

**A SYNTHESIS OF THE LITERATURE ON
THE RELATIONSHIP BETWEEN FOOD ACCESS AND
OVERWEIGHT AND OBESITY IN AFRICAN AMERICAN ADOLESCENTS**

by

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ABSTRACT

Food access shapes a community's nutritional environment and impacts the health and physical well-being of its residents. When a community does not have adequate access to outlets that offer healthy options, it is difficult to maintain a healthy diet. As a result, we often see higher rates of chronic disease, overweight and obesity among some populations. African American communities may be disproportionately affected by overweight and obesity because of limited food access. This literature review examines the public health significance of food access and how the presence of full service grocery stores impacts eating habits and overweight and obesity among African American adolescents. The results are primarily cross-sectional studies organized and presented in three sections: (1) food environment, (2) eating habits, and (3) policy implications. The findings in this literature review suggest that the problem of overweight and obesity in African American adolescents is indeed a multi-faceted issue. While there does appear to be a correlation between access to full service supermarkets and eating behaviors, overweight and obesity, there are other factors to consider. It is unclear if the presence of more full-service supermarkets alone is enough to significantly impact a reduction of overweight and obesity among African-American youth. While quantitative studies provide important baseline data, researchers should consider developing qualitative studies that may offer additional insight into individual, family and environmental factors that vary geographically.

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PREFACE

This paper is dedicated to the memory of the late Dr. Jamila E. Irons-Johnson, who has and will continue to be a source of inspiration in my life's journey. I would like to express my sincere gratitude to my thesis advisor, Dr. Jeanette Trauth for her guidance and encouragement, as well as the contributions of Drs. Patricia Documét and Janice Zgibor. Lastly, I thank my family and dear friends who have supported and cheered me along every step of the way.

1.0 INTRODUCTION

Over the last 40 years, the United States has seen a significant increase in overweight and obesity among children and adolescents (C. Ogden & Carroll, 2010). While there are many factors to consider in addressing this public health issue, it has been well established that the type and quantity of foods we eat have a direct impact on weight status. Healthier food access is a key focus area under nutrition and weight status in Healthy People 2020. Healthy eating habits are an integral part in achieving chronic disease risk reduction and maintaining a healthy weight (U.S. Department of Health and Human Services, 2012). According to the USDA, a healthful diet includes a variety of nutritious foods including whole grains, fruits, vegetables, low-fat or fat-free milk or milk products, and lean meats and other protein sources.

When a community does not have adequate or convenient access to outlets that offer healthy options, it is difficult to maintain a healthy diet. As a result, we often see higher rates of chronic disease, overweight and obesity among some populations (Black, Dixon, & Fryer Jr., 2009; K. B. Morland & Evenson, 2009). African American communities tend to be disproportionately affected by poor health outcomes because of limited food access (S. N. Zenk et al., 2011). The presence of large full service grocery stores is minimal, while there is usually an abundance of small corner, convenience and fast food stores (K. Morland, Wing, Diez Roux, & Poole, 2002; S.N. Zenk et al., 2005). Consequently, calorie-dense food choices are readily available and low in price. Healthy food options, when available, are priced higher and often of

lesser quality, creating an environment where it is increasingly difficult to make nutritious selections on a consistent basis.

Food access shapes a community's nutritional environment and impacts the health and physical well-being of its residents. In the United States, access to quality produce at affordable prices is often a reflection of access to supermarkets, which, because of their economies of scale, make fresh produce available at lower prices than smaller, independently owned grocery stores (Kumar, Quinn, Kriska, & Thomas, 2011). Recent evidence suggests that neighborhoods with access to large, chain supermarkets have a lower prevalence of overweight and obesity than those without such access (Black et al., 2009; K. B. Morland & Evenson, 2009).

This literature review examines how the presence of full service grocery stores impacts eating behaviors and the prevalence of overweight and obesity among African American adolescents. The second chapter provides background information on the issue of overweight and obesity and how African American children and adolescents are disproportionately affected by it. Chapter three describes the methods utilized to gather literature for this review and the criteria for inclusion in the review. Chapter four presents the results of the literature search and outlines key themes that emerged from the studies included in the review. The fifth chapter provides a discussion of the findings and my interpretation of those themes, along with a discussion of the limitations of the review and gaps within the literature. The paper concludes with a summary of what has been presented in addition to implications for future public health research.

2.0 BACKGROUND

2.1 OVERWIGHT AND OBESITY

The problem of overweight and obesity in the United States is widespread among men, women and children of all ages and racial and ethnic backgrounds. Since the early 1960s, the prevalence of obesity among adults aged 20 and older more than doubled from 13.4 to 35.7 percent (Flegal, Carroll, Ogden, & Curtin, 2010; C. Ogden & Carroll, 2010). The prevalence of obesity in children and adolescents also increased in the 1980s and 1990s but at present it has stabilized at 17 percent (C. L. Ogden, Lamb, Carroll, & Flegal, 2010).

According to the Centers for Disease Control (CDC), overweight and obesity are terms that refer to ranges of weight that exceed what is usually considered healthy for a particular height. Overweight describes an excess amount of body weight that may come from muscles, bone, fat, and water (National Institutes of Health, 2012). Obesity describes an excess amount of body fat (National Institutes of Health, 2012). Both overweight and obesity are a result of energy imbalance in the body. Body weight is likely to remain the same when the number of calories consumed is the same as the number of calories burned. When people eat and drink more calories than they burn, the imbalance leads to weight gain, overweight, and obesity over time (National Institutes of Health, 2012).

Body Mass Index (BMI) is the most commonly used tool to estimate overweight and obesity. For adults, BMI is calculated by dividing weight by height for a percentage that estimates the amount of fat in the body (National Institutes of Health, 2012). A BMI in the range of 18.5 to 24.9 describes a normal weight. A BMI between 25 and 29.9 indicates overweight. Obesity occurs with a BMI greater than 30 and greater than 40 in cases of extreme obesity. Because growth rates in children and adolescents vary at different times, BMI is compared to the height and weight of other children of the same sex and age (National Institutes of Health, 2012). Children and adolescents with a BMI at or above the 85th percentile in their group are considered overweight or obese. Those at or above the 95th percentile are considered obese (National Institutes of Health, 2012). In addition, both overweight and obesity describe ranges of weight that have been shown to increase the risk of developing certain diseases and other health problems (Centers for Disease Control and Prevention, 2012).

The costs of obesity in the United States are significant. In 2008, the direct costs for preventive, diagnostic, and treatment services for obesity and related diseases as well as the indirect costs (e.g. wages lost because of illness or disability and future earnings lost because of premature death) were estimated to be \$147 billion. Among children and adolescents, the annual cost of treating obesity-related diseases has increased more than threefold, from \$35 million in 1979-1981, to \$127 million in 1997-1999. According to the Centers for Disease Control and Prevention, a 10 percent weight loss could reduce an overweight person's lifetime medical costs by \$2,200-\$5,300 (U. S. Department of Health & Human Services, 2001 & 2003).

2.1.1 Overweight and Obesity in Children and Adolescents

Overweight and obesity among adolescents is a major public health issue in the United States. During 2005-2008, it was estimated that 16.2 percent of all children and adolescents aged 2-19 years were considered obese. These children are at a greater risk for developing chronic disease risk factors, disease and decreased life expectancy. Obesity is also associated with social stigmatization, lower self-esteem, depression and increased alcohol and tobacco use. Physical, mental and emotional development can be affected as well (Centers for Disease Control and Prevention, 2011).

Obesity disproportionately affects African-American children & adolescents when compared to whites. It is estimated that 20.6 percent of African-American children and adolescents are considered obese compared to 14.1 percent of White children and adolescents (NHANES, 2005-2008). According to the Institute of Medicine, up to 24 percent of African-American children are above the 95th percentile for body mass index (BMI) measurement (Institute of Medicine, 2004). Among girls, the highest prevalence of obesity was found in African-Americans (Institute of Medicine, 2004).

