How the Built Environment Contributes to the Adolescent Obesity Epidemic: A Multifaceted Approach

Amy Lanza, Jamie Pope, and Brian Mayrsohn
College of Arts and Science, Vanderbilt University

The public health status of the United States is in a critical state. Rates of overweight and obese children are on the rise in nearly every community in the nation, and obesity is quickly becoming a global problem as well. While there are many biological, cultural, and psychological factors that play into the rising rates, social factors as a cause of decreasing health are often overlooked. The "built environment," or each community's living, working, and eating spaces, plays a large role in determining the actions taken by individuals in a community. In this study, the built environments of two socioeconomically different neighborhoods in Nashville, Tennessee, are analyzed. The resulting data is compared to Tennessee state health census reports to posit that a decreased quality of food and physical activity related built environments parallels a rise in chronic health problems.

Obesity at a Glance

Obesity is currently the fastest growing cause of disease and death in America. With more than 1 billion overweight adults in the world – and with 300 million of those adults now considered "obese," or with a body mass index of over 30 – the public health problem can now be qualified as a global pandemic.[1] Specifically in the United States, obesity has become a multifaceted issue that involves the common concerns of health and fitness as well as social concerns. Childhood obesity is also on the rise, as the number of overweight children and adolescents in the United States has doubled and tripled, respectively, since 1980.[2]

A rise in obesity parallels the increase in a plethora of other health related problems in adults, including, but not limited to: coronary heart disease, type 2 diabetes, different types of cancer, hypertension, high cholesterol, strokes, sleeping and respiratory problems, and osteoarthritis.[3] Overweight adolescents have a 70% chance of becoming overweight adults, and are at risk for the above health issues and discrimination.[2] In addition to the health and social effects of obesity, the economy is deeply affected as well: in 2008, obesity-related medical costs were estimated at $147 billion.[3]

Contributing Factors: The Built Environment

One cause cannot be blamed for the obesity epidemic – rather, a large number of factors contribute to the public health issue presently sweeping the nation. Sallis and Glanz posit that there are "many links between the built environment… and physical activity." The "built environment," which is made up of neighborhoods, buildings, accessible food sources, streets, and recreational spaces in which the people of the area live and work, has a large effect on children's eating habits and physical activity.[4] The stability and safety of the roads and the presence of sidewalks may either encourage or discourage community members from engaging in play. Adequate street lighting, trusting neighbors, and use of private recreational facilities such as parks, playgrounds, and sports fields encourage regular activity.[5]

The set-up of the built environment, along with the availability of transportation, influences the way that community members interact and physically move themselves from place to place. In the past few decades, there has been a shift from using physical activity as a mode of transportation to a dependency on motor vehicles. The number of private cars per American household rose more than 50% from the years 1969 to 1995.[6] Society's dependency on cars is exacerbated by the set-up of physical environments. About half of American children are driven to school in a private car, and about one third of children ride a school bus. Long distances, combined with dangerous conditions caused by motor-vehicle traffic, are the main reasons that children do not feel comfortable walking and biking to school.[3] This lack of physical activity greatly contributes to the rise in adolescent obesity.

A general increase in physical inactivity has been observed of all populations, partly due to the shift to more sedentary recreational activities, yet the extent of the inactivity varies by ethnicity among American children. Race and socioeconomic status play a large role in analyzing the built environment, as both add to the complexity of the issue of adolescent obesity. Minority adolescents, such as non-Hispanic blacks, Hispanics, and

Asians, have higher levels of inactivity and spend more hours per week in front of the TV, or playing video and computer games in the safety of their home.[7] The accessibility of recreational facilities, which include playgrounds, parks, and community centers, plays a large role in halting the shift to more sedentary activities and is highly correlated with an increase in physical activity.[8] Lower income areas populated by minorities are associated with a lack of physical activity and increasingly overweight community members, largely because of reduced access to recreational facilities.

