased as popular walking destinations. For non-food based SIC codes, establishments that are listed as headquarters are included as popular walking destinations. This is different from the food stores data where they are excluded. For the non-food based, they are included because it was felt that there are fewer chains where they would have just an administrative head that didn’t offer any services as opposed to the food stores where there are many more chains where the headquarters represent just an administrative head without services. There will be some locations that don’t actually offer any services but this will be a small minority of the locations. Less than 2% of the locations at each year 2000-2010 are considered headquarters.

The popular walking destinations are categorized into 6 categories as follows (note that not all separate categories are included in the dataset – only those that are commonly used are included).

1. **Postal Service**
   1. *Technical definition:* Any walking destination with 4 digit SIC code 4311.
   2. *General description*: Post offices and other postal services.
2. **Drug Stores and Pharmacy**
   1. *Technical definition:* Any walking destination with 4 digit SIC code 5912.
   2. *General description*: Drug stores and pharmacies. Does not include those that are also supermarkets.
3. **Banks and Credit Unions**
   1. *Technical definition:* Any walking destination with 4 digit SIC code 6021, 6022, 6029, 6035, 6036, 6061, 6062.
   2. *General description*: Banks and credit unions including private banks and federal and state credit unions.
4. **Food Stores Non-Beverage**
   1. *Technical definition:* Any walking destination with 4 digit SIC code 5411, 5421, 5431, 5441, 5451, 5461, 5499 (except 549902) or 8 digit SIC code 86999907 or on supermarket chain name list as described in the Food Stores section.
   2. *General description*: Food stores designed for grocery shopping including supermarkets, grocers, convenience stores, delis, food co-ops, ect. Excludes any stores used only for purchases of beverages.
5. **Eating and Dining Places Non-Beverage**
   1. *Technical definition:* Any walking destination with 4 digit SIC code 5812 (except 58120205, 58120206, 58120304) or on fast food chain name list as described in the Food Stores section.
   2. *General description*: Food stores designed for dining out and consumption on site. Excludes any stores used only for purchases of beverages including coffee.
6. **Drinking Places Non-Alcoholic**
   1. *Technical definition:* Any walking destination with SIC code 54990200, 54990201, 54990202, 54990203, 54990204, 54990205, 58120205, 58120206, 58120304. Note that this is the same definition as the drinking places non-alcoholic in food stores coding.
   2. *General description*: Food stores that sell coffee, smoothies, juices, and tea for consumption on site.

There is also an overall popular walking destinations variable which sums together all of the above categories which is the recommended variable to use.

### Total Stores

A measure is also created combining all of the coding above into a total stores measure. Since it was determined that this was needed after the densities were created, it was created by adding together the already calculated densities. Due to the overlap in SIC codes being in both social engagement and walking destinations with food stores and recreational coding, the densities selected to be added together captured the most stores possible. This mainly leads to including the social engagement and walking destinations densities. This covers all of the food stores coding but for recreational coding, there are some SIC codes that were left out due to the inconsistencies in how these were coded. An additional density with these SIC codes was created and was added with the other densities for the total stores density.

## Street Connectivity

All network and street calculations were performed using streets from Street Map 03 to represent year 2000 and from StreetMap Premium 2012 for year 2010 which is available for the entire US.

Intersection count is used as a measure of how connected the streets are. A higher intersection count (or intersection density) means higher connections between streets and easier to get to places (more travel options). For this, “dangle points” (cul-de-sacs) were removed and then the number of intersections was counted within each buffer size of ¼, ½, and 1 mile.

Intersection density was created for each buffer by the following formula:

Intersection density = intersection count/total area in hectares

The unit of measure is intersections per hectare.