2.1.2 Obesity and Overweight Classification

Obesity is the result of consuming an excessive amount of calories that are not offset by physical activity. The recommended daily caloric intake for children and adolescents varies by age and activity level (Table 1). The USDA, in conjunction with the Department of Health and Human Services (HHS), issue dietary guidelines for Americans every five years. The 2010 edition is the

seventh edition released since 1980, and will remain current until the 2015 edition is released. Included are recommendations for making healthy food choices and maintaining a healthy weight. The design of [MyPlate](#), a visual tool to help people make better healthy eating choices, was included as a new initiative in the 2010 guidelines. It utilizes the same food group information from the familiar food pyramid, but is depicted visually as an actual place setting. Daily food group targets include a balance of whole grains, vegetables, fruits, dairy, and oils (USDA, 2010). It encourages consumers to make half of your plate fruits and vegetables, at least half of your grains whole grains, and to drink fat-free or low-fat milk. It also encourages one to choose foods lower in sodium, drinking water instead of sugary drinks, and to reduce portion sizes. Specific amounts for each of the food groups are based on sex, height, weight, and physical activity level is available as a [Daily Food Plan](#) on the USDA website.

Table 1. Estimated Calorie Needs per Day by Age, Sex, and Physical Activity Level

Estimated Calorie Needs per Day by Age, Sex, and Physical Activity Level				
Sex	Age (years)	Physical Activity Level		
		Sedentary	Moderately active	Active
Child (male & female)	2-3	1,000 - 1,200 ^c	1,000 - 1,400 ^c	1,000 - 1,400 ^c
Female	4-8	1,200 - 1,400	1,400 - 1,600	1,400 - 1,800
	9-13	1,400 - 1,600	1,600 - 2,000	1,800 - 2,200
	14-18	1,800	2,000	2,400
Male	4-8	1,200 - 1,400	1,400 - 1,600	1,600 - 2,000
	9-13	1,600 - 2,000	1,800 - 2,200	2,000 - 2,600
	14-18	2,000 - 2,400	2,400 - 2,800	2,800 - 3,200

c = calories

Source:
USDA,2010

2.1.3 Racial Disparities in Overweight and Obesity

There are many socio-ecologic factors that have contributed to increased prevalence of obesity among African American adolescents. Individual eating habits and physical activity levels are impacted by economic and environmental circumstances, public policy and culture.

Lutfiyya et al. (2008), found that children of poorer families are more likely to be overweight or obese. African-Americans are three times more likely than whites to live in poverty (Crawford, Story, Wang, Ritchie, & Sabry, 2001; Wang, 2001). Because of this, socioeconomic status places these children at risk (Lutfiyya et al., 2008).

Krebs et al. (2003) posits that “Income impacts childhood BMI in at least two specific ways that cross racial and ethnic boundaries: (1) unsafe neighborhoods and (2) the cost and accessibility of healthy foods in low-income communities.” Children who live in low income areas are more likely to experience issues around safety, which may make it difficult to go outside for physical activity, and more likely to have less access to healthy food choices, including fresh produce, whole grain, and low-fat dairy products (Krebs et al., 2003). Even if available, such foods are often less obtainable to families with limited financial means (Lutfiyya et al., 2008).

Children and adolescents spend a considerable amount of time away from home each weekday at school. The school environment not only impacts academic performance, but influences dietary habits and physical activity levels as well.

In some districts, financial woes and poor academic performance create additional challenges. Wang et al. (2006) describe a severe achievement gap among African-American adolescents in some of Chicago’s public schools. They found that “less than 30 percent of the students in three of four schools studied met the state standards on academic performance in all subjects, for the other one it was 36 percent; 60-70 percent of them failed to meet the standard

for reading (Wang et al., 2006).” These alarming statistics in conjunction with financial constraints and environmental challenges have pushed obesity prevention and health promotion to the back burner. Some schools are so strapped for cash that they cannot offer physical education or may only offer it once per week. There are others who cannot afford to purchase adequate sports equipment to meet the needs of classes (Wang et al., 2006).

School food service programs are also considered when addressing obesity in adolescents. According to Wang et al. (2006), improving the service may be the most direct and effective method of influencing eating behaviors in school, particularly when the majority of students qualify for free or reduced breakfast and lunch.

Sedentary lifestyle and/or lack of physical activity are also contributing factors to obesity among African-American adolescents. In the U.S., children and adolescents are recommended to have at least 30-50 minutes of moderate to vigorous exercise each day (NIH & NIH Consensus Development Panel on Physical Activity and Cardiovascular Health, 1996). Wang et al. (2006) reported that boys in general tended to be more active than girls; however, most of the adolescents in their study reported exercising only 20-30 minutes per day. In contrast, many spent three or more hours per day watching television, playing video games or using a computer, and eating snack foods while doing so.

3.0 METHODS

3.1 LITERATURE SEARCH

A literature search was conducted in order to address the following research questions:

- (1) Does access to full service supermarkets impact the prevalence of overweight and obesity among African American adolescents?
- (2) Does access to full service supermarkets influence eating behaviors in African American adolescents?

The systematic approach for data collection for this review came from peer-reviewed journal articles published in English between 2000 and 2012. They were primarily located using PubMed, SCOPUS, and Ovid online databases via the University of Pittsburgh Health Sciences Library System with the assistance of Barb Folb, Public Health Informationist. The following key words and phrases were searched in multiple combinations: African American, food access, food environments, nutrition environments, food availability, food deserts, supermarket access, obesogenic environments, obesity, overweight, body weight, BMI, weight gain, and weight loss (Table 2). Articles found through the electronic search were supplemented with other articles identified through professional sources (faculty) at the University of Pittsburgh and searches of key article citations.

Table 2. Literature Search Terms

African American	Adolescent	Obesity	Food Access	Food Environments
Black	Child	Obese	Food availability	Nutrition environments
Minority	Children	Overweight	Supermarket access	Food deserts
	Youth	Body weight		Obesogenic environments
	Teens	BMI		
	Teenagers	Weight gain		
		Weight loss		

3.2 INCLUSION CRITERIA

The criteria for including an article in this review were limited to studies that included African Americans or African American adolescents, food access or food environment, nutrition or diet-related components, and impact on BMI or diet. Studies were excluded if they were conducted outside of the U.S., did not pertain to African Americans or African American adolescents, or if access to the full-text article was not available. No time frame was utilized to exclude articles.

As such, reviewed articles were published between 2006 and 2012.

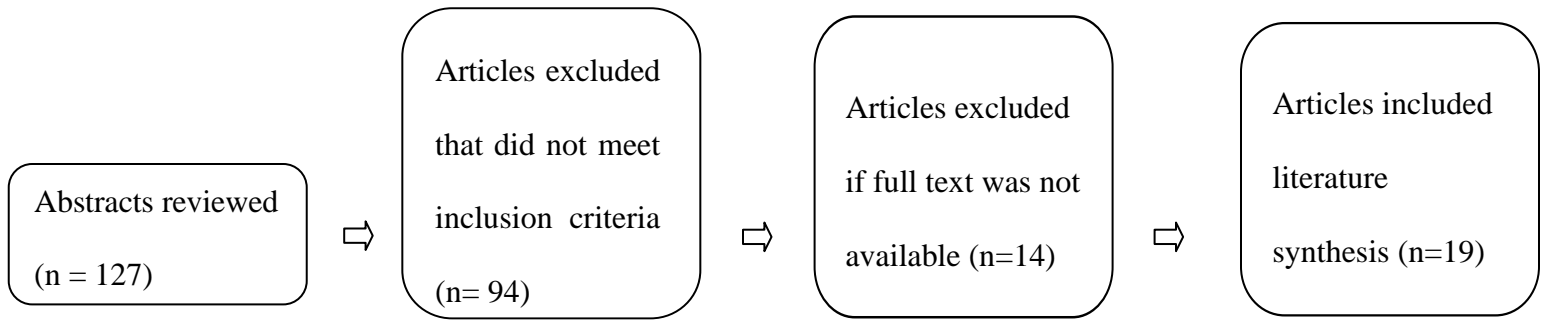


Figure 1. Disposition of articles found

3.3 MODEL OF COMMUNITY NUTRITION ENVIRONMENTS

The Model of Community Nutrition Environments (Figure 2), which was designed to facilitate an understanding of the impact of food environments on individual eating habits, guided this search (Glanz, Sallis, Saelens, & Frank, 2005). The Model integrates public health, health psychology, consumer psychology, and urban planning constructs associated with healthy eating outcomes. Policy variables (government and industry policies) impact environmental variables (community nutrition, organizational nutrition, consumer nutrition, and information environments) which are then driven by individual variables (sociodemographics) that ultimately influence eating patterns.