Food security has become a national dilemma that also contributes to the increased prevalence of obese adolescents. Food security is defined by the World Food Summit as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" in terms of both physical and economic access. Many studies have examined how the physical availability of healthy foods can be a determinant for the food choices an individual makes. In many areas throughout the South, wealthy neighborhoods have more supermarkets and gas stations with convenience stores than poor neighborhoods.[9] The presence of supermarkets is associated with a lower prevalence of obesity in various communities in the United States. In one study, however, supermarkets are about 1.15 miles farther away in minority communities when compared to the distance of supermarkets for white neighborhoods.[10] Independently owned grocery stores – different from supermarkets – common in lower socioeconomic and higher minority neighborhoods tend to charge higher prices. This disparity results in a greater dependency on cheaper, unhealthier, fast food.[11]

The nutrition environment is a vital aspect of the built environment, as actual access to healthy foods is the first step in healthy eating. Studies show that supermarkets stock twice the average number of "heart-healthy" foods when compared to neighborhood grocery stores and 4 times the average number of these foods when compared to convenience stores.[12] Community grocery stores generally allocate less shelf space to these "heart-healthy" (high fiber and lower fat) foods, while supermarkets that do stock these items are associated with higher fruit and vegetable intake.[11] Compounding the problem further is fast food, which is convenient, cheap, and less time consuming than preparing a meal at home. However, fast food is generally up to 65% more energy dense than an average meal and lacks decent portion sizes. While it cannot be proven that a lack of fresh fruits and vegetables in community grocery stores directly effects unhealthy eating and therefore the obesity epidemic, small improvements in fruit and vegetable intake have been found when healthier foods are introduced in minority communities.[11]

One study demonstrates how the large difference in rates of health issues between two different neighborhoods is largely dependent on the status of the built environment. Lower socioeconomic, urban areas are described as "food deserts" with little healthy supermarket options and a multitude of fast food restaurants. High rates of crime also prevent children from engaging in outside physical activity. Poor women, given the chance to live in a more affluent neighborhood – where no more than 10% of residents had incomes below the poverty level – had lower rates of diabetes and obesity.[13] Those women given vouchers to move to a more affluent area had a 19% lower rate of obesity, and a 22% lower rate of diabetes as well.

In addition to the social, physical, and structural factors of the built environment, one of the most overlooked causes of childhood obesity are school lunch programs. Specifically, the Metropolitan Nashville Public Schools' Food Service Department serves more than 2.3 million breakfasts and 6.5 million lunches over the course of the school year.[14] Although the United States Department of Agriculture regulates the lunch program based on a government-supported system, the USDA heavily supports commoditization and "stealth health," which refers to the enrichment of products so that they meet standards laid down by the government. According to Linda Herrel, Nutrition Coordinator of the Nashville Public School System, there is a large drive for school lunches to adhere to the Institute of Medicine's dietary guidelines, a science, rather than commodity, based initiative that would limit the amount of salt, sugar, and overly processed foods in school lunches. Children spend a majority of their time in school, and authority figures, along with the food offered during meal times, can influence a healthy-eating and community-building mindset.

Methods

Purpose

The purpose of this study was to analyze the "built environment" of two socioeconomically different communities in Nashville and examine the potential impact the environment mediates on the health status, particularly the obese, of the population. Comparisons were based on both the nutrition and physical activity environments.

Location

Two different "built environments" in Nashville were examined, which were situated near two prominent elementary schools: Julia Green Elementary, in Belle

Meade, TN, and Bordeaux Enhanced Option Elementary School in the Bordeaux/White-Plains area, both in Davidson County, Tennessee. The nutrition environments that were analyzed – the fast food chains, convenience stores, grocery stores, and supermarkets – were each within about a 2-mile radius of each school.

Measures

Various methods were used in order to thoroughly examine both built environments:

Table 1. Four measures used to analyze the built environment.