Network area and network ratio (network area/total (Euclidean) area) are used as a measure of how connected the streets are. A higher network area and network ratio indicate higher street connectivity (more places accessible within a distance of home). Network buffers were created so as to obtain network area (the land area covered by the network buffers). Network buffers differ from straight-line buffers in that they are the distance away from a point along the network (in our case, streets). An easy way to conceptualize this is as follows: pretend you are an all-powerful evil villain with hundreds of minions. You tie a rope that is X-meters (or miles) long to each minion and then release them from your home. They would walk along the roads and when their rope runs out that is the farthest point in the network buffer. These lines/strings are then buffered 50 meters on either side.

Network ratio was calculated using the following formula:

Network Ratio = Network Area (in meters square)/Total area (in meters square)

When applying the data for use in longitudinal analyses, the two time points for the streets in 2000 and streets in 2010 will be applied as follows:

Years 2000-2005 = Streets 2000 data

Years 2006-2012 = Streets 2010 data

This matches to the closest time period using the mid-point time.

## Population Density

The census-based total population (based on census block population data from Census 2000 and Census 2010 SF1 data downloaded from the US Census American FactFinder) within a study participant’s ½ mile and 1 mile buffers was created. First, a population density is calculated for each block (assuming an equal distribution of people per unit area) which is then multiplied by the new area of the block piece after being intersected with the buffers; a summary table based on the buffer’s ‘uniqid’ provides the total number of people per buffer. Population density was created in persons per square mile for 2000 and 2010 populations for each buffer size by the formula:

Population density per square mile = (Total Population/(Total Area in meters square\* 0.000000386102158542))

The unit of measure is persons per square mile.

In addition, the population density within residential area (per square kilometer) was calculated using the formula:

Population density in residential area per square km = (Total Population/Total Residential Area in meters square)\*1000000

To apply the data to exams, population from Census 2000 is used for years 2000-2005 and from Census 2010 for years 2006-2012. The residential area used matches with the land use by site (see below).

## Land Use

Based on the findings in Daniel Rodriguez’s paper[[11]](#footnote-11), which was based on the MESA baseline built environment data, obtainment of additional parcel land use data was given priority to be able to look at changes in land use (percent retail, residential, and commercial) with changes in health and health behaviors (such as walking). Data on land use was collected from various government sources from Los Angeles, CA; Chicago, IL; Baltimore, MD; St Paul, MN; Forsyth County, NC; and New York, NY. The timing of the data available is highly variable by study site as outlined in Table 2.

Table 2: Land Use- Parcel files for the following sites and years (shading indicates data available in that year):

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Site** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2008** | **2009** | **2010** | **2011** | **2013** |
| CA |  |  |  |  |  |  |  |  |  |  |  |
| IL | \* |  |  |  | \* |  |  |  |  |  |  |
| MD |  | County and City |  | County |  | City | County and City |  |  |  | County |
| MN |  |  |  |  |  |  |  | \*\* | \*\* |  |  |
| NC |  |  |  |  |  |  |  |  |  |  |  |
| NY |  |  |  |  |  |  |  |  |  |  |  |

\*Not parcel data but have aerial from 2001 and 2005

\*\*Based on July 2010 for all counties, except Washington County (October 2009)

For each land use file, the parcels were coded into residential, retail, and commercial. The parcel coding within each file is highly variable in terms of the types of codes and detail available as provided to us. Coding was standardized as much as possible across time periods and sites to have measures that are comparable. Coding was based on what type of service the parcel is zoned for. Two investigators simultaneously classified parcels into three non-mutually exclusive categories (retail, commercial, and residential), based on the land use codes provided for each study area. Three additional investigators verified the classification and resolved disagreements. In general, coding rules are as follows:

1. Residential – Land parcels devoted to areas where people can live. This can include areas that are mixed use.
   1. Any codes that have the term “residential” or “residence” in the name
   2. Single family homes
   3. Duplex dwellings
   4. Apartment complex
   5. Condominium
   6. Mobile Home/Trailer parks
   7. Assisted Living/Nursing Homes
   8. Rooming Houses
   9. Group Quarters
   10. Farmsteads
   11. Seasonal/Vacation homes
   12. Church Residence
   13. Bed and Breakfast (assumed the owners are living here also)
   14. NOT INCLUDING: student housing and fraternities.
2. Retail – Land parcels devoted to retail uses where people can purchase goods
   1. Any codes that have the term “retail” in the name
   2. Shopping Center/Malls
   3. Food stores
   4. Convenience stores
   5. Restaurants
   6. Bars/Night clubs
   7. Clothing stores
   8. Mixed use – this was assumed to have at least some retail as part of the land use mix
   9. Combination of commercial and residential – This was assumed that the commercial when mixed with residential contains some retail, because parcels coded as both commercial and residential may represent development that has stores with goods for purchase below residences.
3. Commercial – Land parcels devoted to commercial uses where people can either purchase goods or obtain services (professional included)
   1. Any coded as “Retail” above are included
   2. Any codes that have the term “commercial” in the name
   3. Trade/Wholesale Trade
   4. Finance/Banks
   5. Insurance
   6. Personal services
   7. Theater
   8. Office Parks
   9. NOT INCLUDING: hospitals and medical facilities

Measures for land use include percent retail, percent commercial, and percent residential that falls within participant buffers for ½ and 1 mile and the straight-line (Euclidean) distance to nearest retail and commercial. Also included are the percent of the participants’ buffers that fall within the jurisdiction where the land use data is available. The indicators for the percent of area that falls within the jurisdiction is used as indicators for which participants will have usable data for the land use measures. For these indicators, a value of 1 means the entire buffer is within the land use jurisdiction and a value of 0 means the buffer is completely outside the land use jurisdiction. Values between 0 and 1 mean that only part of the buffer is within the land use jurisdiction.

The percent of land use was calculated using the formulas:

Percent residential = Residential Area in meters square/total area in meters square

Percent retail = Retail Area in meters square/total area in meters square

Percent commercial = Commercial Area in meters square/total area in meters square

The straight-line (Euclidean) distance to the nearest retail and commercial were created. This gives the distance from the participant’s location to the nearest retail or commercial in terms of “how the crow flies” and does not take into account any road networks.

To apply the data across time for the MESA exams for longitudinal analyses, since there is data for at least two time points for all study sites, the data will be matched by exam date to the year closest in time. See Table 3 for the timeline for how the data is applied by study site.

Table 3: Land Use data applied across study years:

|  | **2000** | **2001** | **2002** | **2003** | | **2004** | **2005** | | **2006** | **2007** | **2008** | | **2009** | **2010** | **2011** | **2012** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Land Use CA** | **2001 data** | | | | **2005 data** | | | | | **2008 data** | | | | | | |
| **Land Use IL** | **2001 data** | | | | **2005 data** | | | | | | | | | | | |
| **Land Use MD** | **2002 data** | | | | | | | **2008 data** | | | | | | | | |
| **Land Use MN** | **2006 data** | | | | | | | | | | | **2010 data** | | | | |
| **Land Use NC** | **2005 data** | | | | | | | **2010 data** | | | | | | | | |
| **Land Use NY** | **2002 data** | | | **2003 data** | | **2004 data** | | **2006 data** | | | | | **2011 data** | | | |

## Public Transportation

Distances to nearest train/subway stops and bus lines were calculated based on public transit files obtained through various government sources. These are available for the 6 main MESA study sites (Los Angeles, CA; Chicago, IL; Baltimore, MD; St Paul, MN; Forsyth County, NC; and New York, NY). The unit of measure for these variables is in meters. The Near Tool in ArcGIS 10.1 was used to identify the nearest transportation station or route to the participant’s address using a 300 mile search radius. These measures are only available for participants who fall within the land use counties where data was collected. If the address is outside the counties, then the data will be missing.

To apply the data across time for the MESA exams for longitudinal analyses, for sites that only have data available at one year, that year will be applied to all exams. For sites where there is more than one year available, the data will be matched by exam date to the year closest in time. See Table 4 for how data was applied across study years.