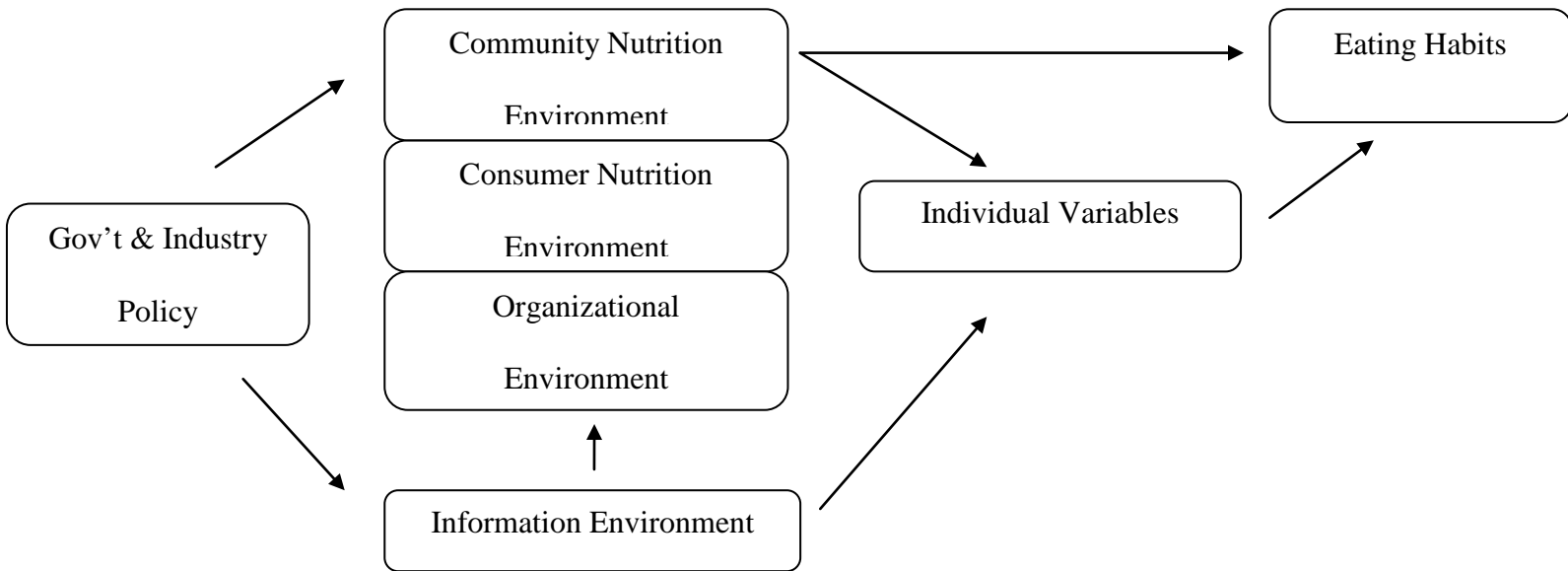


Figure 2. Model of Community Nutrition Environments

Adapted from Glanz et al., 2005

Government and industry policies have been shown to affect food prices and consumer choice (Ralston, 1999). Examples of such influence include USDA food subsidies, public assistance programs (food stamps, WIC), and the recently proposed ban on some sugar-

sweetened beverages in New York City. Such policies drive the environmental effects on eating patterns.

The model also identifies four environmental variables that affect eating patterns: Community Nutrition Environment, Organizational Nutrition Environment, Consumer Nutrition Environment, and Information Environment (Glanz et al., 2005). The community nutrition environment refers to the food environment in a neighborhood or geographic area. This construct is operationalized in terms of the type and location of food outlets and their accessibility. Organizational nutrition environment describes the various settings (home, school or workplace) that are largely available to defined groups as opposed to the general population. Examples of such groups could include elementary school students, corporate office employees, contract employees, etc. Consumer nutrition environment looks at a person's experience while shopping for food. It considers the availability of healthy food items in addition to price, promotion, placement and nutrition information. Media and advertising make up the information environment construct. Examples include marketing and promotion and their outlets. Billboards, radio, television, and product signage and placement within stores can all be sources of information for consumers.

The individual variables in the model are affected by the policy and environmental constructs. These include psychosocial factors such as and individual perceptions of nutrition environment (Glanz et al., 2005). They describe the interaction between the social environment and one's psychological development that influences food selection and purchasing behavior.

This literature synthesis focuses on the community and consumer nutrition environments. These two components of the model have been identified by Glanz et al. (2005) as the constructs

with highest priority because there have been fewer studies examining these aspects and they potentially have far-reaching effects.

3.3.1 Community Nutrition Environment

The community nutrition environment describes the ‘number, type, location and accessibility of food outlets’ in a given area (Glanz et al., 2005). Also referred to as the food environment, the community nutrition environment is typically measured using proximity to or concentration of food outlets. Proximity is the distance between a food outlet and another location such as an individual’s residence. Concentration or density refers to the number of food outlets in a defined area surrounding a location. Food outlets primarily include stores and restaurants. Food stores can be categorized by size and food variety in descending order as follows: supermarkets, grocery stores and convenience stores (Holsten, 2009). Restaurants include full service or sit down and limited or fast food establishments (US Census Bureau, 2002).

3.3.2 Consumer Nutrition Environment

The consumer nutrition environment refers to the consumer’s shopping experience within and around a retail food outlet (Glanz et al., 2005). Measured variables include the availability of healthy food options and the nutrition information found on food packaging.

Marketing principles such as price, promotion, and placement of food items are also measured. Price is calculated per pound of produce, low-fat dairy products, lean meats, and prepackaged dishes. Store displays and shelf placement (high, eye-level, low) of food items are evaluated for healthy and calorie-dense or unhealthy foods. The environment at restaurants is

also considered. Glanz et al. (2005) propose four indicators of the availability of healthy choices or options: healthy main dish choices (low-fat, low-calorie, healthy main dish salads), fruit (without added sugar or sauce), non-fried vegetables (and vegetables without fat-laden sauces), and portion sizing (availability of small portions and the presence of “super-sizing”).

Food items are divided up into categories and compared based on their relationship to healthful eating recommendations (e.g. My Plate) and those that contribute to obesity and other chronic diseases. The categories given the highest priority are dairy products, meat and poultry, fruits and vegetables, packaged main dishes, and baked goods/sweets.

4.0 RESULTS

In total, 127 abstracts were reviewed, of which 19 met the full inclusion criteria (Appendix A). After identifying articles that addressed the research questions a more in-depth evaluation of the articles followed. The results are organized and presented in the following two sections: (1) food access and overweight & obesity, and (2) food access and eating behaviors.

The findings in section 4.1 address the first research question, (1) does access to full service grocery stores/supermarkets impact overweight and obesity among African American children and adolescents? Section 4.2 findings addresses the second question, (2) does access to full service grocery stores/supermarkets influence eating behaviors in African American adolescents? Both sections relate directly to the components of the community nutrition and consumer nutrition environment constructs in the Model of Community Nutrition Environments.