Measures		
Tool	**Description**	**Method of collection**
Census reports	Crime rate reports, demographics, and different rates of distribution of obesity, inactivity, high cholesterol, and other chronic diseases throughout Nashville.	Collected data from online databases and compiled applicable data in tables and graphs.
Physical Activity Resource Assessment Instrument (PARA)	An assessment tool analyzing the quality of a community's recreational facility; examples of factors investigated are sidewalks, playgrounds, amenities, and physical appeal of environment.[16]	Visited two YMCAs, the main community center in both built environments. Explored neighborhoods of each site within a 2-mile radius of each school. Compiled observations on Word.
Nutrition Environment Assessment Tool (NEAT)	A Michigan based measurement; NEAT evaluates a community's built environment in relation to the promotion of healthy eating and access to healthy foods in the workplace, community, and school settings.[15]	Visited grocery stores, supermarkets, and convenience stores for data collection. Explored neighborhoods of each site within a 2-mile radius of each school to collect data on number of fast food chains. Compiled observations on Word.
Focus Groups	Focus group questions aimed at gaining an insight into children's views about food and nutrition.	Questions administered to 2 groups of 1st – 4th grade children at both elementary schools; visited both schools during their lunch periods. Responses recorded on a Word document.

Results

Census Reports

The following tables and graphs present a mixture of county information compiled from various online sources:

Table 2. Police Summary Crime Statistics by Council District in 2010, Including Violent and Property Incidents[18]

Crime Statistics 2010				
	Violent Incidents	*% of County Total Violent Incidents*	*Property Incidents*	*% of County Total Property Incidents*
Bordeaux District 2	435	6.3%	1,098	3.6&
Belle Meade District 34	25	0.40%	370	1.2%

Table 3a-b. Health Related Issues in Bordeaux and Belle Meade[19]

	Geographic Distribution of Health Problems		
	*Mean BMI**	*% Diagnosed with Diabetes*	*% Diagnosed with Hypertension*
Bordeaux	27.40-28.06	0.12-0.13	0.47-0.70
Belle Meade	24.36-25.17	0.02-0.03	0.09-0.16

	Three Health Behaviors		
	*Stage of Change for Dietary Fat***	*% Physically Active in Past Month*	*% Who Smoke*
Bordeaux	2.96-3.21	0.49-0.55	0.29
Belle Meade	3.81-3.88	0.77-0.80	0.04-0.13

*BMI, or body mass index, assuming normal weight < 25, 25 – 30 is overweight, and over 30 is obese

**Stage of Change for Dietary Fat, assuming the following scale: 1 is precontemplation of change, and 5 being maintenance

Table 4. Socioeconomic Data of Residents from Bordeaux and Belle Meade in 2009

Socioeconomic Data 2009			
	*Cost of living index**	*Estimated median household income*	*Residents with income below poverty level*
Bordeaux[20]	82.8	$46,896	18.9%
Belle Meade[21]	93.2	$90,640	5.3%

*Cost of living index U.S. average = 100

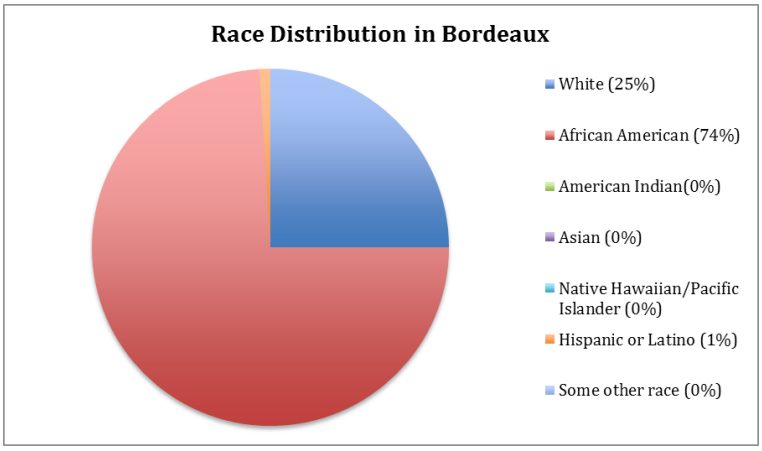

Figure 1. Distribution of Races in the Bordeaux Area[20]