For MN, the Hiawatha commuter rail train line came into existence in 2004. Prior to this year, there was no commuter rail available in this area. Daniel Rodriguez had suggested when applying the data longitudinally to the MESA exams, any exams which took place prior to 2004 should be assigned the maximum of any participant using the 2009 train line data. After further thought, it was decided to give these dates before 2004 an indicator value of “9999999” rather than the maximum. We felt that using an indicator for whether they have a train or not would be better since using the maximum would not be interpretable and we wanted to discourage analysts from trying to have a measure they would want to interpret.

Overall Summary of Public Transportation Data Available and Used in Transportation Measures:

* **CA:** Bus routes (2005, 2007, 2010, 2012); Rail stops (2006, 2010, 2012); Metrolink Stops (2004)
* **IL:** Bus routes (2005); CTA stations (2005); Metra Stations (2005)
* **MD :** City bus routes (2009); charm city circulator routes (2009); light rail stations (2007); railroad (2007); subway station (2007); Train station (2007)
* **MN:** Bus routes (2005 & 2009); Light rail (2009)
* **NC:** Bus routes (2001 & 2009)
* **NY:** Bus routes (2010); Subway Stations (2010)

Table 4: Public transportation data applied across study years:

|  | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | | **2007** | | **2008** | | **2009** | **2010** | **2011** | | **2012** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bus CA** | **2005 data** | | | | | | | **2007 data** | | | | | **2010 data** | | | **2012 data** | |
| **Bus IL** | **2005 data** | | | | | | | | | | | | | | | | |
| **Bus MD** | **2009 data** | | | | | | | | | | | | | | | | |
| **Bus MN** | **2005 data** | | | | | | | | | **2009 data** | | | | | | | |
| **Bus NC** | **2001 data** | | | | | | **2009 data** | | | | | | | | | | |
| **Bus NY** | **2010 data** | | | | | | | | | | | | | | | | |
| **Train CA** | **2006 data** | | | | | | | | | | | **2010 data** | | | | **2012 data** | |
| **Train IL** | **2005 data** | | | | | | | | | | | | | | | | |
| **Train MD** | **2007 data** | | | | | | | | | | | | | | | | |
| **Train MN** | **No train in existence** | | | | **2009 data** | | | | | | | | | | | | |
| **Train NY** | **2010 data** | | | | | | | | | | | | | | | | |

## Built Environment Factor Scores

To create a combined measure that takes into account aspects of the built environment related to walking were created but extracting factors from a principle factor analysis with varimax rotation[[12]](#footnote-12). Variables included in the factor analysis were:

1. Population density per square mile (1 mile buffer)
2. Percent retail (1 mile buffer)
3. Percent residential (1 mile buffer)
4. Popular walking destinations – simple density (1 mile buffer)
5. Distance to bus
6. Network ratio

A three-factor model was chosen for these measures. Initial eigenvalues indicated that the first three factors explained 37%, 19%, and 15% of the variance, respectively. The three-factor solution, which explained 81% of the variance, was preferred because of: (a) the “leveling off” of eigenvalues on the scree plot after three factors; and (b) clarity of interpretation of the factor solution.

Factor scores were created by multiplying the factor weights by the standardized variables and summing for variables loading at 0.8 or higher on that factor. Factor scores are as follows:

Factor 1: Intensity of development

(0.88\*Popular walking density)+(0.87\*population density)+(-0.83\*% residential)

Factor 2: Connected Retail centers

(0.80\*Network ratio)+(0.85\*%retail);

A separate score was not calculated for Factor 3, since only distance to bus was highly loaded on that factor.

Factor scores were created for each buffer size (½ and 1 mile) for simple density of walking destinations to allow for choice of buffer and sensitivity analyses.

## Cumulative Averages

To assess long-term cumulative exposure to the neighborhood environment, we created time-varying cumulative means, defined as the mean across all months from the baseline to each follow-up exam.