4.1 FOOD ACCESS AND OVERWEIGHT & OBESITY

4.1.1 Food Outlet Density/Proximity

Food outlet density and proximity refer to the location and number of food stores in a defined area. They are sometimes used to determine what types of food are available and accessible to community residents. This includes available healthy options and the prices of each. Several

studies have examined this concept when looking at overweight and obesity outcomes in some communities.

Baker, Schootman, Barnidge, and Kelly (2006) conducted an ecological study in St. Louis, Missouri to examine the association between food access (location and selection) that enables individuals to make healthy choices, and social contextual factors (racial distribution and poverty rates). Supermarkets and fast food restaurants were audited to assess the extent to which the location and availability of food choices assist residents in meeting the dietary guidelines set by the U.S. Department of Agriculture (USDA). The guidelines include daily consumption of a variety of fruits and vegetables in addition to lean, low-fat, or fat-free meat, poultry, and dairy products. Findings suggest that individuals have less access to food outlets if they reside in mixed or white high-poverty areas and primarily African American areas (regardless of income) (Baker, Schootman, et al., 2006). In addition, supermarket cluster data suggested that residents of these neighborhoods are less likely to be enabled to make healthy food choices compared to residents in primarily white, higher income neighborhoods (Baker, Schootman, et al., 2006).

There were some limitations to this study. Assessment was conducted in one urban city in the Midwest that has a primarily African American and white population. There may be differences in other geographic areas and comparisons could be different among other racial and ethnic groups. In addition, Baker and colleagues suggest that people may not always eat where they live. Those individuals are more likely to have access to cars and public transportation that allow them to leave their neighborhoods to find healthy or unhealthy food items, which differs from the residents of the study area, where, according to the U.S. census, nearly 50 percent did not have access to a vehicle. It was also noted that the location of food outlets may be related to other geographic factors like proximity to a highway, mall, or airport, and that future studies may

want to examine if these factors influence food access (Baker, Schootman, et al., 2006). It is possible that access is also dictated by the purchasing behavior of the area residents, resulting in an economic decision for supermarkets and restaurants not to sell items that will not be purchased; causality, however, cannot be determined from this study because it is correlational (Baker, Schootman, et al., 2006). There are many other factors that influence eating habits, such as individual level awareness and abilities, family dynamics, and culture that were not explored in this study.

Powell and colleagues(2007) examined associations between access to food stores and adolescent BMI. Individual level, self-reported national data on 8th and 10th grade students taken from the Monitoring the Future (MTF) study were combined with lists of food store and restaurant outlets obtained from Dun and Bradstreet (D&B) and produce price data from the American Chamber of Commerce Researchers Association (ACCRA). Food outlet density and price data were matched to the student data by zip code for years 1997 – 2003 of the MTF study. Per capita income data was taken from the 2000 U.S. census.

Results indicated a positive association between lower adolescent BMI and overweight and increased access to chain supermarkets, whereas higher BMI and overweight was associated with greater availability of convenience stores. The association was greater for African American students compared to their white or Hispanic peers and larger in households where the mother worked full time. Limitations of this study include its cross-sectional design and use of self-reported data for BMI. Causality cannot be determined and the BMI data may be biased.

In 2008-2009, Drewnowski, Aggarwal, Hurvitz, Monsivais, and Moudon (2012) studied the association of obesity risk and physical proximity to supermarkets or supermarket price. The population-based study collected information from 2,001 adult residents with mixed income

levels of King County, Washington. Seven percent of respondents were African American. A 20 minute phone survey administered to participants generated self-reported data for weight and height in addition to other health measures and demographic characteristics. The food environment was determined by geocoding the home address of each respondent and full-service supermarket locations using county assessor parcel data and food permits from the county public health department. Supermarkets were defined as national or regional chains that carried a large variety of fresh produce, fresh and prepared meats, canned and frozen foods (US Census Bureau, 2007). Proximity measures were calculated from each participant's home to the closest supermarket and to the supermarket that was reported as the main food source using Geographical Information Systems (GIS). Supermarkets were characterized by prices into three categories: low, medium, high based on the total cost of "market baskets" which included foods that were part of the Behavioral Risk Factors Surveillance System (BRFSS) Questionnaire for fruit and vegetable intake (a validated assessment tool) for the state of Washington.

The results indicated that there was no impact on obesity based on proximity to the nearest supermarket or preferred supermarket indicated by respondents. There was, however, an association found between the type of supermarket and obesity rates. Customers of low-price supermarkets were three times more likely to be obese than those customers of high-price supermarkets, even after adjusting for SES, education, and income. There were some limitations to this study, however, including a cross-sectional design, self-reported data for BMI, and a non-representative sample.

Laska, Hearst, Forsyth, Pasch, and Lytle (2010) examined the relationship between food outlet proximity and density around adolescents' homes and schools with dietary habits, food purchasing behavior and weight status in Minneapolis, MN. Again, GIS was utilized to calculate

distance to and density of food outlets around the study participants' homes and schools. Multiple dietary recalls were obtained from participants via telephone using the Nutrition Data System for Research and a multiple-pass method (Schakel, Sievert, & Buzzard, 1988). BMI was calculated based on participants' height and weight using CDC growth charts. They found a moderately significant association between BMI and the presence of convenience stores within 1600 meters of the home. The findings were not consistent, however, with a wide variety of neighborhood characteristics but were consistent with two previous studies with similar results (Liu, Wilson, & Qi, 2007; Powell et al., 2007).

A positive association was found between sugar-sweetened beverage intake and the presence of food and non-food retail stores. Consumption of these beverages may be influenced by proximity and access when taking into account convenience, low cost, and abundance in a wide range of retail outlets. As a result, environmental influence on excess sugar-sweetened beverage consumption may be enough to contribute to long-term weight gain in a substantial number of youth (Laska et al., 2010). There was no association, however, in regards to consumption of other food items and the environment around the home. A significant portion of participants resided in suburban neighborhoods where residents may drive outside of their immediate area to purchase food for the home. Consequently, there was little association with dietary intake and food access.

This study had some limitations. Again, a cross-sectional design does not allow for causality to be determined. The sample size was small and non-representative. In addition, GIS data does not provide descriptive details about the food environment.

Jilcott, Keyserling, Crawford, McGuirt, and Ammerman (2011) examined county-level associations between obesity prevalence and food outlet density. This ecologic study used data

from the USDA Economic Research Service Food Environment Atlas to determine per capita farmer's markets, grocery stores/supermarkets, and supercenters (in this case, Wal-Mart) among all counties in the United States. Spatial patterns of obesity rates and the various food outlets per 1,000 capita were mapped. Overall, there was a positive association between the number of grocery stores/supermarkets, farmer's markets, and supercenters and lower obesity prevalence in both metropolitan and non-metropolitan counties. The strength of the association varied by geographic location. The relationship between farmer's markets and obesity weakened when all food outlets were considered. This study was limited by a cross-sectional design and the possibility of bias errors in the Atlas database. In addition, the residents' preferred shopping locations were not examined as a comparison to mapped data.

4.1.2 Food Selection/Availability

Grigsby-Toussaint, Zenk, Odoms-Young, Ruggiero, and Moise (2010) suggest it is not only food access that influences eating habits, but also the availability of culturally relevant produce. Residents of predominantly African American neighborhoods may be at an increased risk for inadequate consumption of fruits and vegetables because of the limited availability of culturally-specific items like okra, collard greens and black-eyed peas at their local food outlets (Grigsby-Toussaint et al., 2010).

Surveys were conducted in 225 food stores in Chicago, IL to examine the availability of fresh produce items commonly consumed by African Americans and Latinos. Commonly consumed items were found to be available at 44 percent of grocery stores and 20.8 percent of convenience and/or corner stores. This study was limited by a cross-sectional design and non-

diverse sample of Latino neighborhoods (majority Mexican American). Additionally, the list of produce items was not based on any actual dietary intake data.