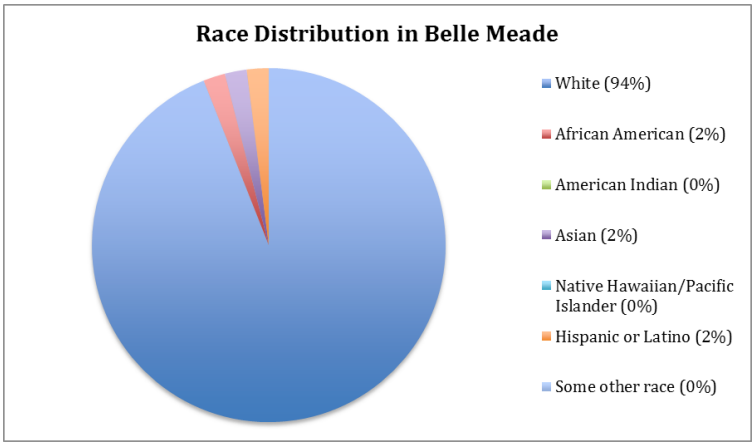

Figure 2. Distribution of Races in the Belle Meade Area[21]

PARA tool

After investigating the nutrition environment, the physical activity environment was analyzed as well. The PARA tool was used to examine the recreational facilities in an area. Both the Bordeaux and Belle Meade communities had access to a YMCA. Both facilities were standardized, except for a few important discrepancies: the YMCA in Bordeaux had just been renovated in the recent past, and the YMCA in Belle Meade held leadership programs that were not available for young adults in Bordeaux.

As previously stated, the physical built environments were analyzed within a 2-mile radius of each school. The neighborhoods were very similar in terms of quality of streetlights, number and quality of sidewalks, and overall maintenance of lawns, yet the neighborhoods in Belle Meade tended towards gated communities. The school in Belle Meade had more up-to-date amenities and more areas for outside play.

NEAT tool

Only a portion of the NEAT tool was utilized in the study. The assessment tool is divided into three separate sections: Community Policies and Environment, Worksite Policies and Environment, and School Policies and Environment. The nutrition-based part of the first section was used in order to investigate the differences in access to healthy foods in both communities. Four different subsections of "Community Policies and Environment" were analyzed: Family Style Restaurants, Fast Food Restaurants, Grocery Stores/Supermarkets, and Convenience Stores/Supermarkets. For each subsection, one point was given if the restaurant or store being studied met the criteria listed, which ranged from the presence of reduced-fat cheese in grocery stores to the availability of a nutrition analysis in restaurants. Results are as follows:

Table 5a-b. NEAT Tool Results: Analyzing the Nutrition Environment

	Your Community's Score		*Max Score*
	Bordeaux	Belle Meade	Both
Family Style Restaurants	12	27	39
Fast Food Restaurants	10	25	39
Grocery Stores/ Supermarkets	13	37	38
Convenience Stores/ Supermarkets	7	16	27

	% of Possible		*Support Rating***	
	Bordeaux	Belle Meade	Bordeaux	Belle Meade
Family Style Restaurants	30.8%	69.2%	Not	Partially
Fast Food Restaurants	25.6%	64.1%	Not	Partially
Grocery Stores/ Supermarkets	34.2%	97.4%	Not	Fully
Convenience Stores/ Supermarkets	25.9%	59.3%	Not	Partially

**Support Rating: determined by "% of Possible"

90 to 100% = This aspect of community is **Fully Supportive** of healthy eating

75 to 89.9% = **Mostly Supportive** of healthy eating

50 to 74.9% = **Partially Supportive** of healthy eating

Less than 50% = **Not at all Supportive** of healthy eating

The prevalence of different types of food stores and food service places in both communities were recorded as well. The North American Industry Classification System (NAICS) categorizes various food places into the following groups:

Table 6. NAICS Results: Distribution of Food Service Places in Bordeaux and Belle Meade[12]

Food Service Places		
Industry Group	*# in Bordeaux*	*# in Belle Meade*
Supermarkets	1	3
Grocery Stores	1	0
Convenience Stores	1	2
Convenience stores with gas stations	3	5
Specialty food stores	0	0
Full-service restaurants	5	20
Fast-food restaurants	12	9
Carryout eating places	1	1
Carryout specialty items	0	5
Bars and taverns	4	2

Focus Groups

The following focus group questions were administered to two groups of students at Bordeaux Elementary and Julia Green Elementary during their respective school lunch times. The students at Julia Green Elementary were 4th graders on a Leadership Committee that the students had applied for, and the students at Bordeaux Elementary were 3rd graders staying after school. Loosely based off of "Focus Group Protocols" from "It's good to talk: children's view on food and nutrition."[17]. Questions and summary of results follow.

1) Are you interested in computers?
2) How much time do you spend using computers?
3) What types of things do you use computers for?
4) What television shows do you like to watch?
5) What other things do you like to do in your free time?
6) How do you get to school?
7) How many meals do you eat per day?
8) Do you eat the school lunch, or do you bring a packed lunch?
9) What are your favorite things to snack on?
10) Do you eat candy? If so, where do you buy it?
11) How many times per week do you eat fast food?

Summary of results: The focus group questions cover two different characteristics of healthy choices: lifestyle decisions and eating behavior.

(1) Lifestyle

Questions 1 through 6 focused on topics related to lifestyle choices and household routines. Both groups of students said that they were interested in computers, yet the students at Julia Green were given much more stringent rules by their parents for the amount of time and for what they could do on the computer. When on the computer, students at Bordeaux mainly played video games, while students at Julia Green searched topics on search engines, played math games, and made PowerPoint presentations in addition to playing video games. While the two groups of students said they used the computer for different things, they watch the same television shows: Spongebob, Disney Channel, Cartoon Network, and Nickelodeon. In their free time, the students took part in very similar activities, such as sports, arts and crafts, and playing with their friends. The main difference was that the children at Bordeaux said they were not allowed to play outside unless their parents were watching. The students at Julia Green stated they were allowed to play alone. A majority of both groups of students are driven to school.

(2) Eating behavior

Questions 7 through 11 focused on topics related to eating behavior at home and at school, perceptions of healthy eating, and barriers to healthy eating. The number of meals that students at Bordeaux ate each day differed drastically from student to student – some replied that they ate 4 "because food is really good," a few said 5 meals, including snacks in their definitions of meals, and one said 9 because he is always very hungry. At Julia Green, 3 meals

and 2 snacks per day was the general consensus. While every child at Bordeaux ate lunch at school, a majority of children packed their own lunches at Julia Green because the school lunches were "disgusting," "not cooked well," or "didn't taste good." Students at Bordeaux were very excited by the cheeseburgers and tacos at school, yet students at Julia Green said they felt sick after eating these foods. Both groups of children enjoyed snacking on fruit, pretzels, chips, and granola bars, yet had different perceptions of the place for candy in a balanced diet. The children at Julia Green overwhelmingly said that candy was only "for special occasions, like Easter and Halloween," yet the children at Bordeaux said they eat candy once a week when their parents have money or when they make a trip to the Kwik Sac convenience store. Fast food was seen in the same way as candy for children at Julia Green. It was "only eaten when traveling" or "too greasy for everyday meals." In contrast, children at Bordeaux reported eating fast food 2 or 3 times per week.