A monthly address dataset was created with a row for each month that the participant was in the study starting with their Exam 1 date. The last row in the dataset is the date at the last exam the participant completed. The cumulative average is then calculated as:

Where t = number of months from Exam 1 to follow-up exam (ie: Exam 2, Exam 3, Exam 4, or Exam 5)

For Exam1, the value of the cumulative average variable is the same as the actual value for Exam1. For any months with missing data, these months are excluded from the calculation of the average. Since the some of the measures only have 2 time changes (3 total values), this will be more relevant in the later exams (after 2004) and for those who moved, where the values will change at the point in which they moved to the new address.

These summary measures are intended to be used in a model such as (Cumulative Average Model):

Ykit= βo+ β1Xki0+ β2Tkit+ β3(avgXkit\*Tkit)+ β4Aki0+ β5( Aki0\*Tkit)+ βmCovki0+βn(Covki0\*Tkit)+ βpCovTkit+ηk+αki+(νki\*Tkit)+ekit

Where:

Y*kit* = Outcome of interest

X*ki0* = Neighborhood exposure at Exam 1 (baseline)

T*kit* = Time elapsed since Exam1. This will be 0 for Exam1 (baseline) since no time has elapsed.

avgX*kit* = Average neighborhood exposure from Exam1 (baseline) to time *t*

Aki0 = Age at Exam1 (baseline). This controls for age and cohort effects assuming that period effects are null.

Covki0 = Covariates for adjustment at Exam1 (baseline - not time varying)

CovTkit = Time Varying covariates for adjustment

β0= Intercept

β1= Coefficient for baseline neighborhood exposure

β2= Coefficient for time trend

β3= Coefficient for the cumulative neighborhood exposure with change in outcome over time

β4= Coefficient for baseline age effect

β5= Coefficient for baseline age with change in outcome over time

βm= Coefficients for baseline covariates

βn= Coefficients for baseline covariates with change in outcome over time

βp= Coefficients for time varying covariates

ηk =Random effect for neighborhood intercept

αki= Random effect for person i intercept

νki\*Tkit= Random effect for person i time slope

e*kit* = measurement error associated with outcome

For the land use measures, if a participant moved outside the study area where data was collected, land use measures are missing for those exams but a cumulative average is still available. This was calculated as the cumulative average to the point when they moved, then carried forward for future dates. You may want to exclude anyone whose land use buffer (PCTLU0, PCTLU1) is zero (outside study area).

## Interpolations

The built environment data of land use, population density, streets, and public transportation are not available yearly. For most of this data, it is only available at two points in time. This means that multiple visits are assigned to the same built environment data and reduces the possible variation in the measures. Interpolations, which create a linear slope to extract a value for each point in time, were created to allow for more variation across visits.

First a date was assigned to each type of data as follows:

Population/Population Density/Streets. Two time points are available.

Census/Roads 2000 = 7/1/2000 (mid-point of the year 2000)

Census/Roads 2010 = 7/1/2010 (mid-point of the year 2010)

Public Transportation. Site specific based on when data was available. Only created for sites where there were at least two time points available. This was only CA (trains and bus), MN (bus), and NC (bus).

CA Trains. Three time points are available.

2006 Trains = 7/1/2006 (mid-point of year 2006)

2010 Trains = 7/1/2010 (mid-point of year 2010)

2012 Trains = 7/1/2012 (mid-point of year 2012)

CA Bus. Four time points are available.

2005 Buses = 7/1/2005 (mid-point of year 2005)

2007 Buses = 7/1/2007 (mid-point of year 2007)

2010 Buses = 7/1/2010 (mid-point of year 2010)

2012 Buses = 7/1/2012 (mid-point of year 2012)

MN Bus. Two time points are available.

2005 Buses = 7/1/2005 (mid-point of year 2005)

2009 Buses = 7/1/2009 (mid-point of year 2009)

NC Bus. Two time points are available.