In 1999, Baker, Kelly, et al. (2006) established a successful program initiative in collaboration with faith-based health advocates and lay church members in St. Louis, Missouri, to improve the access to high-quality, affordable produce and to create a supportive environment within the community that fostered self-efficacy for healthy eating. The Garden of Eden produce market serves members of an economically depressed African American community where access to fresh produce is less than that of surrounding communities.

Development of the program was initiated as a result of geographic and qualitative assessments of socio-economic factors and selection of produce that were conducted as part of a separate project (Baker, Kelly, et al., 2006). GIS data from 220 census tracts indicated an association between produce selection and racial composition. Areas that were primarily African American had fewer supermarkets that offered a wide variety of produce than those that were majority White. The produce selection was greater in areas with higher income levels and had a tendency to decrease as area-level income decreased. Results were similar for racial makeup. Areas that were primarily African American had less selection than those that were primarily White. Racially mixed areas had less selection when income was lower and greater selection where income was higher. Interview participants in the qualitative assessment indicated that they experienced racism and discrimination frequently when they shopped at supermarkets in primarily White areas. Limited public transportation made it difficult to get to those stores that were further away. It was also noted that stores in primarily African American areas had smaller selections of produce and low-fat items.

Rose et al. (2009) examined the link between weight status and neighborhood food environment as it relates to shelf space of produce and energy-dense snack foods within food outlets. The study combined mapping of food outlets, in-store surveys, and telephone interviews of 1,243 residents and 307 food stores from 103 randomly sampled urban census tracts in southeastern Louisiana between October 2004 and August 2005.

Regression models showed no significant association between availability of fruits and vegetables and BMI at 500 meters, 1 kilometer, and 2 kilometers from each household. There was a modest positive association found between availability of energy-dense snack foods and BMI. Positive associations were also found when snack food availability was separated into specific categories (e.g. salty snacks, candies, carbonated beverages). Limitations of this study include a cross-sectional design, self-reported data for BMI, and lack of pricing information from food stores surveyed.

4.1.3 Policy Influences on Overweight & Obesity

Government and industry policies have considerable influence on consumer purchasing and eating behaviors. Such influence may not necessarily result in the most healthful food choices. Three studies examined policy variables that may influence overweight and obesity prevalence. These studies indicated that changes to the built environment and agricultural policies have the potential to positively impact overweight and obesity outcomes in disproportionately affected communities.

Hilmers, Hilmers, and Dave (2012) conducted a literature review of 24 studies on the differences in environmental justice, or neighborhood access to fast food outlets and convenience stores based on socioeconomic and racial demographics. They found that residents of poor

minority neighborhoods were more likely to be subjected to an environment that promotes unhealthy eating because of excessive exposure to unhealthy food choices (Hilmers et al., 2012). The consumption of healthy foods may be limited due to the limited access to supermarkets and grocery stores in these neighborhoods. These factors may explain the higher prevalence of obesity in these neighborhoods (Hilmers et al., 2012).

There was some positive association with partnerships between public and private entities to introduce supermarkets to underserved areas (Hilmers et al., 2012). The Pennsylvania Fresh Food Financing Initiative found that adding a supermarket to such an area increased the availability of healthy foods (Goldstein, Loethen, Kako, & Califano, 2008). This program was designed to increase the number of supermarkets and grocery stores in underserved (low-income) communities in the state of Pennsylvania. It provides grants and loans to qualified food retail enterprises for predevelopment costs of new stores and improvements for existing locations. The initiative has provided funding for 88 fresh-food retail projects in 34 Pennsylvania counties. In addition, it has created or preserved more than 5,023 jobs and improved access to healthy food for more than half a million people (The Food Trust, 2004). This review was limited by its inclusion of studies conducted outside of the U.S. In addition, the majority of studies used a cross-sectional design.

Chen and Florax (2010) utilized data from Marion County, Indiana to target communities with a high prevalence of obesity-related diseases that might benefit from food environment modification. Computer simulations increased access to healthy foods by introducing new chain grocery stores to previously underserved neighborhoods with GIS. The model simulations provided estimates of the total effect of improving access to grocery stores on BMI. There was a significant decrease in BMI, primarily for those residents who lived in close proximity to the

new stores. They conclude that zoning for health based on this model is a cost effective way of implementing a policy intervention for improvement of health outcomes.

This study was limited by its cross-sectional design. In addition, replication would be cost prohibitive for most local communities. Other county public health departments may not have small area estimates of their population's health readily available.

Story, Kaphingst, Robinson-O'Brien, and Glanz (2008) suggest that changes to U.S. food and agriculture policies may impact public health and diet-related chronic diseases and obesity. They developed an ecological framework in order to provide an overview of food environments and strategies for creating healthy eating environments. This included a discussion of disparities in food access, description of environmental factors that may affect healthy eating, and measurement and evaluation issues in conducting environmental and policy research and surveillance.

They conclude that the increased cost of fruits and vegetables may be attributed to the lack of government support for these types of crops in farm policies. "Current agricultural policies have helped make food environments less healthy for Americans. Farm and food policy should be aligned with national public health and nutrition goals (Story et al., 2008)." In addition to expanding program support for local produce in schools, the idea of increasing access to healthier foods in food assistance programs by expanding food outlet choice to include farmer's markets and other retail food stores is also discussed. Data collection methods for this review were not described and should be considered a limitation.

4.2 FOOD ACCESS AND EATING BEHAVIORS

Food access refers to the ability or opportunity to purchase and consume food. It is impacted by individual, environmental and policy variables that, in turn, influence individual eating behaviors (Glanz et al., 2005). Inadequate access to healthy foods like fresh meats and produce leads to poor eating habit formation. Over time, such habits contribute to caloric imbalance in the body that can lead to weight gain, overweight and obesity. The presence of full-service supermarkets has been considered in several studies on food access.

S. N. Zenk et al. (2011) posits that residents of poor African American neighborhoods are more likely to experience additional challenges towards healthy eating than residents of other neighborhoods. Rural, low-income, and minority neighborhoods tend to have poor access to supermarkets and healthful foods (Larson, Story, & Nelson, 2009). According to Kumar et al. (2011), multiple studies have shown that African-Americans have less access to supermarkets, and hence, a different community nutrition environment compared to Whites (Franco, Diez Roux, Glass, Caballero, & Brancati, 2008; Glanz, Sallis, Saelens, & Frank, 2007; K. Morland et al., 2002). K. Morland et al. (2002) report that areas with less than 20 percent Black population had four times as many supermarkets as areas with greater than 80 percent African American population in a study that included four states.

African American neighborhoods not only have fewer supermarkets, but many are of lesser quality with less access to healthy foods compared to White neighborhoods, based on the availability of healthy foods outlined by Glanz et al. (2007) in the Nutrition Environment Measures Survey-supermarket or NEMS-S (Kumar et al., 2011). NEMS-S assesses the availability of healthy food options, price, and quality in retail stores which can be used to explore associations between food store environments and eating behavior (Glanz et al., 2007).

In a qualitative study of food shopping behaviors and environmental influences on food shopping in Chicago, IL, S. N. Zenk et al. (2011) found that for 30 African American women who did grocery shopping for their families, the lack of a full-service market was an obstacle in obtaining healthy foods. Neighborhood stores lacked variety and fresh produce was often identified as missing. Of the foods available in the neighborhood, poor quality was another barrier to obtaining food, especially for fresh foods but sometimes packaged foods as well. Women described “withered fresh fruits and vegetables, rotting “green” fresh meats, and expired canned and packaged foods (S. N. Zenk et al., 2011).” This study was limited by its cross-sectional design and small sample size. Additionally, other types of food outlets were not explored (e.g. restaurants, convenience stores).

A recent study conducted in Pittsburgh, PA utilized surveys and focus groups with residents of predominately African-American neighborhoods to examine perceptions of neighborhood nutrition environment (Kumar et al., 2011). Survey questions asked 236 participants about their ability to find and afford healthy food. Similar discussion was held with focus group participants. It was concluded that some residents in predominately African-American neighborhoods where full-service markets were available believed that the healthy food quality was poorer than that of the same types of stores in predominately white neighborhoods (Kumar et al., 2011). There were some limitations to this study. Surveys were administered in two different formats (electronic and paper), which could have introduced bias. The convenience sample of residents who frequented a local community center was non-representative. Lastly, the survey did not include additional types of food outlets (e.g. convenience stores, fast food restaurants).