Discussion

The obesity epidemic involves multiple factors that overlap and interact – one of the reasons why it is such a difficult problem to fix. People may be well versed in good nutrition and aware of the need for physical activity, yet a lack of access to basic resources greatly influences the actions of a community. Though the literal physical environments may seem similar, the differences in resources and priorities in both communities promote different ways of thinking. Many features of each environment support a common theme – lower socioeconomic groups with a larger number of minorities had the highest risk for chronic health problems, as these groups more often live in areas with decreased access to healthy foods and areas for physical activity.

While a large majority of the Belle Meade area around Julia Green Elementary is white (94%), the residents of Bordeaux are predominantly African Americans (74%). This large racial discrepancy was evident when in both schools – ¾ of the children at the school lunch at Bordeaux were African American, and the same was true for whites at Julia Green Elementary. African Americans typically live more years with chronic health problems than whites.[22] The residents of Bordeaux had a higher mean body mass index, and a significantly larger percentage was diagnosed with diabetes and hypertension. Socioeconomic conditions seem to be the main origin of this racial disparity in health.[22] The estimated median household income for Bordeaux is almost half as much for Belle Meade, and the poverty level in Bordeaux is more than three times as much as the level in Belle Meade. A decline in the economic status of African Americans has been seen over the years, which correlates with a decline in health status as well.[23]

A majority of the deaths in the United States each year are related to unhealthy lifestyle behaviors. 112,000 deaths in 2005 were associated with obesity, making it the second leading cause of death in the U.S.[24] The health behaviors in both communities differed immensely, and in all three measures, the residents of Belle Meade observed much healthier practices. The stage of change for dietary fat, meaning the active steps taken by a community to decrease intake levels of fat, was 0.60 higher in Belle Meade than the stage of change for dietary fat in Bordeaux. This inconsistency could be seen at all levels of the built environment. While Julia Green Elementary has recently implemented a program at its school set on bringing healthier foods into the classroom, Bordeaux did not have a similar program. When visiting the grocery store in the Bordeaux area, Bordeaux Foods, the manager of the store gave some insight into his nutrition knowledge. He believed that a lack of physical activity was to blame for the obesity epidemic, yet felt that he couldn't make his daughter play sports if she didn't want to due to the change in priorities of the new generation. In addition, he believed that "French fries and hamburgers go together – not fruit," and that "everyone gets high blood pressure and cholesterol." The manager's lack of education about healthy living was apparent in the types of food stocked in the grocery store, which further influence what the residents of the community can and cannot buy.

According to a few researchers, social class should be measured at three separate levels: the individual, the household, and the neighborhood. Looking at the community at a neighborhood level can provide much information on "exposure to environmental hazards and levels of neighborhood violence."[23] When the children at both schools were asked what types of things they liked to do in their free time, a majority of them said that they enjoyed playing outside, but only the children at Bordeaux referenced the issue of safety. A few children expressed that their parents sometimes didn't let them play outside because it wasn't safe. A police summary from 2010 supports the fact that Bordeaux has significantly more crime: Bordeaux had 435 violent incidents and 1,098 property incidents, while Belle Meade only had 25 and 370. The frequency of crime in the area prevents the children from being active outside, which is evident in the data shown. In one study, only half of the residents of Bordeaux had been physically active in the past month, and for Belle Meade,

about ¾ of the population. The safety of the neighborhood may also prevent children from walking to school, a factor that plays a large role in childhood obesity. Crime seems to play a larger role than the physical built environment – according to the PARA tool, each neighborhood was very similar in terms of quality of upkeep.