2001 Buses = 7/1/2001 (mid-point of year 2001)

2009 Buses = 7/1/2009 (mid-point of year 2009)

Land Use. Site specific based on when data was available. All sites have at least 2 time points.

CA Land Use. Three time points are available.

2001 Land Use = 7/1/2001 (mid-point of year 2001)

2005 Land Use = 7/1/2005 (mid-point of year 2005)

2008 Land Use = 7/1/2008 (mid-point of year 2008)

IL Land Use. Two time points are available.

2001 Land Use = 7/1/2001 (mid-point of year 2001)

2005 Land Use = 7/1/2005 (mid-point of year 2005)

MD Land Use. Two time points are available.

2002 Land Use = 7/1/2002 (mid-point of year 2002)

2008 Land Use = 7/1/2008 (mid-point of year 2008)

MN Land Use. Two time points are available.

2006 Land Use = 7/1/2006 (mid-point of year 2006)

2010 Land Use = 7/1/2010 (mid-point of year 2010)

NC Land Use. Two time points are available.

2005 Land Use = 7/1/2005 (mid-point of year 2005)

2010 Land Use = 7/1/2010 (mid-point of year 2010)

NY Land Use. Five time points are available.

2002 Land Use = 7/1/2002 (mid-point of year 2002)

2003 Land Use = 7/1/2003 (mid-point of year 2003)

2004 Land Use = 7/1/2004 (mid-point of year 2004)

2006 Land Use = 7/1/2006 (mid-point of year 2006)

2011 Land Use = 7/1/2011 (mid-point of year 2011)

The difference between these dates was calculated in days to use in calculating the slope. For example, for the CA Land Use, time differences in days were calculated for Land Use 2005-Land Use 2001 (7/1/2005-7/1/2001) and Land Use 2008-Land Use 2005 (7/1/2008-7/1/2005).

Next, the differences were created between the values of the built environment variables for each adjacent time period. For example, for the CA Land Use, differences were created for Land Use Variable 2005-Land Use Variable 2001 and Land Use Variable 2008-Land Use Variable 2005.

To create the final slope, the difference in the value was divided by the difference in time. This gives the slope in the PER DAY change for the built environment variable.

The interpolated values were created as follows:

Variables with 5 dates (NY Land Use):

if date ~=. and date <= refdate2 then do;

Interpolated value = (slope1\*(date - refdate1)) + value@time1;

end;

else if date ~=. and date <= refdate3 then do;

Interpolated value = (slope2\*(date - refdate2)) + value@time2;

end;

else if date ~=. and date <= refdate4 then do;

Interpolated value = (slope3\*(date - refdate3)) + value@time3;

end;

else if date ~=. and refdate4 < date then do;

Interpolated value = (slope4\*(date - refdate4)) + value@time4;

end;

Variables with 4 dates (CA Bus):

if date ~=. and date <= refdate2 then do;

Interpolated value = (slope1\*(date - refdate1)) + value@time1;

end;

else if date ~=. and date <= refdate3 then do;

Interpolated value = (slope2\*(date - refdate2)) + value@time2;

end;

else if date ~=. and refdate3 < date then do;

Interpolated value = (slope3\*(date - refdate3)) + value@time3;

end;

Variables with 3 dates (CA Train, CA Land Use)

if date ~=. and date <= refdate2 then do;

Interpolated value = (slope1\*(date - refdate1)) + value@time1;

end;

else if date ~=. and refdate2 < date then do;

Interpolated value = (slope2\*(date - refdate2)) + value@time2;

end;

Variables with 2 dates (Population, Streets, MN Bus, NC Bus, IL Land Use, MD Land Use, MN Land Use, NC Land Use)

Interpolated value = (slope1\*(date - refdate1)) + value@time1;

The caps for variables were set to be 0 and 1 for any percentage variables. For other variables, the caps were set to be the minimum and maximum of any value for that variable within that study site.

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