The formation of eating habits is developed around the age of three and is strongly influenced by environmental, family and social factors (Patrick & Nicklas, 2005; Van Der Horst et al., 2007). Story et al. (2008) discuss the influence physical settings within the community have on which foods are available to eat and how they impact barriers and opportunities that encourage or deter healthy eating. Healthy eating habits among neighborhood residents are impacted by the presence of food outlets and the availability of healthy food choices in those outlets (Glanz & Yaroch, 2004; Story et al., 2008). One study found that consumption of fruits and vegetables increased with each additional supermarket in a census tract, and that increase was nearly three times as large for African Americans (K. Morland et al., 2002).

Low-income African-American children are at higher risk for overweight and obesity compared to other groups (Beydoun & Wang, 2007; Wang et al., 2007), in part due to their more prevalent unhealthy eating behaviors (Wang et al., 2007). Another study noted that low-income, urban African-American youth are at higher risk for obesity and less likely to meet dietary recommendations than white, higher-income youth (Dennisuk et al., 2011). In addition, eating out has been associated with obesity risk in children (Surkan et al., 2011). Food consumed away from home makes up a significant portion of dietary intake of African-American adolescents in urban settings (Surkan et al., 2011). Dennisuk et al. (2011) found that corner stores were the most common place for purchasing food outside of the home. Chips, candy and soda were the most frequently purchased items by adolescents (Borradaile, Sherman, & Vander Veur, 2009).

“Dietary habits among African-Americans reflect historically available foods and complex traditions around eating meals (Airhihenbuwa et al., 1996)...” James (2004), acknowledges that research considering barriers to healthy eating among African-American adults suggests that nutritious diet recommendations may be seen as being culturally

inappropriate and limiting. Traditional African American “soul food” is rich in flavor, primarily due to high animal fat content. Its origins come from the slavery era. Slaves were often provided the leftover and undesirable parts of animals for food. Some of these items included pigs’ feet and intestines (chitterlings), ham hocks, hog maws, and fatback. They were cooked along with whatever vegetables and grains were available. At the time, these meals provided sustenance and necessary calories for long days of hard physical labor. That amount of physical activity is not commonplace today to counterbalance such high caloric and fat intake.

An understanding of how to interpret serving sizes and food label information may also be a challenge to healthy dietary habit formation (James, 2004). According to Gates and McDonald, African-Americans may have less knowledge about recommendations and poorer attitudes about choosing healthy food items compared to Whites (Gates & McDonald, 1997). This may be related to taste preferences.

(Eugeni, Baxter, Mama, & Lee, 2011), noted that in some instances, limitations to eating healthy foods was a matter of personal preference and that the absence of these foods in the family diet was a personal choice as opposed to some other environmental factors. These dynamics have a direct impact on the food environment for children at home and influence their choices and habits as they mature.

Multiple studies also indicated that food consumption is strongly influenced by access (Baranowski & Hearn, 1997; Blanchette & Brug, 2005; Pearson, Biddle, & Gorely, 2009; Rasmussen, Krolner, & Klepp, 2006). In terms of healthy eating, it can serve as either an obstacle or an enabler (Ver Ploeg, Brenerman, & Farrigan, 2009). Accessibility to healthy foods may lower the risk of overweight and obesity by encouraging healthier diets (Cerin et al., 2011), while easy access to unhealthy food options may be linked to excessive and harmful weight gain

(Ver Ploeg et al., 2009). They also found that fast food outlets and convenience stores provide mostly convenient, energy dense, high calorie foods. Customers of fast food outlets were shown to consume larger portion sizes while misjudging the amount of calories in the foods they eat, especially with high-calorie items (Burton, Creyer, Kees, & Huggins, 2006).

Baker, Kelly, et al. (2006) found that health advocates in St. Louis, MO communities were adamant about the importance of having infrastructure in place that allows people to make healthy choices. This includes supermarkets with an adequate selection of quality produce. Most of the supermarkets in the study area had closed, leaving behind those with a smaller selection of food choices. Data collected from previously conducted geographic and qualitative assessments was utilized in the development of an initiative to provide access to high quality affordable produce in addition to infrastructure supports to encourage healthy eating choices (Baker, Kelly, et al., 2006). Consistent with previous studies (French, Story, & Jeffery, 2001; Macintyre, Maciver, & Sooman, 1993; Swinburn, Egger, & Raza, 1999), their findings indicated that health and health behaviors are influenced not only on an individual level, but by other factors including food access social contextual components such as area-level income and racial segregation (Baker, Kelly, et al., 2006). This study was limited, however, by the selection method for program sites. Sites were chosen based on their proximity to participants' churches as opposed to the use of standardized geographic units such as census block or census tract which may make it difficult to replicate in other locations.

In Minnesota, (Bauer, Larson, Nelson, Story, & Neumark-Sztainer, 2009) sought to identify socio-environmental, personal and behavioral factors that predicted fast food intake in adolescents. This longitudinal cohort study identified 806 participants from Minnesota schools to complete assessments while in middle school in 1999 and survey while in high school in 2004.

Results indicated that greater fast food consumption was predicted by availability of unhealthy food at home and a taste preference for these foods. This was especially true for male students who participated in after school sports teams. This study was limited by the use of a single measure and self-reports of fast food intake.

5.0 DISCUSSION

Americans appear to have embraced a culture of convenience and instant gratification where many people live lifestyles that are often not conducive to healthy eating habits and practices. Long work hours and schedules packed with an overabundance of extracurricular activities have conditioned many of us to eat on the go, with a diet consisting mostly of prepackaged, processed and fast foods. Less time is spent on preparation of fresh foods at home and ensuring adequate daily physical activity as it takes time away from endless “to do” lists.

5.1 FINDINGS

The findings from this literature review suggest that the problem of overweight and obesity in African American adolescents is indeed multi-faceted. While there does appear to be a correlation between access to full service supermarkets and eating behaviors, overweight and obesity, there are other factors to consider. There is a considerable amount of influence from the adult in the home who is primarily responsible for food purchasing decisions. The results indicate that socioeconomic status, food outlet density, food quality and food price influence what is accessible and available for consumption.

5.1.1 Socioeconomic Status

Socioeconomic status (SES) is a key determinant that presents itself in several studies. It directly impacts one's ability to seek alternative options for healthy food choices when they are not readily available. This often involves traveling outside of the community (potentially several miles) to seek out full service supermarket options or specialty stores.

Because adolescents rely on their primary caregivers to provide food in the home environment, their choices are a reflection of the choices the adult provider makes. SES also influences adult caregivers' ability to prepare nutritious meals. Long work hours and multiple jobs make prepared and fast foods easier and more convenient options when pressed for time.

5.1.2 Food Outlet Density

The number and location of food outlets directly impacts food access as well. Adolescents may purchase some items from outlets that are located on the path taken to and from school. Their adult caregivers, however, are likely to purchase the bulk of what is consumed on a regular basis.

While there may be a full service supermarket within a neighborhood's geographical boundaries, it may not be accessible to all of its residents. We must consider mode and method of transportation used. For those who own a car, getting to a supermarket located on the other side of town may not be an issue. It may present challenges for those who walk or utilize public transportation. As a result, it may be more convenient to shop at smaller grocers and convenience stores, which typically offer a more limited selection of fresh foods.

5.1.3 Food Quality

Food quality plays an important role in purchasing behavior. There appears to be a noticeable difference in the quality and freshness of meats and produce in predominantly African American neighborhoods compared to predominantly White neighborhoods. Many residents are willing to travel outside of their neighborhoods for these items.