Differences in "accessibility, utilization, and quality of care… are contributing factors to the widening inequality" between socioeconomic groups.[23] Striking dissimilarities appeared between the communities in access to healthy foods and resources. Belle Meade had three times the number of full-service supermarkets, more convenience stores, and about four times the amount of full-service restaurants than Bordeaux. Bordeaux had a larger amount of fast-food restaurants, and only a grocery store to supply everyday food for the home. Both the location and types of food stores play a large role in access to healthy foods, and people's dietary choices are influenced by the availability of food stores.[12] The NEAT tool suggests that food services in Bordeaux are "not at all supportive" of healthy eating, while the services in Belle Meade are "partially" to "fully" supportive. There are various food basics that are not found in the grocery stores in Bordeaux, such as reduced fat cheeses. All of the supermarkets in Belle Meade have multiple nutrition education opportunities, such as healthy grocery tours and recipe cards, yet the manager at Bordeaux Foods said that they were phased out a while ago because of the lack of demand.

Children's knowledge about healthy eating and behavior stems from what they see in their own environment, and the choices that adults around them make each day. The difference in parent involvement at both schools was significant. While Julia Green has its own parent-run committee aimed at setting healthy examples for their children, none of the parents at Bordeaux advocated for an improved school food system. This lack of support is ironic, as a majority of the students at Bordeaux eat the school lunch. During the focus group, it was evident that the students at Julia Green knew a lot about the different types of foods they were eating for lunch and were concerned about the nutrients in their food. In contrast, the students at Bordeaux were concerned with whether or not their favorite hamburgers were being served during lunchtime, and did not have a good perception of the "3 meals per day" concept. Again, education plays a large role in determining the actions of children in each community.

It is apparent that societal factors are the driving force behind our nation of decreasing health and increasing size, and major steps toward change are necessary in future studies. While there are a multitude of external factors that interact with the built environment that may be hard to address right away, such as level of education and socioeconomic status, there are still many steps that each community can take to change the nutrition and physical activity environment. Low educational levels about healthy living, social support for children, and access to healthy foods and health services must be improved in the areas that are severely lacking in order to improve the effect that the built environment has on public health. The strong correlation between race and socioeconomic status must be further investigated so that we can see a decrease in health disparities between different communities. A shift in priorities may empower residents of each community to take the initiative and enact policies that fight the obesity epidemic.

Notes

1. "Global Strategy on Diet, Physical Activity and Health." *World Health Organization*. 2011. Web. 16 Dec. 2011. <http://www.who.int/dietphysicalactivity/publications/facts/obesity/en/>.
2. "About the HHS Childhood Overweight and Obesity Prevention Initiative." *Office of the Surgeon General (OSG)*. Office of the Assistant Secretary for Health. Web. <http://www.surgeongeneral.gov/obesityprevention/about/index.html>.
3. "Obesity: Halting the Epidemic by Making Health Easier - At A Glance 2011." *Centers for Disease Control and Prevention*. 26 May 2011. Web. <http://www.cdc.gov/chronicdisease/resources/publications/aag/obesity.htm>.
4. Sallis, James, Karen Glanz. "The Role of Built Environments in Physical Activity, Eating, and Obesity in Childhood." *The Future of Children* 16.1 (2006): 89-108. Web.
5. Addy, Cheryl L. "Associations of Perceived Social and Physical Environmental Supports With Physical Activity and Walking Behavior." *American Journal of Public Health* 94.3 (2004): 440-43. Web.
6. Jackson, Richard J. "The Impact of the Built Environment on Health: An Emerging Field." *American Journal of Public Health* 93.9. (2003): 1382-1384. Web.
7. Gordon-Larsen, Penny, Robert G. McMurray, and Barry C. Popkin. "Adolescent Physical Activity and Inactivity Vary by Ethnicity: The National Longitudinal Study of Adolescent Health." *The Journal of Pediatrics* 135.3 (1999): 301-06. Web.
8. Gordon-Larsen, Penny, Melissa C. Nelson, Phil Page, and Barry M. Popkin. "Inequality in the Built Environment Underlies Key Health Disparities in Physical Activity and Obesity." *Official Journal of the American Academy of Pediatrics* 117.2 (2006): 417-24. Web.
9. Weisbecker, Andy. "Few Healthy Food Choices in Urban Food Deserts." *Food Safety News - Global Food Safety News & Information*. 21 May 2010. Web. <http://www.foodsafetynews.com/2010/05/few-healthy-food-choices-in-urban-

