## Built Environment Variables

There multiple types of built environment data available as briefly described in this section. For further details on measures described in the section, see the document “*EAC\_MESA\_JHS\_BuiltEnvironment Documentation.docx*”.

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### 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.

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. The intersection count is not available for Puerto Rico for the 2000 streets data.

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 indicates 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. The network area/network ratio is not available for Puerto Rico for the 2000 streets data.

#### APPLYING DATA TO EXAMS/VISITS

When applying the data for use in longitudinal analyses for the JHS study, 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. See Appendix A for the timeline for how the data is applied.

### LAND USE

Based on the findings in Daniel Rodriguez’s paper[[1]](#footnote-1) 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 is only available for Hinds County which was collected from Hinds County Tax Assessor’s office in Jackson, MS.

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 ¼, 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 (ie: those within Hinds County). The indicator 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

#### APPLYING DATA TO VISITS/EXAMS

To apply the data across time for the JHS exams for longitudinal analyses, since there is data for two time points, the data will be matched by exam date to the year closest in time. See Appendix A for the timeline for how the data is applied.

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.

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### POPULATION DENSITY

The census-based total population (based on census block population data from Census 2000 and Census 2010 SF1 data) within a study participant’s ¼ mile, 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 kilometer and persons per square mile for 2000 and 2010 populations for each buffer size by the formula:

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

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

The unit of measure is persons per square kilometer or 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

This uses population from Census 2000 for years 2000-2005 and from Census 2010 for years 2006-2012. See Appendix A for the timeline for how the data is applied.

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### PEDESTRIAN/BIKE CRASH FATALITIES

Data for fatalities suffered in motor vehicle traffic crashes were obtained through the Fatality Analysis Reporting System (FARS), which is a nationwide census providing the National Highway Traffic Safety Administration (NHTSA), Congress, and the American public yearly data regarding these incidents. The data was downloaded through the FARS website (<http://www.nhtsa.gov/FARS>) and is available for years 2001-2011. The data was subset to include only those incidents that involved a pedestrian fatality, which includes any non-motorized transport such as pedestrian, bikes, rollerblades, wheelchair, skateboards, ect. In cases where there was more than one fatality involved in an incident, these were counted as one incident and the additional fatalities were excluded from analysis.

Kernel and simple densities of pedestrian fatality crashes were calculated for ¼, ½, and 1 mile buffers around the addresses. For the kernel density, these were created using the kernel density command in ArcGIS using the Silverman kernel, which is a quadratic kernel function as described by Silverman[[2]](#footnote-2). This gives a density of the number of crashes per square mile weighted by the distance from the address. For the simple densities, these were created using the point density command in ArcGIS. This is the simple density of the number of crashes per square mile (unweighted).

#### APPLYING DATA TO EXAMS/VISITS

When applying the data for use in longitudinal analyses for the JHS study, each year can be applied directly to the date of the exam/visit. For example, if the exam is in 2001, then density from 2001 will be applied to that exam. For exams that take place before 2001 (where there is no data available), then the 2001 data will be applied. For exams that take place after 2011, then the 2011 data will be applied. See Appendix A for the timeline for how the data is applied.

### PUBLIC TRANSPORTATION

Distances to nearest bus stops and bus routes were calculated based on Jatran bus stops and routes obtained through the city of Jackson, MS. 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 are within 5 miles of the boundaries for the city of Jackson. If the address is more than 5 miles from the city of Jackson, then the data will be missing.

The public transportation data for JHS study is only available at year 2013, which year will be applied to all JHS exams.

# APPENDIX A: Timeline to apply data to Visits/Exams

|  | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Streets Connectivity** | **2000 data** | | | | | | | **2010 data** | | | | | | |
| **Population density** | **Census2000** | | | | | | | **Census 2010** | | | | | | |
| **Land Use** | **1998 data** | | | | | | **2013 data** | | | | | | | |
| **Pedestrian/Bike Fatality crashes** | **2001 data** | | **2002 data** | **2003 data** | **2004 data** | **2005 data** | | **2006 data** | **2007 data** | **2008 data** | **2009 data** | **2010 data** | **2011 data** | |
| **Public Transportation** | **2013 data** | | | | | | | | | | | | | |

1. 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. [↑](#footnote-ref-1)
2. Silverman, B.W. *Density Estimation for Statistics and Data Analysis*. New York: Chapman and Hall, 1986., Page 76, Equation 4.5 [↑](#footnote-ref-2)