The availability of fresh meats and produce for consumption in some households might be dependent upon such shopping trips if the primary shopper in the home deems local food items unfit. Likely substitutes in between are prepared, processed and fast food items that are readily available in most food outlets with little variance in quality.

5.1.4 Price

As discussed previously, unit cost for food items is typically lower in large chain markets than smaller grocery and convenience stores. This is particularly true for fresh meats and produce. Unfortunately, fast food outlets offer most calorie dense and sugar-sweetened options at low prices. Many processed and prepackaged food items fall into this category as well, and often supplement or are interchangeable with some fast food choices. It can be cheaper and more convenient to consume these items which provide little nutritional value. This has become routine for many, whereas fresh meals prepared at home are relegated to weekends and holidays.

5.2 LIMITATIONS

The vast nature of the problem of overweight and obesity is so great that it is difficult to conduct an exhaustive review of all relevant literature to this topic. Because there are many complex socio-ecologic factors that affect food access, it was necessary to guide the focus of this review with a theoretical model that prioritizes these variables. Therefore, the community and consumer nutrition environments are given particular attention.

There are other factors affecting overweight and obesity that are beyond the scope of this review. Within the organizational environment, for instance, emerging programs in schools were not explored. The School Food FOCUS program is a national initiative that supports large school districts with 40,000 or more students in their efforts to procure more healthful, more sustainably produced and regionally sourced food to help children perform better in school and maintain healthier lifestyles (School Food FOCUS, 2010).

Geographic differences within the country were not specifically examined. For example, rural areas in the Deep South have a disproportionately high prevalence of obesity compared with urban areas of the United States (Jackson, Doescher, Jerant, & Hart, 2005; Patterson, Moore, Probst, & Shinogle, 2004; Williamson et al., 2009), as have African-American populations compared with white American populations (Centers for Disease Control and Prevention, 2009). “Stressors associated with racism and low SES are likely daily occurrences for African-American youth in this context (Scott & Wilson, 2011).” “Such environmental stressors have been shown to be associated with increased activation of physiologic stress pathways, including the hypothalamic-pituitary-adrenal (HPA) axis; chronic HPA stimulation can lead to metabolic disruption that may contribute to increased risk of obesity (Bose, Olivan, & Laferrere, 2009; Vicennati, Pasqui, Cavazza, Pagotto, & Pasquali, 2009).”

5.3 GAPS IN RESEARCH

The majority of studies reviewed were primarily cross-sectional. Data from this type of research design shows only a snapshot at one point in time. As such, causality cannot be determined for why associations between food access and overweight and obesity exist.

In addition, there were few studies that utilized empirical data. Information utilized for food outlet density mapping was obtained from existing databases. This data does not account for differences in food outlets, for example, those establishments that are considered to be fast food outlets, which do not all offer the same types of foods. Furthermore, mapping of this data only gives us location and density of food outlets. It does not tell us if area residents are patronizing the outlets closest to where they live.

Lastly, few studies assessed qualitative data. In order to establish a more complete picture of what food access looks like, future studies should include in-depth consumer interviews and surveys. There is a need to better understand what the real life food purchasing experience entails, not solely how it looks on a map. Supermarket conglomerate and fast food executives should be interviewed as well. The criteria they use to make decisions about site locations for their outlets are critical in addressing this issue.

6.0 CONCLUSION

6.1 SUMMARY

It is unclear if the presence of more full-service supermarkets alone is enough to significantly impact a reduction of overweight and obesity among African-American youth. Urban, suburban, and rural cities across the country are very unique and have different challenges. A “one size fits all” approach is not likely to address specific needs. Therefore, additional research is needed to assess healthy food availability, quality and variety in both full-service supermarkets and smaller neighborhood stores.

6.2 IMPLICATIONS FOR FUTURE RESEARCH

Because overweight and obesity persists as a major public health issue, there is a great need to continue further research that explores socio-environmental causes. Food access is a complex issue with many different dimensions. Proximity and density of food outlets does not paint a complete picture of the relationship with overweight and obesity. While quantitative studies provide important baseline data, researchers should consider developing qualitative studies that may offer additional insight into individual, family and environmental factors that vary geographically. Assessment should include: (a) food cost, type and quality; (b) modes of

transportation utilized for food shopping; (c) participation in food assistance programs; (d) food preferences; and (e) parental influence.

Longitudinal studies are also needed explore changes in dietary habits and food purchasing behavior over time. Changes in the food environment may impact these activities. These behaviors, in addition to food preferences, may change with age.

APPENDIX

Article Summary Table

Table 3. Article Summary

Author (Year)	Overall Purpose	Sample: Number & Location	Study Design	Data Collection Method	Outcomes Measured	Other Variables	Results	Limitations
Baker, Kelly et al. (2006)	Develop an initiative to provide access to high quality affordable produce & infrastructure support to encourage healthy eating habits	220 census tracts St. Louis, MO	Cross-sectional, qualitative assessment	GIS Interviews	Spatial clustering of supermarkets Produce availability	SES	Shortage of supermarkets in some AA communities Inadequate quality & quantity of fresh produce in existing supermarkets	Cross-sectional design Site selection criteria is difficult to replicate in other locations
Baker, Schootman et al. (2006)	Examine the association between food access & poverty rates & racial distribution	81 supermarkets & 355 fast food restaurants St. Louis, MO	Ecological	Direct observation of food environments	Spatial clustering of supermarkets Supermarket audit	Race/ethnicity % below poverty level	Clustering of supermarkets was not significant ($p < 0.50$) Clustering of supermarkets using quality scores was significant ($p < 0.01$; $p < 0.03$) with supermarkets in the highest tiers clustered in census tracts with >75% White and <10% below poverty	Assessment conducted in one mid-western city Location of food outlets may be due to other geographic factors Food access may be a result of purchasing behaviors Causality cannot be determined

Table 3. Continued

<p>Bauer et al. (2009)</p>	<p>Identify socio-environmental, personal & behavioral factors that predict fast-food intake in adolescents</p>	<p>806 school students Minnesota</p>	<p>Longitudinal cohort</p>	<p>In-class assessments in 1999; mailed surveys in 2004</p>	<p>Fast food intake</p>	<p>Race/ethnicity SES</p>	<p>31.2% of male & 30.9% of females reported frequent consumption of fast food 21.2% of males & 21.8% of females reported low consumption of fast food Fast food intake varied by race/ethnicity, SES, and age among females</p>	<p>Self-reported data on fast food intake Single measure of fast food intake</p>
<p>Chen & Florax (2010)</p>	<p>Examined potential impact of food environment modification using computer simulations</p>	<p>3,550 adults Marion County, IN</p>	<p>Cross-sectional</p>	<p>Survey and administrative county-level data</p>	<p>BMI</p>	<p>Neighborhood SES</p>	<p>Significant decrease in BMI of 0.43 ($p < 0.05$) for those resident who lived in close proximity to new stores</p>	<p>Cross-sectional design Study replication would be cost prohibitive most local communities Other county public health departments may not have the small area estimates of</p>

Table 3. Continued

								their population's health to utilize this strategy
Dennisuk et al. (2011)	Examined food purchasing behaviors of low-income, urban AA youth	242 youth 10-14 years Baltimore, MD	Cross-sectional	Youth Impact Questionnaire (YIQ)	Money spent on food in a typical day	SESRace/ethnicity	Older age was associated with more money spent on food in a typical day (p<0.01) Corner stores were the most frequent food source (avg. of 2 times per week) Chips, candy, & soda were the most frequently purchased items	Cross-sectional design Food purchase recall data Low response rate No differentiation made regarding timing & quantity of food purchases
Drewnowski et al. (2012)	Association of obesity risk & physical proximity to supermarkets or supermarket price	N = 2,001 adults; 7% AA King County, WA Phone survey	Cross-sectional	Mapping of full-service supermarket locations using GIS Food price based on BRFSS for the state of WA	BMI	Home address of each survey participant	No impact on obesity based on supermarket proximity Positive association between the type of supermarket and obesity (23% & 62% lower for medium & high priced shoppers respectively) Patrons of low-price supermarkets were 3 times more likely to	Cross-sectional design Non-representative sample Self-reported height & weight data