food-deserts/>.
10. "Interactive Web Tool Maps Food Deserts, Provides Key Data." *Let's Move!* Web. <http://www.letsmove.gov/blog/2011/05/03/interactive-web-tool-maps-food-deserts-provides-key-data>.
11. Cummins, Steven, and Sally Macintyre. "Food Environments and Obesity neighbourhood or Nation?" *International Journal of Epidemiology* 35.1 (2006): 100-04. Web.
12. Morland, Kimberly, Steve Wing, Ana D. Roux, and Charles Poole. "Neighborhood Characteristics Associated with the Location of Food Stores and Food Service Places." *American Journal of Preventive Medicine* 22.1 (2002): 23-29. Web.
13. Khan, Amina. "Poor Neighborhoods May Contribute to Poor Health - Los Angeles Times." *Featured Articles From The Los Angeles Times*. 20 Oct. 2011. Web. 1 Dec. 2011. <http://articles.latimes.com/2011/oct/20/health/la-he-obesity-neighborhoods-20111020>.
14. "Nutrition Services." *Metropolitan Nashville Public Schools*. Web. <http://www.mnps.org/Page56795.aspx>.
15. Halfmann, Stephanie. "Michigan Nutritional Environments Assessment Tool." *Michigan Health Tools Maps*. Michigan Healthy Communities Collaborative, Jan. 2011. Web. <http://www.mihealthtools.org/neat/>.
16. Lee, R.E., Booth, K.M., Reese-Smith, J.Y., Regan, G., Howard, H.H.. "The Physical Activity Resource Assessment (PARA) instrument: Evaluating features, amenities and incivilities of physical activity resources in urban neighborhoods." *International Journal of Behavioral Nutrition and Physical Activity* 2.13 (2005).
17. McKinley, MC, C. Lowis, PJ Robson, JM Wallace, M. Morrissey, A. Moran, and MB Livingstone. "It's Good to Talk: Children's Views on Food and Nutrition." *European Journal of Clinical Nutrition* 59.4 (2005): 542-51. Web.
18. "Metro Nashville Crime Statistics." *Nashville.gov - Police Department*. 2010. Web. 16 Dec. 2011. <http://www.police.nashville.gov/stats/metronashville.asp>.
19. Miller, Stephania, David Schlundt, Celia Larson, Ronald Reid, James Pichert, Margaret Hargreaves, Anne Brown, Linda McClellan, and Michelle Marrs. "Exploring Ethnic Dispairites in Diabetes, Diabetes Care, and Lifestyle Behaviors: The Nashville REACH 2010 Community Baseline Survey." *Ethnicity & Disease* 14 (2004): 38-45. Web.
20. "37218 Zip Code (Tennessee) Profile - Homes, Apartments, Schools, Population, Income, Averages, Housing, Demographics, Location, Statistics, Sex Offenders, Residents and Real Estate Info." *Stats about All US Cities*. Onboard Informatics, 2010. Web. <http://www.city-data.com/zips/37218.html>.
21. "37215 Zip Code (Forest Hills, Tennessee) Profile - Homes, Apartments, Schools, Population, Income, Averages, Housing, Demographics, Location, Statistics, Sex Offenders, Residents and Real Estate Info." *Stats about All US Cities*. Onboard Informatics, 2010. Web. <http://www.city-data.com/zips/37215.html>.
22. Williams, David, Chiquita Collins. "US Socioeconomic and Racial Differences in Health: Patterns and Explanations." *Annual Review of Sociology* 21 (1995): 349-386. Web.
23. "The Importance of Behavior in Cancer Prevention and Early Detection." *American Cancer Society*. 2011. Web. <http://www.cancer.org/Research/ResearchProgramsFunding/BehavioralResearchCenter/TheImportanceofBehaviorinCancerPreventionandEarlyDetection/index>.