Table 3. Continued

							be obese than those of high-price supermarkets	
Ebbeling et al. (2012)	Examined the relationship between regular sugar-sweetened beverage consumption and weight gain in overweight & obese adolescents	224 overweight & obese adolescents Boston, MA	Randomized control trial	Self-reported beverage consumption via phone calls & check-in visits	BMI (measured weight & height)	Television viewing physical activity home delivery of non-caloric beverages to experimental group	Change in BMI was significant between experimental and control groups at year 1 ($p < 0.001$) but not at year 2 Replacement of sugar-sweetened beverages with intervention beverages did not improve weight over a 2-year period, but differences in dietary habits and weight were observed at the end of the 1-year intervention period (-0.57, $p = 0.045$)	small sample size self-reported data of dietary intake & physical activity lack of data on obesity-related risk factors
Eugeni et al. (2011)	Examined barriers for AA public housing residents to participating in healthful behaviors & programs	22 adults Midwestern city	Qualitative, mixed methods	Interviews	Height & weight % body fat Blood pressure Resting heart rate	Neighborhood environmental factors	Personal & environmental barriers reported Limited awareness of local opportunities for physical activity & healthy eating Limited adherence to health promotion	Small sample size Un-validated interview protocol

Table 3. Continued

							recommendations	
Glanz et al. (2007)	Reported on development & evaluation of retail food store assessment tool	4 neighborhoods Atlanta, GA	Observational measure development	County retail food license lists Georgia Regional Transportation Authority (land use data) Yellow Pages/Online business directories	Food availability, quality, & price	Neighborhood SES	24 grocery & 64 convenience stores identified 90.6% rate for completing all measures at stores More healthful options available at grocery than convenience stores	Sample size Limited food environment variables
Hilmers, Hilmers, & Dave (2012)	Examine differences in neighborhood access to fast food outlets & convenience stores based on SES & race/ethnicity	24 peer-reviewed studies published between 2000 – 2011	Literature review	MEDLINE, PubMed, PsycINFO, EBSCO Academic Search Premier, & Scopus databases	Accessibility of fast food outlets	SES Race/ethnicity	Residents of poor minority neighborhoods were more likely to be subjected to an unhealthy food environment that promotes unhealthy eating habits Consumption of healthy foods may be limited because of limited access to supermarkets/grocery stores	Studies conducted outside of the U.S. included Majority cross-sectional studies
Jilcott et al. (2011)	Examined county-level	National	Cross-sectional	USDA Economic	Spatial patterns of	Per capita farmer's markets, grocery	Positive association between the number	Cross-sectional design

Table 3. Continued

	associations between obesity prevalence & food outlet density			Research vice Food Environment Atlas	obesity rates	stores/supermarkets, and supercenters (Wal-Mart) among all counties in the U.S.	of grocery stores/supermarkets, farmer's markets, & supercenters and lower obesity prevalence in metropolitan & non-metropolitan counties (0.07% per 1,000 residents) An increase of 1 std. deviation of grocery stores/supermarkets results in a 0.59% decrease in obesity prevalence per 1,000 residents in metropolitan counties Relationship between farmer's markets and obesity weakened when all food outlets were considered	Preferred shopping locations of residents not examined Possibility of bias & errors in Atlas database
Kumar et al. (2011)	Examined AA perceptions of neighborhood nutrition environment	236 adults Pittsburgh, PA	Mixed methods	Surveys Focus groups GIS	Food availability, affordability, & quality	SES Race/ethnicity Age Primary grocery store	AA perceive food quality to be poorer in primarily AA neighborhoods (p<0.001) Access to transportation is a barrier to shopping at	Convenience sample Survey administered in two different formats

Table 3. Continued

							more favorable supermarkets	Did not include other types of food stores (e.g. convenience stores, fast food outlets)
Laska et. al (2010)	Examined the extent to which food outlet proximity & density was associated with dietary intake, food purchases and weight status	349 adolescents Minneapolis, MN	Cross-sectional	24 hour dietary recall	BMI (height & weight measured)	Demographics Sugar sweetened beverage intake Percentage body fat	BMI z-score & % body fat were positively associated with the presence of a convenience store within a 1600m buffer Sugar-sweetened beverage intake was associated with proximity to food outlets within 800m & 1600m buffers (p<0.01)	Cross-sectional design Small, non-representative youth sample Dietary recall data GIS data limitations in describing food environment
Powell et al. (2007)	Examine association between food access & adolescent BMI	73,079 observations of 8th & 10th grade students from 1997-2003	Cross-sectional	Self-reported data from the Monitoring the Future (MTF) study External data on food store & restaurant outlets from Dunn &	BMI	Gender, race/ethnicity SES Local area food prices	Positive association between lower BMI & overweight and increased access to chain supermarkets (0.11 units lower BMI per 10,000 capita) Higher BMI & overweight associated with	Cross-sectional design Self-reported data for BMI Use of secondary data

Table 3. Continued

				Bradstreet Produce price data from the American Chamber of Commerce Researches Association (AACRA)			greater availability of convenience stores (0.03 units higher BMI per 10,000 capita) Association was greater for AA students compared to their White or Hispanic peers	
Rose et al. (2009)	Examined the link between weight status & neighborhood food environment	1,243 adults & 307 food outlets in 103 urban census tracts Southeastern, LA	Cross-sectional	Mapping of food outlets In-store surveys Telephone interviews	BMI	Linear shelf space of fruits, vegetables & energy-dense snack foods	No significant association between availability of produce & BMI Modest positive association between availability of energy-dense snack foods & BMI (0.1 unit increase for each 100 m additional shelf space within 1 km of an individual's home)	Cross-sectional design No price data from stores Self-report data for BMI
Story et al. (2008)	Provide an overview of food environments & strategies for creating healthy eating environments	Not described	Ecological framework based on literature review	Not described	Food environment Influence on food choices	Environmental setting	Description of environmental factors affecting healthy eating Discussion of disparities in food access Discussion of	Data collection method not described

Table 3. Continued

							measurement & evaluation issues in conducting environmental & policy research & surveillance	
Surkan et al. (2011)	Examine the association of home food environment & individual factors are associated with healthy food purchasing behavior in low-income AA youth	206 AA youth, 10-14 years Baltimore, MD	Cross-sectional	Youth Impact Questionnaire (YIQ) Interviews	food purchasing behavior	SES Age Sex	Healthy food purchases accounted for an average of 11.6% of total food purchases for the week prior to the interview 30% purchased more than 1 healthy food item per week 32% purchased more than 15% healthy foods per week	Cross-sectional design Low response rate No differentiation in timing of food purchasing behavior
Grigsby-Toussaint et. al. (2010)	Examine the impact of the availability of culturally relevant produce on eating habits	225 food stores Chicago, IL	Cross-sectional	Survey	Availability of produce commonly consumed by AA & Latinos	Racial/ethnic makeup of neighborhood	44% of commonly consumed items were available at grocery stores 20.8% of commonly consumed items were available at convenience/corner stores	Cross-sectional design List of produce items not based on actual dietary intake data Non diverse sample of Latino neighborhoods

Table 3. Continued

<p>Zenk et al. (2011)</p>	<p>Examined food shopping behaviors & environmental influences on food shopping</p>	<p>30 AA women Chicago, IL</p>	<p>Qualitative</p>	<p>Interviews</p>	<p>Food environment perceptions</p>	<p>SES Age</p>	<p>Lack of a full-service market was an obstacle in obtaining healthy foods Neighborhood stores lacked variety & sometimes fresh produce Poor food quality was another barrier to obtaining healthy foods</p>	<p>Small sample size Additional food outlet types not explored (restaurants, convenience stores)</p>
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AA - African American

BMI - Body Mass Index

GIS - Geographic Informational Systems

SES - Socioeconomic status

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